

## Abstracts of the 2005 North American Congress of Clinical Toxicology Annual Meeting

### 1. Increasing Sirolimus Levels in a Multiorgan Transplant Patient Related to Interaction with Ciprofloxacin

Geib A, Burns Ewald M. *Children's Hospital Boston, Harvard Medical School, and the MA/RI Regional Center for Poison Control and Prevention, Boston, MA, USA.*

**Introduction:** We describe a pharmacokinetic interaction between sirolimus and ciprofloxacin. **Case Report:** A 5-year-old male was admitted for gastrointestinal bleeding. His medical history was significant for small bowel, liver, and pancreas transplant. He took multiple medications including sirolimus and ranitidine. Meropenem was started on hospital day (HD) 11, and ciprofloxacin on HD 13 for treatment of a *Serratia* indwelling line infection. Despite decreases in dosing, he experienced a sudden and persistent increase in sirolimus concentration to above therapeutic range (goal 10 ng/ml) after introduction of ciprofloxacin. Simultaneously, serum phosphate declined to a nadir of 1.7 mg/dl despite increasing supplementation. Physical exam and laboratory parameters otherwise remained unchanged from baseline. Sirolimus and phosphate concentrations normalized after ciprofloxacin withdrawal on HD 18. Sirolimus therapy was replaced with tacrolimus, which was continued after discharge. Calculation of mean residence time (MRT) of sirolimus did not demonstrate a substantial increase with ciprofloxacin co-administration. This implies no impairment of clearance and linear pharmacokinetics. The normalized area under the curve (AUC<sub>n</sub>) of sirolimus doubled during the last three days of ciprofloxacin. This suggests saturable elimination such as P-glycoprotein (P-GP) or P450. **Case Discussion:** Sirolimus is a CYP3A4 and P-GP substrate. Ciprofloxacin is a CYP3A4 inhibitor. A pharmacokinetic interaction increased sirolimus concentration. Literature review reveals no previously reported interaction between these drugs. Dose related side effects include anemia and hyperlipidemia; hypophosphatemia, leukopenia and pulmonary fibrosis do not appear to be dose related. **Conclusion:** We recommend careful monitoring of sirolimus concentrations; and renal, pulmonary, hematologic, and metabolic parameters when sirolimus and ciprofloxacin are co-administered.

Pharmacokinetics of Sirolimus with and without Ciprofloxacin

Hospital day	Daily sirolimus dose (mg)	Ciprofloxacin day	MRT (hours)	AUC <sub>n</sub>
1–12	6.5	–	27.17	47.07
13–15	6	1–3	30.54	49
17–19	5	5–6 (dc HD 18)	26	94
21–28	5	–	25	52.8

### 2. Excess Fatality from Desipramine in Children and Adolescents

Amitai Y,<sup>1</sup> Frischer H.<sup>2</sup> <sup>1</sup>Ministry of Health, Jerusalem, Israel; <sup>2</sup>Rush University Medical Center, Chicago, IL, USA.

**Background:** The reports of sudden death in children treated with desipramine have raised concern and triggered a debate about the safety of desipramine in children. The sporadic nature of these reports and the lack of a defined denominator create difficulties in assessing the risk of fatality associated with desipramine usage in children. A recently published study reported an excess fatality from desipramine in the *general* US population, based on the robust database of the AAPCC—TESS, for 1983–2002. Similar studies have not been reported in children. **Objective:** To compare the case fatality rate (CFR) from desipramine ingestion in children and adolescents with that of other tricyclic antidepressants (TCAs). **Methods:** All exposures to

desipramine, amitriptyline, imipramine, nortriptyline and doxepin, in children and adolescents reported to the AAPCC—TESS during 1983–2002 were analyzed. The CFR for each drug was defined as: the ratio of the number of deaths/number of exposures. *Result:* There were 24 fatalities in children <6 years (desipramine N=10, amitriptyline N=6, doxepin N=3, imipramine N=4, nortriptyline N=1) and 131 fatalities in older children and adolescents (desipramine N=52, amitriptyline N=24, doxepin N=16, imipramine N=30, nortriptyline N=9). The CFR from desipramine was significantly higher compared with the other TCAs, in children <6 years ( $X^2=37$ ,  $P<0.001$ ) and in older children and adolescents ( $X^2=162$ ,  $P<0.001$ ). The CFR from desipramine exceeded that of amitriptyline, doxepin, imipramine, and nortriptyline by 9, 4, 6–9 and 8–10 fold, respectively. *Conclusion:* The excess CFR from desipramine in children and adolescents and the reports of sudden death in children treated with therapeutic doses, call for more caution in prescribing desipramine to children and adolescents. AAPCC-TESS database is useful for pharmacosurveillance and detecting excess fatality rates.

### 3. Telithromycin-Induced Cholinergic Crisis in Myasthenia Gravis

Halcomb SE,<sup>1</sup> Nelson LS,<sup>1</sup> Shah C,<sup>2</sup> Chaudry A,<sup>2</sup> Hoffman RS.<sup>1</sup> <sup>1</sup>New York City Poison Center, New York, NY, USA; <sup>2</sup>Brooklyn Hospital Center, Brooklyn, NY, USA.

*Introduction:* Telithromycin (Ketek) is a new ketolide antibiotic indicated for respiratory tract infections. We report a case of severe respiratory failure associated with Ketek use in a 34 year old man on pyridostigmine for myasthenia gravis (MG). *Case Report:* On the day of presentation, the patient started Ketek for a community-acquired pneumonia. Shortly after taking the first dose of 800 mg he developed severe respiratory distress. On arrival to the ED he was diaphoretic, tachypneic, unable to speak, and cyanotic. His initial vital signs were: BP, 200/100 mm Hg; P, 110/min; RR, >30/min; afebrile; and an O<sub>2</sub> Sat was 97% on a non-rebreather mask. The patient was immediately intubated for impending respiratory arrest. During the procedure the patient was noted to have moderate secretions in his airway and bilateral diffuse rhonchi. These findings were consistent with a cholinergic crisis and 1 mg of atropine was given IV with marked improvement. *Case Discussion:* Telithromycin is a new ketolide antibiotic related to the macrolides that was recently approved for the treatment of upper respiratory tract infections. Macrolides are known to exacerbate myasthenic crises by interfering with neuromuscular transmission. Unique to telithromycin is the addition of a carbamate side chain, which confers improved antimicrobial activity against erythromycin-resistant bacteria. This side chain may also have anticholinesterase properties which may be additive with the anticholinesterase activity of pyridostigmine. Further studies are needed to evaluate this as a possible mechanism of toxicity. *Conclusion:* Pharmacovigilance is important in the post-marketing surveillance of the safety profile of drugs. Many adverse reactions are reported after a drug has been released. To date there have been 10 cases of severe respiratory failure associated with Ketek use in myasthenic patients. The mechanism of this adverse reaction is not clear. This reaction was reported to Medwatch.

### 4. Serotonin Syndrome in a Patient Treated with Linezolid

Riley BD, Ruha AM. Banner Good Samaritan Medical Center, Phoenix, AZ, USA.

*Introduction:* Linezolid was first developed as an MAO inhibitor, and as such has the potential for serious drug–drug interactions secondary to such activity. Current indications include infections caused by MRSA and VRE. We present a case of an individual receiving multiple serotonergic medications chronically, who after the addition of linezolid, developed serotonin syndrome. *Case Report:* A 49 year old man with Wegener's granulomatosis and chronic renal failure requiring dialysis was recovering in a rehabilitation hospital. His current medications included caspofungin, erythropoietin, clonidine, enoxaparin, metoclopramide, metoprolol, fentanyl, lansoprazole, lisinopril, nystatin, gabapentin, risperidone, and vancomycin, along with his normal psychiatric medications bupropion and venlafaxine. He was started on trazodone each night for sleep. The following day he developed rash, his vancomycin was implicated and he was switched to linezolid to treat his MRSA. After approximately 24 hours of combined treatment with trazodone and linezolid he began to complain of feeling dizzy, and family noted ataxia. That evening he received his nightly dose of trazodone and within one hour was noted to have altered mental status with confusion and inability to communicate. Exam showed HR 120, Temp 101°F, and myoclonic jerking of all his extremities. He was transferred to the ICU, and a broad workup begun, including EEG, blood cultures and laboratory data. Toxicology consult was obtained, and after examination and review of the medications received a presumptive diagnosis of serotonin syndrome was

made. The patient was treated with IV lorazepam, and his linezolid, trazodone, venlafaxine, and bupropion were held. He improved dramatically over the next 24 hours with resolution of all symptoms. *Case Discussion:* This case demonstrates a patient with serotonin syndrome secondary to the interaction of linezolid, an MAO inhibitor, with multiple serotonergic drugs. The patient responded well to conservative care, including benzodiazepines and stopping the offending agents. *Conclusion:* Clinicians should be aware linezolid's MAO-I activity, and exercise caution in its use with serotonergic drugs.

## 5. Sildenafil Citrate Ingestion and Prolonged Priapism and Tachycardia in a Pediatric Patient

Wills BK,<sup>1,2</sup> Albinson C,<sup>2</sup> Clifton J,<sup>1</sup> Wahl M.<sup>3</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL; <sup>2</sup>University of Illinois, Chicago, IL; <sup>3</sup>Illinois Poison Center, Chicago, IL.

*Introduction:* In 1998 sildenafil citrate was FDA approved as the first oral medication indicated for the treatment of erectile dysfunction (ED). Little is known about the toxicity of sildenafil in the pediatric population. We present a case of the prolonged priapism and tachycardia due to accidental sildenafil overdose in a child. *Case Report:* A 19 month old male ingested up to six 50 mg Viagra<sup>®</sup> tablets 45 minutes prior to presentation at the emergency room by history. In the emergency department the blood pressure was 90/58 mmHg, heart rate was 140. Physical exam revealed mild facial flushing and an erect penis which was normal in color and had a capillary refill of two seconds. The patient appeared comfortable. No gastrointestinal decontamination was performed. The patient was started on maintenance IV fluids and admitted to the pediatric floor for observation. The patient had a non-painful tumescent penis and mild tachycardia for about 24 hours post ingestion. The child never had pain from the constant erection. Sildenafil concentration drawn approximately 7 hours after ingestion was 3900 ng/ml (reporting limit 24 ng/ml) and N-desmethylsildenafil level was 1700 ng/ml (reporting limit 24 ng/ml). *Conclusion:* This is the largest known pediatric sildenafil ingestion (30 mg/kg) to date if the history is correct. Ingestion in this child initially resulted in facial flushing which resolved in a few hours. The child had asymptomatic tachycardia and prolonged priapism that remained until hospital discharge approximately 24 hours after ingestion. The constant erection was non-painful and required no urologic intervention, most likely because the priapism was secondary to a high flow state. Large sildenafil ingestions in children may be treated with supportive care.

## 6. Pediatric Fatality Following Accidental Flecainide Ingestion

Bottema C, Bilden EF, Bangh S. Hennepin Regional Poison Center, Minneapolis, MN, USA.

*Introduction:* Flecainide is a class IC antidysrhythmic agent found to be effective in the treatment of supraventricular tachycardia (SVT) in children. Toxicity is often due to its proarrhythmic activity. Fatalities may result due to rapid onset hypotension and ventricular dysrhythmias. Despite its potential for toxicity, few case reports are cited in the literature; the overdose reports usually involve adults or adolescents. We report a rare pediatric fatality in a toddler due to accidental overdose. *Case Report:* A 14-month-old female, with a history of Wolff-Parkinson-White syndrome, was being treated with flecainide oral liquid. Treatment began in the neonatal period and she was followed closely, with routine serum drug levels, by a pediatric cardiologist. One evening, the patient was found with the open bottle of flecainide, having removed the safety cap, and reportedly ingested a large swallow of the medication. The medication concentration was 20 mg/mL and usual dose was 1 cc TID. En route to the hospital in a private vehicle, the patient became limp and cyanotic; 911 was called. During ambulance transport, the child's heart rate was about 50 beats per minute and she was lethargic. Oxygen was provided and IV attempts unsuccessful. On arrival to the emergency department, the patient had moaning respirations, a heart rate in the 50's, and oxygen saturations in the low 90's while on oxygen. She had a generalized seizure and became apneic. She was ventilated using a bag valve mask and 1 mg of lorazepam was given. Atropine, midazolam, and vecuronium were administered prior to endotracheal intubation. She soon became more bradycardic and then pulseless. Further treatment included epinephrine, atropine, sodium bicarbonate, and isoproterenol. Heart rate increased to approximately 140 bpm and she was admitted to the ICU. Shortly after admission, she developed bradycardia which progressed to full cardiac arrest. Despite resuscitation efforts, she died within a few hours of the ingestion. Post-mortem flecainide blood concentration was 6.87 mcg/mL (therapeutic range 0.2–1). *Conclusion:* This case represents a tragic death of a child from an accidental overdose of her own medication and serum drug level 6 times therapeutic.

## 7. A Referral Decision Rule for Pediatric Hydrocarbon Oral Exposure

Bond GR, Pieche S, Sonicki Z, Gamaluddin H, El Guindi M, El Saddawy A, Sakr ML. *WHO EMRO Pediatric Hydrocarbon Study Group, Cairo, Egypt.*

**Background:** Unintended hydrocarbon (HC) ingestion is a common reason for pediatric hospitalization in the developing world. Sites of primary care often do not have appropriate treatment resources, even oxygen, so transfer decisions must be made immediately. Over and under triage are issues. We sought to develop a practical decision rule for early clinical identification of patients likely to require treatment (severe). **Methods:** A prospective study of children <5 y presenting within 2 hours of oral HC exposure. Pre-presentation symptoms and objective signs were recorded for each patient at admission and at 6, 12, 24 hours. Assessment of symptoms and signs were subjected to kappa analysis for inter-rater variability. Criteria for those requiring any treatment (severe) were: oxygen saturation <94% at any time, with or without oxygen; any treatment with salbutamol; any care in the ICU or hospitalization beyond the minimum protocol of the study. **Result:** 633 pediatric patients presented to an urban poison treatment facility after HC exposure. 295 refused enrollment. 338 enrolled, 256 met the inclusion criteria and completed the study. 172 had a severe course, 84 were mild. The presence of wheezing, any alteration in consciousness (“coma” >0 or any restlessness) or rapid breathing (RR>50 if age <12 mo, >40 if age >12 mo) at presentation identified 167 of 172 patient courses classified as severe (Sens. 0.97). 3 of the 5 not detected questionably met the inclusion criteria. The other 2 developed later symptoms and could have been referred on the basis of changing symptoms. 50 of 84 mild patients were mis-identified as severe (spec. 0.40). No combination of clinical symptoms provided better discrimination while preserving sensitivity. Inter-rater reliability for these signs was excellent. **Conclusion:** Use of a decision rule is expected to lead to more rational use of resources and improve outcome. If validated in other settings, this decision rule could allow evaluation at a remote facility or physician office and spare hospital referral for 40% of those who will not require treatment for HC ingestion/aspiration.

## 8. Chronic Acetaminophen Exposure Resulting in Hepatorenal Failure in a Neonate Treated with Acetadote®

Daubert GP, Smolinske S, White S. *Children’s Hospital of Michigan Regional Poison Control Center, Detroit, MI, USA.*

**Introduction:** The first chronic oral overdose of acetaminophen (APAP) in a neonate is reported. Acetadote® is not approved in cases of chronic overdose with hepatic toxicity but may serve as a method of delivering continuous N-acetylcysteine (NAC) in critically ill patients. **Case Report:** A previously healthy 5-day-old male infant weighing 3 kg presented for an evaluation of decreased feeding and lethargy. The infant had been prescribed APAP suspension upon discharge for pain control of his circumcision. The child received 3 days of acetaminophen every 4 hours measured as a 1-inch deep level in a cup. The initial APAP level was 107 mcg/ml. Other presenting laboratory studies included ALT, 978 U/L; BUN, 40 mg/dl; Cr, 3.2 mg/dl, total bilirubin 9.0 mg/dl; PT, 18.2 sec; INR, 1.8; and glucose, 27 mg/dl. The infant was treated with Acetadote® for 5 days. He was discharged on day 6 after a complete recovery. **Case Discussion:** The pain of circumcision causes both short and long term changes in infant behaviors. APAP is commonly used for postoperative analgesia. Pharmacological studies on APAP in neonates are limited. The majority of studies have focused on single dose APAP with the problem of cumulative toxicity from repeated dosing not addressed. However, neonates and infants are capable of generating NAPQI, particularly after multiple dosing. Neonates have an immature glucuronide conjugation system, and their sulphation metabolic pathway plays a more active route of APAP metabolism than adults or older children. In addition, infants have a greater capacity to synthesize glutathione, thereby inactivating toxic metabolites of APAP more effectively. **Conclusion:** We present the first case of chronic APAP toxicity in a neonate resulting in significant hepatorenal toxicity. The toxicity of APAP in neonates is unclear, but appears to be low because of slow oxidative metabolism and rapid glutathione synthesis. Continuous intravenous NAC remains an effective treatment in cases of severe hepatic toxicity in the neonate.

## 9. Acute Coronary Syndrome Following Subcutaneous Sumatriptan Administration in a Child

Hoffman RJ,<sup>1</sup> Ginsburg BY,<sup>2</sup> Nelson LS,<sup>2</sup> Hahn I.<sup>3</sup> <sup>1</sup>*Beth Israel Medical Center, New York, NY, USA;* <sup>2</sup>*New York City Department of Health Poison Control Center, New York, NY, USA;* <sup>3</sup>*St. Luke’s-Roosevelt Hospital Center, New York, NY, USA.*

*Introduction:* Coronary artery vasospasm is an uncommon side effect of sumatriptan unreported in children. We report a case of acute coronary syndrome (ACS) in a child resulting from sumatriptan. *Case Report:* A 13 year old boy presented to an ED with a 2-day constant, pounding, bilateral headache rated at 7/10 pain which was diagnosed as a migraine headache. He had a past medical history of severe headaches. He denied trauma, use of illicit drugs or smoking. His vital signs and physical examination were normal. His treatment included ibuprofen 600 mg PO, followed later by prochlorperazine 10 mg IV. A noncontrast CT of the head was normal. For persistent 7/10 headache, sumatriptan 6 mg SC was administered. Within seconds he complained of excruciating, crushing chest pain rated as 10/10. Cardiopulmonary monitoring revealed a decrease in heart rate from 80/min to 48/min as well as blood pressure from 94/70 mmHg to 80/40 mmHg. A 12-lead ECG revealed sinus bradycardia with no evidence of myocardial ischemia. After 5 minutes the chest pain continued to be 8/10. Nitroglycerine .4 mg SL was administered and within 1 minute his chest pain diminished to 2/10. At that time, his headache was 8/10. The patient was treated with  $\text{MSO}_4$  4 mg IV, after which his chest pain resolved and headache improved to 2/10. Repeat ECG testing and serial troponin measurements were all normal. It was later discovered that, unbeknownst to the patient and other family, his mother had experienced ACS after subcutaneous sumatriptan administration. *Case Discussion:* Chest pain immediately after sumatriptan use, the quality and intensity of chest pain, relief of chest pain with nitroglycerine, as well as maternal ACS from sumatriptan suggest that this patient experienced ACS from sumatriptan. *Conclusion:* Sumatriptan is a serotonin agonist that reduces migraine pain by cerebral vasoconstriction, but it may cause vasoconstriction at other sites including the coronary arteries. ACS should be considered in children with suggestive signs and symptoms in the setting of sumatriptan use, and should be managed accordingly.

## 10. Tacrolimus Overdose Resulting in Metabolic Acidosis and Renal Failure

O'Connor AD, Rusyniak D. *Indiana University School of Medicine, Indianapolis, IN, USA.*

*Introduction:* Tacrolimus is a potent macrolide immunosuppressant used to prevent organ transplant rejection. Overdose of tacrolimus has previously been reported to cause metabolic acidosis and renal failure, but only in persons with previous kidney or liver transplants. To our knowledge, significant toxicity has not been reported in a non-transplant patient. *Case Report:* A 42-year-old female, with a previous stable C2 fracture, was admitted to the hospital for observation of her fracture following an alcohol-related motor vehicle collision. On hospital day two she was diagnosed with new onset hypertension and was started on ramipril and clonidine, and also began daily thiamine and prn lorazepam to prevent alcohol withdrawal. On hospital day four she was discharged home. Shortly after discharge, the pharmacy discovered that an error had occurred resulting in the patient having been given tacrolimus instead of thiamine. Based on dispensary records, it was estimated that she may have received as much as 400 mg of intravenous tacrolimus over a 4 day period. The patient was called back to the hospital and upon re-admission was found to have a BUN/Cr of 22/4.2 mg/dl and a serum bicarbonate of 12 mmol/L. On day three of her previous hospitalization BUN and Cr had been 20 mmol/L and 0.6 mg/dl respectively. On readmission, a tacrolimus level was 96.8 ng/ml (therapeutic 0.2–6 ng/ml). The patient was hospitalized and started on IV fluids with sodium bicarbonate and adequate urine output was maintained. Phenytoin therapy was initiated to increase metabolism of the tacrolimus via the cytochrome P450 3A pathway. After three days, she was discharged with a serum bicarbonate of 25 mmol/L, a Cr of 0.9 mg/dl, and a tacrolimus level 7.8 ng/ml. She remained asymptomatic throughout her hospital stay. Other possible factors which may have contributed to her renal insufficiency include her hypertension, her ACE inhibitor, and IV contrast she received on the initial hospitalization for radiologic studies. *Conclusion:* Tacrolimus overdose can result in metabolic acidosis and renal insufficiency in patients without previous organ transplantation.

## 11. Lamotrigine Hypersensitivity Syndrome with Fatal Fulminant Hepatic Necrosis

Riley BD, Curry SC. *Banner Good Samaritan Medical Center, Phoenix, AZ, USA.*

*Introduction:* Lamotrigine is an aromatic anticonvulsant used also as a mood stabilizer. We report a case of fulminant hepatic necrosis and death typical of anticonvulsant hypersensitivity syndrome associated with lamotrigine use. *Case Report:* A 30 y.o. woman presented to an outside hospital with 3 days complaint of fever, malaise, headache and rash. She had taken valproic acid for several years for psychiatric reasons, and lamotrigine which had been added 2 weeks prior. Exam showed

temp 103.2°F; heart rate 140; normal mental status, posterior cervical lymphadenopathy, and a fine macular rash most prominent on the chest and back. Initial labs results showed AST 607 IU/L and ALT 672 IU/L. Over 3 days transaminases continued to rise peaking at AST 4420 IU/L and ALT 5586 IU/L, and encephalopathy developed. Upon transfer to our facility her fever and rash had resolved, and her clinical syndrome was consistent with fulminant hepatic failure. Laboratory tests showed AST 2525 IU/L, ALT 5586 IU/L, ammonia 125 mmol/L, PT 24 s, and bilirubin 4.7 mg/dl. Glasgow Coma Scale was 8. Work up failed to establish other causes of hepatic failure, including viral or metabolic, and a presumptive diagnosis of lamotrigine hypersensitivity syndrome was made. She deteriorated from hepatic failure despite maximal supportive care and died on hospital day 38 of cerebral herniation. Post-mortem liver histology showed massive panlobular hepatic necrosis with minimal bile staining and extensive post necrotic portal-bridging fibrosis. *Case Discussion:* A lamotrigine hypersensitivity syndrome similar to that seen with other aromatic anticonvulsants has been rarely described. The exact etiology of the syndrome is unclear. Some studies suggest a reactive arene oxide metabolite, as is seen with some other aromatic anticonvulsants. However, animal studies indicate potential for an immune response resulting from presentation of the parent compound directly to T-cells. Evidence supports potential for cross reactivity with traditional aromatic anticonvulsants such as phenytoin. *Conclusion:* Lamotrigine should be considered when presented with a clinical syndrome suggestive of anticonvulsant hypersensitivity.

## 12. Therapeutic Error: Carboprost Tromethamine Given to a Newborn Intramuscularly

Robinson RF,<sup>1,2,3</sup> Baker SD,<sup>3</sup> Casavant MJ,<sup>3</sup> Griffith JRK.<sup>3</sup> <sup>1</sup>Colleges of Pharmacy and Medicine, The Ohio State University, Columbus, OH, USA; <sup>2</sup>Columbus Children's Research Institute, Columbus, OH, USA; <sup>3</sup>Central Ohio Poison Center, Columbus, OH, USA.

*Introduction:* Carboprost tromethamine (Hemabate<sup>®</sup>) a synthetic prostaglandin analogue (15-methyl prostaglandin F<sub>2</sub>-alpha) is given intramuscularly to postpartum women for control of uterine bleeding. *Case Report:* A 2.7 kilogram 37+4 week gestation male was born to a 35 year old, gravida 2, para 1 via Cesarean section after failure to progress. He initially did well with Apgar scores of 8 and 9. He accidentally received 125 mcg carboprost/ 41.5 mcg tromethamine intramuscularly in the delivery room instead of hepatitis B vaccine. Within 12 minutes the infant became acrocyanotic, progressing to apneic spells and requiring bag and mask ventilation. Within 4 1/2 hours the child became hyperthermic (101°F), hypotonic and was intubated. The child required intermittent intubation for approximately 26 hours. Blood pressure and heart rate remained stable over this time period. An echocardiogram 36 hours after exposure showed a widely dilated patent ductus arteriosus and very mild tricuspid and mitral incompetence. *Case Discussion:* There are three prior case reports of infants who received carboprost tromethamine; two who received the above dose and were asymptomatic and one full-term infant who received twice the above dose and had full resolution of symptoms (i.e., bronchospasms, tachypnea, dystonia, seizure, hyperthermia and diarrhea) within 18 hours of exposure. Low dose carboprost can cause life-threatening adverse events. *Conclusion:* Delaying routine newborn medications until infants are in the newborn nursery may reduce medication errors in the delivery room.

## 13. Evaluation of Pramoxine Ingestion as Reported to Poison Centers

Spiller HA, Baker SD, Spiller GW. Kentucky Regional Poison Center, Louisville, KY, USA; Central Ohio Poison Center, Columbus, OH, USA; Louisiana Drug and Poison Information Center, Monroe, LA, USA.

*Background:* Pramoxine is a local anesthetic primarily used as an antipruritic in over 100 topical OTC products. Probably because pramoxine is exclusively a topical anesthetic, there are neither published reports of pramoxine ingestion nor human or animal studies of pramoxine ingestion. This lack of information makes decisions concerning pramoxine ingestion difficult to assess. *Methods:* We performed a retrospective chart review of the records of 3 regional poison centers for the years 2000–2004. Inclusion criteria were ingestion of a pramoxine-containing product by a human. An exclusion criterion was lack of follow up. *Result:* Over five years there were 151 patients with ingestion of a topical pramoxine-containing product with adequate follow-up, of which 13 (9%) had symptoms. Clinical effects reported were all minor and included Oral irritation (n=5), Vomiting (n=4), Nausea (n=2), Numbness (n=2) and Diarrhea (n=1). Oral irritation and numbness were of short duration, but nausea and vomiting persisted for up to four hours. *Conclusion:* This is the first case series report of ingestion of pramoxine-containing

products. Clinical effects from ingestion of a pramoxine-containing product were minor and did not require direct medical supervision. Nausea and vomiting may persist for several hours. Home management of these exposures is appropriate.

#### 14. Outcome of Emergency Department (ED) Patients with Elevated International Normalization Ratio (INR)

Lee DC, Johnson AB, Rudolph GS. *North Shore University Hospital, Manhasset, NY, USA.*

**Background:** With the increasing indications for long-term anticoagulation, there has been a greater incidence of over-anticoagulation. Prior studies have reported that higher anticoagulation profiles lead to a greater risk for bleeding. An INR above 6.0 has been associated with significant near-term morbidity and mortality. Our hypothesis is that the height of the INR correlates with worse outcomes. We compared INR on presentation with admission rates, length of hospital stay (LOS), hemoglobin levels on the first (H1) and third day (H3), and mortality. **Methods:** We performed an IRB-approved, retrospective, chart review on a consecutive cohort of patients presenting to a suburban, academic ED (60,000 annual census) who had an initial INR of 4.0 or greater. Patients who presented in a 1-year period between 12/2002 to 11/2003 were included. All charts were reviewed by physician/investigators in a standardized fashion. Data collected included: demographics, initial laboratory values, and hospital course. Data was analyzed by student t-test and Spearman rank correlation. A  $p < 0.05$  was considered significant. **Result:** 269 charts were identified (135 males and 134 females). There were no differences in the INR of admitted patients as compared to patients discharged from the ED; 246 were admitted (mean INR of 6.5, SD 2.3) and 23 were discharged (mean INR of 6.1, SD 2.2,  $p = 0.80$ ). No subjects died. The mean and  $p$  values of admitted patients correlating INR to age, anemia, and LOS by Spearman rank are tabled below. **Conclusion:** In our study of patients who had elevated INR, we did not detect a correlation between the level of INR and morbidity and mortality as defined by admission rate, length of stay, and death. However, the level of the INR did weakly correlate with the level of anemia on day 1 and day 3. Other outcome measures such as need for blood products, surgery, and death are presently being investigated.

INR versus Age, Anemia, and LOS

Mean INR	Mean age	Mean H1 (g/dL)	Mean H3 (g/dL)	Mean LOS
6.4 (SD 2.3)	73 (SD 13.7) $r = 0.03$ $p = 0.65$	11.6 (SD 2.3) $r = -0.13$ $p = 0.04$	11.0 (SD 2.2) $r = -0.15$ $p = 0.04$	8.6 (SD 7.8) $r = -0.09$ $p = 0.17$

#### 15. Prophylactic Long-Term Antibiotic Induced Vitamin K Deficiency with Resultant Coagulopathy

Stork CM,<sup>1</sup> Marraffa JM,<sup>1</sup> Ragosta K,<sup>2</sup> Cantor RM.<sup>1</sup> <sup>1</sup>SUNY Upstate Medical University, Central New York Poison Center, Syracuse, NY, USA; <sup>2</sup>SUNY Upstate Medical University, Syracuse, NY, USA.

**Introduction:** This was an 11 year old male with cerebral palsy who experienced vitamin K deficiency related coagulopathy after chronic prophylactic use of antibiotics. **Case Report:** An 11 year old male with cerebral palsy and maintained on chronic azithromycin 200 mg every other day, for anti-inflammatory and/or immunomodulatory properties, presented to the emergency department (ED) and was diagnosed with gallstone related pancreatitis. An incidental INR at the time of ED presentation returned at 6.54 with an aPTT of 53.8 s with no apparent cause. Physical examination was not significant for actively bleeding or bruising. A medication review revealed no warfarin, warfarin-like agent or alternative/herbal medication use. The elevated INR was subsequently confirmed 2 hours later at 6.52. At this time, a single dose of 2 mg of vitamin K was administered intramuscularly. Fourteen hours after vitamin K administration, an INR returned at 0.93 which remained normal at 0.89 two days thereafter with no additional vitamin K therapy. **Case Discussion:** Chronic use of antibiotics in severely ill patients is described to result in vitamin K deficiency and subsequent impaired coagulation, particularly in children. This case illustrates coagulopathy after chronic prophylactic antibiotic use in a patient with cerebral palsy. Vitamin K deficiency is thought due to inhibition of vitamin K production by intestinal microorganisms or through an inhibitory action of these antibiotics on endogenous vitamin K metabolism. Treatment with vitamin K1 is reported to rapidly and completely reverse the coagulopathy, as was seen in our patient. **Conclusion:** Macrolide antibiotics have been recognized for having immunomodulatory effects that are beneficial in patients suffering from chronic pulmonary inflammatory syndromes. Awareness of this risk should be

highlighted as their use is increased. Vitamin K supplementation should be considered in patients at risk for vitamin K deficiency when placed on chronic prophylactic antibiotic therapy.

## 16. 198 Cases of Severe Injury or Death in Children Resulting from an Unintentional Therapeutic Error Outside of a Health Care Facility

Tzimenatos L, Bond GR. *Cincinnati Children's Hospital Medical Center, Cincinnati, OH.*

**Background:** Decreasing medication related injury is a key public health goal. Little is known about medical errors in children and pharmaceutical errors in particular. **Methods:** The AAPCC TESS database was queried for 2000 to 2004 using the following criteria: 1) age is less than 6 years 2) exposure reason is unintentional therapeutic error 3) outcome is major effect or death 4) exposure site is not a health care facility. This database provides limited case data, including age, exposure site, route of exposure, chronicity, symptoms, therapies, and limited scenario codes for reason for exposure. **Result:** 198 cases were identified, including 18 deaths. Anti-epileptic drugs were most frequent (39 cases, 1 death). Acetaminophen-associated hepatic injury was present in 22 cases (4 deaths). Other cough and cold medications accounted for 19 patients (4 deaths) with narcotic ingredients in 7 (3 deaths) and dextromethorphan in 6. Other narcotic-containing products accounted for 2 more deaths. 3 infants (all  $\leq 2$  months) were exposed to imidazoline-containing topical decongestants. Dosing errors with metoclopramide (16 cases, most  $< 1$  year, 10X dosing errors in 9) were frequent. GI products were involved in another 14 cases including 8 in children  $\leq 2$  months: hyoscyamine (5), Fleet's enema (1), MOM (1), "antacid" (1, a death). CV agents were involved in 6 cases; both patients with digoxin-related errors died. Other medications of interest included clonidine (8), baclofen (8), risperidone (5). IV administration accounted for 16 cases, presumably in special needs children. 5 of these received oral preparations IV, local anesthetic toxicity was reported in another 5 (1 death), and 2 experienced fosphenytoin dosing errors. **Conclusion:** These data identify some specific medication classes, individual agents and populations for target interventions. Addressing home IV care risks may be particularly fruitful. Accessing the PCC data from these exposures may provide a better explanation of events (including whether the medications were prescribed for the victims or the exposure was the result of caregiver choice to use another person's medication) and would allow checking for coding error.

## 17. Liver Injury During Repeated Dosing of Acetaminophen (APAP): What Does the Medical Literature Really Say?

Bailey JE,<sup>1</sup> Bogdan GM,<sup>1,2</sup> Dart RC.<sup>1,2</sup> <sup>1</sup>Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO, USA; <sup>2</sup>University of Colorado, Denver, CO, USA.

**Background:** Controversy exists regarding the toxicity of APAP at therapeutic (adults:  $\leq 4$  g/day; children:  $\leq 90$  mg/kg/day) and supratherapeutic doses. The medical literature describing APAP dosing for  $\geq 24$  hours was systematically reviewed. **Methods:** All English articles catalogued in MEDLINE (1966–2003) and EMBASE (1980–2003) identified by the keywords "APAP", "acetaminophen", "paracetamol", or the APAP CAS registry number were screened manually. Articles reporting APAP dosing for  $\geq 24$  hours were abstracted using the American College of Physician technique. **Result:** Of 26,748 APAP articles, 684 articles (33,245 patients) reported dosing  $\geq 24$  hours: 410 (31,514 patients) prospective studies; 274 (1,731 patients) retrospective. Patient outcomes (injury described as AST/ALT  $\geq 300$  IU/L, elevated AST/ALT [level not reported], or liver transplant; and death from APAP) by study design and dose are:

APAP dose	Prospective studies			Retrospective studies		
	Injury N (%)	Death N (%)	No injury/death N (%)	Injury N (%)	Death N (%)	No injury/death N (%)
Therapeutic	13 (0.1)	0 (0.0)	27,692 (99.9)	55 (5.2)	6 (0.6)	991 (94.2)
Supratherap.	19 (1.5)	0 (0.0)	1,278 (98.5)	155 (35.7)	44 (10.1)	235 (54.1)
Unknown	26 (1.0)	0 (0.0)	2,486 (99.0)	19 (7.8)	8 (3.3)	218 (89.0)
Total	58 (0.2)	0 (0.0)	31,456 (99.8)	229 (13.2)	58 (3.4)	1,444 (83.4)

*Conclusion:* Despite administration to 31,514 patients in a wide range of clinical trials, prospective studies reported very few injury outcomes and no transplants or deaths related to APAP. Of the 13 patients who received a therapeutic APAP dose during prospective studies and reported injury, 1 patient developed an AST of 527 IU/L 2 days after also taking warfarin. The remaining 12 patients experienced minor elevated AST or ALT levels, but the exact levels were not reported. In contrast, retrospective studies accounted for nearly all adverse effect reports. In the retrospective articles, 6 deaths occurred after therapeutic doses of APAP. These cases were reviewed, and all had concomitant illness or conflicting information that questions the diagnosis of APAP injury.

## 18. Fatal Hepatic Failure Due to *Fructus Xanthii* in a Child

Wu ML, Wang CP, Deng JF. *Division of Clinical Toxicology, Department of Medicine, Taipei Veterans General Hospital and School of Medicine, National Yang-Ming University, Taipei, Taiwan.*

*Introduction:* *Fructus Xanthii*, fruit of *Xanthium sibiricum* Patr. ex widd, is commonly used in rhinology in Traditional Chinese medicine. *Fructus Xanthii*-induced acute hepatitis has not been reported in Taiwan. We report a case of *Fructus Xanthii*-induced acute hepatic failure. *Case Report:* A 20-month-old girl consumed two-month herbal remedy, prescribed by a Traditional practitioner for neurofibromatosis. The prescriptions were confirmed to contain major in *Fructus Xanthii* and minor in mixing with *Prunella vulgaris*, *Schizonepeta tenuifolia*, *Glycyrrhiza uralensis*, and *Gallus gallus domesticus*. She was noted to have vomiting, and followed by hypoglycemia, seizure, coma and hepatic failure. Initial laboratory tests were remarkable with leucocytosis, marked hypoglycemia (glucose 1 mg/dL), elevation of alanine aminotransferase (ALT): 808 U/L, aspartate aminotransferase (AST): 381 U/L, ammonia: 98 mg/dL. Peak ALT, AST were 8,588 U/L and 22,384 U/L on day 3 and 4, respectively. The total bilirubin and direct bilirubin progressively increased up to 44.2 mg/dL and 22.9 mg/dL on day 28. Despite intensive treatment, she died on day 32. *Case Discussion:* Toxicity of *Xanthium sibiricum* is due to the presence of two toxic glucosides, atractyloside and carboxyatractyloside. They are hepatotoxic, nephrotoxic and potent hypoglycemic agents. Poisoning in human may present with either acute hepatic or renal pathology. *Conclusion:* The child died of hepatic failure after consuming *Fructus Xanthii*-containing herbs. The reason of intoxication may be due to unusual large dose and cumulative toxicity.

## 19. Therapeutic Errors with Ranitidine in Pediatric Patients

Burda A, Razo M, Wahl M. *Illinois Poison Center, Chicago, IL, USA.*

*Background:* Therapeutic errors involving ranitidine are frequent occurrences in pediatric patients. There is, however, a lack of data characterizing the frequency and outcome of these exposures. *Methods:* A total of 146 poison center cases regarding therapeutic errors with ranitidine in children <6 years of age were reviewed for the 3.5 year time period, 7/1/01 to 12/31/04 (a rate of 3.5 cases per month). Cases were analyzed for age distribution, sex, product, chronicity, dosage, reason for therapeutic error, disposition and outcome. *Result:* Age distribution: 111 (76%) <1 yr; 14 (9.6%) 1 yr to <2 yrs; 21 (14.4%) 2 yrs to <6 yrs. Sex: 73 (50%) females; 70 (48%) males; 3 (2%) unknown. Product: 144 (98.6%) ranitidine 15 mg/ml liquid; 2 (1.4%) ranitidine 75 mg tablet. Chronicity: 68 (46.5%) were single dose; 43 (29.5%) were multiple doses ≤24 hrs; 35 (24%) were multiple doses >24 hrs. In 6 cases (4.1%) ranitidine (Zantac<sup>®</sup>) was given instead of cetirizine (Zyrtec<sup>®</sup>). A concurrent therapeutic error involving metoclopramide liquid occurred in 7 (4.8%) cases. Median dose/day: 60 mg/day (range 0.6–375 mg/day); median dose/kg/day: 10 mg/kg/day (range 0.13–52.9 mg/kg/day). Usual pediatric dose: 2–4 mg/kg/day for duodenal and gastric ulcer; and up to 10 mg/kg/day for GERD and erosive esophagitis. Reason for therapeutic error: double dose 36 (24.7%), ten fold/decimal point 36 (24.7%), confused units 14 (9.6%), wrong med 13 (8.9%), iatrogenic 9 (6.2%), given/took other's med 6 (4.1%), dosing cup 1 (0.7%), other/unknown 27 (18.5%). Disposition: 37 (25.3%) patients were treated in a HCF; none were admitted. None received GI decontamination. Nine (6.2%) patients had recorded CBCs and LFTs; all were WNL. There were 38 (26%) cases followed to a known outcome: 28 (73.7%) had no effect; 8 (21%) had minor effects; and 2 (5.3%) had unrelated effects. Reported effects included: drowsiness (8), vomiting (4), irritability (4), constipation (1) and nausea (1). *Conclusion:* Total doses of 375 mg/day or 52.9 mg/kg/day, related to acute or chronic therapeutic errors, result in minimal toxicity in children <6 yrs. Health care professionals, however, should communicate both written and verbal directions to assure accurate medication dosing.

## 20. Salicylate Toxicity with Topical Exposure on Intact Skin

Cull M, Vicas IM-O. *Alberta Poison Centre, Calgary, AB, Canada.*

*Introduction:* Reported cases of salicylate toxicity from dermal exposure have usually occurred in patients with skin diseases such as psoriasis, ichthyosis or erythroderma. *Case Report:* We report a case of salicylate toxicity after topical application of salicylate cream to intact skin. *Case Discussion:* A 27 year-old healthy male was self-medicating intact skin with a topical preparation of 20% salicylic acid. He had previously used this product on a smaller surface area without consequence. After taking a hot shower in the evening, he liberally applied the product to his arms, legs, and a small section of the abdomen (estimated 56% surface area). The product was left on overnight for a total of 10 hours. He awoke in the morning with tinnitus and malaise. Home self-management included decontamination and hydroxyzine 50 mg. He presented to hospital 2.5 hours later with persistent tinnitus and nausea. There were no CNS or respiratory abnormalities. His initial labs included: Na 143 mmol/L, K 4.1 mmol/L, Cl 103 mmol/L, CO<sub>2</sub> 24 mmol/L, glucose 5.1 mmol/L, urea 4.6 mmol/L, Cr 113 mol/L, anion gap 16, arterial blood pH 7.51 and salicylate level 4.35 mmol/L (60 mg/dL). He was treated with intravenous saline, bicarbonate and potassium. Twenty-two hours post presentation, he was asymptomatic with a serum salicylate of 1.69 mmol/L (23 mg/dL). *Conclusion:* Topical salicylate toxicity can occur with application to intact skin. Possible factors contributing to increased absorption in this patient include: extensive application, high concentration, increased duration of exposure and showering preapplication.

## 21. Toxicity Following Buprenorphine Ingestions

Doyon S,<sup>1</sup> Klein-Schwartz W,<sup>1</sup> Welsh C.<sup>2</sup> <sup>1</sup>*Maryland Poison Center, University of Maryland School of Pharmacy, Baltimore, MD, USA;* <sup>2</sup>*University of Maryland School of Medicine, Baltimore, MD, USA.*

*Background:* To examine the toxicity of exposures to buprenorphine utilizing national poison center data. Buprenorphine was approved in late 2002 for sublingual administration in the management of opioid dependence. Ceiling effects suggest that minimal toxicity would be expected in overdoses. Little published literature exists describing buprenorphine toxicity. *Methods:* Data on single substance ingestions to buprenorphine followed to known outcome reported to the American Association of Poison Control Centers Toxic Exposure Surveillance System in from October 2002 thru December 2003 were retrospectively analyzed. *Result:* There were 33 cases that met the inclusion criteria. Ages ranged from 16 months to 57 years, with 10 cases involving children between 16 months and 2 years of age. Overall, the majority of patients (87.9%) experienced clinical effects. The most common clinical effects were drowsiness (12, 36.4%), agitation (4, 12.1%) and tachycardia 3 (9.1%). Dose was known in 19 cases and ranged from 2 mg to 140 mg (median, 8 mg). The dose was 2 mg and 4 mg in the 2 asymptomatic patients with known dose. Excluding the outlying dose of 140 mg, the dose range in symptomatic patients was 2 mg to 16 mg with a mean dose of 7.2 mg ( $\pm 5.4$ ). Non-HCF management occurred in 11 cases. For patients already in or referred to an HCF, 13 were treated and released from the ED, 7 were admitted for medical care, 1 refused the referral and 1 left AMA. Ultimate medical outcome was coded as no effect in 4 (12.1%), minor in 21 (63.6%), moderate in 7 (21.2%), and major in 1 (3.0%) case. No deaths were attributed to buprenorphine. *Conclusion:* These data demonstrate that the majority of patients who ingest only buprenorphine do not experience serious toxicity.

## 22. Elevated Troponin Level and ST Wave Depression Secondary to Disulfiram-Like Reaction Resulting from Suspected Deficit in Ethanol Metabolism

Eldridge DL, Stoeckle MM, Holstege CP, Rowden AK, Kirk MA. *Division of Medical Toxicology/University of Virginia, Charlottesville, VA.*

*Introduction:* Certain ethnic groups are known to have enzyme polymorphisms that can lead to a disulfiram-like reaction when consuming ethanol. We report such a suspected case where this reaction produced elevated serum troponin levels and ST wave depression on ECG. *Case Report:* A 19-year-old Korean female was brought to the emergency room after becoming unresponsive within 1–2 hours of an episode of binge drinking (“3 shots of vodka”). Her friends had consumed from the same

bottle without illness. On admission she was hypotensive, tachycardic and tachypneic (BP 69/29; P:136; R:30) with a low core body temperature (35.6°C). On exam her skin was warm and flushed. She was sedate but arousable to voice and answered some questions. While in the ED, she had repeated emesis and complained of chest pain. Her initial ECG revealed diffuse ST depression and troponin level was elevated at 0.18 ng/mL (normal <0.1). Ethanol level was 118 mg/dL. She received 6 L of IVF over 7 hours with normalization of vital signs. After 24 hours, she was awake, alert and without further chest pain or nausea. Blood acetaldehyde level (7 hours postingestion) was 0.81 mg/dL ( $\leq 0.02$ ). Subsequent troponins were normal and her ECG normalized. Urine drug screen, salicylate, GHB, and theophylline levels were negative. She denied any other ingestion (including disulfiram). With her only other ethanol ingestion, she reported a milder, similar episode. Past medical and family history were non-contributory. *Conclusion:* This patient suffered symptoms consistent with a disulfiram-like reaction with a significantly elevated blood acetaldehyde after moderate alcohol consumption. In temporal relation to this clinical presentation, she also developed signs of cardiac ischemia (presumably due to hypotension) which has been reported when ethanol is ingested with disulfiram use. To our knowledge, cardiac ischemia associated with a disulfiram-like reaction has not previously been reported without a causative co-ingestion.

### 23. Fatal Cocaine Metoprolol Interaction

Fareed FN, Chan GM, Hoffman RS. *New York City Poison Control Center, NY, NY, USA.*

*Introduction:* Although experimental evidence in animals and humans suggests that the use of beta-blockade is detrimental in cocaine toxicity, clinical evidence to support this adverse drug interaction is entirely lacking. We present a case of cardiac arrest and death in close temporal association to the administration of a beta-blocker in a patient with cocaine associated chest pain. *Case Report:* A 54 year old man complained of midsternal chest pressure, nausea and vomiting after using 1 gram of cocaine intranasally 4 hours prior to ED arrival. His pain resolved with ASA and nitroglycerin spray given by EMS personnel. On arrival to the ED, his vital signs were: BP, 145/95 mm Hg; P, 114/min; RR, 20/min; Temp, 96.8°F; O<sub>2</sub> saturation, 97%. The patient was alert and in no distress and his physical examination was only remarkable for JVD. An ECG showed sinus tachycardia at 116/min with nonspecific ST and T wave abnormalities in the precordial leads, and a CXR showed cardiomegaly with mild pulmonary vascular congestion. Despite 15 mg of diazepam IV, the patient remained tachycardic. Laboratory work was significant for a troponin of 1.51 ng/mL (normal <0.07 ng/mL), and at 2 hours into his ED stay, he received 2.5 mg of metoprolol IV, which was repeated 10 minutes later. Ten minutes after the second dose, the patient complained of severe chest pain (10 out of 10), and rapidly became unresponsive. His rhythm deteriorated to PEA, and a bedside echocardiogram showed global akinesis of his left ventricle. Multiple resuscitative efforts were unsuccessful, and the family refused a post-mortem examination. *Case Discussion:* Beta-blockers enhance lethality in experimental animals given cocaine. Likewise, in human volunteers, beta-blockers enhance cocaine-induced coronary vasoconstriction. This case highlights the risk of beta-blockers in patients with cocaine toxicity. Although the exact mechanism of death is unknown, it is possible that unopposed alpha-adrenergic excess provoked severe coronary spasm as evidenced by a recurrence of chest pain and global left ventricular dysfunction. *Conclusion:* Given the lack of data demonstrating a benefit of beta-blockade and the experimental and theoretical risks, the use of beta-blockers should remain contraindicated in the setting of cocaine use.

### 24. Aripiprazole: A 24-Month Review of Acute Overdoses in Adults

Lackey GD,<sup>1,2,3</sup> Alsop JA,<sup>1,2,3</sup> Albertson TE.<sup>1,2</sup> <sup>1</sup>*California Poison Control System (CPCS), Sacramento, CA, USA;* <sup>2</sup>*University of California Davis Medical Center, Sacramento, CA, USA;* <sup>3</sup>*University of California San Francisco School of Pharmacy, San Francisco, CA, USA.*

*Background:* Aripiprazole is a newer quinolinone atypical antipsychotic. Published reports of clinical experience with acute overdose of aripiprazole are minimal. *Methods:* A 24-month retrospective study was completed on all cases of adult ingestion of aripiprazole reported to CPCS. The parameters used in the case analysis were aripiprazole as the single substance, age 18 years or older, sex, amount ingested, clinical symptoms, and patient outcome. *Result:* A total of 48 cases of aripiprazole ingestion without coingestants were identified. Of the 48 exposures, 50% were male, and 50% were female with a mean age of 34 years old (range 18 yo–65 yo, SD 13.4 years). 17 of the 48 exposures (35%) were due to accidental ingestions and 31 of the

48 exposures (65%) were due to suicidal ingestions. The mean amount ingested was 143 mg (range 5 mg to 540 mg, SD 192 mg). Of the 48 patients, 14 patients (29%) developed somnolence, 6 patients (13%) developed mild extrapyramidal symptoms all treated with diphenhydramine, 5 patients (10%) developed tachycardia (range 104–120 bpm), 5 patients (10%) developed mild nausea, 3 patients (6%) developed mild anxiety, and one patient (2%) developed hypotension (90/palp) and was treated only with IV fluids. 34 patients (71%) were treated in the ED. Activated charcoal was administered to 22 patients (65%). Of the cases that presented to the ED, none exhibited EKG changes and all were discharged without sequelae. Outcome: no effect in 25 patients (52%), minor effects in 19 patients (40%): somnolence, nausea, agitation, and tachycardia; 4 patients (8%) had moderate effects: dystonias and one case of hypotension. *Conclusion:* Aripiprazole toxicity manifested primarily as CNS depression, mild extrapyramidal symptoms, mild cardiovascular symptoms of tachycardia and hypotension, nausea, and agitation. Supportive care, diphenhydramine for EPS, and gastric decontamination with activated charcoal appear to be the mainstays of therapy for acute ingestions of aripiprazole in adults.

## 25. Pancreatitis and Diabetic Ketoacidosis Associated with Aripiprazole Therapy

Babu KM, Ganetsky M, Liang IE, Bird SB, Boyer EW. *University of Massachusetts Medical School, Worcester, MA, USA.*

*Introduction:* Atypical antipsychotics are associated with a lower incidence of extrapyramidal symptoms and tardive dyskinesia than typical antipsychotics. However, the use of atypical antipsychotic medications has been linked to impaired glucose tolerance testing, hyperglycemia, dyslipidemia and diabetic ketoacidosis. These complications have been described after use of clozapine, olanzapine, quetiapine, and risperidone. Little is known about the metabolic effects of aripiprazole, a newer atypical antipsychotic. *Case Report:* A 15-year-old girl presented to the emergency department with a change in mental status. Her past medical history was significant for bipolar disorder. She was maintained on oxcarbazepine, escitalopram, lithium and aripiprazole. The aripiprazole had been started four months prior to presentation. In the ED, the patient was obtunded and tachycardic. Her initial labwork revealed a serum glucose of 949 mg/dL, with a bicarbonate of less than 5 mEq/L. Her first ABG was significant for a pH of 6.82 and pCO<sub>2</sub> of 13 mmHg. The patient was treated with insulin and IV fluids, and the aripiprazole was held. Her lipase was 400 U/L on hospital day #3. The patient's ASA and APAP levels were negative. After twelve days in the hospital, her blood sugars had stabilized, and she was discharged home with insulin and without any antipsychotic medications. Two months after discharge, the patient was doing well, but still had an insulin requirement. She is no longer on any psychiatric medications. *Case Discussion:* Patients who present with diabetic ketoacidosis associated with atypical antipsychotic use tend to be female and be of younger age. Symptoms typically begin within six months of initiation of the atypical antipsychotic. This case demonstrates a possible association between aripiprazole use and new onset DKA. Further study of aripiprazole effects on glucose metabolism is warranted. *Conclusion:* We report a case of pancreatitis and diabetic ketoacidosis associated with aripiprazole therapy.

## 26. A Two-Year Review of Pediatric Aripiprazole Ingestions

Lackey GD,<sup>1,3</sup> Alsop JA,<sup>1,3</sup> Albertson TE.<sup>1,2</sup> <sup>1</sup>California Poison Control System (CPCS), Sacramento, CA, USA; <sup>2</sup>University of California Davis Medical Center, Sacramento, CA, USA; <sup>3</sup>University of California San Francisco School of Pharmacy, San Francisco, CA, USA.

*Background:* Aripiprazole is a newer quinolinone atypical antipsychotic. Published reports of clinical experience with acute overdose in children of aripiprazole are minimal. *Methods:* An 24-month retrospective study was completed on all cases of pediatric ingestion of aripiprazole reported to CPCS. The parameters used in the case analysis were aripiprazole as the single substance, age 17 years or younger, sex, amount ingested, clinical symptoms, and patient outcome. *Result:* A total of 52 cases of aripiprazole ingestion without coingestants were identified. Of the 52 exposures, 52% were male, and 48% were female with a mean age of 8.6 years old (range 18 months–17 yo, SD 6.05 yo). The mean amount ingested was 80 mg (range 5 mg to 900 mg, SD 192 mg). Of the 52 patients, 19 patients (37%) developed somnolence, 6 patients (11%) developed mild extrapyramidal symptoms treated with diphenhydramine, 6 patients (11%) developed tachycardia (range 120–186 bpm), 6 patients (11%) developed nausea, and 2 patients (4%) developed anxiety treated with lorazepam. Of the 52 patients, 33 patients (63%) were treated in the ED. Activated charcoal was administered to 14 patients (23%). None of the 33 patients (100%) in the ED exhibited

any EKG changes and were discharged without sequelae. Outcome: no effect in 20 patients (38%), minor effects in 25 patients (48%): somnolence, nausea, and tachycardia; 6 patients (11%) had moderate effects: mild extrapyramidal symptoms. *Conclusion:* In contrast to typical antipsychotics, aripiprazole toxicity manifested primarily as CNS depression, mild extrapyramidal symptoms, and mild tachycardia. Pediatric aripiprazole ingestions showed favorable outcomes with minimal supportive care, diphenhydramine for EPS, and gastric decontamination with activated charcoal. Continued evaluation of pediatric ingestions of aripiprazole is essential to determine more specific thresholds for toxicity.

## 27. Pediatric "Pesticide" Poisoning in a Pill: Predominant Nicotinic Cholinergic Effects After Exposure to a Therapeutic Carbamate

Lai MW,<sup>1,2</sup> Burns Ewald M.<sup>1,2</sup> <sup>1</sup>Harvard Medical Toxicology Fellowship, Boston, MA, USA; <sup>2</sup>Regional Center for Poison Control and Prevention Serving Massachusetts and Rhode Island, Boston, MA, USA.

*Introduction:* Rivastigmine is a centrally-acting carbamate acetylcholinesterase (AChE) inhibitor used for the treatment of Alzheimer's disease. AChE inhibitors are also being investigated for treatment of Tourette's syndrome, autistic spectrum and attention-deficit hyperactivity disorders in children. Absence of muscarinic symptoms has been reported in children who have been poisoned with carbamate insecticides, but not in cases of exposure to therapeutic carbamates. *Case Report:* An 11-month old healthy female (7.5 kg) presented to a pediatric hospital with onset of general weakness over 6 hours without concurrent diarrhea, wet diapers, or lacrimation. She was hypotonic, hyporeflexic, and had miosis and a weak cry. Electrolytes, BUN, creatinine, glucose, CBC, liver function tests, ECG, urinalysis, CT head and lumbar puncture studies were normal. There was no family history of myasthenia gravis or neuromuscular disorders. There was no history suggesting botulism. There were no plants in the home and no pesticide use; as it was winter in New England there was no exposure to insecticide. Further history revealed that the patient's mother had found the child 8 hours earlier chewing a broken-open capsule of the grandmother's rivastigmine (1.5–6 mg); powdered medication had spilled into the child's mouth. An RBC cholinesterase activity level was not obtained. An oxime was not given as they do not speed recovery from nicotinic effects (Lifshitz 1994). The patient improved with supportive care and was asymptomatic with a normal neurologic exam and strength by 48 hours following ingestion. *Conclusion:* We report a case of severe nicotinic effects following rivastigmine ingestion without demonstrative muscarinic effects. This case is consistent with previous literature showing that children manifest predominantly nicotinic signs following AChE inhibitor carbamate exposure. As this class of drugs achieves more widespread use across a broader age range, we suggest that carbamate exposure should be included in the differential of sudden onset of weakness in children.

## 28. Toxicity Associated with Pediatric Topiramate Ingestions

Lindsay S,<sup>1</sup> Mrvos R,<sup>1</sup> Krenzelok EP.<sup>1,2</sup> <sup>1</sup>Pittsburgh Poison Center, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA; <sup>2</sup>Schools of Pharmacy and Medicine, University of Pittsburgh, Pittsburgh, PA, USA.

*Background:* Topiramate is an FDA-approved second generation anti-epileptic medication that is prescribed commonly as adjunctive therapy in the treatment of generalized tonic-clonic seizures. There are limited toxicity data on the effects of topiramate in pediatric ingestions. *Methods:* A four year retrospective review (2000–2003) of the AAPCC TESS database was performed. Inclusion criteria consisted of: single substance human ingestion exposures in children less than or equal to 12 years of age. Data analysis included: age, gender, treatment, symptoms, management site and outcome. *Result:* 1115 exposures met the inclusion criteria. The mean age was 4.79 years, median 3 years, (range of 1–12 years). Males accounted for 49.0% of exposures, females 50.7% and unknown gender 0.3%. Treatment sites included: managed on site 772 pts (69.2%), managed in HCF 325 (29.2%), and 18 (1.6%) other or unknown treatment sites—133 (40.1%) were referred for health care evaluation by poison center staff. Of the cases managed in a HCF, 211 (64.9%) were treated and released, 52 (16.0%) admitted [17 (33%) managed in a critical care unit and 35 (67%) in a noncritical care unit]. Ten patients (3.1%) were admitted to a psychiatric unit, 28 (8.6%) were lost to follow-up and 24 (7.4%) refused admission. The 5 most commonly reported symptoms were: drowsiness 82 patients (7.3%), agitation 23 (2.0%), confusion 22 (2.0%), ataxia 18 (1.6%), and hallucinations 14 (1.2%). Of the 605 (54.2%) followed to definitive outcome, 448 (74%) had no effects, 115 (19%) minor effects, 36 (6%) had moderate effects and 6 (1%) had major effects. No fatalities were reported. *Conclusion:* Although there is the potential for severe

toxicity in pediatric topiramate exposures, the majority of pediatric exposures followed to a definitive outcome in this series, experienced either no effect or only minor effects.

## 29. Amlodipine Ingestions in Children Less Than Six Years Old

Marquardt KA, Alsop JA, Albertson TE. *California Poison Control System, Sacramento Division, Sacramento, CA, USA.*

**Background:** There is limited data on the toxicity of amlodipine ingestions in children. We decided to evaluate the pediatric ingestions of amlodipine in our poison control system. **Methods:** A retrospective review of all exposures to amlodipine in children 6 years of age or younger from Jan. 1, 2000 to Dec. 31, 2004 was conducted. These blinded cases were retrieved using Visual Dotlab search criteria. Human Subjects Review approval was obtained. **Result:** 256 cases were retrieved. 137 cases were eliminated because they were followed for less than 4 hours or contained coingestants that could alter blood pressure (BP), heart rate (HR), or mental status. This left 119 evaluable cases. The average age was 1.67 years. There were 51 males and 68 females. The dose ingested was available on only 79 cases. The average dose was 9.63 mg—ranging from a taste to 75 mg. The mg/kg amount was available on only 41 patients. The average dose was 0.88 mg/kg—ranging from 0.07 to 2.8. There was 1 case of bradycardia, occurring at 4 hours post ingestion. The HR dropped from 120 to 72 but resolved within 30 minutes without treatment. There was 1 case of hypotension with BP=56/34 and HR=142. Onset was 1.5 hours post ingestion and duration was 4 hours. Hypotension resolved with IV fluids only. One child had sedation, but was noted to be awake and oriented 30 minutes later. Vomiting occurred in 1 child. Treatments were charcoal in 97, observation only in 20, lavage in 3, other emetic in 4, whole bowel irrigation in 5, IV fluids in 10, calcium in 1, ipecac in 2. No pressors were needed. The patient receiving calcium had neither hypotension nor bradycardia. No effect was seen in 115 patients, minor effects in 3, and moderate effect in 1. The treatment site was the ED in 111 cases and home in 8 cases. **Conclusion:** This study showed that pediatric ingestions of amlodipine rarely cause serious toxicity when treated with charcoal and minimal supportive care. Since histories are often inaccurate, and most patients received GI decontamination, the amount of drug actually absorbed was unknown. We recommend continued further prospective evaluation of pediatric amlodipine ingestions to better determine triage guidelines.

## 30. Sildenafil in Children—Send Into the ED or Watch at Home?

Marquardt KA, Alsop JA, Albertson TE. *California Poison Control System—Sacramento Division, Sacramento, CA, USA.*

**Background:** Use of Viagra<sup>®</sup>, Cialis<sup>®</sup>, and Levitra<sup>®</sup> is becoming more prevalent and exposures in children are occurring. Our study was to determine if all exposures in children should be sent into the ED due to the potential for hypotension. **Methods:** A retrospective review of all exposures to sildenafil, tadalafil, or vardenafil in children six years of age or younger from Jan.1, 2000 to Dec 31, 2004 was conducted. These blinded cases were retrieved using Visual Dotlab criteria. Human Subjects Review approval was obtained. **Result:** 103 cases were retrieved—102 cases of sildenafil, and 1 case of tadalafil. We eliminated the tadalafil case and concentrated our study on sildenafil (Viagra<sup>®</sup>). Of the 102 cases, 54 were eliminated due to the presence of coingestants or lack of follow up, leaving 48 evaluable cases. The average age for exposure was 1.98 years. There were 22 males and 26 females. The dose was unknown in 5 cases—of the remaining 43 cases, the average dose was 59.4 mg. Weights were available on only 25 patients. Of those, the average dose was 3.3 mg/kg (SD=3.282). There were no incidences of hypotension. There were 2 cases of priapism—one lasting 5 min, the other lasting 4–5 hr without evidence of pain. There were 2 cases of flushing and one incidence of vomiting. The treatments used were “observation only” in 34 and “single dose activated charcoal (SDAC)” in 14. No patient received IV fluids or vasopressors. **Outcomes:** “No effect” was seen in 43 and “Minor effects” seen in 5 patients. In the 5 symptomatic patients, the duration of symptoms was less than 8 hours. A multivariate analysis was performed examining the association of adverse outcome with age <3 yo, male, dose <5 mg/kg, presence of priapism, and the use of SDAC. Not unexpectedly, only the presence of priapism was associated with an adverse outcome ( $t=6.06$ ,  $p \leq 0.0001$ ). Stata Release Eight, Stata Press Publication, Stata Corporation, College, Texas 2003. **Conclusion:** Ingestions of sildenafil in children less than 6 years old are usually mild, resulting in primarily no effect, with a few cases of flushing or priapism occurring. These cases do not need to be sent into the Emergency Department, but can be managed at home with careful home follow-up.

### 31. Strychnine Poisoning Following Ingestion of a Chinese Herbal Liniment

Moltz E, Marshall S, Andrenyak D, Crouch D, Moon M, Caravati EM, Crouch BI. *Utah Poison Control, University of Utah, Salt Lake City, UT, USA; Center for Human Toxicology, University of Utah, Salt Lake City, UT, USA; Pioneer Valley Hospital, West Valley City, UT, USA.*

*Introduction:* Strychnine is an alkaloid present in the *Strychnos nux-vomica* plant. It has been used historically as an oral tonic to improve gastric motility, topically as a rubefacient, and as a rodenticide. Strychnine antagonizes glycine, an inhibitory neurotransmitter, producing muscle contractions and tetany. We present a unique case of strychnine poisoning following ingestion of a compounded Chinese herbal liniment. *Case Report:* A 50 year-old man ingested up to 10 ounces of a rubefacient liniment made from alcohol and seeds purchased from an Asian herbal market. It was prepared and given to the patient in an unlabeled container by friends for dermal application. He ingested the liniment believing it was a tonic for oral ingestion. Within 30 minutes he developed severe pain and tetany of the upper and lower extremities. His initial vital signs were BP 190/118, HR 150, RR 30 and GCS 15. He received IV fluids, activated charcoal 50 g, and a total of 20 mg of diazepam IV in the ED. His symptoms improved over the next 2 hours. Initial creatine kinase was 243 U/L and about 12 hours later was 4098 U/L. Sixteen hours following presentation the patient was asymptomatic and required no further therapy. The liniment solution contained seeds suspected to be from the *Strychnos nux-vomica* plant. Gas chromatography/mass spectrometry analysis of the sample revealed a strychnine concentration of 1.05 mg/mL. By history, the total strychnine dose was approximately 300 mg. *Conclusion:* Chinese herbal remedies containing strychnine are available to the public. This patient suffered classic strychnine poisoning due to a therapeutic error with such a product.

### 32. Unknown Radiopaque Material Obscuring the Diagnosis of Appendicitis

Rhee JW,<sup>1,2</sup> Diaz A,<sup>2</sup> Paloucek FP,<sup>2</sup> Erickson TB.<sup>2,1</sup> <sup>1</sup>*Toxikon Consortium, Chicago, IL;* <sup>2</sup>*University of Illinois at Chicago, Chicago, IL.*

*Introduction:* Ingestions with high radiodensities, such as lead and iron, are consistently radiopaque on plain radiographs. This property is sometimes used clinically as a diagnostic adjunct for ingestions of known radiopaque material. The serendipitous finding of radiopaque material during radiologic studies warrants investigation to rule out toxic ingestions, but should not preclude the complete evaluation of a patient. *Case Report:* A previously healthy 3-year-old male presented to the hospital with a 2-day history of increasing abdominal pain with associated fever. His initial exam was significant for a fever of 100.6°F and abdominal tenderness. He subsequently had a plain radiograph and a noncontrast CT scan of the abdomen. Both of these imaging studies demonstrated multiple, small, dense, radiopacities throughout the gastrointestinal tract. Patient was subsequently transferred to a tertiary academic hospital for further evaluation of these radiopacities and abdominal pain. Blood lead level was 2 µg/dL and serum iron level was 9 µg/dL. Further questioning revealed that the father had administered chewable bismuth subsalicylate to the child 1 day prior to evaluation. The patient was ultimately diagnosed with appendicitis on a repeat CT scan. Diffuse peritonitis was evident during the surgery and patient was placed on intravenous antibiotics. He had a benign postoperative course. *Case Discussion:* The finding of radiopacities on the initial radiographs distracted attention away from the underlying diagnosis of appendicitis and delayed definitive treatment. Aggressive decontamination with whole bowel irrigation would have had clinically significant consequences had it been initiated. *Conclusion:* Radiopacities found on plain radiographs should not distract attention away from other potential diagnoses, and should not be treated empirically unless either confirmatory tests or history are obtained.

### 33. Beta Blocker Ingestion by Young Children: One Pill May Make You Mildly Ill

Sheth PP,<sup>1</sup> Morgan DL,<sup>2</sup> Vincent CB,<sup>1</sup> Zube R,<sup>3</sup> Borys DJ.<sup>1</sup> <sup>1</sup>*Central Texas Poison Center, Temple, TX;* <sup>2</sup>*Scott and White Memorial Hospital, Temple, TX;* <sup>3</sup>*Texas A&M University, College of Medicine, Temple, TX.*

*Background:* Current recommendations for gastric decontamination of children who have ingested beta adrenergic antagonists (BAA) are based on the daily therapeutic dose of each BAA. Our goal was to determine the rate of clinical effects caused by the

ingestion of one tablet or less of BAA by young children who did not receive gastric decontamination. *Methods:* Retrospective case series by searching the Texas TESS database for ingestions of the three most common BAAs from January 1, 2000 to December 31, 2004. The inclusion criteria were children under the age of 6 years, single substance, follow-up call with a known outcome, and an ingestion of less or equal to propranolol 160 mg, atenolol 100 mg, or metoprolol 200 mg. Mild clinical effects were defined as those that required no medical treatment, and severe effects were those requiring medical intervention. *Result:* There were 365 patients who met the inclusion criteria. The average age was 30.5 months. Metoprolol was ingested by 57%, propranolol by 23.3%, and atenolol by 19.7%. There were 151 patients who had no gastric decontamination. Of these, only 1 patient had a minor symptom (vomited once). The minor clinical effect rate was 0.66% (95%CI 0.12%–3.66%), and the severe clinical effect rate and mortality rate was 0% (95%CI 0%–2.48%). There were 214 patients who did receive gastric decontamination (96.3% activated charcoal and 11.2% gastric lavage). Of these, there were 8 mild effects and no severe effects. For all 365 patients, the mild clinical effect rate was 2.47% (95%CI 1.3%–4.62%), and the severe effect rate and mortality rate was 0% (95%CI 0–1.04%). Only 255 patients had recorded weights, and the amount of BAA ingested ranged from 0.26 mg/kg to 19.5 mg/kg. *Conclusion:* It is well known that young children who ingest more than one or two tablets of a beta-blocker may suffer severe symptoms and even death. However, this study provides evidence that children under the age of 6 years who ingest one tablet or less of the three most common BAAs may be managed at home without gastric decontamination with only a small risk of mild clinical effects.

#### 34. Status Epilepticus from Intrathecal Cefazolin: Quantitation of Therapeutic CSF Drainage

Bouchard NC,<sup>1</sup> Etienne M,<sup>2</sup> Marraffa JM,<sup>3</sup> Liberato B,<sup>2</sup> Edelstein E,<sup>2</sup> Stork CM,<sup>3</sup> Howland MA,<sup>1</sup> Nelson LS,<sup>1</sup> Hoffman RS.<sup>1</sup>  
<sup>1</sup>New York City Poison Control Center, NY, NY, USA; <sup>2</sup>Columbia University Medical Center, NY, NY, USA; <sup>3</sup>Central New York Poison Center, Syracuse, NY, USA.

*Introduction:* Rare reports of seizures and death follow inadvertent intrathecal (IT) cephalosporin administration. Therapeutic CSF drainage and CSF exchange are often advocated without supporting evidence. We report status epilepticus from IT cefazolin and quantitate the effects of CSF drainage. *Case Report:* A 56 year old man with chronic back pain was electively admitted for IT morphine. He was inadvertently administered cefazolin via his lumbar drain. The error was noted 13 h into the infusion (350 mg given) when he complained of severe low back and leg pain. Soon after, he developed generalized seizures and was treated with IV lorazepam, loaded with fosphenytoin and required additional IV diazepam to abort seizures. Status epilepticus recurred 7 hours later and he was intubated and started on phenobarbital and propofol. Passive CSF drainage was initiated via the lumbar drain and he was transferred to a tertiary care center. Propofol was stopped during transport because of hypotension, and on arrival rhythmic jerking of the right arm and leg, and nystagmus of his right eye were noted, which responded to IV midazolam. A midazolam infusion and CSF drainage (300 ml total) were continued for 48 h. Continuous video EEG revealed no further epileptic activity. When the midazolam was stopped, he regained full consciousness and his EEG no seizure activity. He was discharged on day 9 with only a mild impairment of attention and recall. On follow-up, he had several episodes of right arm shaking despite therapeutic phenytoin levels. Since it was unclear whether these represented partial seizures or myoclonic jerks, levetiracetam was added to treat both. These events have not recurred. Serial CSF cefazolin levels (mcg/mL) were: 1009 (15 mins), 970 (2 h), 165 (20 h), 71 (28 h), 22 (37 h). *Case Discussion:* Slow constant CSF drainage appears to produce 1st order elimination, with a CSF half-life of 8 h. *Conclusion:* CSF drainage or exchange may be a useful adjunct in cases of IT cephalosporin administration.

#### 35. Treatment of Inadvertent Intrathecal Administration of Iothalamate Meglumine Contrast: Case Report

Starr PE,<sup>1</sup> Galuardi CJ.<sup>2</sup> <sup>1</sup>Maryland Poison Center, Baltimore, MD, USA; <sup>2</sup>Maryland General Hospital, Baltimore, MD, USA.

*Introduction:* Iothalamate meglumine 30%, is an **ionic contrast media** (ICM) with high osmolarity used intravascularly in diagnostic radiographic procedures. Severe CNS, cardiac, renal symptoms, and death have been reported with the intrathecal administration of ICM.

This case illustrates some of the CNS effects of intrathecal ICM and suggests a treatment to minimize morbidity. *Case Report:* A 52 year old female with a history of neuropathic pain from treated Giant Cell tumors of the thoracic spine had an

intrathecal catheter inserted to infuse morphine. A myelogram verified correct placement and catheter patency. The patient had no new neurological deficits upon completion of the procedure. Within two hours, she developed paralysis and rigidity in both legs, mostly in the left. Investigation revealed Conray 30<sup>®</sup>, an ICM, was used instead of Isovue M300<sup>®</sup> (non-ionic). Dexamethasone 10 mg was given IV every 6 hours. Hydration was maintained with IV fluids. Twenty cc's of CSF was aspirated. Contrast was found in the first 10 cc's but not the second. She was kept head up and placed on continuous CSF drain at 5–10 cc's/hour. Benzodiazepines were ordered for seizures but not needed. The paralysis and rigidity abated after initial CSF drainage and resolved within 24 hours. *Case Discussion:* The use of different contrast medias in an area lends itself to possible inadvertent administration of the wrong product. The patient's symptoms are consistent with toxicity associated with introduction of iothalamate meglumine dye to the intrathecal space. Decontamination was done with aspiration of CSF at a rate no faster than 10 cc per hour since higher rates put the patient at risk for brain herniation. Steroids were administered to head off the development of any inflammatory processes. Partial elevation of the head and upper body decreased migration of the high osmol media towards the brain decreasing chance of seizures and edema. *Conclusion:* The best treatment is prevention. Strict adherence to reading and verifying drug labels by operating room personnel is vital. Treatment for intrathecal ICM administration is decontamination by CSF drainage, IV steroids, hydration, and head elevation.

### 36. Reversible Cardiomyopathy Complicating Intrathecal Baclofen Withdrawal

Pizon AF,<sup>1,2</sup> Curry SC,<sup>1,2</sup> LoVecchio F.<sup>1,2</sup> <sup>1</sup>Banner Good Samaritan Medical Center, Phoenix, AZ; <sup>2</sup>Maricopa Medical Center, Phoenix, AZ.

*Introduction:* Intrathecal baclofen (ITB) withdrawal includes seizures, autonomic instability, hyperthermia, rigidity, encephalopathy, multi-system organ failure, and death. ITB withdrawal complicated by acute cardiomyopathy (CM) requiring support with intraaortic balloon pump (IABP) is infrequently reported in the literature. *Case Report:* A 45 yo quadriplegic man received ITB for several years before it was weaned over 4 months. Within 12 hrs of complete cessation of ITB, he suffered pruritus, spasticity, fever, and fatigue. He presented 40 hrs after ITB discontinuation in a coma and respiratory failure. Initial HR=160 bpm, T=106.4 F, and SBP ranged from 75 to 160 mmHg. He had diaphoresis, mottled skin, and diffuse muscle rigidity. IV lorazepam and NG baclofen were given while arrangements were made to reinstitute ITB. About 60 hrs after stopping ITB, but before ITB was reinstated, he became consistently hypotensive; an ECG showed ST segment elevations in anterior-lateral leads, and troponin-I was elevated at 20.3 ng/ml. Emergency cardiac angiogram showed normal coronaries with an EF of 10% and cardiac index (CI) of 1.6. In addition to IV norepinephrine and dopamine, IABP was initiated. 72 hrs after ITB had been halted, 25 mcg of ITB was given over 4 hrs and an infusion of 22 mcg/24 hrs was continued. Rigidity and hyperthermia resolved, and he became alert. IABP was discontinued on day 3 and vasopressors were stopped on day 5. Over this same time, serial CI's and echocardiograms showed improvement. After 11 days of reinstating ITB, an echocardiogram demonstrated an EF of 50–55% and was normal. *Conclusion:* A case of reversible CM associated ITB withdrawal is described. As has been reported previously in the literature, PO baclofen does not successfully control ITB withdrawal. In our case, myocardial ischemia did not play a role in the development of CM. However, reinstatement of ITB promptly resulted in improvement. One could hypothesize that myocardial stunning from sympathetic hyperactivity and hyperthermia lead to CM as seen with catecholamine excess or acute sympathomimetic poisoning.

### 37. Low-Dose Aspirin Poisoning in a Child—How Accurate Are Existing Triage Guidelines?

Cantrell FL,<sup>1</sup> Nordt SP,<sup>2</sup> Farson-Collier M.<sup>1</sup> <sup>1</sup>California Poison Control System-San Diego Division, San Diego, CA, USA; <sup>2</sup>Univ. of Calif. San Diego Medical Center, San Diego, CA, USA.

*Introduction:* Published toxicity ranges for acute salicylate (SAL) ingestions resulting in mild-moderate poisonings are broad (150–300 mg/kg). We utilize a 250 mg/kg threshold for emergency department (ED) referral. SAL poisonings from low-dose aspirin have become extremely rare over the last 2–3 decades. We present a case of metabolic acidosis and elevated SAL level following ingestion of chewable aspirin. *Case Report:* A 2 year-old, previously healthy 12 kg female was found with an empty bottle of 81 mg chewable aspirin tablets. The bottle contained 36 tablets the day before and only 4 tablets had been used. Pill residue was found in mouth, no pills were found in the immediate area and a 5 year-old sibling witnessed the ingestion. The

maximum amount ingested based on weight was 216 mg/kg. The parents brought the child to the ED. Upon evaluation, 1.5 hours after ingestion, physical exam was unremarkable and vital signs were normal. A dose of activated charcoal was given after which the child vomited 2–3 times. Serum chemistries and SAL level drawn upon arrival were remarkable for SAL level 30 mg/dl, serum bicarbonate (SB) 21 mEq/L. Intravenous (IV) fluids of D5 1/2 normal saline with 20 mEq/L KCl at 1.5 times maintenance rate were started and the patient was admitted. A presumed peak SAL level of 52 mg/dl was drawn 5 hours after the ingestion occurred. Blood chemistries drawn 7 hours after ingestion showed a SB of 15 mEq/L, a BUN and serum creatinine of 11 mg/dL and 0.5 mg/dL, respectively. Physical exam revealed tachypnea with a respiratory rate of 32 bpm and otherwise normal vital signs. IV hydration was continued over the next 24 hours, the SAL level continued to decrease, BUN and Cr decreased to 8 and 0.4, respectively, and SB returned to within normal range. *Conclusion:* We present a case of elevated SAL, tachypnea, metabolic acidosis following an acute ingestion of low-dose aspirin. This case suggests that low-dose aspirin ingestions are still a viable source of concern in the pediatric population and that currently accepted send-in amounts should be reassessed and better defined.

### 38. Acute Oxatomide Poisoning: A Case Report

Faraoni L,<sup>1</sup> Vedovati S,<sup>2</sup> Bacis G,<sup>1</sup> Farina ML.<sup>1</sup> <sup>1</sup>Bergamo Poison Control Center, Ospedali Riuniti, Bergamo, Italy; <sup>2</sup>Anaesthesia and Reanimation III Service, Ospedali Riuniti, Bergamo, Italy.

*Introduction:* Oxatomide is an H1-receptor antagonist antihistamine used for treating allergy. The peak plasma concentration is at 2–4 hours, the therapeutic concentration is 40 ng/ml and the half-life is 14–30 hours. Agitation, drowsiness (more common in paediatric poisoning), hallucinations, mydriasis, facial flushing, dry mouth, tachycardia and hypotension are the typical symptoms caused by oxatomide poisoning. The cardiac toxicity (QT prolongation leading to ventricular arrhythmia) has never been reported in the literature. *Case Report:* A moroccan 22-month-old 14-Kg child ingested oxatomide 2,5% drop solution (750 mg total dose) at home playing with his 5-year-old brother. After ninety minutes he had loss of consciousness with vomiting so the emergency medical service and the Poison Center were alerted. At hospital admission the child was partially responsive to painful stimuli (GCS 7) with myosis and tremors. Blood pressure was 80/45, heart rate was 103 beats/min. The EKG showed a prolonged QTc interval of 520 msec. The patient was transferred to the intensive care unit where multiple-dose activated charcoal (8 g over 6 hours) was administered by a nasogastric tube. Ten hours after the ingestion, the child was drowsy and showed an episode of agitation. After 24 hours the child was completely awake with only slight mydriasis and the QTc interval returned normal (430 msec). The plasma concentrations at 7, 11, 15, 19, 35 and 45 hours were: 2000 ng/ml, 1450 ng/ml, 650 ng/ml, 460 ng/ml, 167 ng/ml and 100 ng/ml respectively. The oxatomide half-life was 5.3 hours during activated charcoal administration, while without it was prolonged to 11.7 hours. *Conclusion:* Oxatomide poisoning with moderate or severe CNS depression and high plasma level can be complicated with QT prolongation. Kinetic data suggest that multiple-dose activated charcoal increases oxatomide elimination with high efficacy.

### 39. Clinical Outcome of Unintentional Amphetamine Exposures

Ling JM,<sup>1</sup> Lopez GP,<sup>1</sup> Cragin LS,<sup>1</sup> Geller RJ.<sup>1,2</sup> <sup>1</sup>Georgia Poison Center, Grady Health System, Atlanta, GA; <sup>2</sup>Emory University School of Medicine, Atlanta, GA, USA.

*Background:* Stimulants have been used safely for the treatment of attention deficit hyperactivity disorder (ADHD) for many years, yet information is scarce about the toxicity of these agents after an unintentional exposure. This study aims to characterize the clinical effects and outcomes following unintentional exposures to products containing amphetamine salt combinations. *Methods:* All unintentional, single-substance, oral exposures to amphetamine salt combination products reported to the AAPCC TESS database from 2000–2003 were reviewed. A subset analysis of cases from our center was also performed to define the dose-effect relationship. *Result:* TESS identified a total of 12,982 cases (60% male); 52% were <6 years, 28% were 6–12 years, 9% 13–19 years, and 11% >19 years. An exposure scenario was documented in 5,240 cases; 2,048 cases involved a double dose and an additional 2,628 some other therapeutic error. Of the 3,307 cases that documented duration of clinical effect,

findings resolved within 24 hours in 89% of these cases. The most common effects charted as related were agitation, tachycardia, drowsiness, vomiting, hypertension, and hallucination. Of the 7,287 cases followed to a known outcome, 3,980 (54.6%) had no effect, 2,337 (32.1%)—minor effect, 943 (12.9%)—moderate effect, 27 (0.4%)—major effect, and 0 deaths. Within our center's data, 75 cases with a reported dose were identified. Major clinical effects and doses are listed in the table below. Triage to an ED for dose >1.2 mg/kg would refer 55% of all patients. All those with hallucinations or hypertension would be referred, but 52% of patients referred would not have these findings (sensitivity 1.0, specificity 0.48). *Conclusion:* Most calls to poison centers for accidental ingestions of mixed amphetamine salt combination products involve therapeutic errors and commonly result in minimal effects. A triage strategy is proposed but needs confirmation with a larger data sample.

Reported Dose—Symptom Relationship

Clinical effect	n	Dose range (mg/kg)	Median dose (mg/kg)
None	27	0.41–7.00	1.60
Tachycardia	8	1.10–1.91	1.58
Hypertension	2	1.27–1.69	1.48
Hallucinations	2	1.22–1.69	1.46

#### 40. 24-Month Retrospective Study of Adult Atomoxetine Ingestions

Lackey GD,<sup>1,3</sup> Alsop JA,<sup>1,3</sup> Albertson TE.<sup>1,2</sup> <sup>1</sup>California Poison Control System, Sacramento, CA, USA; <sup>2</sup>University of California Davis Medical Center, Sacramento, CA, USA; <sup>3</sup>University of California San Francisco School of Pharmacy, San Francisco, CA, USA.

*Background:* Atomoxetine is a new class of selective norepinephrine reuptake inhibitors called methylphenoxy-benzene propanamine derivatives. Published reports of clinical experience with acute overdose in adults of atomoxetine are minimal. *Methods:* A 24-month retrospective study was completed on cases of adults (18 years and older) having ingestions of atomoxetine reported to CPCS. The parameters used in the case analysis were atomoxetine as the single substance, age 18 years or older, sex, reason for exposure, amount ingested, clinical symptoms, and patient outcome. *Result:* A total of 30 cases of atomoxetine ingestion without coingestants were identified. Of the 30 exposures, 40% were male, and 60% were female with a mean age of 34 years old (range 18–65 yo, SD 12.3 yo). 21 of the 30 exposures (70%) were due to accidental ingestions and 9 of the 30 exposures (30%) were due to suicidal ingestions. The mean amount ingested was 183.5 mg (range 10–1200 mg, SD 300.3 mg). Of the 30 patients, 5 patients (17%) developed tachycardia (range 110–135 bpm), 3 patients (10%) developed nausea, 2 patients (7%) developed vertigo, 2 patients (7%) developed agitation treated with lorazepam, and 1 patient (3%) developed diaphoresis. Of the 30 patients, 13 patients (43%) were treated in the ED. Activated charcoal was administered to 4 (31%) of the 13 patients. All 13 patients (100%) in the ED were discharged without sequelae. *Outcome:* no effect in 21 patients (70%), minor effects in 9 patients (30%): tachycardia, nausea, vertigo, agitation and, diaphoresis. *Conclusion:* A-Atomoxetine toxicity manifested primarily as tachycardia, nausea, vertigo, and agitation. Supportive care and gastric decontamination with activated charcoal appear to be the mainstays of therapy for acute ingestions of atomoxetine. Continued evaluation of ingestions of atomoxetine is essential to determine more specific thresholds for toxicity.

#### 41. Can Dorzolamide Eye Drops Cause Profound Metabolic Acidosis?

Pemberton LB, Miller MA, Fortson SJ, Coon TP. *Darnall Army Community Hospital, Ft. Hood, TX, USA.*

*Introduction:* Dorzolamide is a topical carbonic-anhydrase inhibitor used in the treatment of glaucoma. Given ophthalmically it has been shown to produce less systemic acidosis and to be better tolerated than oral acetazolamide. We present a case of severe, anion-gap acidosis in a patient with renal failure and excessive use of his dorzolamide. *Case Report:* A 72 yo male presented to the emergency department (ED) with trouble breathing, vomiting, and diarrhea for 3 days. His PMH was notable for hypertension and gout, for which he was taking lisinopril and Indocin. He also noted more frequent use of dorzolamide to

treat his “dry eyes.” His vital signs were 175/55, P: 115, T: 99.4, RR: 36, and Pulse-Ox of 96%. Exam showed tachypnea with deep respirations and clear lungs. In the ED he became obtunded and was intubated. CXR was normal. ECG showed sinus-tachycardia at 110 bpm. A pre-intubation ABG demonstrated a pH of 7.01, paO<sub>2</sub> of 145, pCO<sub>2</sub> of 14.9, and bicarbonate of 3.8. Serum electrolytes demonstrated hyperkalemia of 8.5 mEq/L, and hyperchloremic metabolic acidosis with a bicarbonate of 5 mEq/L, a BUN=121 mg/dl and a creatinine of 11.9 mg/dl. Salicylate and toxic alcohols levels were negative. The patient was treated for presumed sepsis and transferred for emergent hemodialysis. Following hemodialysis the patient had an uneventful course. Blood and urine cultures, and a renal ultrasound failed to reveal a cause for his acidosis. Lisinopril and Indocin use with concurrent dehydration were considered most likely. *Case Discussion:* This is a case of metabolic acidosis of unclear cause. While dorzolamide typically does not produce high serum levels, excessive use is likely to cause acidosis. It has been theorized that carbonic-anhydrase inhibitors produce lactic acidosis with an increased lactate-to-pyruvate ratio in addition to a type-4 renal tubular acidosis. This hypothesis has been confirmed by animal models. Unfortunately, dorzolamide levels were unavailable in the U.S. or Canada. We propose that excessive dorzolamide use can produce a significant acidosis that may contribute to the morbidity of a patient with intercurrent illness. Vigilance for other such cases is warranted in light of this agent’s increasing use in the U.S.

#### **42. Massive Unintentional Digoxin Ingestion Successfully Managed Without the Use of Activated Charcoal or Digoxin-Specific Antibody Fragments**

Offhaus JM, Judge BS. *DeVos Children’s Hospital Regional Poison Center, Grand Rapids, MI, USA.*

*Introduction:* Several authors recommend the use of digoxin-specific antibody fragments after acute ingestion of more than 10 mg of digoxin in an adult. We report the successful management of a 78 year-old female who accidentally ingested 11 mg of digoxin and did not receive activated charcoal or digoxin-specific Fab. *Case Report:* A 78 year-old female with dementia presented to the ED with persistent nausea and vomiting. A family member had found an empty bottle in the trash that had been filled two days prior with ninety 0.125 mg tablets of digoxin. The family member estimated that the patient took 88 tablets approximately 6–8 hours prior to presentation. Her initial vitals signs were: T—35.2°C, P—53/min, BP—110/60 mm Hg, RR—20/min and O<sub>2</sub> saturation on room air—100%. Physical exam was unremarkable. Her initial laboratory studies included K<sup>+</sup> 4.8 mmol/L, creatinine 1.1 mg/dL and a serum digoxin level 20.7 ng/mL. Repeat serum digoxin level 2 hours later was 14.3 ng/mL. ECG demonstrated sinus bradycardia with “digitalis effect”, QRS—64 msec and QTc—410 msec. The patient did not receive activated charcoal and was admitted to a monitored bed with digoxin-specific Fab made available at her bedside. The patient’s serum potassium and blood pressure remained within normal limits during her hospitalization. Nadir for her pulse was 41/min without symptoms or requiring use of atropine. On the day of discharge (43 hours after presentation) her serum digoxin level had declined to 3.4 ng/mL. *Conclusion:* Despite an acute massive ingestion of digoxin, our patient was successfully managed without the use of activated charcoal or digoxin-specific Fab and was discharged less than 48 hours after admission.

#### **43. Medication Errors in Children Under 12 Months of Age**

Powers M, Stremski E, Dellinger J, Anderson D, Casavant M, Jacobitz K, Kalin L, Spiller H, Thompson M, Mazor S. *WI Poison Center, Milwaukee, WI, USA; WI Poison Center, Milwaukee, WI, USA; WI Poison Center, Milwaukee, WI, USA; Minnesota Poison Center, Minneapolis, MN, USA; Central Ohio Poison Center, Columbus, OH, USA; The Poison Center, Omaha, NE, USA; Iowa Statewide Poison Center, Sioux City, IA, USA; Kentucky Regional Poison Center, Louisville, KY, USA; Cardinal Glennon Regional Poison Center, St. Louis, MO; Illinois Poison Center, Chicago, IL.*

*Background:* Determine a scenario that most frequently lead to development of any significant clinical effect in infants due to a poison exposure. *Methods:* 6 month review of demographics from exposure cases of 7 US Poison Centers where age <1 Y. Significant Adverse Effect (SE+) was defined as a case having any related clinical effect classified as Moderate or Major by TESS. Med Error (ME) reviews included 1) who gave the med, and 2) for who was the med intended. *Result:* 11,645

total cases, 51.5% Male. Most cases occurred in infants >6 mo. 166 cases (1.4%) were SE+, most likely to involve an infant <6 mo. 83 Med Errors (ME) were the most common cause of all SE+cases (50%). Infants <6 mo more often had a SE+due to a ME.

Age group:	< 6 months	6–11 months	OR (95% C.I.)
Total cases	1,560 (13%)	10,085 (87%)	
SE+ (all cases)	62 (4%)	104 (1%)	3.97 (2.8–5.4)
SE+ as ME	44 (3%)	39 (0.4%)	7.48 (4.7–11.1)
SE+ as H-ME	27 (2%)	22 (0.2%)	8.06 (4.6–14.1)

The most frequent scenario for a SE+case was a ME in the home, when an infant received their own med given by a parent (H-ME)=49 cases. H-ME cases were more common in infants <6 mo. In the H-ME cases: 31 were dosing errors (4 as 10-fold dose), 11 were dose interval errors, 3 had a wrong medication given. Six non-hospital SE+cases were found, (2) pharmacy dispensed wrong medication and (4) med labeled with wrong dose. *Conclusion:* MEs made at home by parents in children <6 months were the most likely cause of SE+cases in infant s. Educating parents on safe med administration is imperative in preventing significant effect due to infant poison exposure.

#### 44. Misleading Product Packaging Contributing to Salicylate Toxicity in an Infant

Lewis TV,<sup>2</sup> Schaeffer SE,<sup>1</sup> Hagemann TM,<sup>2</sup> Badillo RB,<sup>1</sup> McGoodwin PL.<sup>1</sup> <sup>1</sup>Oklahoma Poison Control Center, Oklahoma City, OK, USA; <sup>2</sup>The Children's Hospital at OU Medical Center, Oklahoma City, OK, USA.

*Introduction:* In this case of pediatric salicylate toxicity, the combination of a poorly informed consumer and potentially misleading product packaging resulted in the development of a serious adverse drug event. The product selected by the parents for administration to their infant featured a picture of a smiling baby on the front. The parents erroneously assumed the product would be safe for their three month old child with a history of colic. This antidiarrheal product contained bismuth subsalicylate 1050 mg/10 mL. *Case Report:* A 3-month old male with colic developed salicylate toxicity due to the chronic administration of bismuth subsalicylate. For three weeks the child's parents administered the medication, which supplied an aspirin equivalent dose of 57–84 mg/kg/day, without incident. One morning the child was noted to be inconsolable and was taken to a local ED. Evaluation noted CNS depression and respiratory distress. Lab assessment revealed metabolic acidosis with respiratory compensation and a serum salicylate level of 747 mg/L. Abdominal x-ray revealed a possible concretion in the lower colon. Also noted were increased PT and INR. After stabilization the child was transferred to our facility. The infant presented with rapid, shallow respirations (RR 60). He remained alert and active. Hemodialysis was considered, but not initiated due to lack of severe, life-threatening symptoms. The patient responded well to a more conservative treatment plan consisting of whole bowel irrigation, rehydration, electrolyte replacement, and alkalinization therapy. Coagulopathies were corrected with cryoprecipitate, leukofiltered red blood cells, fresh frozen plasma and phytonadione. The child required four days of management in the PICU and two days of observation in a general nursing unit before being discharged home. *Conclusion:* Misleading product packaging may instill a false sense of security related to OTC medicines. The picture of a smiling baby on the package led the parents to believe this product was safe their infant.

#### 45. 65 Cases of Severe Injury or Death in Children Resulting from Unintentional Therapeutic Error in a Health Care Facility

Tzimenatos L, Bond GR. Cincinnati Children's Hospital Medical Center, Cincinnati, OH.

*Background:* Decreasing iatrogenic injury is a key public health goal. Little is known about medical errors in children and pharmaceutical errors in particular. *Methods:* The AAPCC TESS database was queried for 2000 to 2004 using the following

criteria: 1) age is less than 6 years 2) exposure reason is unintentional therapeutic error 3) outcome is major effect or death 4) exposure site is health care facility. This database provides limited case data, including age, exposure site, route of exposure, chronicity, symptoms, therapies, and limited scenario codes for reason for exposure. *Result:* 65 cases were identified, including 5 deaths. All but one involved a pharmaceutical agent. Based on the scenario codes, wrong dose errors (n=36), including 10X errors (n=17, 3 of 5 deaths), were most common, but the origin of the error (incorrect order, compounding, dispensing/administration) could not be determined. Wrong patient, wrong route, and wrong medication (wrong order or unintended substitution) were difficult to detect. At least one wrong route case was present (IV infant formula). Among the most frequently reported types of medications were sedative hypnotics (n=13), local anesthetics (n=8), anticonvulsants (n=7) and narcotics (n=5). Fosphenytoin errors accounted for 4 of the dose related errors. Only 3 errors related to CV drugs (digoxin, flecainide, propafenone). 6 cases of unintentional administration of methylergonovine to infants were reported, all on the first day of life. Parenteral administration in at least 5 of these patients suggests misadministration of medication meant for the mother. *Conclusion:* The number of cases of hospital-based therapeutic error reported to the AAPCC resulting in major outcome or death is relatively small, but may reveal patterns not released from an individual institution. Based on the importance of this public health issue, it may be prudent to add specific data fields to selected reason codes with severe outcome and to require a double check of the data entry (as with deaths). These data suggest the need for additional safeguards around Methergine, procedural anesthesia/sedation and treatment of seizures.

#### 46. 3° AV Block from Diltiazem XR Ingestion in a Nine Month Old

Wills BK,<sup>1,2</sup> Liu J,<sup>4</sup> Montana R,<sup>3</sup> Wahl M.<sup>5</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL; <sup>2</sup>University of Illinois, Chicago, IL; <sup>3</sup>Cook County Hospital, Chicago, IL; <sup>4</sup>Northwestern University, Chicago, IL; <sup>5</sup>Illinois Poison Center, Chicago, IL.

*Introduction:* Dysrhythmias and atrioventricular (AV) block have been associated with calcium channel blocker (CCB) ingestions in adults however; documented reports of AV block in pediatric patients are rare. *Case Report:* A nine month old female was found playing with tablets of extended-release diltiazem 120 mg. A white substance was noted around the mouth. The patient had two episodes of emesis which contained pill fragments, and was brought to the emergency department (ED) 4.5 hours after being found. The patient had no prior medical history and was on no medications. On physical exam, the child weighed 9.8 kilograms. Vital signs included a rectal temperature of 37.1, pulse of 87, respiratory rate of 30–40, blood pressure of 72/48, and SpO<sub>2</sub> of 99% on room air. The patient was well-appearing with normal skin color and had a normal physical examination. A nasogastric tube was placed and five grams of activated charcoal was administered. The ECG revealed 3° atrioventricular block with a ventricular rate of 90, QRS of 68 msec, and QTc of 411 msec. A dose of atropine 0.1 mg IV was given. The patient's heart rate subsequently increased to 100–110. Calcium gluconate, 500 mg was also given intravenously. Laboratory evaluation was remarkable for a bicarbonate of 17 mEq/L, anion gap of 16, and glucose of 129 mg/dl. On hospital day 1, the patient was noted to have a junctional rhythm with a heart rate of 90 to 100, and systolic blood pressure of 80–90. No additional medications were given. Early on hospital day 2 the patient converted spontaneously to a normal sinus rhythm and was discharged approximately 42 hours after presentation to the ED. *Conclusion:* In addition to bradycardia and hypotension, this nine month old patient manifested 3° AV block after ingesting extended-release diltiazem.

#### 47. Two Cases of Lead Poisoning from Ayurvedic Medicine: The Tip of the Iceberg?

Dargan PI, Greene SL, House IM, Jones AL. *National Poisons Information Service, London, United Kingdom.*

*Introduction:* We report two cases of significant lead poisoning related to the use of Ayurvedic medicines. *Case Report:* The first case was a 60 year old man who presented with an encephalopathy requiring a 6 week ICU admission. For ten years he had been taking ayurvedic medicine bought in India for his diabetes; analysis of the tablets showed a lead content of 68 µg/g (6.8%). His initial blood lead concentration was 331 µg/dL. He received three 5 day courses of intravenous calcium disodium edetate, a 14 day course of intramuscular dimercaprol and three 19 day courses of oral 2,3-dimercaptopropanesulphonate (DMSA). He required a further 6 weeks of rehabilitation for an extensor motor neuropathy. Nine months post-discharge he is independently mobile, his neuropathy has resolved and his blood lead concentration is 27 µg/dL. The second case was a 33 year old female who took 5 weeks of Ayurvedic medicine for arthritis which she bought in the UK; analysis of the tablets showed a lead content

of 50 µg/g (5.0%). She presented with abdominal pain and anaemia (haemoglobin 8.0 g/dL) and her blood lead concentration was 75 µg/dL. She was treated successfully with a 19 day course of oral DMSA. 5 months later she developed further abdominal pain, her blood lead concentration rose to 47 µg/dL and she received a further 19 day course of oral DMSA. 13 months later she is asymptomatic with a blood lead concentration of 14 µg/dL. *Case Discussion:* There have been previous reports of heavy metal poisoning from Ayurvedic medicines, but all of these related to products bought in the Indian subcontinent. We report two patients with significant lead poisoning from Ayurvedic medicines, one of whom bought the products in the UK. The use of these traditional medicines is increasing in both Europe and North America and so many people could be at risk of significant heavy metal poisoning. There is currently no regulation or specific safeguards on the quality or safety of traditional medicines. *Conclusion:* There is a need for further studies to quantify the potential risk of heavy metal poisoning related to Ayurvedic medicines and for culturally appropriate education to inform people of the potential for toxicity associated with these products.

#### 48. Comparison of Iron Poisoning Patterns in 602 Preschool Children: A Population-Based Study from Illinois and Israel

Finkelstein Y,<sup>1,2</sup> Wahl MS,<sup>3</sup> Bentur Y,<sup>4</sup> Erickson TB,<sup>1</sup> Schechter T,<sup>2</sup> Chodick G,<sup>2</sup> Aks SE.<sup>1</sup> <sup>1</sup>The Toxikon Consortium, Chicago, IL, USA; <sup>2</sup>Schneider Children's Hospital, Tel Aviv Univ., Tel Aviv, Israel; <sup>3</sup>Illinois Poison Control Center, Chicago, IL, USA; <sup>4</sup>Israel Poison Information Center, Haifa, Israel.

*Background:* Iron poisoning is still a leading cause of death in children worldwide. Its supplementation in developed countries to prevent anemia makes iron readily accessible, and its candy-like appearance makes it appealing to young children. Different iron preparations and supplementation guidelines exist between the 2 countries. *Methods:* We conducted a population based study of all cases of acute iron poisoning in children <7 years reported to the Illinois Poison Control Center, and to the Israeli Poison Information Center, between Jan. 1, 2001 to Dec. 31, 2001. Data collected included gender, age, type of preparation, type of iron salt, dose, development of symptoms and severity, treatment and management site and outcome. *Result:* A total of 602 iron poisoning cases were investigated; 459 from Illinois and 143 from Israel. The mean age for Illinois children was significantly higher than Israeli children ( $3.1 \pm 1.2$  vs.  $2.3 \pm 1.4$  years, respectively,  $p < 0.001$ ). Male: female ratio was 2.3:1 in Illinois vs. 1:1 in Israel ( $p < 0.001$ ). Different types of iron preparations were responsible for poisoning in Illinois vs. Israel: Tablets (95% vs. 43%), drops (4% vs. 54%) and syrup (1% vs. 4%), respectively,  $p < 0.001$ . Multivitamin preparations comprised 94% of cases in Illinois, but only 22% in Israel ( $p < 0.001$ ). The leading iron salt ingested in Illinois was ferrous sulphate (75%), while in Israel it was iron hydroxide polymaltose (63%). The iron doses ingested were significantly higher in Israel ( $p < 0.001$ ). In Illinois, 4% of children were referred to hospital, compared to 34% in Israel. No deaths were reported in any group. *Conclusion:* Iron poisoning patterns in young children differ significantly between countries in response to different health guidelines.

#### 49. 24-Month Retrospective Review of Atomoxetine Ingestions in Children Less Than 6 Years Old

Lackey GD,<sup>1,3</sup> Alsop JA,<sup>1,3</sup> Albertson TE.<sup>1,2</sup> <sup>1</sup>California Poison Control System (CPCS), Sacramento, CA, USA; <sup>2</sup>University of California, Davis Medical Center, Sacramento, CA, USA; <sup>3</sup>University of California San Francisco School of Pharmacy, San Francisco, CA, USA.

*Background:* Atomoxetine is a new class of selective norepinephrine reuptake inhibitors called methylphenoxy-benzene propanamine derivatives. Published reports of clinical experience with acute overdose in children of atomoxetine are minimal. *Methods:* A 24-month retrospective study was completed on cases of children less than 6 years old having ingestions of atomoxetine reported to CPCS. The parameters used in the case analysis were atomoxetine as the single substance, ingestions >1.4 mg/kg (manufacturer's maximum recommended daily dose), age 6 years or younger, sex, amount ingested, clinical symptoms, and patient outcome. *Result:* A total of 43 cases of atomoxetine ingestion without coingestants were identified. Of the 43 exposures, 58% were male, and 43% were female with a mean age of 2.3 years old (range 9 months–6 yo). The mean amount ingested was 2.73 mg/kg (range 1.42 mg/kg to 4.42 mg/kg, SD 0.9 mg/kg). Of the 43 patients, 4 patients (9%) developed somnolence and 2 patients (5%) developed agitation. None of the patients developed headache, seizures, cardiovascular, or

gastrointestinal symptoms. Of the 43 patients, 20 patients (47%) were treated in the ED. Activated charcoal was administered to 12 (60%) of the 20 patients. All 20 patients (100%) in the ED were discharged without sequelae. Outcome: no effect in 37 patients (86%), minor effects (somnolence and agitation) in 6 patients (14%). *Conclusion:* Atomoxetine toxicity at doses greater than the manufacturer's maximum daily dosing guidelines of 1.4 mg/kg manifested primarily as CNS depression and agitation in children less than 6 years old. Pediatric atomoxetine ingestions up to 4.4 mg/kg showed favorable outcomes with supportive care and gastric decontamination with activated charcoal in the ED. Continued evaluation of pediatric ingestions of atomoxetine is essential to determine more specific thresholds for toxicity.

## 50. Methadone Causing Prolonged QTc Interval and Syncope After Paroxetine Initiation

Marraffa JM,<sup>1</sup> Darko W,<sup>3</sup> Stork CM,<sup>1</sup> Villarreal D.<sup>2</sup> <sup>1</sup>SUNY Upstate Medical University, Central New York Poison Center, Syracuse, NY, USA; <sup>2</sup>SUNY Upstate Medical University, Syracuse, NY, USA; <sup>3</sup>SUNY Upstate Medical University, Syracuse, NY, USA.

*Introduction:* Many pharmacologic agents have the ability to prolong the corrected QT interval (QTc) and increase subsequent risk for torsades de pointes (TdP). Inhibition of the rapid delayed rectifier potassium channels (I<sub>Kr</sub>) is most likely to result in this finding. Methadone is recently found to cause prolongation of the QTc and TdP. We describe a case of a pharmacokinetic drug interaction of the inhibition of the substrate, methadone, by a CYP 3A inhibitor, paroxetine resulting in syncope and long QTc interval. *Case Report:* A 34 year old male presented to the ED after three syncopal episodes in the previous 2 days. He had multiple syncopal episodes and dizziness starting 4 weeks prior to presentation. The patient was maintained for 2 years prior on 129 mg daily of methadone for previous heroin abuse. Paroxetine 12.5 mg daily was initiated approximately 6 weeks prior to presentation. He was taking no other medications. Electrocardiogram (ECG) revealed a QTc interval of 502 ms. Cardiac enzymes were negative. Echocardiogram was normal. Methadone and paroxetine were discontinued upon admission with complete resolution and normalization of the QTc interval after 16 hours. Methadone 80 mg daily was re-initiated on hospital day 3 without problem. The patient was discharged to home on hospital day 4 without complaints and a normal ECG. *Case Discussion:* Often described in the literature as a dose-dependent effect of prolonging the QTc interval, the importance of drug–drug interactions resulting in inhibition of CYP 3A and increases in methadone concentrations should be underscored. We describe such an interaction with resultant prolongation of the QTc interval and resolution upon drug discontinuation. *Conclusion:* Methadone is associated with increases in QTc interval and in patients with concurrent medications known to pharmacokinetically interact with methadone, this risk is increased.

## 51. Accidental Oral Ingestion of Spiriva® HandiHaler Capsules: A Case Series

Robinson RF,<sup>1,2,3</sup> Griffith JRK,<sup>3</sup> Baker SD,<sup>3</sup> Casavant MJ.<sup>3</sup> <sup>1</sup>Colleges of Pharmacy and Medicine, The Ohio State University, Columbus, OH, USA; <sup>2</sup>Columbus Children's Research Institute, Columbus, OH, USA; <sup>3</sup>Central Ohio Poison Center, Columbus, OH, USA.

*Background:* The Spiriva® HandiHaler is an inhalation device that uses a tiotropium bromide powder filled capsule, an antimuscarinic agent with anticholinergic properties, for the treatment of bronchospasm associated with chronic obstructive pulmonary disease (COPD). Since release on the market there have been many dosage route errors reported to the Central Ohio Poison Control Center due to its capsule shape. Because tiotropium bromide is a quaternary ammonium compound, little GI absorption would be expected; however, little is known about its effects, toxic thresholds, and the outcome of oral ingestion of the inhalation capsule. *Methods:* A retrospective chart review was performed to assess the clinical effect, toxic threshold and outcome of all cases involving tiotropium bromide ingestion reported to the Central Ohio Poison Control Center. *Result:* Thirty-four patients (11 male, 19 female), 52.5±17.0 years of age (range 25 to 82) reported inadvertently taking a capsule for inhalation by mouth. Of these cases, 14 follow up calls were placed. Eight patients (23.5%) reported no effect and two patients (5.9%) reported adverse effects. One patient, a 57-year-old female with emphysema, hypertension and hypothyroidism reported feeling nervous two-hours post ingestion and was asymptomatic five hours post ingestion. The patient was receiving an anticholinergic medication for overactive bladder prior to ingestion

without sequelae. A second patient, a 50-year-old male with COPD, asthma and diabetes mellitus took a tiotropium capsule by mouth two days in a row and reported having headaches. The patient was not receiving any other stimulant, antimuscarinic or anticholinergic medications. *Conclusion:* The dosage form of this product may encourage administration route errors which is likely be more significant in patients on concurrent antimuscarinic and/or anticholinergic medications. Elderly patients may be at greater risk for the accidental ingestion and adverse events associated with tiotropium bromide capsule exposure.

## 52. Cerebral Hypoperfusion Following Trimix Administration

Spivak LA, Horowitz BZ. *Oregon Poison Center Oregon Health and Sciences University, Portland, OR, USA.*

*Introduction:* Trimix is a compound of vasoactive drugs used to treat erectile dysfunction (ED). It contains varying amounts of papaverine, phentolamine, and prostaglandin E1. *Case Report:* A 27-year old quadriplegic male reported headache and vision loss shortly after the intracavernosal injection of Trimix. He then lost consciousness, had a seizure and became apneic. He was intubated in the field. His vital signs were normal in the ER. He was extubated the following day. He had no EKG or lab abnormalities, no further seizure activity, and no new neurologic deficits. A brain CT on admission showed no abnormalities. A brain MRI one day later showed abnormalities consistent with ischemia in the cerebral hemispheres and brainstem. A repeat MRI 15 days later showed resolution of these findings. The patient reports a history of headaches following Trimix injection. *Case Discussion:* In 1996, PGE-1 became the first vasoactive drug approved by the FDA for ED. It modulates adenylyl cyclase, causing c-AMP upregulation and a subsequent decrease in calcium with resultant cavernous smooth muscle relaxation. It also acts upon presynaptic neurons to modulate norepinephrine release. The plasma t<sub>1/2</sub> is less than one minute, and it is converted in the penis, liver, and kidney to inactive metabolites. Papaverine is an opium alkaloid originally isolated from *Papaver somniferum*. It acts via phosphodiesterase inhibition. It is metabolized in the liver, with a t<sub>1/2</sub> of one to two hours. It has not been approved by the FDA for the treatment of ED. Phentolamine is an alpha-adrenergic antagonist, acting on alpha-1 and alpha-2 receptors equally. It is not effective for ED when used alone. The paired corpora cavernosa are separated by a fenestrated midline septum. This allows for rapid infusion of Trimix between both corpora with a single injection. Following injection, a rapid increase in cavernous blood flow occurs. Venous outflow is blocked secondary to venule compression. *Conclusion:* The rapid onset of headache, vision loss, and syncope following the Trimix injection is likely due to drug-induced vasodilation with resultant cerebral hypoperfusion. This is supported by the subsequent reversal of brain abnormalities seen on a follow-up MRI.

## 53. Pulmonary Toxicity Associated with Rapamycin in a Pediatric Renal Transplant Patient

Rowden AK, Eldridge DL, Kirk MA, Holstege CP. *Division of Medical Toxicology/University of Virginia, Charlottesville, VA.*

*Introduction:* Rapamycin induced pulmonary toxicity is a rare complication reported in adults. We report the first case of rapamycin induced pulmonary toxicity in a pediatric patient. *Case Report:* A 16 year old female diabetic who received a kidney transplant 6 years previously presented with progressively worsening hypoxia. Her O<sub>2</sub> requirement had gradually increased to 5 L/min over the previous 2 months from her baseline 1.5 L/min. Just prior to presentation, she began having episodes of cyanosis with minimal exertion despite O<sub>2</sub>. She presented with respiratory distress requiring intubation. Her medications included tacrolimus, rapamycin, prednisone, atenolol, amlodipine, pioglitazone, cetirizine, insulin, citalopram, and oxybutynin. Her presenting rapamycin level was 11.7 ng/mL (therapeutic: 2–19 ng/mL). Her chest x-ray showed diffuse interstitial lung disease. An echocardiogram and a cardiac catheter were significant only for mildly elevated pulmonary arterial pressure. CT angiography showed no pulmonary embolus. Bronchoalveolar lavage and lung biopsy specimens were culture negative. Cytology showed mild inflammation and hemosiderin-laden macrophages. Pathology was significant only for diffuse alveolar damage with mild inflammatory change. Serology for collagen vascular disorders was negative. Cultures of blood, urine, and cerebral spinal fluid were negative. Pulmonary function tests showed decreased diffusion capacity. Rapamycin was discontinued, the patient gradually improved, and she was removed from mechanical ventilation after 2 weeks. She was

discharged on her baseline 1.5 L/min O<sub>2</sub> requirement. *Conclusion:* Pulmonary rapamycin toxicity is a rare complication. We report the first case of rapamycin induced pulmonary toxicity in a pediatric transplant patient. Clinicians should be aware of this rare but serious adverse reaction.

#### 54. Accidental OD of Verapamil in an Infant from Medical Error

Schaeffer TH,<sup>1</sup> Waksman JC,<sup>2</sup> Schaffer MS.<sup>3</sup> <sup>1</sup>Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO, USA; <sup>2</sup>University of Colorado Health Sciences Center, Denver, CO, USA; <sup>3</sup>University of Colorado School of Medicine, Denver, CO, USA.

*Introduction:* Calcium channel blocker overdose can be a source of significant morbidity and mortality, especially at the extremes of age. Medication error is also a cause of morbidity as well as major healthcare costs. Verapamil is usually not indicated for children under 1 yr as reports show them to be more at risk for cardiovascular collapse even in therapeutic doses. We report the case of a 3 mo old who received an overdose of verapamil after medical error. *Case Report:* A 5.6 kg 3 mo healthy male was discharged after admission for control of verapamil sensitive ventricular tachycardia. In the hospital he was started on oral verapamil and titrated to dose of 9 mg (1.6 mg/kg/dose) every 6 hrs. Prescription written by the physician was "50 mg/1 ml, sig 1.8 ml q 6 hrs" instead of "0.18 ml q 6 hrs" and filled by the pharmacy as written. During administration, the mother called the pharmacy as the amount seemed excessive and was told to give the full dose. This resulted in dose of 90 mg (16 mg/kg). 30 minutes later he was found pale with weak cry and limp extremities and brought to the hospital. On presentation, he was agitated and flushed. An NGT was placed and he was given a dose of AC. He was intubated and received a 20 cc/kg NS bolus and bolus of calcium chloride. He had occasional episodes of junctional rhythm in the 90 s but never became hypotensive. An echo a few hours after the ingestion was normal. Verapamil levels approx. 7 and 13 hrs after ingestion were 76 ng/ml and 29 ng/ml respectively (70–350 ng/ml therapeutic). Within 24 hrs of admission he was extubated and remained hemodynamically stable. He began having increasing runs of ventricular tachycardia and verapamil was restarted. He was titrated to a dose of 12 mg every 8 hrs (2.2 mg/kg/dose) with an uneventful recovery. *Conclusion:* Verapamil has historically not been recommended for infants due to adverse effects even in therapeutic doses. We report the case of an infant who recovered after treatment for a verapamil overdose after a 10 fold dosing miscalculation from medical error.

#### 55. Quetiapine Overdose in an 8 Year Old

Slattery A,<sup>1</sup> King WD,<sup>1</sup> Dorough L.<sup>2</sup> <sup>1</sup>Regional Poison Control Center, Children's Hospital, Birmingham, AL, USA; <sup>2</sup>Alabama Poison Control Center, Tuscaloosa, AL, USA.

*Introduction:* Few pediatric and adolescent case reports of quetiapine overdoses have been published in the literature. Thus, information regarding clinical safety and patient outcomes after overdoses are lacking for these age groups. In two previous reports involving a preteen and an adolescent, ingestions of 22.2 and 21.6 mg/kg, respectively, resulted in moderate and severe clinical effects. We report a pediatric case involving a therapeutic misadventure resulting in moderate CNS depression, tachycardia and hypotension. *Case Report:* An eight year old male (30.9 kg) was unintentionally given 2 Seroquel 300 mg (19.4 mg/kg) by a caregiver rather than his prescribed oseltamivir. He was referred to the emergency department (ED), where he received activated charcoal. Initially he was lethargic and pale with a BP of 98/47 and HR of 157. Intravenous fluids were begun. He became unresponsive and was transported to PICU. Oxygen was administered (RR 16). UDS was positive for opiates (child therapeutically on a hydrocodone cough syrup) and naloxone was given without results. Symptomatic and supportive care was administered. The patient became more responsive over the next 8 hours and was discharged the following day (within 24 hours of admission). *Case Discussion:* This case has some unique characteristics: (1) the amount ingested is reliable due to therapeutic error (2) it is a pediatric case (3) it is a smaller dose per kilogram of body weight (19.4 mg/kg) than previously reported to have caused significant clinical effects. EKG results were within normal limits (no QRS or QTc prolongation noted). *Conclusion:* Since no therapeutic pediatric dose had been established, our Center had not established a pediatric minimal acceptable dose for home management of quetiapine acute

ingestions. Consequent to this case experience, a standard approach of home observation with serial follow-ups calls (for pediatric patients) has been implemented for acute ingestions involving the lowest dose of any atypical neuroleptic agent. Until further, more definitive data can be evaluated, acute ingestions of atypicals exceeding the standard will be referred to the ED for care.

## 56. Benzonatate Overdose in an Infant and Review of Literature

Boehm K,<sup>1,2</sup> Caraccio TR,<sup>1,2</sup> McGuigan MA,<sup>1,2</sup> McFee R.<sup>1,2</sup> <sup>1</sup>Long Island Regional Poison and Drug Information Center, Mineola, NY, USA; <sup>2</sup>Winthrop University Hospital, Mineola, NY, USA.

*Introduction:* **Benzonatate** (BZ) is a non-narcotic antitussive on the market for over 30 years. In overdose, a patient can develop seizures, cardiac dysrhythmias and death. We present a case of an infant who ingested 800 mg of BZ and a review of the literature. *Case Report:* An 11 month old male ingested eight 100 mg BZ perles at an unknown time. When the child presented to the ED, he was in status epilepticus and required multiple doses of lorazepam. He was intubated to protect his airway, placed on assisted ventilation and given AC. Initial ABGs were normal. On the 2nd day, he developed copious amounts of secretions from his mouth and worsening breath sounds with rales and wheezing. A chest x-ray revealed a upper right lobe collapse. He was started on IV Piperacillin/tazobactam therapy for aspiration pneumonia. On day 5 he was extubated and discharged on day 6. *Case Discussion:* The maximum therapeutic dose of BZ in adults is 600 mg/day. Its structure is closely related to tetracaine and anesthetizes the stretch receptors of the lungs/pleura. The incidence of BZ exposure is not available in TESS. The off-label use of BZ has gained popularity as an anesthetic agent for conscious sedation, an adjunct agent for EEG and MRI procedures and for cancer patients with opioid resistant coughs. Four of 5 case reports in the literature have resulted in death. Two of 4 deaths involved unintentional overdoses in infants. Toxicology analysis is complicated and not routinely available because it contains 8 compounds. *Conclusion:* Despite the fact the FDA has deemed BZ unsafe for OTC use in 1987, its use seems to be growing and clinicians need to be aware of its potential toxicity and management.

## 57. Poison Center's Role on Drug Exposures in Pregnancy and Lactation: Bergamo's Experience in 2004

Eleftheriou J, Peila E, Carrara M, Faraoni L, Bacis G, Farina ML. Bergamo Poison Control Center, Ospedali Riuniti, Bergamo, Italy.

*Background:* After thalidomide disaster several teratology information services were opened around the world for advising pregnant women and their physicians on drug safety. Bergamo Poison Center has been increasing this activity from 751 calls in 2002 to 3720 in 2004. *Result:* 3720 requests for information in pregnancy (82%) and lactation (18%) were received in 2004. The 62.5% of the callers were the women directly involved, 15% were gynaecologists, 4% were paediatricians, 2% were psychiatrists, 2% were obstetricians, 10% were relatives and 4.5% other categories. The calls were 3479 (93.5%) about drugs (81.5% in pregnancy and 18.5% in lactation), 75 (2.0%) radiation exposures, 47 (1.2%) cosmetics and 123 (3.3%) others. At the time of the consultation, 1310 (43%) of the women were in the first trimester of pregnancy. In particular for the drugs, 724 (22.4%) of the questions were related to CNS drugs (41.9% antidepressants, 30.2% anxiolytics, 14.8% antiepileptics, 11.7% antipsychotics, and 1.4% anti-Parkinson drugs), 643 (19.9%) antimicrobials for systemic use, 379 (11.7%) respiratory drugs, 361 (11.2%) gastrointestinal tract and metabolism drugs, 264 (8.2%) NSAIDs, 154 (4.8%) cardiovascular drugs and 21.8% others. Concerning the drugs monitored by the FDA in the list of pregnancy registries, 24 (0.7%) of the questions involved the new antimigraine drugs rizatriptan and sumatriptan, 10 (0.31%) lamotrigine, 6 (0.18%) interferon beta-1a, and 5 (0.15%) montelukast. Concerning the use of drugs during lactation, 127 (19.9%) of the questions were related to antimicrobials for systemic use, 103 (16.2%) NSAIDs, 72 (11.3%) drugs for the gastrointestinal tract and metabolism, 65 (10.2%) cardiovascular drugs, 60 (9.4%) respiratory drugs, 59 (9.3%) CNS drugs (44.1% antidepressants, 28.8% anxiolytics, 23.7% antiepileptics, 3.4% antipsychotics), and 23.7% others. *Conclusion:* Because pregnant and lactating women are not included in clinical trials, also poison centers should conduct studies on human teratogenesis and lactation effects of drugs.

## 58. Pediatric Cefepime Neurotoxicity Treated with Hemodialysis

Geib A,<sup>1</sup> Nikkanen H,<sup>2</sup> Salhanick S.<sup>1</sup> <sup>1</sup>MA/RI Regional Poison Center, Children's Hospital Boston, Boston, MA, USA; <sup>2</sup>Brigham and Women's Hospital, Boston, MA, USA.

*Introduction:* Cefepime, a fourth-generation broad-spectrum cephalosporin, is associated with seizures in patients with impaired renal function. We report a pediatric patient with encephalopathy and seizures temporally related to cefepime overdose, treated with hemodialysis (HD). *Case Report:* A 9 year-old male was admitted to the hospital with unresponsiveness and tonic-clonic seizure activity. He had been treated for three days with cefepime for an *Enterobacter* line infection. Medical history was significant for end-stage renal disease on HD and hypertensive encephalopathy. Recurrent seizure activity was controlled with benzodiazepines. Emergent HD was performed the day of admission to remove cefepime and repeated the following day. Seizure activity ceased within 24 hours of admission. Within 48 hours, he was arousable and responded appropriately to simple questions. Cefepime concentration pre-dialysis was 419 mcg/mL, and 104 mcg/mL after two 4-hour runs (therapeutic, 30–180 mcg/mL). Half life (T<sub>1/2</sub>) calculated during hemodialysis was 11.3 hours. A review by hospital personnel indicates that cefepime dosing exceeded the amount and frequency recommended for patients with ESRD. *Case Discussion:* Beta-lactams are antagonists at the GABA<sub>A</sub> chloride channel. Uremia and/or infection increase CNS permeability to cephalosporins. After intravenous dosing, cefepime is 85% renally excreted unchanged. These 2 factors can lead to toxic CNS cephalosporin concentrations. The T<sub>1/2</sub> with HD was an improvement from 13.5 hours in patients with end-stage renal disease receiving therapeutic doses of cefepime. We expect that in the overdose setting the T<sub>1/2</sub> would be greater. Two cases of pediatric cephalosporin overdose leading to nonconvulsive status epilepticus are reported but neither treated with HD. *Conclusion:* HD was effective in reducing serum concentrations, with subsequent clinical improvement in this patient.

## 59. Acute Myocardial Infarction After Infusion of the Experimental Drug TLK199

Liang IE, Bird SB, Brush DE, Boyer EW. *Division of Toxicology, University of Massachusetts School of Medicine, Worcester, MA, USA.*

*Introduction:* TLK199 (Telintra™) is a glutathione analog inhibitor of glutathione S-transferase packaged into liposomes, and is currently being evaluated in Phase I-IIA experimental trials for the treatment of myelodysplastic syndrome (MDS). We present a case of myocardial infarction which rapidly followed the first infusion of this medication in a 68 year old female. *Case Report:* A 68 year old female with a history including MDS, COPD, hypertension, smoking and significant family history for CAD presented after receiving her first dose of TLK199 (600 mg/m<sup>2</sup> over 60 minutes). Within the first minute of infusion, she developed flushing, shortness of breath, and hypertension. She was transferred to the emergency department with vitals including: HR=154, BP=170/103 (dropped to 89/69), RR=26, and pulse oximetry of 91% on 100% O<sub>2</sub> by face mask. She was intubated for respiratory distress. An EKG demonstrated ST segment elevations anteriorly. Emergent cardiac catheterization demonstrated multiple high grade atherosclerotic lesions. Her cardiogenic shock was initially stabilized with an intraaortic balloon pump. Subsequently, per her request, she was transferred to another facility for CABG. Her creatine kinase peaked at 48 IU/L, and troponin I at 1.19 ng/mL. *Case Discussion:* Glutathione S-transferase is thought to be a negative regulator of white blood cell production, therefore inhibition of this enzyme by TLK199 should promote increased counts. Very little information is known about this drug; a recent abstract lists adverse events as “mild” including flushing, rigors, nausea, headache, vomiting, and musculoskeletal pain. We present the case of a patient that likely had a severe hypersensitivity reaction to this drug. She then progressed to an acute MI, which may represent decompensation of underlying disease from this physiologic stress. *Conclusion:* A 68 year old female developed acute hypersensitivity to TLK199, an investigational myelostimulant, which progressed to an acute myocardial infarction. Further safety studies must be done to investigate direct cardiotoxicity, or perhaps consider the utility of pretreatment risk stratification.

## 60. Methyl Ethyl Ketone Peroxide Ingestion in a Toddler Treated with N-Acetylcysteine

Maloney GE,<sup>1</sup> Pallasch EM,<sup>2</sup> Ahkter S,<sup>3</sup> Clifton JE.<sup>1</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL, USA; <sup>2</sup>Illinois Poison Control Center, Chicago, IL, USA; <sup>3</sup>Rush University, Chicago, IL, USA.

*Introduction:* Methyl ethyl ketone peroxide is a fixative agent in kits used to make children's plastic hand molds. Previous cases of ingestion in the literature have been associated with severe caustic injury and hepatotoxicity and poor outcomes. Use of N-acetylcysteine has been described in both animal studies and case reports, though no set regimen was followed. We present the case of a toddler with a methyl ethyl ketone peroxide ingestion who was treated with N-acetylcysteine. *Case Report:* A 14 month old female ingested an unknown amount of liquid from a bottle of fixative agent determined to be methyl ethyl ketone peroxide in an unknown concentration. She presented in respiratory distress and was intubated and transferred to a tertiary care center. On her initial ABG, she had a pH of 7.30, pCO<sub>2</sub> 31, pO<sub>2</sub> 287 (on ventilator), BE-10. Serial chest X-Rays were normal. Her initial transaminases were AST 28, ALT 13, and INR 0.9. An IV infusion of N-acetylcysteine was initiated within 2 hours of the ingestion, following the standard 48 hour protocol for acetaminophen ingestion, as no protocols for administration had been previously established. Endoscopy at 24 hours revealed superficial mucosal thickening but no strictures. Serial transaminases showed no evidence of hepatotoxicity and her metabolic acidosis resolved within 24 hours. N-acetylcysteine was discontinued on hospital day 2. She was extubated and ultimately discharged home on hospital day 3. *Conclusion:* We report a case of methyl ethyl ketone peroxide ingestion with a good outcome, where early treatment with N-acetylcysteine was initiated.

### 61. Relationship Between Reported Single Acute Dose of Diphenhydramine Hydrochloride Exposures in Children ≤6 Years of Age and Clinical Outcomes

Stojanovski SD,<sup>1,2</sup> Robinson RF,<sup>1,2,3</sup> Baker DS,<sup>3</sup> Casavant MJ,<sup>3</sup> Nahata MC.<sup>1,2</sup> <sup>1</sup>Colleges of Pharmacy and Medicine, The Ohio State University, Columbus, OH, USA; <sup>2</sup>Columbus Children's Research Institute, Columbus, OH, USA; <sup>3</sup>Central Ohio Poison Center, Columbus, OH, USA.

*Background:* To determine the relationship between reported single acute dose diphenhydramine hydrochloride (DPH) exposures in children ≤6 years of age and clinical outcomes. *Methods:* Retrospective study was conducted of all single, acute, accidental, DPH exposures in children ≤6 years of age reported to the AAPCC-TESS from 1/1/2000 to 12/31/2001. Demographics, symptoms, treatment, and treatment site (patients' residence vs. health care facility) were obtained from the medical records. Patients were divided into four groups based on symptom severity: asymptomatic, minor symptoms (nausea, vomiting, lethargy, mydriasis, flushing, and fever), moderate symptoms (agitation, confusion, hallucinations, psychosis) and severe symptoms (loss of consciousness, seizures, respiratory depression) and symptoms were subsequently compared to dose (mg/kg). *Result:* Nine hundred and thirty-nine cases were reported: 48.7% were male, mean age was 29.7±13.0 months (range=1–72 months) and mean dose ingested was 6.4±6.1 mg/kg (range=0.22–67.9 mg/kg). Sixty-seven percent of children were asymptomatic (mean dose 6.4±6.0 mg/kg); about 33% of patients were symptomatic: minor (23.9%), moderate (7.9%), severe (0.3%) and unknown description (1.1%). No deaths occurred. The moderate and severe cases had ingested doses of 7.7±7.8 and 7.8±7.6 mg/kg, respectively. In the moderate group, 56% were observed at home and 44% were seen at healthcare facility (p=0.001). In the severe symptoms group, 33% cases were observed at home, 67% were seen at healthcare facility. The relationship between diphenhydramine dose ingested (<7.5 mg/kg or ≥7.5 mg/kg) and severity of symptoms reported (mild versus moderate to severe) was not statistically significant (chi-square=2.36, p=0.125). *Conclusion:* DPH dose as well symptoms must be considered to determine the management approach for children.

### 62. Accidental Dextromethorphan Ingestions in Children Less Than 5 Years Old

LoVecchio F,<sup>1,2,3</sup> Pizon AF,<sup>1,2</sup> O'Patry S,<sup>3</sup> Matesick L.<sup>3</sup> <sup>1</sup>Banner Poison Control Center, Phoenix, AZ, USA; <sup>2</sup>Maricopa Medical Center, Phoenix, AZ, USA; <sup>3</sup>Arizona College of Osteopathic Medicine, Phoenix, AZ, USA.

*Background:* Dextromethorphan (DXM) is a frequently encountered accidental ingestion in the pediatric population. However, little has been reported about treatment for this type of ingestion. The purpose of this study is to evaluate the clinical presentation of accidental DXM ingestions in children less than 5 years old. *Methods:* Following a brief training, reviewers blinded to the purpose of the study completed a standardized data collection sheet. Two consecutive years of poison center patient encounters were reviewed. Data including age, outcomes, amount of DXM ingested, co-ingestions, vital signs, clinical manifestations, hospital admissions, and mortality were abstracted. Data were analyzed using descriptive statistics. The two reviewers, who were blinded to the purpose of the study, extracted the data and a third reviewer evaluated every chart; a Kappa value was calculated. *Result:* 304 cases were identified with a mean age of 28.2 months (72% were ≥23 months). All cases

co-ingested other products of over-the-counter cough and cold medications (i.e. acetaminophen, pseudoephedrine, guaifenesin, ibuprofen, and various H<sub>1</sub> receptor antagonists). The mean DXM dose ingested was 35.0 mg (mean of 2.64 mg/kg). 62 (20.4%) patients experienced lethargy as their only neurological sign and no patient had any cardiovascular abnormalities. Only one (a 13 month old) patient, who ingested 3.2 mg/kg and presented with lethargy, was hospitalized and subsequently discharged 14 hours later. No deaths were recorded. A Kappa score for inter-reviewer reliability was 0.74 95% CI [0.61–0.81]. *Conclusion:* Despite growing experience treating intentional ingestions of DXM, little is known about accidental pediatric ingestions. In our cohort, only one patient was hospitalized and no deaths occurred. In addition, no patient required specific treatment for any co-ingestion (i.e. n-acetylcysteine for acetaminophen toxicity). As demonstrated in our patient population, accidental ingestions of DXM in the pediatric patient did well with supportive care alone and rarely require inpatient treatment.

### 63. Serious Liver Injury from an Acute Pediatric Acetaminophen Ingestion

Anderson K,<sup>1</sup> Dahl B,<sup>1</sup> Habis A,<sup>2</sup> Caravati EM.<sup>1</sup> <sup>1</sup>Utah Poison Control Center, University of Utah, Salt Lake City, UT, USA; <sup>2</sup>Primary Children's Medical Center, Salt Lake City, UT, USA.

*Introduction:* Liver injury from acute unintentional acetaminophen (APAP) exposure is rarely reported in children less than 6-years-old. We report a case of a pediatric APAP ingestion that resulted in an elevated serum APAP level and markedly elevated aminotransferases. *Case Report:* An 11-month-old 11-kg male with a history of ingesting an unknown number of APAP 500 mg tablets was brought to the emergency room due to vomiting. The child arrived at the hospital 35 minutes after ingestion. Gastric lavage resulted in return of pill fragments and a loading dose of acetylcysteine (NAC) was given via NG tube 90 minutes after ingestion. The serum APAP concentration was 701 mcg/mL 90 minutes after ingestion and 592 mcg/mL 5 hours after ingestion. A maintenance dose of NAC was given via NG tube while he was transported to a tertiary pediatric hospital. He was subsequently treated with IV Acetadote<sup>®</sup> for 60 hours. Initial AST was 44 IU/L and ALT 66 IU/L which peaked at 48 hours with AST 21,168 IU/L and ALT 20,202 IU/L. The patient's INR peaked at 1.7. His symptoms included anion gap acidosis, lethargy, poor appetite and a fever of 39 C. After 7 days, his AST was 251 IU/L, ALT 2644 IU/L, INR 0.8 and he was discharged home. *Case Discussion:* Our patient developed substantial liver injury despite receiving NAC therapy 90 minutes after ingestion. *Conclusion:* Serious liver injury from an unintentional acute pediatric ingestion of APAP can occur with a large ingestion and timely administration of NAC therapy.

### 64. Artificially Elevated Serum Creatinine Determination After Nitromethane Ingestion

Mell HK,<sup>1</sup> Lintner CP,<sup>2</sup> Sztajnkrzyer MD.<sup>1,2</sup> <sup>1</sup>Mayo Clinic, Rochester, MN, USA; <sup>2</sup>Hennepin Regional Poison Center, Minneapolis, MN, USA.

*Introduction:* In contrast to serum electrolyte determination, which most commonly uses a direct ion-selective electrode (ISE) technique, serum creatinine is typically measured through a complex reaction with alkaline picrate, referred to as the Jaffe reaction. We present a case of apparent isolated creatinine elevation after consumption of remote control (RC) fuel, due to interference with the serum creatinine assay. *Case Report:* One-year-old and two-year-old male siblings presented to an emergency department after each taking a "swig" of an unknown liquid from a soda can. The mother reported that liquid appeared blue in color and smelled of alcohol while an ED nurse stated it smelled more like acetone. Both children were asymptomatic upon arrival and throughout their emergency department course. Serum electrolytes, including bicarbonate, blood urea nitrogen, and anion gap, were all within normal limits when assayed approximately 90 minutes after ingestion. Serum creatinine determinations for the two siblings were 3.5 mg/dL and 3.8 mg/dL respectively. The product was subsequently identified as Blue Thunder RC racing fuel, containing nitromethane 20% and unspecified methanol. Serum methanol levels were determined to be 10 mg/dL and 12 mg/dL respectively. The patients were discharged with follow-up. *Case Discussion:* Nitromethane may cause isolated dramatic elevations of serum creatinine in the absence of other evidence of nephrotoxicity and acute renal failure. This elevation is artifactual, relates to interference with the complex Jaffe reaction, and requires no further intervention. *Conclusion:* In analyzing laboratory results, clinicians should interpret unexpected isolated

laboratory abnormalities cautiously, especially when not consistent with clinical circumstances and the remainder of the laboratory evaluation.

### 65. Yohimbine Poisoning from Slimming Pills Bought Over the Internet

Dargan PI, Shiew CM, Greene SL, Jones AL. *National Poisons Information Service, London, United Kingdom.*

*Introduction:* There is an increasing market of unlicensed pharmaceutical products bought over internet. We describe a unique case of yohimbine poisoning from slimming tablets, with measurement of serum catecholamines. *Case Report:* A 38 year old man presented to ED 3 hours after ingestion of 2 ‘‘ADiPREN’’ slimming tablets obtained via the internet. The recommended dose on the packet was 1 tablet. 45 minutes post-ingestion he felt hot, anxious and developed palpitations. Initial examination revealed sinus tachycardia of 130 bpm and BP 150/96 mmHg. 6 hours after presentation he had an episode of narrow complex tachycardia 180 bpm with BP 140/80 mmHg. This was successfully terminated with a Valsalva manoeuvre and he was admitted for cardiac monitoring. Serum potassium and magnesium were normal. He had a continuing sinus tachycardia 110–130 bpm and hypertension 160/100–130/90 mmHg and received oral diazepam (20 mg day 1, 20 mg day 2, 40 mg day 3, 10 mg day 4) for symptom control. He was asymptomatic with normal vital signs on discharge from hospital on day 4. Urine and serum catecholamines were checked daily (samples obtained via an in-situ butterfly catheter). A full toxicology screen and serum caffeine concentration were also undertaken using gas chromatography (GC). *Case Discussion:* ADiPREN contains a number of sympathomimetic drugs including yohimbine bark extract, L-tyrosine and caffeine. Caffeine (6.6 mg/L) was the only substance detected in the toxicology screen, concentrations up to 15 mg/L are seen with dietary intake. Yohimbine is an antagonist at central  $\alpha$ -2 receptors and can act peripherally (causing increased release of norepinephrine and sympathetic stimulation) and centrally (via medullary receptors causing hypertension). Catecholamine concentrations were all within normal limits (serum norepinephrine 1.1–2.4 nmol/L, epinephrine 0.22–0.62 nmol/L) indicating that the sympathomimetic syndrome seen was due to a central  $\alpha$ -2 effects and not catecholamine release from the adrenal medulla. *Conclusion:* We present a case of significant yohimbine poisoning from a slimming remedy bought over the internet. Patients are increasingly purchasing medication over the internet and the quality standards and safety of these medicines is often unestablished.

### 66. Bilateral Central Retinal Artery Occlusion Secondary to Inhalation of Crack Cocaine

Catenacci MH, Tuckler VE. *LSU Health Science Center—New Orleans, New Orleans, LA, USA.*

*Introduction:* Cocaine abuse has been associated with several vascular complications in younger patients including acute myocardial infarction, stroke, and aortic dissection. Central Retinal Artery Occlusion (CRAO) secondary to intravenous or intranasal cocaine abuse has been reported very infrequently in the medical literature. There has been only one case reported as secondary to inhalation of crack cocaine. To the best of our knowledge, there are no case reports of bilateral CRAO secondary to cocaine abuse. *Case Report:* A 50 year-old female with no past medical history presented with decreased vision in her right eye. The patient stated she awoke with blurred vision in the right eye two days prior to presentation, and lost vision completely in the right eye the day of presentation. The patient also admitted to a lesser degree of blurred vision in the left eye and to smoking crack cocaine the night before onset of symptoms. She denied eye pain, headache, temporal scalp tenderness, jaw claudication, weakness, or other neurologic complaints. Vital signs were BP of 211/119, HR of 85, and T=98.5F. Physical exam revealed no visual acuity in the right eye with 20/100 vision in the left. An afferent pupillary defect was present on the right, the left pupil was fully reactive, and the consensual light reflex was preserved on the right. Extraocular movements were intact. On fundoscopy, both retinæ appeared edematous with whitening, there was ‘boxcarring’ of retinal arteries on the right, and cherry-red spots were present on both macula. Neurologic exam was normal. Laboratory studies were unremarkable. The patient was admitted, blood pressure was controlled, and subsequent CT scanning of the head and carotid doppler ultrasound were normal. The patient’s visual acuity improved in the left eye, and minimally in the right. *Case Discussion:* Cocaine has known atherogenic and platelet-aggregating qualities, but due to the bilateral presentation of disease in this case, we speculate the pathogenesis may be more related to a sudden intense vasospasm than in-situ thrombosis. *Conclusion:* Although rare, inhalation of crack cocaine should be included in the differential diagnosis of CRAO in younger patients.

## 67. QRS Prolongation Following Massive Methamphetamine Ingestion

O'Connor AD, Kao LW. *Division of Medical Toxicology, Indiana University School of Medicine, Indianapolis, IN, USA.*

*Introduction:* Methamphetamine is a potent sympathomimetic agent well known to produce cardiovascular effects but has not been reported to cause QRS prolongation. *Case Report:* A 21-year-old male was pulled over by police and was witnessed ingesting a handful of pills. A field test identified the substance as methamphetamine and friends reported the quantity to be 10 grams. At the initial emergency department he was noted to be diaphoretic, agitated, and hyperthermic (104.8°F). The initial EKG revealed sinus tachycardia (175 bpm) and a QRS of 86 msec. A urine drug screen was positive for amphetamine but negative for cocaine. On arrival to our tertiary care center, the patient was intubated due to increasing agitation. An EKG obtained 3 hours after the initial EKG revealed sinus tachycardia (131 bpm) with a QRS of 120 msec and right axis deviation. A concomitant bedside chemistry panel revealed K-4.0, Na-142, Cl-112, HCO<sub>3</sub>-18, BUN-23, Cr-2.5 and Glu-153. The patient was given 4 amps of sodium bicarbonate and started on an infusion. QRS prolongation persisted for 20 hours and normalized on HD#2 (88 msec). Echocardiography and cardiac enzymes were within normal limits. Confirmatory testing revealed urine methamphetamine level of 84,900 ng/ml and amphetamine level of 3290 ng/ml. The patient had a prolonged hospitalization complicated by rhabdomyolysis, acute renal failure, encephalopathy, and severe ARDS. *Conclusion:* We report a case of QRS prolongation following acute massive methamphetamine ingestion, an association not previously reported to our knowledge.

## 68. "What a Tangled Web We Weave...": Poison Center Contribution to DEA Investigation of Illegal Chemical Supply Web-Sites

Arnold TC, Hindman BW. *Louisiana Poison Control Center, Monroe, LA, USA.*

*Background:* The Internet has become the new street corner for many modern-day drug traffickers. The United States Drug Enforcement Agency is constantly challenged to stay one step ahead of individuals marketing synthetic analogues as safe and legal products. Poison Centers are uniquely positioned to alert drug enforcement officials when there has been an adverse event reported secondary to these agents. *Methods:* During management of a drug overdose case that resulted in the unintentional death of a 22 year-old male, the poison center learned that the responsible product, 2C-T-21 (a phenethylamine) had been purchased over the internet from a "chemical supply company." With permission from the family, the poison center immediately contacted the local DEA field office regarding the case. Evidence collected in this case was combined with other information obtained during the DEA's ongoing "Operation Web Tryp." This operation ultimately led to the arrest of 10 individuals and the removal of five internet web sites selling this and similar chemicals. Indictments handed down in this case specifically implicated one of these sites with the death of our patient. *Result:* Federal agencies including the DEA and others are continually attempting to remain ahead of the illegal and illicit drug trafficking organizations. Many times it is the local Poison Control Center that is involved in the index case when a new product has made its way to the streets. Our role as guardians of the public health compels us to cooperate with Federal, State and local authorities to ensure the safety of the citizens we serve. *Conclusion:* We report a case in which Poison Center notification of suspected illegal activity led the DEA to 10 arrests and closure of five illegal chemical web sites. As illegal drug trafficking makes its way from the street corner to the internet, it becomes incumbent upon the Poison Control community to be aware of cases that result from illegal activity and work with law enforcement officials to prevent their propagation.

## 69. Death from Ingestion of 2C-T-21: A Novel Phenethylamine

Arnold TC, Hindman BW, Walker AL, Ryan ML. *Louisiana Poison Control Center, Monroe, LA, USA.*

*Introduction:* "2C-T-21," 2,5-dimethoxy-4-(2-fluoroethylthio)phenethylamine, was the last of the 2C-T line of phenethylamines synthesized by Alexander Shulgin. Several favorable "trip reports" available via internet regarding this compound and multiple internet sources for purchase have combined to produce this inevitable result. We report a human death.

*Background:* from ingestion of 2C-T-21 purchased from an internet source. *Case Report:* A 22 year-old male patient presented to his local ED with initial complaints of blurred vision almost immediately after the witnessed ingestion of a small amount of ‘‘2C-T-21’’ which he had recently purchased over the internet from a chemical supply company. Later investigation revealed that one-third to three-fourths of the contents from a vial originally containing 1000 mg had been ingested. Initial vital signs revealed tachycardia at 132, BP 166/79, temperature 102.2°F, and O<sub>2</sub> saturation of 98%. The patients past medical history was significant for being quadriplegic from a motor vehicle collision one year earlier and he was currently being treated for a bladder infection. His current medications included neurontin, tizanidine, prevacid, melatonin, paroxetine and oxybutynin. Information was forwarded to the ED regarding management with benzodiazepines and cooling. He quickly developed frank hallucinations, seizures and hyperthermia to 108°F. His pupils became fixed and dilated shortly thereafter. A CT scan performed the next day revealed cerebral edema and hemorrhage. Brain death was confirmed on hospital day two. *Case Discussion:* To date, this case represents only the second reported death from this compound. Although not currently a scheduled substance, cases involving 2C-T-21 have been prosecuted under the Federal Analogue Act. Although Shulgin has reportedly discontinued his investigation and experimentation with this line of phenethylamines, many others chemistry enthusiasts and opportunists now have the recipe for this dangerous compound. *Conclusion:* We report a case of human death from ingestion of 2C-T-21, a novel psychoactive phenethylamine compound.

## 70. Symptomatic Bilateral Adrenal Infarction Associated with Cocaine Use

Ginsburg BY,<sup>1</sup> Weinberg HR,<sup>2</sup> Hoffman RS,<sup>1</sup> Nelson LS.<sup>1</sup> <sup>1</sup>New York University School of Medicine, New York, NY, USA; <sup>2</sup>Northern Westchester Hospital, Mount Kisco, NY, USA.

*Introduction:* Cocaine is associated with adverse effects often related to coronary, cerebral, and peripheral vasoconstriction. We report a case of bilateral adrenal infarction associated with cocaine use. *Case Report:* A 43 year-old man with a history of alcohol, cocaine, and heroin abuse presented to the ED after being found unresponsive at home. According to family members, he complained of nausea and vomiting earlier that day. Vital signs were: BP, 168/133 mm Hg; P, 125/min; RR, 24/min; T, 95.4°F; and O<sub>2</sub> saturation of 92% on room air. Examination was remarkable for lethargy, scattered rales and wheezing, and guaiac positive brown stool. Shortly after his arrival, he became hypotensive (BP of 60/30 mm Hg) for which he received fluids, phenylephrine, dopamine, albumin, ceftriaxone, and hydrocortisone. His BP increased to 130/66 mm Hg and his level of consciousness improved. A non-contrast CT scan of the chest, abdomen, and pelvis demonstrated bilateral adrenal infarctions. A urine toxicology screen was positive for cocaine. Laboratory results included a lactate of 5.5 mEq/L, a WBC of 25,700/mm<sup>3</sup>, a creatinine of 2.0 mg/dL with a BUN of 17 mg/dL, an AST of 533 U/L and ALT of 379 U/L, and a CPK of 890 U/L. Electrolytes, hematocrit, platelets, troponin, and urinalysis were normal. An ECG revealed sinus tachycardia without any ischemic changes. Blood and urine cultures did not reveal any source of infection. The patient admitted to using cocaine one day prior to presentation. He was successfully treated for adrenal insufficiency with IV hydrocortisone followed by an oral prednisone taper. *Case Discussion:* The patient developed adrenal insufficiency due to bilateral adrenal infarction. This likely occurred from cocaine-induced vasoconstriction, which is responsible for many of the adverse effects associated with cocaine toxicity. An alternative explanation may be depletion of catecholamines, secondary to cocaine use, resulting in hypotension, which may have caused adrenal ischemia secondary to hypoperfusion. *Conclusion:* We believe that this is the first report of bilateral adrenal infarction associated with cocaine use.

## 71. Unsolicited Contamination of Drinks in Bars and Clubs: Toxicological Analysis of Alleged Cases

Greene SL, Shiew CM, Earl B, Dargan PI, Jones AL. *National Poisons Information Service, London, United Kingdom.*

*Background:* There is increasing awareness and media coverage surrounding the potential for ‘spiked drinks’ (unsolicited addition of a drug to a drink consumed in a bar or club) and drug-facilitated sexual assault. The perceived increasing incidence and spectrum of implicated drugs highlights the need for a deeper understanding of the issue. This study aims to quantify the incidence and pattern of possible intoxicants in suspected cases presenting to a large urban Emergency Department (ED) in the United Kingdom (UK). To our knowledge, no similar study has been undertaken in the UK. *Methods:* Patients presenting to the ED of one hospital concerned their drink may have been ‘spiked’ in the previous 12 hours were offered toxicological analysis of blood and urine. Time and place of possible exposure and clinical details/drug history were recorded. Patients who

admitted using a recreational drug were excluded. A single blood and urine sample was analysed for drugs of abuse and ethanol (immunoassay and gas chromatography-mass spectroscopy). The study was approved by the Hospital Ethics Committee (IRB). *Result:* Initial results in this ongoing study from the first 36 patients indicate that ethanol was the predominant intoxicant detected. Only one sample was collected from 3 patients (2 urine+1 serum sample missing). Ethanol was detected in 30/34 urine samples (88.2%) and 29/35 serum samples (82.8%), serum range 15–280 mg/dL, mean 163 mg/dL. Ethanol was the *only* substance detected (excluding metoclopramide given by ED) in 30/36 patients (83.3%). Of the remaining 6 patients, 4 (11.1%) were positive for MDMA, 1 (2.7%) cannabinoids and 1 (2.7%) for opioids and benzodiazepines. All 6 patients denied using drugs. *Conclusion:* Ethanol is the predominant substance involved and the sole substance found in 83% of patients presenting to the ED worried their drink may have been spiked. A substantial number of patients had high serum ethanol concentrations which could account for symptoms leading to the erroneous belief that their drink was spiked. There were a small number with positive results, indicating a low but significant incidence of possible spiked drinks in this ED population.

## 72. Cocaine Adulterated with Atropine: An Epidemic Poisoning in Northern Italy in 2004

Bacis G,<sup>1</sup> Papa P,<sup>2</sup> Rocchi L,<sup>2</sup> Nerini T,<sup>2</sup> Faraoni L,<sup>1</sup> Farina ML.<sup>1</sup> <sup>1</sup>Bergamo Poison Control Center, Ospedali Riuniti, Bergamo, Italy; <sup>2</sup>Toxicology Analytical Laboratory, San Matteo IRCCS Hospital, Pavia, Italy.

*Background:* Several adulterants of cocaine were reported in the past: amphetamines, phencyclidine, narcotics, local anesthetics, antihistamines, caffeine, ephedrine, acetaminophene, benzocaine, arsenic, thallium and strychnine. Anticholinergic intoxications by adulterated cocaine with scopolamine and atropine have also been published previously. *Case Report:* On November 2004, the Bergamo Poison Control Center was alerted because four patients were admitted to the emergency department of three near hospitals with confusional state, agitation, convulsions, hallucinations, areflexic mydriasis, tachycardia and blood hypertension after cocaine abuse. In suspicion of adulterated cocaine, blood and urine specimens were collected for detailed toxicological investigations. The samples were positive for cocaine and surprisingly also for atropine. Immediately an alert was diffuse to the emergency medical services and hospitals, drugs addiction services, police departments and to the mass-media. During the following 10 days another 9 patients were admitted and treated for cocaine and atropine poisoning in the province of Bergamo, while 3 patients were observed in the province of Milan. After one week the police confiscated few amounts of cocaine adulterated with atropine. One month later, a new epidemic cluster appeared in the near province of Brescia, with a total of 17 patients involved. Toxicological analysis done on 30 patients confirmed the presence of atropine in 22. All the patients recovered after symptomatic (sedation with benzodiazepine) or intensive treatment. *Conclusion:* If abnormal effects are observed after drug abuse, the presence of adulterants should be considered and toxicological investigations can be helpful for identifying the causative agent.

## 73. “Parachuting”: A Novel Delivery Method for Methamphetamine Use

Spivak LA,<sup>1</sup> Hendrickson RG,<sup>1</sup> Horowitz BZ,<sup>1</sup> Notenboom H,<sup>2</sup> Norton R. <sup>1</sup>Oregon Posion Center/Oregon Health and Science University, Portland, OR, USA; <sup>2</sup>Sacred Heart Medical Center, Eugene, OR, USA.

*Introduction:* We report an unusual method of ingesting methamphetamine called “parachuting” and its implications for the treatment of “body stuffers.” *Case Report:* A 25-year old man wrapped methamphetamine in a plastic, resealable bag and swallowed it. He intended for the methamphetamine to be released in a sustained manner in order to keep him awake during a long drive. When he noticed no drug effect, he realized that he had made a critical error in not cutting an opening in the bag. He visited an ED approximately ten hours post-ingestion complaining of abdominal pain. His physical exam was unremarkable except for a mild tachycardia. There was no evidence of a foreign body or obstruction on abdominal radiographs. His UDS was negative for amphetamines. He received activated charcoal and whole-bowel irrigation with no retrieval of the baggie. He was discharged after 12 hours and returned 18 hours later (42 hours post-ingestion) with agitation, tremor, and diaphoresis. His HR was 210 bpm, BP was 179/74, and temperature 38.3°C. His pupils were 6 mm and reactive. He had a resting tremor and ankle clonus. The patient was sedated, intubated, and treated again with charcoal and WBI. No baggie was retrieved. He was extubated three days later and discharged. *Case Discussion:* “Parachuting” describes an ingestion technique in which methamphetamine is placed in a plastic bag. The plastic is tightly rolled and one end is cut open prior to ingestion. As the bag unfurls in the GI tract, methamphetamine is theoretically dispensed in a sustained-release manner. Alternatively, crushed methamphetamine

tablets may be rolled within a paper wrapper and swallowed. The pharmacokinetics of “parachuting” have not been described, thus it is unclear whether the use of this technique leads to delayed, sustained, or bolus release of the drug. *Conclusion:* This case demonstrates a novel technique for ingesting methamphetamine and suggests that an extended period of observation may be warranted in patients who swallow poorly packaged drugs. Whether “parachuting” needs to be treated differently than “body stuffing” remains to be determined.

#### 74. Use of Propofol for Severe GHB Withdrawal: Two Cases

Wiegand TJ,<sup>1</sup> Zvosec DL,<sup>2</sup> Smith SW.<sup>2</sup> <sup>1</sup>California Poison Control System, Department of Clinical Pharmacy, UCSF, San Francisco, CA; <sup>2</sup>Hennepin County Medical Center, Minneapolis, MN.

*Introduction:* Patients in withdrawal (w/d) from Gamma hydroxybutyrate (GHB) and its precursors gamma butyrolactone (GBL) and 1,4-butanediol (BD) may require massive amounts of benzodiazepines (B) for management of agitation. An optimal w/d protocol has not been described. We report 2 cases of GHB w/d refractory to B but treated successfully with propofol. *Case Report:* A 37-year-old GHB-dependent female was found banging her head on the ground. In the ED, she alternated from lethargy to profound agitation requiring four-point restraints and intubation. Pulse and blood pressure were normal. GHB in urine by GC-MS was 5140 mg/L. She was refractory to diazepam (325 mg) and lorazepam (80 mg), but responsive to propofol averaging 60 mcg/kg/minute for 2 days. She was subsequently weaned with a propofol-lorazepam conversion and transferred to chemical dependency treatment on Day 8. The patient reported ingesting “1 oz/hour” of a dietary supplement called “Zen,” confirmed by GC-MS to be 16% BD. A 32-year-old GHB-dependent male was found incoherent. In the ED he was attending to unseen stimuli and chewing on his arms. Vital signs were normal. Extreme agitation required large amounts of droperidol (ED total 27.5 mg) and lorazepam (ED total 8 mg). Agitation was ultimately only controlled with intubation and propofol up to 80 mcg/kg/minute for 3 days (average 74.7 mcg/kg/min) with lorazepam and diazepam. Intermittent recurrent agitation necessitated resumption of propofol with ultimate discharge on Day 26. The patient reported hourly ingestion of an unspecified amount of “contact cement remover,” confirmed by GC-MS to be 100% GBL. *Case Discussion:* Unlike B, propofol affects both NMDA and GABA receptors. It has thus been successfully used for delirium tremens refractory to B. It is highly lipophilic and redistributes quickly with a short duration of action. After fatty tissues are saturated, it leeches back to the bloodstream, thus having a very long effective duration of action, maintaining sedation for a prolonged period, and making it an ideal agent for sedative withdrawal syndromes. *Conclusion:* We present two patients whose withdrawal was refractory to B but immediately responsive to propofol.

#### 75. Gamma Hydroxybutyrate-Related Fatalities: 146 Deaths

Zvosec DL,<sup>1</sup> Smith SW,<sup>1</sup> Porrata T,<sup>2</sup> Haller C,<sup>3</sup> Dyer JE.<sup>3</sup> <sup>1</sup>Hennepin County Medical Center, Minneapolis, MN, USA; <sup>2</sup>ProjectGHB, Pasadena, CA, USA; <sup>3</sup>UCSF/California Poison Control Ctr., San Francisco, CA, USA.

*Background:* Gamma hydroxybutyrate (GHB) and its analogs are drugs of abuse that have also been marketed as purported dietary supplements. Although many case series have documented GHB toxicity, there have been only scattered reports of GHB fatalities. We sought to investigate the nature and range of lethal risks posed by GHB/analogues. *Methods:* We identified cases by contacting Medical Examiner/Coroners in every state of the US by letter and by phone. We requested specific cases identified through the Project GHB website and requested database searches to identify additional deaths. We also contacted researchers abroad. We requested information on deaths due to GHB directly (cardiopulmonary arrest, aspiration and asphyxiation) and due to fatal accidents resulting from GHB intoxication. We accessed autopsy reports with toxicology findings for deaths related to GHB/analogues. We utilized a GC/MS blood GHB cut-off of 50 mg/L to avoid overlap with endogenous GHB levels. *Result:* We identified a total of 146 GHB-related fatalities from 1995–2005. 139 include autopsy and toxicology reports and 7 have toxicology findings only. 142 US deaths were from 26 states and Washington DC and 4 deaths were from the UK. Decedents included 97 men and 49 women, of ages 15–53 years (mean=28.1 years) 138 suffered cardiopulmonary arrest (of which 21 reports noted aspiration or asphyxiation), 4 drowned in hot/bathtubs or pools, 3 died in lethal motor vehicle accidents (1 GHB-intoxicated driver and 2 GHB-intoxicated pedestrians), and 1 died of smoke inhalation from a fire started while intoxicated. 48 deaths (32%) occurred with GHB as the only intoxicant (blood GHB range 70–4400 mg/L) and 98 deaths

occurred with co-intoxicants; 24 with stimulants only (range 106–2900 mg/L) only, 36 with depressants only (range 59–2300 mg/L), and 38 with both. *Conclusion:* Data collection is ongoing and specific analysis of GHB and co-intoxicant levels and autopsy findings will be performed. However, our series currently demonstrates that GHB is lethal both with and without co-intoxicants, directly and also due to lethal accidents.

## 76. Isolated Methadone Overdose Typically Require Naloxone Within the First 9 Hours of Ingestion

LoVecchio F,<sup>1</sup> Sami A,<sup>2</sup> Pizon AF,<sup>3</sup> Riley BD.<sup>3</sup> <sup>1</sup>Maricopa Medical Center, Phoenix, AZ, USA; <sup>2</sup>Arizona College of Osteopathic Medicine, Phoenix, AZ, USA; <sup>3</sup>Banner Poison Control Center, Phoenix, AZ, USA.

*Background:* Methadone ingestion may cause delayed coma and require naloxone infusion. Few studies exist regarding the time to development of symptoms following methadone overdose in adults. *Methods:* Following a brief training, reviewers blinded to the purpose of the study completed a standardized data collection sheet. Two consecutive years of poison center patient encounters were reviewed. Age, outcomes and co-ingestions, vital signs, clinical manifestations, hospital admissions, and mortality were abstracted. Data were analyzed using descriptive statistics. The one reviewer, who was blinded to the purpose of the study, extracted the data and a second reviewer reviewed 20% of all the charts and a kappa value was calculated. *Result:* 44 cases of isolated methadone overdose in pts >18 years old were identified with a mean age of 32.5 [18–58] yrs and a mean presumed ingestion of 106 mg. 32/44 received naloxone for symptoms consistent with opiate toxicity. All symptoms occurred within 9 hrs with a mean symptom onset of 3.2 hrs. All patients had resolution of symptoms within 24 hrs. No deaths were recorded. A kappa score for inter-reviewer reliability was 0.69 95% CI [0.58–0.73]. This was a retrospective study that was limited by patient history. *Conclusion:* Acute methadone toxicity typically results in symptoms within 9 hrs of ingestion.

## 77. Rectal Overdose with Fentanyl Patches; a Case Report

Miller MA, Kaylor DW, Jones-Spangle K, Shawcross DL, Coon TP. *Darnall Army Community Hospital, Ft. Hood, TX.*

*Introduction:* Fentanyl, like many opioids, has been abused in many forms. It has been substituted for heroin, utilized as an agent for suicide and surreptitiously administered by physician narcotic addicts. With the development of drug eluting patches, new methods of fentanyl abuse and overdose have evolved. The patches contain large amounts of the drug and have been smoked, dissolved into “teas”, and even eaten with serious resulting intoxication. We describe the first known case of purposeful suicide attempt by rectal fentanyl patch insertion. *Case Report:* A 41 year old male arrived in the emergency department (ED) after inserting 3 fentanyl 100 mcg/hr patches into his rectum. Prior to arrival in the ED the patient had become comatose. He had received 6 mg of intravenous naloxone without response and was subsequently intubated. In the ED the patient had a clinical picture consistent with classic opioid overdose. A rectal examination to remove the patches was performed and no patches were able to be removed. Subsequently the resident physician with the longest fingers in the emergency department was recruited to perform a rectal examination, returning 3 fentanyl patches. The patient awoke approximately 1 hour later and fully recovered after a brief hospital stay. *Conclusion:* To our knowledge we report the first case of intentional opioid overdose using rectally inserted fentanyl patches. Because these patches contain enough drug to deliver at least 100 mcg/hr for 72 hours, ingestion or internalization in any form should be considered as a serious overdose. In the case of rectal insertion, aggressive digital rectal examination should be done and consideration of therapeutic anoscopy or sigmoidoscopy considered to obviate the need for a prolonged hospital stay.

## 78. Life-Threatening Toxicity from Intravenous Injection of Benzonatate

Doyon S,<sup>1</sup> Welsh C.<sup>2</sup> <sup>1</sup>University of Maryland School of Pharmacy, Baltimore, MD, USA; <sup>2</sup>University of Maryland School of Medicine, Baltimore, MD, USA.

*Introduction:* Benzonatate is a non opioid antitussive structurally similar to tetracaine that is formulated as a perle for oral administration only. Injection of 2–3 perles of benzonatate has resulted in one death. We present a case of life-threatening benzonatate toxicity after intravenous injection of one perle containing 100 mg of benzonatate. Inactive ingredients include methyparaben, polyparaben, glycerin, water and color. *Case Report:* The wife of a 43 year old male with a history of intravenous drug use was awakened when he collapsed in the bathroom after the intentional injection of one benzonatate perle. She found him unconscious in his own vomitus. EMS transported the patient. The patient was intubated immediately upon arrival to the ED. His pulse rate was 113 beats per minute, blood pressure 224/119 mmHg and temperature 97.9 F. Physical examination was unremarkable except for coarse breath sounds. Laboratory findings, including the ECG, were only notable for bilateral perihilar infiltrates on post-intubation chest xray and ABG (60%): 7.19/59/98/94%. The blood pressure responded to ventilation and sedation. The patient has a 3-week ICU course complicated by severe ARDS and tracheostomy and a 6-week hospital course. He recovered completely. After discharge, he stated that he injected the entire content of one 100 mg benzonatate perle. *Case Discussion:* Oral benzonatate overdoses may result in seizures, cardiac arrhythmias and death. Only one case report of intravenous use of 2–3 100 mg benzonatate perles is found in the literature and it resulted in death. There are no reports of injection of one benzonatate perle. It is entirely possible that this patient experienced a seizure and aspirated immediately after injecting the benzonatate. This would explain his level of consciousness and respiratory findings. No cardiac arrhythmias were noted throughout his hospital stay. *Conclusion:* We report a case of injection of a 100 mg benzonatate perle resulting in immediate loss of consciousness with preservation of vital signs. The hospital course was characterized by the development of severe ARDS but ultimately the patient made a complete recovery.

## 79. Influence of Marketing on Tramadol Prescribing Practices in an Urban Teaching Hospital

Rowden AK,<sup>1</sup> Calise AG,<sup>2</sup> Holstege CP.<sup>1</sup> <sup>1</sup>*Division of Medical Toxicology/University of Virginia, Charlottesville, VA;* <sup>2</sup>*Seton Hall, South Orange, NJ.*

*Background:* Tramadol was combined with acetaminophen in 2001 and was marketed under the trade name Ultracet. Ultracet was marketed as an alternative to other opioid/acetaminophen combination analgesics. The objective of this study was to determine if physicians might alter prescribing habits because the Ultracet name is similar to other controlled opioid analgesics. *Methods:* Surveys were distributed throughout the hospital to a convenience sample of physicians in all specialties. The survey asked physicians to name their specialty, rate the influence the trade name of Tramadol Containing Products (TCP) had on their prescribing practices, rate their opinion of the abuse potential of TCP, and included instructions on how to anonymously return the survey to the researcher. The chi squared test was used to compare data based on gender and specialty. *Result:* A total of 157 of 250 surveys were returned (63%). Overall 9% (8% males and 12% of females) of respondents stated the trade name of TCP influenced their prescribing practices. By specialty: 13% surgeons, 9% internal medicine, 10% gynecologists, 8% emergency medicine stated they were influenced by trade name of TCP. No statistical difference was seen between specialty or gender in regard to influence of the trade name of TCP. Overall 26% (males 27%, females 25%) stated that TCP had high abuse potential. By specialty, surgeons 19%, internal medical 40%, gynecology 19%, emergency medicine 11% stated that TCP had high abuse potential. Internal medicine specialists were more likely to state TCP had high abuse potential ( $p=0.001$ ) and emergency physicians were less likely to state TCP had high abuse potential ( $p=0.025$ ) when compared to all other specialists. No statistical difference was seen between gender or other specialties. *Conclusion:* The trade name of TCP does not appear to influence prescribing practices. Internal medicine physicians were more likely and emergency physicians were less likely to believe that TCP had high abuse potential.

## 80. Risk of Selected Birth Defects with Prenatal Illicit Drug Use, 1986–2002

Forrester MB,<sup>1</sup> Merz RD.<sup>2</sup> <sup>1</sup>*Texas Department of State Health Services, Austin, TX, USA;* <sup>2</sup>*Hawaii Birth Defects Program, Honolulu, HI, USA.*

*Background:* The literature on the association between prenatal illicit drug use and birth defects is inconsistent. The objective of this study was to determine the risk of a variety of birth defects with prenatal illicit drug use. *Methods:* Data were derived from an active, population-based adverse pregnancy outcome registry. Cases were all infants and fetuses with any of 54 selected

birth defects delivered during 1986–2002. The prenatal methamphetamine, cocaine, and marijuana use rates were calculated for each birth defect and compared to the prenatal use rates among all deliveries. *Result:* Among all deliveries, the prenatal use rate was 0.52% for methamphetamine, 0.18% for cocaine, and 0.26% for marijuana. Methamphetamine rates were significantly higher than expected for 14 (26%) of the birth defects. Cocaine rates were significantly higher than expected for 13 (24%) of the birth defects. Marijuana rates were significantly higher than expected for 21 (39%) of the birth defects. Increased risk for the three drugs occurred predominantly among birth defects associated with the central nervous system, cardiovascular system, oral clefts, and limbs. There was also increased risk of marijuana use among a variety of birth defects associated with the gastrointestinal system. *Conclusion:* Prenatal use of methamphetamine, cocaine, and marijuana are all associated with increased risk of a variety of birth defects. The affected birth defects are primarily associated with particular organ systems.

## 81. ED Visits and Hospitalizations Are Increasing Among Young Adults Abusing Oral Narcotics

Mycyk MB,<sup>1,2,3</sup> Tudor BC,<sup>1</sup> DiMaano JQ.<sup>3</sup> <sup>1</sup>Northwestern University; <sup>2</sup>Toxikon Consortium; <sup>3</sup>Illinois Poison Center, Chicago, IL, USA.

*Background:* The National Institute for Drug Abuse (NIDA) estimates that 1 out of 10 U.S. youths abuse Vicodin<sup>®</sup> for euphoria at least once before graduating from high school. Characteristics of school-age young adults seeking emergency care and requiring hospitalization for recreational abuse of Vicodin<sup>®</sup> and other prescription narcotics has not been previously described. *Methods:* A 3-year (1/1/02 to 12/31/04) retrospective analysis of all prescription narcotic abuse cases recorded by a regional poison center was conducted. Included were all school-age patients from 4 to 25 years old with reported prescription narcotic misuse. Excluded from analysis were patients <4 and >25 years old, and all unintentional, therapeutic error, and suicide cases. *Result:* 171 patients met inclusion criteria. Mean age was 19.3 years (95% CI: 18.6–19.9), 57% were female, 43% male. Reported abuse cases increased by 13% between 2002–03 and by 47% between 2003–04. Route of abuse was ingestion in 164 cases, snorting in 5, IV in 1, and IM in 1. Concomitant abuse of non-narcotic prescription medicines occurred in 58 (33.9%) cases, over-the-counter (OTC) medications in 24 (14.0%) cases, alcohol in 35 (20.5%) cases, and illegal drugs in 14 (8.2%) cases. 30 patients (17.5%) reported abusing their own prescribed narcotic, 29 (17%) abused another person's prescribed narcotic, and origin was not acknowledged in 112 (65.5%) cases. Of the 59 (34.5%) patients hospitalized from the ED for medical complications from narcotic abuse, 40 (67.8%) were admitted to an ICU. Admission to the ICU was significantly associated with concomitant recreational abuse of other non-narcotic prescription medicines (odds ratio 3.71, 95% CI: 1.78–7.75, P<0.001). Hospital admission was not associated with age, sex, use of OTC medications, or alcohol use. *Conclusion:* Reported abuse of prescription narcotics increased over a three-year period. Concomitant abuse with other prescription medicines is common and is associated with ICU admission. The increasing number of young adults requiring emergency care and hospitalization for abuse of prescription narcotics warrants further prospective evaluation.

## 82. Lick or Stick: The Common Routes of the Misuse and Abuse of Fentanyl

Hughes AA,<sup>1</sup> Dart RC,<sup>1,2</sup> Bailey JE,<sup>1</sup> RADARS(R) Poison Center Group. <sup>1</sup>Rocky Mountain Poison and Drug Center—Denver Health, Denver, CO, USA; <sup>2</sup>University of Colorado, Denver, CO, USA.

*Background:* Case reports describe fentanyl overdoses via excessive transdermal application, ingestion, inhalation, or injection. However, data are lacking regarding the most common routes of misuse and abuse with fentanyl reported by poison centers and their medical outcome. *Methods:* 15 poison centers, serving over 102 million people, reported fentanyl intentional exposure cases (suicide, abuse, misuse, and intentional unknown) for a two-year period (1/03–12/04). Case notes of each intentional exposure involving fentanyl were reviewed to confirm the product ID, route of the exposure and medical outcome. *Result:* Of 1,562 cases, 499 (32%) were intentional exposures. Specifically, 453 (91%) involved transdermal products and 52% of these cases had a moderate to major outcome; 11 (2%) involved the lozenge/lollipop with 36% having a moderate to major outcome; 5 (1%) involved injection with 80% having a moderate to major outcome, and in 30 (6%) of the cases the product was unknown/unsure. Transdermal intentional exposures most commonly involved males (58%) and patients in the 20s–40s (73%). The major routes of transdermal exposures were ingestion (57%), dermal, (25%), and parenteral (8%). Most parenteral cases (58%) specifically stated intravenous injection of the gel or after boiling/heating the product. The routes of exposure were statistically

significant for medical outcome (chi sq,  $P < 0.05$ ). Routes of ingestion included ingestion of the patch (61%), ingestion of the gel (17%), and masticating or licking without ingestion (14%), however, the medical outcome for these routes were not statistically different ( $P > 0.05$ ). *Conclusion:* Abuse and misuse of fentanyl most commonly involved transdermal products and cases these products had more severe medical outcomes overall. Ingestion of the transdermal product accounts for more than half of the intentional exposures. Determining the most common routes of abuse and misuse of fentanyl may enable manufacturers of transdermal products to create different delivery systems that may be more difficult to abuse.

### 83. Transplacental Isopropanol Intoxication: A Report

Wood JN,<sup>1</sup> Calello DP,<sup>1,2</sup> Carney J,<sup>1</sup> Szczepanski K,<sup>1</sup> Hurt H.<sup>1</sup> <sup>1</sup>The Children's Hospital of Philadelphia, Philadelphia, PA, USA; <sup>2</sup>The Poison Control Center, Philadelphia, PA, USA.

*Introduction:* Isopropanol can cause significant toxicity in infants. The majority of neonatal isopropanol exposures have been caused by sponge bathing for fever control. We present the first reported case of transplacental isopropanol exposure and toxicity. *Case Report:* An intoxicated 35 y.o. woman with no prenatal care and a history of cocaine and ethanol use precipitously delivered a 2.340 kg 34 wk gestation infant with Apgar scores of 2 and 5. The newborn was hypotensive, hypotonic, and cyanotic with a weak respiratory effort and underwent aggressive resuscitation. Within the first hour of life she developed seizure activity which was treated with multiple doses of phenobarbital. A urine immunoassay was positive for cocaine, barbiturates, and nicotine. An blood alcohol panel sent at 1.5 hours of life was negative for ethanol but showed an isopropanol level of 140 mg/dl and an acetone level of 16 mg/dl. Maternal blood sent 4.5 hours post delivery was negative for isopropanol but still contained acetone at 31 mg/dl. Subsequent infant levels were: at 10.5 hours, isopropanol  $< 2$  mg/dL and acetone 18 mg/dl, at 24 hours, isopropanol 0 mg/dl and acetone 10 mg/dl. By 42.5 hrs the acetone level had fallen to 3 mg/dl. The patient improved over the next 2 weeks. Her infectious workup was negative. Her seizures resolved within 24 hours of life, her tone improved, and by the time of discharge she was bottle feeding and had a normal neuro exam. *Case Discussion:* There are no previous reports of isopropanol toxicity due to transplacental exposure, but it is well established that alcohols can cross the placenta, causing fetotoxicity and teratogenicity. Hypotonia, hypotension and seizure activity have been reported in neonatal isopropanol poisoning. The etiology of our patient's clinical picture was multifactorial and likely included birth hypoxia and placental insufficiency; however, the elevated isopropanol level and concomitant acetone levels, in the context of maternal acetone levels and alcohol exposure, suggests isopropanol toxicity. *Conclusion:* While rare, isopropanol toxicity should be considered in infants with CNS depression and possible transplacental exposure.

### 84. Vascular Occlusion and Digit Necrosis After Intra-Arterial Cocaine Injection

Stover M,<sup>1</sup> Chang B,<sup>2</sup> Jackson O,<sup>2</sup> Perrone J.<sup>1</sup> <sup>1</sup>Hospital of the University of Pennsylvania, Philadelphia, PA, USA; <sup>2</sup>Hospital of the University of Pennsylvania, Philadelphia, PA, USA.

*Introduction:* Cocaine related morbidity is a common cause of ED visits in substance users. Cocaine is a potent sympathomimetic, vasoconstrictor and prothrombotic agent. We report partial ischemic necrosis of the hand secondary to intentional cocaine injection into the radial artery. *Case Report:* A 54-year old man with a history of parenteral substance abuse and poor peripheral venous access presented to our emergency department with a history of progressive pain, swelling, and discoloration of his left thumb. Four days prior, seeking a drug euphoria, he had allowed a friend to inject cocaine into his left wrist. Examination revealed a swollen, dark thumb with tenderness over the thenar eminence, pain with range of motion, and absent capillary refill. An angiogram demonstrated an abrupt interruption of flow in the radial artery at the level of the wrist, with no collateral flow to the thumb. Exploratory surgery for possible bypass was performed; firm thrombus in the radial artery at the wrist and at the metacarpal-phalangeal joint were revealed; the entire distal vasculature was filled with thrombus and attempts at surgical revascularization were abandoned. Despite subsequent heparin therapy, revascularization did not occur and necrotic demarcation was managed with surgical revision. *Case Discussion:* Inadvertent intraarterial injections of many substances have been reported and often lead to significant distal complications. The prothrombotic properties of cocaine: enhanced platelet aggregation, increased concentration of plasminogen-activator inhibitor, increased production of endothelin and decreased production of nitric oxide likely contributed to the significant vascular compromise due to thrombus formation

and distal ischemia. *Conclusion:* Cocaine is a potent vasoconstrictor and pro-thrombotic agent. Inadvertent or intentional intraarterial injections may result in vasoconstriction, thrombus formation and distal ischemia. Prompt angiography to determine the role of mechanical or pharmacologic thrombolysis may help in tissue salvage.

### 85. Life Threatening Toxicity in a Cocaine “Stuffer” Greater Than Fourteen Hours from Ingestion

Cumpston KL,<sup>1,2</sup> Laeben L,<sup>1</sup> Crandall C.<sup>1</sup> <sup>1</sup>*Medicine, University of New Mexico, Albuquerque, NM, USA;* <sup>2</sup>*New Mexico Poison Center, Albuquerque, NM, USA.*

*Introduction:* Crack cocaine body “stuffers” ingest the evidence to avoid detection by law enforcement. Prospective and retrospective studies have described seizures and cardiac arrest within two hours from ingestion of crack cocaine. We present a case of seizures and dysrhythmia greater than fourteen hours after ingestion of cocaine. *Case Report:* A 33 yo male admitted to ingesting a quarter ounce of crack cocaine at 1800, the day before, to avoid possession. The patient was detained by the police department overnight. At 0800 the following day, 14 hours post ingestion, a caretaker at the detention center noticed the patient hallucinating. During transport to the emergency department (ED) one witness thought the patient had seizurelike activity. In the ED, the blood pressure (BP) was 148/98, heart rate 120 bpm, and temperature 37.7 Celsius, and the physical examination was notable for agitation and diaphoresis. The patient was treated with multiple doses of lorazepam, and activated charcoal was administered. Overall, he was clinically improving until seizures refractory to benzodiazepines began. The trachea was intubated and 0.5 grams of phenobarbital IV were administered. The cardiac rhythm was a wide complex tachycardia, which was presumed to be hyperkalemia and treated with two ampules of sodium bicarbonate (SB) IV along with 1 gram of calcium carbonate IV. This treatment narrowed the QRS complex to 154 ms on ECG with a BP of 67/25 mmHg. He was treated with three additional ampules SB IV and the QRS narrowed to 120 ms and the BP improved to 112/86 mm Hg. No further bicarbonate therapy was administered. An emergent EEG revealed no seizure activity. The hospital course was uncomplicated and the patient was extubated the following day. The urine toxicology screen was positive for cocaine, marijuana, opioids, and methadone, and the serum TCA screen was negative. *Conclusion:* The clinical course of this patient is atypical of what is described in the literature. Further discussion must continue about the appropriate length of observation of crack cocaine body “stuffers.”

### 86. Recent Changes in the Treatment of Toxic Alcohol Ingestions

Morgan DL,<sup>1</sup> Cooney NL,<sup>2</sup> Cooney DR,<sup>2</sup> McCuskey CF.<sup>3</sup> <sup>1</sup>*Central Texas Poison Center, Temple, TX, USA;* <sup>2</sup>*Texas A&M University College of Medicine, Temple, TX, USA;* <sup>3</sup>*Scott and White Hospital, Temple, TX, USA.*

*Background:* Fomepizole (4-methylpyrazole) was approved by the FDA for the treatment of ethylene glycol poisoning in 1997 and for methanol poisoning in 2000. Our goal was to determine the changes in treatment and outcome of these patients over the last five years. *Methods:* This was a retrospective, observational study of the American Association of Poison Control Centers' Toxic Exposure Surveillance System (TESS) database. All patients who had methanol or ethylene glycol ingestions from 1999 to 2003 were included. The data was analyzed using the Newcombe-Wilson method without continuity correction. *Result:* There were 42,203 patients (30.4% methanol and 69.6% ethylene glycol). There was no significant change each year for total number of patients, their ages, number treated in a health care facility and medical outcomes. The ethylene glycol patients were more likely than the methanol patients to be adults (OR 1.8, 95% CI 1.73–1.88), have intentional overdoses (OR 1.23 95% CI 1.15–1.32), and were less likely to be treated in a health care facility (OR 0.74, 95% CI 0.71–0.77). The fraction of patients that received an antidote rose from 7.3% (95% CI 6.8–7.9) to 14.8% (95% CI 14.1–15.6). Ethanol use decreased from 7.3% to 5.0% (95% CI 4.6–5.5) during the study period. Fomepizole use increased from 0% (95% CI 0–0.1) to 9.8% (95% CI 9.2–10.4). By 2001, fomepizole use exceeded ethanol use. Mortality rates of the methanol and ethylene glycol patients were similar, and the overall mortality rate remained basically unchanged during the study period (0.5%, 95% CI 0.4–0.7). *Conclusion:* Fomepizole has been rapidly accepted for the treatment of toxic methanol and ethylene glycol ingestions over the last 5 years. Although the annual number of patients poisoned by methanol and ethylene glycol has remained constant,

physicians are treating more of these patients with an antidote (more fomepizole and less ethanol). The hospitalization rate and mortality rate has not significantly changed.

### 87. A Retrospective Evaluation of Shortened Course Oral N-Acetylcysteine for the Treatment of Acute Acetaminophen Poisoning

Betten DP, Burner EE, Williams SR, Clark RF. *California Poison Control System, San Diego Division, San Diego, CA, USA.*

*Background:* Treatment of acetaminophen (APAP) overdose with oral N-acetylcysteine (NAC) has traditionally consisted of an 18 dose (72 hour) regimen. A retrospective study was performed to assess the applicability and safety of a shortened course of oral NAC and to evaluate treating physician's acceptance of these recommendations. *Methods:* A large statewide poison center database was reviewed for all individuals treated with oral NAC for acetaminophen poisoning over 2 years. According to protocol, poison specialists recommended shortened course NAC (SCN) treatment ( $\leq 48$  hours) if no detectable APAP and normal or near normal transaminases were obtained after a minimum of 6 to 9 doses of NAC. All case in which laboratory information was available 20–48 hours after NAC initiation were identified. Cases in which a SCN was given ( $\leq 48$  hours) were divided into acute ingestions ("possible" or "probable" toxicity based on the Rumack-Matthew nomogram), chronic ingestions, or ingestions of unknown time. Data was reviewed to assess implementation of these recommendations and to identify subsequent contact by health care professionals concerning individuals previously treated who required further NAC administration. *Result:* 63.3% (817/1339) of all included cases met criteria for SCN (acute=532, chronic=110, unknown=117). 38.5% (205/532) of acute ingestions were considered in the "possible" toxic range and 61.5% (327/532) in the "probable" toxic range. Of the 817 individuals eligible for SCN, 514 (62.9%) received  $\leq 48$  hours of NAC, 189 (23.1%) received  $>48$  hours at the treating physicians discretion, and 114 (14.0%) were treated for an unknown duration of time. Of the 514 individuals treated with SCN, 156 (30.2%) received 20–32 hours of NAC, 191(37.2%) received 32–40 hours, and 167 (32.5%) received 40–48 hours. No individuals treated with SCN were identified who subsequently died, developed laboratory abnormalities, or required further hospitalization or treatment with NAC. *Conclusion:* A shortened course of oral NAC appears to be a safe and appropriate treatment option in a large proportion of individuals with potentially toxic acetaminophen ingestions.

### 88. Octreotide for Pediatric Sulfonylurea Overdose: Review of 5 Cases

Calello DP,<sup>1,2</sup> Osterhoudt KC,<sup>1,2</sup> Henretig FM,<sup>1,2</sup> Perrone J.<sup>1,2</sup> <sup>1</sup>The Poison Control Center, Philadelphia, PA, USA; <sup>2</sup>The University of Pennsylvania School of Medicine, Philadelphia, PA, USA.

*Background:* Octreotide, a synthetic somatostatin analogue, is a useful antidote for sulfonylurea-induced hypoglycemia after overdose. However, pediatric experience with octreotide in this context is very limited. *Methods:* We retrospectively reviewed cases of pediatric sulfonylurea overdose identified via poison center records who were treated with octreotide at our institution within the last four years. During the period of study, octreotide was generally reserved for those children with hypoglycemia refractory to IV dextrose administration. Extracted data included: demographics, ingested agent and dose, time of ingestion, arrival, and octreotide dosing, episodes of hypoglycemia before and after octreotide, IV dextrose therapy, and adverse events. *Result:* We identified five cases, age 1.6–17 years. The agent ingested was either glipizide(n=3) or glyburide(2), with doses from 0.08–0.92 mg/kg. The patients were discovered to have hypoglycemia as early as 1.5 h, or as late as 16 h after ingestion. Octreotide was administered SC or IV, with doses ranging 0.51–1.6 mcg/kg/dose. None of the 5 had hypoglycemia in the 6 hours after treatment. However, 4 of 5 experienced recurrence of hypoglycemia after octreotide dosing, at 6, 7, 10, and 17 hours after administration. 1 patient experienced an episode of hypertension and apnea approximately 30 minutes after administration. There were no other adverse events including vomiting, diarrhea, or bradycardia. *Conclusion:* Although considerable experience with octreotide in children with congenital hyperinsulinism exists, this is the largest reported case series of its use in pediatric sulfonylurea overdoses. In our study, octreotide stabilized blood glucose levels for at least 6 hours in all 5 patients. However, all but 1 patient experienced recurrence of hypoglycemia. In addition, there was one event temporally related to octreotide administration, the significance of which is unclear. We add to the growing experience with octreotide in children. Further study is needed appropriately define dosing schedules to prevent hypoglycemic relapse.

### 89. Does the Addition of Chocolate Milk Reduce the Adsorption Capacity of Orally Administered Activated Charcoal for GI Decontamination of Acetaminophen Ingestion?

Bonner AB,<sup>1</sup> Liebelt EL,<sup>2</sup> Williamson E,<sup>1</sup> Rajab MH,<sup>1</sup> Johnson SE,<sup>1</sup> Kim HS.<sup>1</sup> <sup>1</sup>Scott & White Hospital, Temple, TX, USA; <sup>2</sup>UAB School of Medicine, Birmingham, AL, USA.

*Background:* Activated charcoal is commonly used as a GI decontaminant; however its color, taste and gritty texture make it difficult to administer orally. The objective is to determine if the addition of chocolate milk to activated charcoal significantly decreases the adsorptive capacity of the charcoal. *Methods:* Healthy volunteers, ages 18 and older, were recruited and consented. Participants were randomized to one of three interventions: 1) activated charcoal alone; 2) activated charcoal/chocolate milk in a 3:1 ratio; or 3) activated charcoal/chocolate milk in a 1:1 ratio. Baseline acetaminophen levels were drawn and acetaminophen was administered in a one-time dose of 50 mg/kg (max 4 grams). Thirty minutes later, patients drank activated charcoal ( $\pm$ chocolate milk) administered in an 8:1 ratio (charcoal:drug). Serum acetaminophen levels were subsequently drawn at 120, 180 and 240 minutes. Comparison of serum acetaminophen levels between groups was performed using one-way ANOVA and repeated measures analysis. A sample size of 27 patients per group would provide a power of 0.8 to detect a 20% difference in acetaminophen levels between groups, at a significance level of 0.05. *Result:* Eighty-nine of 90 participants completed the study. There were no significant differences among the three groups for age, weight, gender and amounts of acetaminophen and charcoal ingested. Comparisons of serum acetaminophen levels between groups at 120, 180 and 240 minutes demonstrated no statistically significant reduction in the adsorptive capacity of the activated charcoal mixed with chocolate milk as compared to activated charcoal alone. *Conclusion:* Addition of chocolate milk as a flavoring agent to orally administered activated charcoal did not significantly decrease the adsorptive capacity of the charcoal for acetaminophen.

### 90. Masking the Smell and Taste of Acetylcysteine (NAC): What Is the Best Option?

Dandoy CE, Crouch BI, Caravati EM. Utah Poison Control Center, University of Utah, Salt Lake City, UT, USA.

*Background:* To determine what beverage best masks the smell and taste of NAC. *Methods:* A 5% solution of NAC was prepared using the following 5 diluents: water (W), Fresca™ (F), Coca Cola™ (CC), cranberry juice (CJ), chocolate milk (CM). Subjects used a 10cm visual analog scale (VAS) to rate the smell and taste for each 5% solution with the left margin representing a non-offensive odor or taste and the right margin representing a very offensive odor or taste. For the taste portion, approximately 10 mL of each 5% solution was placed in a cup with a lid and straw. Each subject tasted each solution in a different order than for smell. The subjects ate soup crackers between each taste test to limit carryover between solutions. The difference in VAS for taste and smell was measured using the Kruskal-Wallis ranked sum test. Multiple comparisons were performed using the Mann Whitney U test with the Bonferoni correction with significance at  $p < 0.005$ . *Result:* A total of 42 subjects participated in the study. The mean VAS score (cm) for smell and taste, respectively, of each diluent was: (F) 1.1738, 4.2833; (CC) 2.6405, 7.2714; (CJ) 3.9762, 8.1786; (W) 4.1071, 7.7810; and (CM) 5.1286, 8.076. F was rated as the least offensive diluent with respect to smell by 22 (53.7%) of subjects and taste by 33 (78.6%). CM was rated as the most offensive beverage with respect to smell by 22 (53.7%) and to taste by 11 (26.2%). CJ was rated the most offensive taste by 12 (28.6%) of subjects. The VAS score for F was statistically lower than all other beverages with respect to both smell and taste ( $p < 0.005$ ). *Conclusion:* NAC diluted with F to a 5% solution had the least offensive odor and taste and should be considered as an option when administering oral NAC to adults.

### 91. Evaluation of Impact of Activated Charcoal (AC) Use in Acute Acetaminophen Overdoses Treated with N-Acetylcysteine (NAC)

Spiller HA. Kentucky Regional Poison Center, Louisville, KY, USA.

*Background:* Previous studies have suggested that patients receiving both AC and NAC after acute APAP overdoses had improved outcomes when compared with those receiving NAC alone. These studies exhibited non-randomized design and small size. Evaluation of a larger multi-year database may add or remove support for this hypothesis. *Methods:* Retrospective

TABLE 1

Outcome/clinical effect	NAC+AC	NAC alone	
Total of group	18,756	26,003	
Major effect	552 (3%)	2331 (9%)	P<0.005, OR 0.31, 95% CL 0.28–0.34
Death	37 (0.2%)	156 (0.6%)	P<0.005, OR 0.33, 95% CL 0.23–0.47
AST/ALT >1000 U	558 (3%)	3285 (12.6%)	P<0.005, OR 0.22, 95% CL 0.20–0.25
PT prolonged	584 (3.1%)	2397 (9.2%)	P<0.005, OR 0.32, 95% CL 0.29–0.35
Increase creatinine	41 (0.2%)	258 (1%)	P<0.005, OR 0.22, 95% CL 0.16–0.31
Renal failure	29 (0.2%)	132 (0.5%)	P<0.005, OR 0.31, 95% CL 0.20–0.47

evaluation of the American Association of Poison Control Centers Toxic Exposure Surveillance System (TESS) database. All acute APAP overdoses without co-ingestants that received NAC therapy reported to the TESS database for the years 1993 through 2004 were separated in two groups based on therapy received: 1) both AC and NAC and 2) NAC alone. Outcomes compared between groups were: medical outcome and clinical effects. Statistic used were chi square (Yates corrected). *Result:* 44,579 acute APAP overdoses treated with NAC were located, of which 18,576 (42%) received AC and NAC (Table 1). Previous studies suggested a post-absorptive role for AC, perhaps that of GI dialysis: most recently in a blinded randomized trial after cardiac glycoside overdose. Use of TESS data in this study has a number of limitations, including its retrospective nature and no documentation of when NAC therapy was initiated. *Conclusion:* Evaluation of 12 years of acute APAP overdoses without co-ingestants reported to TESS suggests that use of AC, in addition to NAC therapy, may provide improved patient outcomes in acute APAP overdoses. Prospective studies may be warranted.

## 92. Algorithm for Activated Charcoal (AC) Use for Ingestions

Wiegand TJ, Wu L, Dempsey DA. *California Poison Control System-SF, San Francisco, CA, USA.*

*Background:* Controversy surrounds the use of AC for potentially toxic ingestions. Recently it has been postulated that AC is futile in many situations, unnecessary in others, and its indiscriminate use is associated with adverse outcomes. No standard protocol exists for administration of AC. *Methods:* We propose an algorithm for AC administration in a decision tree format with multiple branch options at each level of assessment or clinical finding. The goal is to assist bedside assessment and decision to use AC by identifying when its use is probably efficacious (e.g. colchicine) and when there is risk of harm from AC (e.g. amoxicillin ingestion in an uncooperative toddler). Efficacy is defined as ability to reduce drug toxicity. Unfortunately there is only one controlled clinical trial, so that efficacy will be based on in vitro and in vivo binding data, animal data, and clinical studies—case reports, case series and retrospective studies. Additionally, the recent AACT/EAPCCT position paper on AC administration is considered. The major decision branches include: identification of ingested agent; ability of agent to bind to AC; lethality of agent; lethality of dose of agent; time since ingestion; triage when agent is unknown or when time of agent is unknown; and relative or absolute contraindications to AC use (uncooperative patient, vomiting, compromised airway, seizures, compromised GI tract, etc). A set of special circumstances that do not fit into the algorithm are identified and recommendations for AC use are given (e.g. multi-dose activated charcoal to interrupt enterohepatic recirculation). *Conclusion:* It would be most desirable to base an algorithm upon a prospective randomized clinical trial but such data may never be available. The geographic dispersion and sporadic nature of serious poisonings as well as the unavailability of funding may make such a study prohibitive. The available data is, however, adequate to develop an algorithm which will provide a rational decision tree for the use of AC by identifying situations when it will be most efficacious in preventing serious morbidity or mortality and identifying situations when its use is futile or may lead to adverse outcomes.

## 93. Steroids in Second Degree Caustic Burns of the Esophagus: A Metanalysis of Studies: 1956–2005

Fulton JA, Hoffman RS. *NYC Poison Control Center, NY, NY, USA.*

*Background:* Esophageal strictures result from repair of damaged tissue with production of collagen and eventual scar formation. They are a debilitating complication of acid and alkaline ingestions. Although steroid therapy (ST) is universally

withheld in 1st and 3rd degree burns, controversy continues regarding ST in 2nd degree burns. Since 2 meta-analyses, including data from 1956–1991 and 1991–2003, disagree in their therapeutic recommendations, this study was designed to re-evaluate the use of ST in 2nd degree esophageal burns. *Methods:* All studies included in the 2 above analyses were reviewed, and references were hand-searched for additional citations. A Medline search identified subsequent reports of caustic esophageal injury. Inclusion criteria: 1) endoscopically documented 2nd degree burns and 2) at least a 10-day course of ST or no steroid therapy (NST). Data were evaluated with a  $X^2$  test and  $\alpha$  was set at 0.05. *Result:* Eleven studies were identified from prior analyses; 1 additional study was found in Medline. Four studies were prospective and 8 were retrospective. Three included patients receiving either ST or NST; 8 included patients with ST only; and 1 had patients with NST only. A total of 295 patients comprised the analysis. 30 of 244 patients receiving ST developed strictures as compared to 6 of 51 patients in the NST group. The percentage of strictures for the ST and NST groups were: 12.3% and 11.8%, respectively. This difference was not statistically significant. *Conclusion:* Adequate human data from controlled studies demonstrating the efficacy of ST in patients with 2nd degree caustic burns are unlikely to be generated based on experimental difficulties. However, the available data, which is largely retrospectively generated, fails to show a difference in the prevention of strictures with ST. Additionally, the inherent risks involved with ST, such as perforation and infection, provide further support against the routine use of ST in the management of 2nd degree burns. Thus existing data fail to support the routine use of steroids in patients with caustic-induced 2nd degree esophageal injury. Since most reports involve alkaline exposures data are insufficient to comment on acid exposures as a unique subgroup.

#### 94. Case Series of Physostigmine for Olanzapine and Quetiapine-Induced Anticholinergic Syndrome

Ganetsky M, Babu KM, Liang IE, Brush DE, Bird SB, Boyer EW. *Division of Toxicology, University of Massachusetts Medical School, Worcester, MA, USA.*

*Introduction:* The hallmark of atypical antipsychotic medications is low affinity at  $D_2$  receptors, in addition to antagonism of other neurotransmitter binding. Olanzapine and quetiapine have potent anti-muscarinic properties and can produce the anticholinergic toxidrome in acute overdose. Physostigmine can reverse agitated delirium due to central anticholinergic syndrome, but its administration following atypical antipsychotic overdose is rarely reported. *Case Report:* 1) A 44 year-old woman ingested olanzapine in a suicide attempt. She became agitated, exhibited mumbling speech, and demonstrated a classic anticholinergic syndrome. Administration of one mg of physostigmine reversed her agitation and normalized her mental status. She required three subsequent doses of physostigmine over the ensuing 48 hours. 2) A 49 year-old female became extremely agitated after an overdose of quetiapine. Her agitation was not controlled with 15 mg of lorazepam. Her clinical presentation was consistent with an anticholinergic syndrome. Four mg of physostigmine reversed her delirium. She required no further doses of physostigmine. 3) A 39 year-old woman overdosed on quetiapine and clonazepam. She was agitated, delirious and demonstrated anticholinergic syndrome. One mg of physostigmine reversed her agitation, but she later required intubation for airway compromise, likely secondary to clonazepam. She did not require any further doses of physostigmine. *Case Discussion:* Few published case reports describe physostigmine as a treatment for anticholinergic syndrome from typical antipsychotics, clozapine and olanzapine. There are no reports of physostigmine use after quetiapine ingestion. Physostigmine administration can avert intubation, as well as the need for physical restraints. There were no adverse effects from physostigmine in this case series. Physostigmine is an effective and safe antidote for the reversal of anticholinergic agitated delirium; atypical antipsychotics may be a new indication for this antidote. *Conclusion:* We report three cases of anticholinergic syndrome due to ingestion of atypical antipsychotics that were successfully treated with physostigmine.

#### 95. Physostigmine for Gamma Hydroxybutyrate Coma: Lack of Efficacy and Adverse Events in 5 Patients

Zvosec DL,<sup>1</sup> Smith SW,<sup>1</sup> Litonjua MR.<sup>2</sup> <sup>1</sup>Hennepin County Medical Center, Minneapolis, MN; <sup>2</sup>Detroit Receiving Hospital, Detroit, MI.

*Background:* Physostigmine (P) has been proposed as an antidote for gamma hydroxybutyrate (GHB) intoxication, based on associated awakenings in patients anesthetized with GHB and in 5 of 6 patients given P for GHB toxicity. There is no plausible mechanism for P reversal of GHB effects, no supportive animal studies, and no randomized, placebo-controlled trials

demonstrating safety, efficacy, or improved outcomes. Recent animal data demonstrated inefficacy and toxicity of P for GHB toxicity. *Methods:* Retrospective case series. In 2001, St. Vincents Hospital in NY City instituted a protocol for ED and radio-ordered prehospital administration of P to comatose patients with a history of GHB ingestion. Initial dose was 1.0 mg administered IM or IV over 1 minute. We searched and reviewed the ED records for patients receiving P under this protocol. We also reviewed 18 GHB toxicity case series to tabulate incidence of stimulant co-intoxicants (which may heighten risk of P) and complications of supportive care for GHB toxicity. *Result:* We located 5 cases of GHB toxicity given P at a mean total dose of 1.4 mg. All had stimulant co-intoxicants. Mean GCS prior to P was 7.2; mean GCS 30 minutes after P was 5.8. No patient demonstrated arousal within 2 hours of P. Associated adverse events in 3 of 5 patients (60%) included atrial fibrillation (AF) in 2 patients, one of whom also had myocardial infarction and bradycardia. Another patient had pulmonary infiltrates and hypotension. Our review of case series of GHB toxicity in 646 adults identified only one case of atrial fibrillation. Co-intoxication with stimulants was as high as 44%. Supportive care was safe, with 104 (16.2%) intubations performed and only one significant complication (aspiration during pre-hospital intubation). *Conclusion:* P is not indicated for the reversal of GHB-induced coma; it is not efficacious, and may be unsafe, particularly in the setting of recreational drug use, in which stimulant co-intoxication is common. Need for and benefit of a reversal agent is therefore unsupported. The natural history of GHB intoxication managed supportively is relatively benign and does not warrant the use of P.

## 96. In Vitro Charcoal Binding of Staphylococcal Enterotoxin B

Hoffman RJ,<sup>1</sup> Hahn I,<sup>2</sup> Shen JM,<sup>1</sup> Sandoval M,<sup>1</sup> Shu C,<sup>3</sup> Nelson LS.<sup>4</sup> <sup>1</sup>Beth Israel Medical Center, New York, NY, USA; <sup>2</sup>St. Luke's-Roosevelt Hospital Center, New York, NY, USA; <sup>3</sup>The Brooklyn Hospital Center, Brooklyn, NY, USA; <sup>4</sup>New York City Department of Health Poison Control Center, New York, NY, USA.

*Background:* Staphylococcal enterotoxin B (SEB) is a CDC category B bioterror agent. We sought to determine if SEB can be adsorbed by activated charcoal (AC) in vitro. *Methods:* Aqueous standard solutions of highly purified SEB (Toxin Technologies, Sarasota, Florida) were produced in concentrations of 10 mcg/mL, 2 mcg/mL, and 0.4 mcg/mL. The presence of SEB in each solution was confirmed using a semi-quantitative point-of-care immunoassay (Alexeter Technologies, Chicago, Illinois) with a lower limit of detection of 12.5 ng/mL. Each of the standard solutions were divided into aliquots. Three would be treated with varying amounts of AC and three left untreated. AC treatment was addition of 10 g, 5 g, or 2.5 g to 40 mL of the SEB solution. Each mixture was stirred in a beaker with a magnetic stirring bar for 10 minutes followed by centrifugation for 10 minutes to separate the charcoal from the supernatant liquid. The supernatant from each sample was removed and tested with the SEB immunoassay to detect the presence of SEB. A sample from each untreated aliquot that had not been combined with AC was also tested at that time to confirm that SEB was still detectable. All waste materials were treated with household bleach to inactivate the SEB. *Result:* SEB was detectable in each untreated control solution. SEB was undetectable in the 2 mcg/mL and 0.4 mcg/mL solutions after treatment with each quantity of AC tested. SEB was detected in the 10 mcg/mL solution after treatment with each quantity of AC tested. *Conclusion:* At concentrations of 2 mcg/mL and less, SEB was adsorbed by AC when combined in the manner described. At concentrations of 10 mcg/mL, combination with AC did not bind enough SEB to lower the concentration below the assay limit of detection. There may be a role for use of AC in treating patients exposed to SEB or purifying liquids or gases containing SEB.

## 97. Adverse Reactions to Ethanol Antidote for Toxic Alcohol Poisoning: A Multi-Center Retrospective Review

Lepik KJ,<sup>1,2</sup> Purssell RA,<sup>1</sup> Levy AR,<sup>2</sup> Daws DE.<sup>1</sup> <sup>1</sup>BC Drug and Poison Information Centre; <sup>2</sup>UBC, Vancouver, BC, Canada.

*Background:* Persons poisoned with methanol (ME) and ethylene glycol (EG) poisoning are often treated with ethanol to block toxic metabolite production. Other investigators have reported a low adverse event rate in children treated with ethanol for ME poisoning. The adverse reaction (AR) rate in young children may differ from that in older persons. Our objective was to estimate the incidence and severity of ethanol ARs in patients  $\geq 13$  years of age treated for ME and EG poisoning. *Methods:* We performed a 5 year retrospective review of hospital admissions for ME and EG poisoning from 1996–2001. Cases at 9 regional hospitals were identified by ICD-9 codes 980.1 (ME) and 982.8 (EG). Patients age 13 years or older were included if they received at least 1 dose of ethanol. ARs were defined as symptoms temporally related to ethanol treatment and not attributable to

another cause. ARs were classified by body system, with the most severe AR recorded for each system. Hypoglycemia was defined as blood glucose <60 mg/dL. *Result:* One hundred and three cases (63 ME and 40 EG) met inclusion criteria. Ethanol was given IV in 98% and orally in 2%. There were 92 adults and 11 adolescents. Median age was 33 years, 69% were male. Forty four patients (43%) had at least one ethanol AR: **CNS:** Mild-moderate effects occurred in 29 cases (28%), including CNS depression (GCS 9–14), ataxia, slurred speech, euphoria or agitation. Coma (GCS ≤ 8) occurred in 5 (5%). **GI:** nausea or vomiting in 8 (8%). **Cardiovascular:** 2 (2%) patients developed hypotension requiring pressors, 1 of whom also had a cardiac arrest. **Metabolic:** 2 (2%) patients had a lowest blood glucose of 49 and 56 mg/dL, but neither showed symptoms of hypoglycemia. **Other:** 7 (7%) had transient IV site or infusion complications, 1 (1%) had polyuria. *Conclusion:* Ethanol antidote caused adverse effects in 43% of the adults and adolescents in this series. Approximately 7% experienced a serious CNS or cardiovascular event, often associated with the IV loading dose or high blood ethanol levels. This report may underestimate ethanol toxicity, as it does not include symptoms due to additive effects with ME, EG or other medications.

## 98. Adverse Reactions to Hemodialysis in 72 Cases of Toxic Alcohol Poisoning

Lepik KJ,<sup>1,2</sup> Purssell RA,<sup>1</sup> Levy AR,<sup>2</sup> Daws DE.<sup>1</sup> <sup>1</sup>BC Drug and Poison Information Centre; <sup>2</sup>UBC, Vancouver, BC, Canada.

*Background:* Methanol (ME) and ethylene glycol (EG) poisoning are treated with antidote to block formation of toxic metabolites and hemodialysis (HD) to remove toxins and provide renal support. In cases with moderately elevated toxic alcohol levels and no acidosis or renal failure, clinicians must weigh the risks and benefits of treating with antidote alone, or administering HD to enhance toxin elimination. HD-related morbidity has not been characterized in toxic alcohol poisoning. Our objective was to estimate incidence and severity of HD-related adverse reactions (ARs) in the treatment of ME and EG poisoning. *Methods:* We performed a 5 year retrospective review of hospital admissions for ME and EG poisoning from 1996–2001. Cases at 9 hospitals with HD facilities were identified by ICD-9 codes 980.1 (ME) and 982.8 (EG) and were included if they received HD to enhance elimination of ME or EG or correct metabolic acidosis. HD sessions given solely for support of renal failure were not included. ARs were defined as symptoms temporally associated with HD and not attributable to another cause. Procedure complications (e.g. clogged lines) were recorded if HD was interrupted >30 minutes. *Result:* Seventy two cases (38 ME, 34 EG) received HD, all of whom were also treated with ethanol antidote. There were 9 adolescents and 63 adults. Median age was 35 years, 69% were male. A mean (sd) of 1.5 (1.0) HD sessions were used per case at 6.3 (3.5) hours per session.

Twenty patients (28%) experienced a HD-related AR: Ten had procedure interruptions >30 minutes, but these did not appear to affect case outcome. Seven had pain or transient bleeding at the catheter site. Three patients developed hypotension: 2 required no treatment, 1 needed pressors. One patient suffered an arterial tear during catheter insertion leading to internal bleeding, shock and cardiac arrest with eventual recovery. There were no serious ARs due to heparinization. *Conclusion:* Two patients (3%) in this series experienced serious HD-related adverse events, one of which was life-threatening. The decision to employ HD for enhancing ME or EG elimination in the absence of other indications must be weighed against the risks of the procedure.

## 99. The Availability and Use of Charcoal Hemoperfusion in the Treatment of Poisoned Patients

Shalkham AS, Kirrane BM, Goldfarb D, Hoffman RS, Nelson LS. *New York City Poison Control Center, New York City Department of Health, New York, NY, USA.*

*Background:* Currently charcoal hemoperfusion (CH) is the preferred method to enhance the elimination of certain toxins in selected poisoned patients. However, availability of CH may be limited due to cartridge expense, their limited shelf life, and improvement in hemodialysis. We investigated the availability of CH in inpatient hemodialysis units (IHUs) at 911-receiving hospitals in New York City and their recent history of use in poisoned patients. *Methods:* The medical director or managers of IHUs in the 911-receiving hospitals of New York City were contacted via email and/or telephone. Participants were administered a standard survey that included questions regarding the availability of CH cartridges, and the date and indication of last use of CH. Participants at institutions that did not stock CH cartridges were questioned about their opinions on the utility of CH. *Result:* 42 IHUs were surveyed, of which 34 (81%) completed the survey. Ten (29%) IHUs had CH cartridges available for immediate use. Each IHU stocked between one and four adult CH cartridges; one IHU stocked two pediatric CH cartridges. Nine IHUs had in-date CH cartridges and one IHU had only expired CH cartridges. Two IHUs had performed CH in the last five

years, both in cases of theophylline intoxication. Of the directors from the 24 units without CH cartridges, 21 felt that most common toxins could be effectively removed via hemodialysis and thus CH was rarely indicated. Only one cited expense as a factor in not stocking the CH cartridges. Two reported no specific reason for not stocking the cartridges. *Conclusion:* CH cartridges are available in approximately one third of 911-receiving hospitals in New York City. CH is infrequently performed to enhance toxin elimination in poisoned patients.

### 100. Benefits of Magnesium Sulfate in the Management of Acute Human Poisoning by Organophosphorus Insecticides

Shadnia SH, Rahimi M, Abdi M, Abdollahi M. *Poison Center, Loghman-Hakim Hospital, Faculty of Medicine, Shaheed-Beheshti University of Medical Sciences, Tehran, Islamic Republic of Iran; Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran.*

*Introduction:* Organophosphorus chemicals (OPs) are the pesticides most often involved in serious human poisoning. Treatment of intoxication with OPs conventionally involves atropine and oximes. Although atropine and oximes are traditionally used in the management of such poisoning, their efficacy remains a major issue of debate; thus, the goal of this prospective clinical trial was to elaborate the value of magnesium sulfate ( $MgSO_4$ ) in the management and outcome of OP<sub>s</sub> poisoning. *Case Report:* This unicenter, randomized, single-blind trial study was conducted on patients who were acutely poisoned with OP<sub>s</sub> and admitted to the Poison Center in Tehran. In a systematic sampling, every fourth eligible patient was chosen to undergo  $MgSO_4$  treatment. Magnesium sulfate was administered at dose of 4 g/day intravenously continued for only the first 24 hours after admission. *Case Discussion:* The mean daily oxime requirement and the mean daily atropine requirement were not statistically significant between two treated groups. The mortality rate and hospitalization days of patients who received  $MgSO_4$  treatment were significantly lower than those who had not received  $MgSO_4$  ( $P < 0.01$ ). *Conclusion:* It is concluded that administration of  $MgSO_4$ , in a dose of 4 g/day concurrent to conventional therapy, in OP acute human poisoning is beneficial by reducing the hospitalization days and rate of mortality.

Medication requirements, duration of hospitalization and outcome of the patients

	Treated without $MgSO_4$	Treated with $MgSO_4$
Mg level after treatment (mEq/L)	1.61±0.03	1.86±0.06**
Duration of hospitalization (Days)	5.00±0.82	2.90±0.66**
Mean daily atropine requirement (mg)	4.70±1.01	3.40±0.84
Mean daily pralidoxime requirement (g)	2.8±1.2	2±0
Mean daily obidoxime requirement (mg)	722.8±55.98	743.10±90.24
Mortality No. (%)	5 (14.7%)	0 (0%)**

Data are mean±SE. \*\*There is significant difference between two groups ( $P < 0.01$ ).

### 101. Acute Aluminum Encephalopathy from Alum Bladder Irrigation: Aluminum Extraction with High Flux Hemodialysis is Superior to Charcoal Hemoperfusion

Bouchard NC,<sup>1</sup> Malostovker I,<sup>2</sup> Harbord N,<sup>2</sup> Nelson LS,<sup>1</sup> Feinfeld DA,<sup>2</sup> Dubrow A,<sup>2</sup> Hoffman RS,<sup>1</sup> Winchester JF.<sup>2</sup> <sup>1</sup>New York City Poison Control Center, NY, NY, USA; <sup>2</sup>Beth Israel Medical Center, NY, NY, USA.

*Introduction:* Life threatening and fatal encephalopathy is reported with Alum bladder irrigation, especially in the setting of renal insufficiency. Treatments for acute aluminum (Al) toxicity include chelation with deferoxamine (DFO), high flux hemodialysis (HFD) and charcoal hemoperfusion (CHP). There are no data comparing Al extraction with CHP to HFD. *Case Report:* A 75 year-old woman with a history of radiation therapy for uterine cancer, dementia and recurrent hematuria was admitted for refractory hemorrhagic cystitis. Labs showed; BUN, 11 mg/dL; creatinine, 1.2 mg/dL. Continuous intravesical irrigation with a 1% Alum solution was performed for 1.5 days. Subsequently, she became more confused, and on day 6 she only responded to sternal rub. Her serum Al level was 423 mcg/dL (normal <4 mcg/dL). She was treated with DFO (500 mg IV over 2 hours) and HFD (6 hours later). After 2 days of combined DFO/HFD therapy she opened her eyes spontaneously and she was

responsive to verbal stimuli. A CHP cartridge (Gambro Adsorba 300C) was used for the 3rd session. Al extraction ratios (ER) were compared between CHP and HFD (polysulfone, F200 Dialyzer). The ER for DFO/HFD alone was good and remained high throughout (ER15 mins=17, ER2 h=34.5, ER4 h=20). The ER across CHP was good at 15 minutes, but negligible at 2 and 4 h (ER15 mins=38, ER2 h, 4 h=5). During CHP she developed thrombocytopenia with hematuria and hypotension. DFO/HFD was performed 6 times over the next 2 weeks and her mental status gradually returned to baseline. Serum Al remained elevated (~170–300 mcg/dL) for more than 4 weeks. She expired of medical complications after an 8-week hospitalization. *Case Discussion:* Historically CHP compared favorably to low flux dialyzers which are obsolete. Conservative DFO dosing in series with HFD minimizes sharp increases in serum Al. In this case, the Al CHP cartridge saturated rapidly. *Conclusion:* Given superior Al extraction with HFD and the added risk of thrombocytopenia from CHP, DFP in series with HFD is recommended for acute Al toxicity.

### 102. Inhalational Intravenous N-Acetylcysteine (Inh IVNAC) Use in Children for Acetaminophen Toxicity

Feng S, Stephan M. *UT Southwestern/Children's Medical Center of Dallas, Dallas, TX, USA.*

*Background:* N-acetylcysteine (NAC) is the preferred method of treating acute acetaminophen (APAP) toxicity in adults and children. Although the safety and efficacy of the IV use of NAC labeled for oral and inhalation use has been supported, there are few published pediatric safety data. *Methods:* This is a retrospective chart review of patients less than 17 years of age who ingested a toxic amount of APAP requiring antidote administration of NAC. Data was abstracted on the following criteria: demographics, reason for ingestion, amount of toxin ingested, laboratory values, method and dose of oral and IV NAC given, method of preparation of IV medication, number of dosages both oral and IV, vital signs during infusion, length of hospital stay, adverse outcomes, cost and disposition. All pts receiving only oral NAC were excluded. *Result:* 7 pts were identified who received IV NAC. Age range: 11 mo–16 y. 42.8% presented as suicide attempts. APAP ingested:150–500 mg/kg. 2 patients coingested NSAIDs. Charcoal was administered in 71.4%. Oral NAC attempted in 4(57%). Antiemetics were given to all pts—6 (85.7%) received ondansetron, with 4 (57%) continuing to vomit. 6 (85.7%) received the inhalational NAC prepared for IV use: 5 patients started secondary to persistent vomiting and 1 for intubation. 1 received continuous Acetadote<sup>®</sup> per 20.5 hr protocol. One abnormal vital sign was noted during infusion of Inh IVNAC described as O<sub>2</sub> desaturation to 93%. None had adverse or anaphylactic reactions. All other vital sign remained normal for all pts receiving IV NAC. 2 pts received subsequent oral NAC dosing after initial Inh IVNAC, 4 continued Inh IVNAC (70 mg/kg q4 hrs × 17 doses). Hospitalization varied from 1–4 days. 57% patients were transferred for inpatient psychiatry. All LFTs normalized. All pts had good outcomes. *Conclusion:* Inh IVNAC use for APAP toxicity is safe and effective in the pediatric population. Our study revealed that all patients, regardless of the treatment regimen used (exclusive Inh IVNAC, oral NAC switched to Inh IVNAC) developed no adverse outcomes.

### 103. Don't Hold the Mayo

Schultz OE, Stephens TL. *Kentucky Regional Poison Center, Louisville, KY, USA; Kentucky Regional Poison Center, Louisville, KY, USA.*

*Background:* There is a need for an inexpensive, readily available, non-toxic and effective decontamination for dermal, and occasionally, oral exposures to common household and occupational substances. Although not life threatening per se, the intensity of problems (e.g. body part or substance adhesion, intense burning sensation, and redness) warrants intervention and resolution. We evaluated the effectiveness of mayonnaise as a useful tool for decontamination of commonly contacted substances over a three year period. *Methods:* Retrospective chart review of all cases reported to a regional poison center in which mayonnaise was utilized for decontamination from April 2002 until March 2005. *Result:* 598 patients utilized mayonnaise for decontamination and treatment. The substance groups included chemicals (n=32), essential oils and capsaicin (n=309), paints/glues (n=77), tar/phenol and hydrocarbons (n=75), and other miscellaneous unclassified (n=106). 546 cases were managed at home and 52 were treated in hospital setting. Tar/asphalt was successfully removed by mayonnaise. Capsaicin plant exposures were effectively treated, as were capsaicin-based ointments and lacrimators. Oxalate-containing plant exposures experienced relief. Essential oil contacts were managed well when removed by mayonnaise. Paints, cyanoacrylates, and nail

TABLE 1  
Efficacy vs. substance category

Substance group	Full resolution	Significant improvement	Moderate improvement	Minor improvement	No improvement
Chemicals	12 (38%)	7 (22%)	4 (12%)	2 (6%)	7 (22%)
Essential oils	213 (69%)	42 (14%)	22 (7%)	13 (4%)	19 (6%)
Paints/glues	54 (70%)	12 (16%)	7 (9%)	2 (3%)	2 (3%)
Tar/phenols and hydrocarbons	47 (64%)	16 (22%)	4 (5%)	4 (5%)	3 (4%)
Other unclassified	41 (39%)	31 (29%)	17 (16%)	6 (6%)	11 (10%)

polish were removed without other chemicals. Expanding foam insulation was removed or partially eliminated from hands in some cases. *Conclusion:* Mayonnaise is a simple, soothing, non-toxic, effective, readily available, and inexpensive decontaminant (Table 1).

#### 104. Activated Charcoal Aspiration: Death in a Dose

Hack JB, Meggs WJ, Gilliland MGB. *Brody School of Medicine at East Carolina University, Greenville, NC, USA.*

*Introduction:* Although much is written on the timing, indications for initiation of therapy, and complications of activated charcoal administration, death is rarely reported. This is the first case report of an activated charcoal aspiration associated death since 1988. In it we describe a case, with accompanying photographs of gross specimens, histologic slides, and description of the pulmonary reaction. *Case Report:* An 87 year old man with an advance directive of Do Not Intubate presented to the ED several hours after an intentional single-drug oral ingestion of 46 (15 mg) temazepam tablets. He was sleepy but arousable on admission and had oro-gastrointestinal lavage performed followed by activated charcoal administration through the orogastric tube. Over the next several hours, his respiratory status deteriorated. He suffered a cardiopulmonary arrest and was pronounced dead. At autopsy gross examination of his pulmonary tree revealed activated charcoal in his oropharynx, trachea and within pulmonary parenchyma. There were both diffuse and focal black geographic discoloration of both lung fields with airways containing black particulate matter. Histologic slides revealed activated charcoal within bronchiole and in peribronchiolar alveolar spaces with very extensive polymorphonuclear leukocytic infiltration. *Case Discussion:* Activated charcoal is generally considered safe. Rarely, adverse events including fatal aspiration can occur. Autopsy findings show extensive focal and diffuse black discoloration of the lungs. On histology, charcoal particles are found throughout the airways into bronchioli and alveoli. Polymorphonuclear leukocytes are seen. *Conclusion:* This case graphically illustrates several points including the need for careful patient selection when deciding to administer activated charcoal, and the potentially fatal complications associated with its use.

#### 105. Calcium Channel Blocker Overdose: One Center's Experience

Pizon AF,<sup>1,2</sup> LoVecchio F,<sup>1,2,3</sup> Matesick LD.<sup>3</sup> <sup>1</sup>Banner Good Samaritan Medical Center, Phoenix, AZ; <sup>2</sup>Maricopa Medical Center, Phoenix, AZ; <sup>3</sup>Arizona College of Osteopathic Medicine, Phoenix, AZ.

*Background:* Various treatments (including calcium, insulin, glucagon, and phosphodiesterase inhibitors) have been suggested for the treatment of calcium channel blocker (CCB) poisoning, however, very few controlled studies exist in humans. The purpose of this study is to evaluate various treatments used in CCB poisoned patients. *Methods:* Retrospectively, 10 years of medical records were reviewed from a tertiary care teaching hospital with acute CCB poisoning. Data including serum pH, amount of calcium, glucagon and insulin used, hours on vasopressors, time to normal vital signs, and mortality were abstracted using a standardized data collection form. Data were analyzed using descriptive statistics. *Result:* Forty-five poisonings from 44 patients were identified. CCB agents involved included amlodipine (n=9), diltiazem (n=16), nifedipine (n=8), and

verapamil (n=13). One patient ingested both amlodipine and verapamil. Vasopressors were used in 28 cases, calcium in 28, glucagon in 17, and insulin in 4. Ten cases received >2 gm of calcium chloride or calcium gluconate with a mean serum pH of 7.25 and a mean time to normal vitals of 29.4 hrs (p=0.11). Ten cases received >5 mg of glucagon with a mean serum pH of 7.22 and a mean time to normal vitals of 23.1 hrs (p=0.12). Twenty cases received vasopressors and <5 mg of glucagon with a mean serum pH of 7.31 and a mean time to normal vitals of 21.0 hrs (p=0.07). Four cases received insulin with a mean serum pH of 7.31 and a mean time to normal vitals of 36.7 hrs (p=0.18). No case received a phosphodiesterase inhibitor. Only one case died and had received vasopressors, calcium, glucagon, and insulin. *Conclusion:* Vasopressors and calcium were most frequently used to treat CCB poisoning in our patients. Few patients received insulin. Despite multiple therapeutic options for CCB overdose, most patients recovered with aggressive critical care in the absence of insulin or phosphodiesterase inhibitor treatment. As demonstrated by only one death, patients did well after CCB poisoning regardless of treatment.

### 106. Pediatric Ingestion of Seven Lead Bullets Successfully Treated with Outpatient Whole Bowel Irrigation

Schwarz KA,<sup>1</sup> Alsop JA.<sup>1,2</sup> <sup>1</sup>University of California, San Francisco, San Francisco, CA, USA; <sup>2</sup>California Poison Control System, Sacramento, CA, USA.

*Introduction:* Over 5000 cases of lead exposure in children under the age of six are reported to US Poison Centers annually. Gut decontamination as whole bowel irrigation (WBI) has been successfully used in the hospital setting to prevent absorption after ingestion of lead-containing foreign bodies. *Case Report:* A 14 month old female presented to clinic 1-hr post ingestion of seven lead bullets. Syrup of ipecac was given but no bullets were in the emesis. X-rays confirmed all bullets were in the small bowel. The physician then called the Poison Center (PCC) for recommendations. Referral to a hospital for WBI, blood lead level (BLL), complete blood count, and straining stools to account for all bullets was advised. Five hours post-ingestion the physician stated the parents refused hospital referral and were administering WBI to the child at home without complications. Twenty-four hours post ingestion the child remained stable at home, had passed four bullets, and was still receiving WBI without complications. At 48 hours post-ingestion the child remained asymptomatic, still tolerating WBI and five bullets had passed. Seventy-two hours post-ingestion two bullets were confirmed by X-ray to be in the bowel. The patient remained asymptomatic and was still tolerating WBI. By 96 hours post ingestion seven bullets were recovered and X-ray confirmed no bullets remained. One month post ingestion BLL=15.5 mg/dL and the child had no signs or symptoms of lead toxicity. *Case Discussion:* In the acidic environment of the stomach, lead can dissolve and be absorbed resulting in potentially serious lead toxicity. WBI has been successfully used in the management of lead exposures in the hospital setting. This case illustrates the successful use of gut decontamination with WBI in the outpatient setting to treat a potentially toxic lead-containing foreign body ingestion. *Conclusion:* Rather than admitting a child for a lengthy stay for WBI after ingestion of lead-containing foreign objects, compliant parents may administer WBI at home to asymptomatic children. Follow-up with X-rays to ensure the passage of the foreign object and a BLL are also recommended.

### 107. Does Maximal Therapeutic Dosing of Acetaminophen Perturb Hepatic Biomarkers in Recently Abstinent Alcoholics?

Bartels SA, Crosby DL, Richard JI, Sivilotti MLA. *Queen's University, Kingston, ON, Canada.*

*Background:* Controversy surrounds whether therapeutic doses of acetaminophen cause hepatotoxicity in alcoholics, especially those rendered most vulnerable by recent abstinence. We sought to identify subclinical changes in hepatic markers, including the experimental biomarker  $\alpha$ -glutathione-S-transferase ( $\alpha$ -GST), which is sensitive to centrilobular injury. *Methods:* This randomized, triple-blind, placebo-controlled trial was carried out at a community detoxification center. Chronic alcohol abusers (defined as >6 drinks daily for  $\geq 6$  weeks) who had discontinued alcohol consumption 12–72 hours prior to enrolment were eligible. We excluded patients with self-reported viral hepatitis, intravenous drug use, baseline AST or ALT>120 IU/L, or INR>1.5. Subjects were block-randomized in strata based on baseline AST quartile. The experimental group received sustained-release acetaminophen 1.3 g orally q8h for 11 doses, while the control group received a taste- and color-matched placebo. Hepatic function tests were measured daily for 5 days. The primary outcome was change in serum  $\alpha$ -GST; the secondary outcomes were AST, ALT, INR, and study withdrawal for a doubling of aminotransferases to >120 IU/L. The study was designed to detect a 0.9  $\mu$ g/L increase in  $\alpha$ -GST with 80% power. *Result:* The study enrolled 48 subjects, including 40 who completed at least 4 days of the protocol. Subjects were well matched at baseline. Complete  $\alpha$ -GST data are available on 32

patients at this time, and demonstrate no significant difference (relative change +46% [95%CI 12%, 91%] vs. +29% [-6%, 77%], P=0.5). Secondary outcomes have been ascertained in all subjects, and also demonstrate no significant difference between groups (e.g. relative change in AST -3% [-14%, +10%] vs. -6% [-21%, +13%]; P=0.8). No subjects were withdrawn for safety concerns. *Conclusion:* Despite using a more sensitive biomarker of hepatocellular injury, and attempting to maintain more uniform serum drug concentrations over 4 days with a sustained-release formulation, we were unable to identify a significant change in hepatic biomarkers in this supposedly vulnerable population.

### 108. A Prospective Evaluation of Shortened Course Oral N-Acetylcysteine for the Treatment of Acute Acetaminophen Poisoning

Betten DP,<sup>1</sup> Cantrell FL,<sup>1</sup> Thomas S,<sup>2</sup> Williams SR,<sup>1</sup> Clark RF.<sup>1</sup> <sup>1</sup>California Poison Control System, San Diego Division, San Diego, CA, USA; <sup>2</sup>Naval Medical Center, San Diego, CA, USA.

*Background:* Treatment of acute acetaminophen (APAP) overdoses with oral N-acetylcysteine (NAC) has traditionally consisted of an 18 dose (72 hour) regimen. A shortened duration of oral NAC therapy could decrease hospital admission times resulting in lower costs. This prospective study was designed to evaluate the clinical efficacy and safety of a shortened course of oral NAC therapy. *Methods:* Acute acetaminophen overdose patients with blood levels considered in the “possible” or “probable” toxic range on the Matthew-Rumack nomogram who were eligible for shortened course oral NAC therapy were prospectively identified from a statewide poison center database over a 9 month period. Shortened course NAC (SCN) consisted of a minimum of 6 total doses (20 hours) and a maximum of 13 total doses (48 hours). NAC was discontinued after a minimum of 6 doses when APAP levels were no longer detectable and AST, ALT, and INR were within or near normal range. Follow-up phone numbers were obtained and individuals were contacted at least 3 days following NAC discontinuation and questioned regarding the presence of abdominal pain, vomiting, jaundice, or confusion. *Result:* 232 patients were identified who were found to be eligible for SCN with 165 (71.1%) receiving < 13 doses with an average treatment duration of 35.9 hours. 67 patients received >48 hours of NAC at the treating physicians discretion. Of individuals treated with SCN, 67/165 (40.6%) had levels in the “possible” toxic range and 98/165 (59.4%) were in the “probable” toxic range. 55/165 (33.3%) received <32 hours of NAC, 57/165 (34.5%) received NAC for 32.5–40 hours, and 52/165 (31.5%) received NAC for 40.5–48 hours. Seven patients (4.2%) receiving SCN were unable to be contacted following hospital discharge. Of those receiving SCN, six individuals (3.6%) reported abdominal pain or vomiting, however none of these individuals required further hospitalization. *Conclusion:* A shortened treatment course of oral NAC appears to be safe and effective when used in appropriate candidates following acute acetaminophen ingestions.

### 109. Hepatic Microvascular Response to Acetaminophen Toxicity

Houle J,<sup>1,2</sup> Ondiveeran HK,<sup>2</sup> BeGora A,<sup>2</sup> Fox-Robichaud A.<sup>2</sup> <sup>1</sup>Ontario Regional Poison Information Centre, Toronto, ON, Canada; <sup>2</sup>McMaster University, Hamilton, ON, Canada.

*Background:* Acetaminophen (APAP) toxicity results in hepatic centilobular necrosis and microcirculatory disturbances. The toxic metabolite, N-acetyl-p-benzquinoneimine, depletes glutathione, an important anti-oxidant in the tissues and the resulting oxidative stress is believed to contribute to the damage. Administration of the antidote, N-acetylcysteine (NAC), replenishes these glutathione stores in order to minimize this damage. We have developed a mouse model of APAP toxicity to study the temporal relationship between APAP ingestion, the development of hepatic microvascular disturbance and the effect of NAC therapy or other interventions. *Methods:* 600 mg/kg APAP was administered to C57Bl/6 mice by oral gavage. Intravenous NAC (150 mg/kg) or an equivalent volume of saline (SAL) was given 2 hours post-gavage via a right internal jugular line. The hepatic microcirculation was examined 4 hours post-APAP dosing by intravital microscopy and leukocyte endothelial cell interactions recorded. *Result:* There was no significant difference in the number of rolling leukocytes or adherent leukocytes in the post-sinusoidal venules between the 2 groups. However, there was a significantly greater number of adherent leukocytes within the pericentral sinusoids in SAL treated mice ( $3.5 \pm 0.5$ ) compared to NAC mice ( $0.5 \pm 0.5$ ). Sinusoidal flow was also significantly reduced in SAL treated mice ( $66.5\% \pm 4.5$ ) versus NAC mice ( $91.5\% \pm 2.5$ ). Both groups had significantly increased ALT levels. Although, there was a trend towards a greater increase in SAL treated mice ( $140 \pm 65.5$  U/L) compared to NAC treated mice ( $96.5 \pm 17.5$ ), this did not reach significance. *Conclusion:* In conclusion, hepatocellular injury secondary to APAP precedes microvascular disturbance within the hepatic microcirculation at this early time point. Administration of NAC reduced

hepatic leukocyte recruitment at the 4-hour time point and probably exerts its benefit by minimising the secondary injury that occurs with the influx of inflammatory cells into the liver.

### 110. Survival Following Liver Transplants Performed Following Acetaminophen Toxicity

Rhee JW,<sup>1,2</sup> Leikin JB,<sup>4</sup> Akhter S,<sup>3</sup> Wills BK.<sup>1,2</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL, USA; <sup>2</sup>University of Illinois at Chicago, Chicago, IL, USA; <sup>3</sup>Rush University, Chicago, IL, USA; <sup>4</sup>Evanston Northwestern Healthcare OMEGA, Glenview, IL, USA.

**Background:** Acetaminophen (APAP) toxicity is a common reason for liver transplantation. Survival outcomes of these patients who have received liver transplants for APAP toxicity have not been well described in the literature. **Methods:** Using the United Network for Organ Sharing data from January 1988 to June 2003, Kaplan-Meier patient survival rates in patients receiving liver transplants for APAP toxicity and patients receiving liver transplants for all other causes were generated. Causes of death were also described for both groups. **Result:** APAP-induced liver transplant patients had a lower 6-month survival rate when compared to patients who received liver transplants for other causes (75.06 v. 86.51, p=0.0202). A separate table further describes the survival rates. The rates of death were higher in the APAP group for operative mortality, cerebrovascular causes, graft failure, and subsequent suicide. **Conclusion:** When compared to patients receiving liver transplants for other causes, APAP-induced liver transplant patients have a higher 6-month mortality rate and are more likely to die due to operative mortality, cerebrovascular causes, graft failure, or suicide.

Kaplan-Meier patient survival rates—transplants performed 1/1988–6/2003

Primary diagnosis	Number of transplants	Month posttransplant	Survival rate	95% Conf. limits	Log-rank P-value
Acetaminophen toxicity	197	6	75.06	[68.52,81.60]	0.0202
		12	73.97	[67.34,80.59]	
		24	71.36	[64.47,78.25]	
		36	68.43	[61.21,75.64]	
		48	67.47	[60.11,74.84]	
		60	65.17	[57.34,72.99]	
Other	59252	6	86.51	[86.23,86.80]	
		12	83.56	[83.25,83.87]	
		24	79.63	[79.29,79.97]	
		36	76.71	[76.34,77.07]	
		48	74.05	[73.67,74.44]	
		60	71.48	[71.07,71.89]	

Causes of Death (Condensed)

Cause of death	Primary diagnosis			
	APAP toxicity		Other	
	N	%	N	%
Operative	12	16.22	386	2.10
Cerebrovascular	11	14.86	833	4.53
Sepsis	8	10.81	2447	13.30
Graft failure	8	10.81	1165	6.33
Multiple organ failure	6	8.11	1502	8.17
Cardiac arrest	5	6.76	478	2.60
Pulmonary insuff or edema	4	5.41	242	1.32
Suicide	2	2.70	49	0.27
Total deaths	74		18393	

### 111. Hepatic Function in Alcoholics Throughout 5 Days of Maximal Therapeutic Dosing of Acetaminophen (APAP)

Green JL,<sup>1</sup> Kuffner EK,<sup>1</sup> Bogdan GM,<sup>1</sup> Dart RC.<sup>1,2</sup> <sup>1</sup>*Rocky Mountain Poison and Drug Center—Denver Health, Denver, CO, USA;* <sup>2</sup>*University of Colorado, Denver, CO, USA.*

*Background:* The use of APAP in alcoholic patients remains contentious despite prospective studies indicating safety during 2 or 3 days of APAP administration. One concern has been the duration of APAP treatment and its use in patients with pre-existing liver disease (e.g. alcoholic hepatitis, hepatitis C). The half-life of CYP2E1 induction in humans is about 1.5 days. The objective of this study was to evaluate hepatic function in alcoholic patients given acetaminophen for 5 consecutive days. *Methods:* This is a randomized, double-blind, placebo-controlled trial of active alcoholics. Exclusion criteria included a baseline serum APAP > 20 mcg/ml, AST or ALT > 200 IU/L, or INR > 1.5. Laboratory measures were obtained at baseline and days 2, 4, 6, and 7. Patients were randomized 1:1 to APAP (1 g every 4 hr for 4 doses, for 5 days) or placebo. *Result:* 100 patients completed the trial (49 APAP group, 51 placebo group). No significant differences were found between the treatment groups in demographics, nutritional status or baseline measures ( $p > 0.05$ ). Baseline ALT > 40 IU/L (upper limit normal) were reported for 17 (35%) patients in APAP group and 20 (39%) in placebo ( $p > 0.05$ ). 23 (45%) patients in placebo group and 18 (37%) patients in APAP were reactive for hepatitis C virus (HCV) antibody ( $p > 0.05$ ). Change in ALT, AST and INR measures were not significantly different between treatment groups or between groups with baseline ALT within or above normal limit. ALT levels in HCV positive patients were significantly higher throughout the study than HCV negative patients ( $p < 0.05$ ), regardless of treatment group assignment. *Conclusion:* Maximal therapeutic dosing of APAP does not appear to affect ALT, AST, or INR measures in alcoholic patients, even in the presence of elevated baseline ALT or in patients with hepatitis C.

### 112. Multiplying the Aminotransferase by the Acetaminophen Concentration to Identify Overdose Patients at Risk for Hepatotoxicity

Sivilotti MLA, Green TJ, Yarema MC, Juurlink DN, Johnson DW. *Queen's University, Kingston, ON, Canada.*

*Background:* Changes in serum aminotransferase ([AT]) and acetaminophen ([APAP]) concentrations are the first available markers of hepatotoxicity following APAP overdose. We have recently suggested that the interrelationship between these parameters may identify patients at risk of serious outcomes, and ultimately allow for risk prediction even in patients to whom the Rumack-Matthew nomogram does not apply. To support this claim, we set out to characterize [AT] in a previously described cohort of hepatotoxic APAP overdose patients. *Methods:* All subjects with hepatotoxicity (peak [AT]  $\geq 1000$  IU/L) following single, acute overdose were selected from the Canadian APAP Overdose Study, a multicenter hospital admission review. [AT] (AST or ALT, whichever was greater) were described relative to time of ingestion, and relative to the simultaneously measured or predicted [APAP]. *Result:* In the 94 cases meeting study criteria selected from 3202 admissions, the median initial [AT] was 211 [IQR 87–497] IU/L measured at 15.3 [12.1–19.2] hr, and was > 50 IU/L by 12 hr and > 100 IU/L by 24 hr in all but 1 case. [AT] rose exponentially, doubling every 9.0 [5.8–12.0] hr during the interval spanning 1000 IU/L. At the time of the initial [AT], [APAP] was 570 [314–983]  $\mu\text{M}$ , and detectable in almost all cases. Interestingly, by plotting the initial [AT] against the simultaneous [APAP] on a log–log scale, all cases were found to lie above the straight line passing through (10, 1000) and (1000, 10). To capture this interrelationship, we propose the multiplication product of simultaneously measured  $[\text{AT}] \times [\text{APAP}]$ , which averaged 98,000 [52,000–243,000]  $\mu\text{M} \times \text{IU/L}$  overall and was nearly ten-fold higher in patients with earlier onset hepatotoxicity. *Conclusion:* The likelihood of developing biochemical hepatotoxicity appears remote when the  $[\text{AT}] \times [\text{APAP}]$  product is below 10,000  $\mu\text{M} \times \text{IU/L}$  at presentation. This simple relationship does not require graphical interpretation or complex calculations. While it needs to be independently validated and tested in exposures beyond the single, acute overdose, clinical intuition and kinetic modeling suggest this observation will retain high sensitivity.

### 113. Multistate Outbreak of Clenbuterol Contaminated Heroin and Cocaine

Hoffman RS, Burkhart K, Chan G, Ford M, Ginsburg B, Hahn I, Halcomb S, Johnson-Arbor K, Kirrane B, McKay C, Nelson L, Poppenga R, Ruck B, Schechter E, Stajic M, Tarabar A, Marcus S. *Clenbuterol Outbreak Investigation Group, NJ, NY, PA, NC, CT, USA.*

**Background:** Clenbuterol is an illicit, potent, long-acting  $\beta$ -adrenergic agonist used in asthma, body building and the cattle industry. We report an outbreak of clenbuterol contaminated heroin and cocaine and describe the clinical, laboratory and epidemiologic investigation. **Methods:** Beginning on 1/29/05 patients from NJ and PA presented to emergency departments with hypotension, tachycardia, headache, mydriasis, tremor, nausea, hyperglycemia, hypokalemia, increased venous O<sub>2</sub> content, and lactic acidosis following heroin use. In several drug specimens, the FBI laboratory identified heroin and clenbuterol by GC/mass spec, and excluded cyanide. A case definition was released on EPI-X. **Result:** A total of 26 patients who met the case definition were identified from NJ, NY, NC and CT, involving both heroin and cocaine use. The mean age was 33 and 92% were men. The mean systolic BP was 108 mm Hg and 8 patients had a BP of 90 mm Hg or less. An elevated pulse pressure was common (mean 54 mm Hg). The mean pulse was 135 (range 116–188). For cases tested, the mean K was 2.6 mEq/L (lowest 1.9); the mean glucose was 228 mg/dL and the mean lactate 7.1 mmol/L. Venous hyperoxia was common. Clenbuterol was confirmed by HPLC in the urine of 3 NY cases; a 4th case who was not tested shared drug with a confirmed case. Other urine specimens are pending. Treatments included fluids, cyanide antidote (early cases only),  $\beta$ -blockers (cocaine negative cases) and  $\alpha$ -agonists. Although some patients had myocardial injury (+troponin) no fatalities were reported. **Conclusion:** Contamination of illicit drugs with clenbuterol resulted in multiple cases of serious toxicity with characteristic  $\beta$ -adrenergic manifestations. Rapid notification via EPI-X, followed by cooperation between poison centers, law enforcement, and both national and regional health authorities helped to identify the toxin, define cases, and disseminate treatment information. The motives for adulteration of heroin and cocaine with clenbuterol have not been established, and the outbreak is ongoing.

#### 114. The Tokyo Subway Sarin Attack Revisited

Salzman MS,<sup>1</sup> Haroz R,<sup>1</sup> Bartrand TA,<sup>2</sup> Haas CN,<sup>2</sup> Greenberg MI.<sup>1</sup> <sup>1</sup>*Emergency Medicine, Drexel University College of Medicine, Philadelphia, PA, USA;* <sup>2</sup>*Drexel University, Philadelphia, PA, USA.*

**Background:** On March 22, 1995, approximately five liters of sarin (25–35%) were released in the Tokyo subway system. More than 5,500 people were affected with 12 fatalities reported. This release occurred in railcars with limited ventilation and filled to more than 200% capacity. Utilizing computer plume modeling, we sought to determine the effects had this release occurred at street level in open air. **Methods:** We utilized the BREEZE Haz Professional product suite, a program designed to model releases of environmental pollutants. Using a dense gas dispersion model (DEGADIS), plume models for a release similar to the one that occurred in Tokyo in 1995 were generated. The chemical and physical properties of sarin were obtained from Toxnet, medical journals and published Department of Defense reports. Meteorological data and census data were obtained via the Japanese government. Data were entered into DEGADIS to predict the extent and concentration of a sarin plume, assuming a ground spill of one liter of 35% sarin under the same meteorological conditions in Tokyo on the day of the subway attack. Concentration cutoffs for mild, moderate and severe exposures were based on U.S. military data. Numbers of casualties were determined by calculating the area within the plume corresponding to the exposures and multiplying it by the average population density in central Tokyo. **Result:** The Tokyo release remodeled at ground level in open air indicated casualties as shown.

Area and population affected by sarin spill

Time (sec)	Severely contaminated area in hectares	Mildly and moderately affected area in hectares	Number of severely affected victims	Number of mildly/moderately affected victims
358	1.95	8.35	168	718
666	1.8	33.0	155	2838
1282	2.1	23.9	181	2053

1 hectare=10,000 square meters.

Our model used less than 25% of the amount of sarin released in 1995, consequently the modeled casualty numbers are likely to be underestimated. **Conclusion:** The release of sarin in an open air environment has the potential to affect more people than a similar release in a relatively closed space, such as a subway.

### 115. The Impact of a Poison Control Center on the Length of Hospital Stay for Patients with Poisoning

Vassilev ZP,<sup>1</sup> Hempstead K,<sup>2</sup> Jacquemin B,<sup>2</sup> Marcus SM.<sup>1</sup> <sup>1</sup>UMDNJ, New Jersey Poison Information and Education System, Newark, NJ, USA; <sup>2</sup>New Jersey Department of Health and Senior Services, Trenton, NJ, USA.

*Background:* While previous research suggests that poison control centers (PCC) can reduce significantly the number of emergency room visits and resultant healthcare costs for poisonings, little is known regarding the potential impact of PCC on the length of hospital stay related to poisonings. The aim of this study was to examine whether assistance from PCC is associated with shorter length of hospital stay for patients admitted with poisonings. *Methods:* We compared all cases reported to our PCC over a period of one year with the hospital admissions e-coded as poisonings in the Uniform Billing (UB) Data maintained by the state health department. Cases from the PCC database were first matched to hospital admissions by using variables that were common in the two datasets: patient's first and last name, date of admission and "start date", patient's gender and age, county of residence and "caller's county". The length of hospital stay was then compared between the cases for which PCC had provided assistance (matches) and the cases for which PCC had not been contacted. *Result:* During the study period, there were 32,245 hospitalizations for poisoning in the UB data and 52,498 poisonings reported to the PCC. The matching process yielded 1,736 cases. The average length of hospital stay for patients who received assistance from the PCC was 3.9 days (SD 6.1), which was statistically shorter than the 7.2 days (SD 8.2) of hospital stay for cases that were never called to the PCC ( $P < .001$ ). To eliminate the role of mortality in the observed associations, a separate analysis of only non-fatal cases was conducted and similar pattern of hospital stay were found. *Conclusion:* The results of this study suggest that patients with poisonings who receive PCC assistance have measurable reduction in average hospital stay. Such a decrease may translate into substantial savings in health care costs and resources.

### 116. High Levels of Perchlorate in Drinking Water Did Not Affect Neonatal Thyroxine Levels

Amitai Y,<sup>1</sup> Sack J,<sup>2</sup> Wasser J,<sup>3</sup> Leuis M,<sup>4</sup> Winston G.<sup>5</sup> <sup>1</sup>Ministry of Health, Jerusalem, Israel; <sup>2</sup>Department of Community Genetics, Ministry of Health, Jerusalem, Israel; <sup>3</sup>Ministry of Health, Jerusalem, Israel; <sup>4</sup>Tel Aviv Health district, Ministry of Health, Tel viv, Israel; <sup>5</sup>Ministry of Health, Jerusalem, Israel.

*Background:* Contamination of drinking water with perchlorate, from its usage in rocket fuel and explosives, may affect about 20 million persons in Arizona, California and Nevada. The National Academy of Sciences has recently proposed a drinking water standard for perchlorate of 24.5 ppb, based on a NOEL for inhibition of iodide uptake by the thyroid at 0.007 mg/kg/day of perchlorate in adults and an uncertainty factor of 10, to protect human fetuses. Evaluation of the effect of high exposure to perchlorate during pregnancy on the thyroid function of newborns, is important for regulation of drinking water standard. These effects were studied in neonates from Ramat Hasharon, Israel, following exposure to high concentrations of perchlorate in drinking water. *Methods:* Thyroxine ( $T_4$ ) values obtained from the National Screening Program for congenital hypothyroidism, were compared between newborns whose mothers resided in suburbs with perchlorate levels in drinking water of 684–1,100 ppb (Group A,  $n = 88$ ), 50–88 ppb (Group B,  $n = 233$ ) and  $< 14$  ppb (Group C,  $n = 1,480$ ). In Group A, values of  $T_4$  were further compared between 23 newborns whose mothers drank tap water (Group A1) and 24 whose mothers drank bottled water during pregnancy (Group A2). *Result:* Mean ( $\pm$ ) S.D. values in Groups A, B and C were  $14.1 \pm 3.7$  ug/dL,  $14.0 \pm 3.4$  ug/dL, and  $14.2 \pm 3.4$  ug/dL, respectively ( $P = NS$ ). None of the newborns had abnormally low  $T_4$  ( $< 8.2$  ug/dL). Mean ( $\pm$ ) S.D.  $T_4$  values in Groups A1 and A2 were  $15.2 \pm 3.8$  ug/dL and  $13.2 \pm 3.1$  ug/dL respectively ( $P = 0.054$ ). Thyroid function in newborns ( $T_4$ ) was not affected by gestational exposure to perchlorate in drinking water, in the range of 50–88 ppb, and probably up to 684 ppb. *Conclusion:* The threshold effect of perchlorate in drinking water in pregnancy on neonatal  $T_4$  is  $> 50$  ppb. A more liberal regulation of perchlorate in drinking could be considered.

### 117. Interactive Voice Response System for Automated Drug Identification

Bronstein AC, Banerji S, Seroka AM, Wruk KM, Neil RM. Rocky Mountain Poison and Drug Center—Denver Health, Denver, CO, USA.

**Background:** The most recent American Association of Poison Control Centers (AAPCC) 2003 TESS Annual Report listed 3,708,732 calls. Of these, 1,167,776 were information calls. A majority, 52.9% (617,414), were drug identification (DID) requests. Most requests were from the public (74.4%) followed by health care professionals (12.7%), and law enforcement (11.8%). Published data estimate the cost of a poison center call at \$25–\$30. Therefore, the cost for US poison centers to respond to DID calls was approximately \$1.5–\$1.9 M. We propose that this expense can be substantially decreased by development of an interactive voice response (IVR) DID system. **Methods:** We compared our 2003 DID statistics to AAPCC data and stratified the requests by AAPCC generic code. The proportion of DID requests to general information requests was similar in the two data sets. We designed a conceptual IVR model database and menu structure based on pill shape, capsule, score mark, color and imprint code. Callers must declare no exposure and provide demographic information in order to obtain DID information. Built into the system is a “press-through” option to reach a poison information provider or specialist. **Result:** Our five state service area received 42,271 drug information inquiries with DID requests totaling 65.5% (27,813). DID requests consisted of 227 unique TESS generic code categories. The top five queries were acetaminophen with hydrocodone (8.9%), benzodiazepines (8.4%), acetaminophen with oxycodone (4.2%), antibiotic (3.6%), and carisoprodol (3.0%) comprising 28.1% of all DID’s. Unique medications making up the top five generic categories numbered 1463. **Conclusion:** Use of an IVR DID system for common drug identification requests would dramatically decrease information delivery costs and demands on poison center personnel. Even if only used for half of these calls, this system would save approximately \$7.5–\$9.3 M for US poison centers providing DID services. We conclude that these savings justify the program development, implementation, and maintenance expense.

### 118. Poison Center Medical Error Detection, Characterization, and Reduction

Seifert SA,<sup>1</sup> Boyer LV,<sup>2</sup> Bronstein AC,<sup>3</sup> Jacobitz K,<sup>1</sup> McNally J,<sup>2</sup> Meza JL.<sup>1</sup> <sup>1</sup>Nebraska Regional Poison Center, Omaha, NE, USA; <sup>2</sup>Arizona Poison and Drug Information Center, Tucson, AZ, USA; <sup>3</sup>Rocky Mountain Poison and Drug Center, Denver, CO, USA.

**Background:** This was Phase 2 of a multi-center study to detect, characterize and reduce the incidence of medical error (ME) at poison centers (PCs). **Methods:** Human exposures over a one-year period from two PCs were randomly, prospectively, and independently reviewed by two Certified Specialists in Poison Information (CSPI) for ME. A three-physician medical review panel (MRP) subsequently reviewed and characterized CSPI-identified, potential ME cases. Two new protocols, one regarding acetaminophen-related recommendations in intentional exposures (ARR), and one requiring independent verification of complicated calculations (CC), were introduced at one center prior to the start of Phase 2. **Result:** Of 2,017 cases reviewed, the MRP confirmed 64 MEs in 60 cases (2.97%). ME was more likely to occur with: 1) Intentional exposures; 2) Referral to a healthcare facility; 3) Known outcome effects coding; and 4) SPIs with <5 years’ experience. No adverse outcomes occurred as a result of ME but two (3%) were judged as potentially serious. The detection of errors increased by 20% to 30% with the addition of a second reviewer, but by only 3% with the addition of a third. There was fair agreement between CSPI reviewers (kappa=0.33) but a very high level of agreement among the MRP (kappa=0.97). Following introduction of the new protocols, rates of ARR errors and CC errors were significantly reduced compared with Phase 1 (p=0.0001; p=0.0381). **Conclusion:** The overall medical error rate was similar to the retrospective phase of the study. Differences in error types and TESS associations from Phase 1 may reflect error-reduction efforts. Within the limitations of chart review, detection of medical error is efficiently accomplished by two, independent CSPI reviewers and a single subsequent medical reviewer. TESS associations with medical error suggest more efficient surveillance methods. Protocol changes significantly reduced two types of medical error. This work was supported by DHHS/HRSA/MCHB Grant #4 H4B MC02322-01-01.

### 119. The Diagnostic Value of Biological Markers of Cellular Hypoxia in Cyanide Poisoning in a Rat Model

Renard C,<sup>1,2</sup> Borron SW,<sup>1</sup> Renaudeau C,<sup>2</sup> Baud FJ.<sup>1</sup> <sup>1</sup>INSERM U26, Fernand Widal Hospital, Paris, France; <sup>2</sup>Laboratoire de Biochimie Toxicologie, Hôpital d’instruction des armées Percy, Clamart, France.

**Background:** The definitive diagnosis of cyanide poisoning (CP) is made via laboratory measurement of blood cyanide concentrations, which are not immediately available in an emergency setting. Disturbances of biological markers of cellular

hypoxia have been reported with CP. However, their diagnostic value remains to be clarified. *Methods:* Potassium cyanide (4 mg/kg, IP) induced severe CP in male Sprague-Dawley rats. Arterial and venous blood gases (ABL radiometer) and arterial blood cyanide concentrations (Rieders's method) were repeatedly measured up to 120 min postinjection. *Result:* The maximal measured arterial blood cyanide concentration was  $2.18 \pm 0.1$  mg/L, 10 min postinjection. The elimination half-life of cyanide from blood was  $38.4 \pm 3.6$  min. Maximal arterial and venous lactate concentrations ( $11.0 \pm 2.3$  and  $9.6 \pm 1.1$  mmol/L, respectively) and areas under the curve (AUCs) were not significantly different. The arterial peak was at 10 min postinjection while the venous one was at 25 min. There was a nonsignificant increase in PvO<sub>2</sub> and SvO<sub>2</sub> and a significant but transitory decrease in Da-v SO<sub>2</sub> at 10 min postinjection. Among the various parameters of cellular hypoxia, blood cyanide concentrations best correlated with arterial plasma lactate concentrations. *Conclusion:* During the onset of acute cyanide poisoning in rats, arterial plasma lactate concentrations closely correlated with arterial blood cyanide concentrations. The decrease of cellular oxygen consumption assessed using Da-v SO<sub>2</sub> occurred early and was only transitory. Lactate concentrations may be a good biomarker for CP. These results in rats cannot necessarily be extrapolated to man.

### 120. Rapid Detection of Cyanide in Blood Using the Cyantesmo<sup>®</sup> Kit

Rella JG,<sup>1</sup> Marcus S,<sup>2</sup> Wagner BJ.<sup>1</sup> <sup>1</sup>New Jersey Medical School, Newark, NJ, USA; <sup>2</sup>New Jersey Poison Information and Education System, Newark, NJ, USA.

*Background:* There are many sources of cyanide exposure including laboratories, industry, and combustion of plastic or vinyl such as from a house fire. It is desirable to make a definitive diagnosis in order to prevent potential complications of empiric treatment of presumptive cyanide poisoning from the cyanide antidote kit currently approved by the US Food and Drug Administration. However, rapid and definitive diagnosis of cyanide poisoning is unavailable in the emergency department setting. We previously demonstrated that Cyantesmo<sup>®</sup> test strips, used by water treatment facilities and medical examiners, accurately and rapidly detected in a semi-quantifiable manner concentrations of cyanide greater than 1 mcg/mL in water. This investigation attempted to determine if our method is effective for rapid detection of clinically important concentrations of cyanide in blood. *Methods:* Varying standardized dilutions of KCN ranging from 0.5 mcg/mL to 30 mcg/mL were added to pooled, discarded blood that had been warmed to 37°C in a water bath for 30 minutes. Test samples were then acidified with 100 µL of sulphuric acid in a closed system under a ventilation hood at room temperature. Cyantesmo<sup>®</sup> test strips were placed into the test tubes just above the fluid level where liberated HCN gas interacted with the test strip to effect a color change. Color changes were compared to negative controls and to each other. *Result:* The test strips demonstrated an incrementally increasing deep blue color change over a progressively longer portion of the test strip in less than 5 minutes for each concentration of KCN including 3, 10, and 30 mcg/mL. The concentrations of 0.5, and 1 mcg/mL did not demonstrate any color change in less than 2 hours. *Conclusion:* The Cyantesmo<sup>®</sup> test strips accurately and rapidly detected, in a semi-quantifiable manner, concentrations of CN greater than 1 mcg/mL contained in each test sample of human blood. Future work is planned to validate this test in clinical specimens.

### 121. A Simple Qualitative Procedure for the Detection of Chloroquine in Urine with Potential for Use in Clinical Analytical Toxicology in Developing Countries: A Preliminary Report

Tagwireyi D,<sup>1</sup> Gadaga L,<sup>1</sup> Ball DE,<sup>2</sup> Nhachi CF.<sup>1</sup> <sup>1</sup>University of Zimbabwe, Harare, Harare, Zimbabwe; <sup>2</sup>University of Kuwait, Kuwait City, Safat, Kuwait.

*Background:* Despite the importance of chloroquine poisoning (CqP) in developing countries, there is no simple, specific and cheap method for the detection of chloroquine in biological fluids with potential for use in clinical toxicology. We describe a simple procedure for its qualitative detection in urine which combines an established simple colorimetric test for basic alkaloids (Dill-Glazko's test), with a modified confirmatory spectrophotometric test we developed and cross validated. *Methods:* The developed confirmatory test (DCT) utilised 3 mls of urine in which 5 drops of 6 M NaOH and 5 ml of ethyl acetate were added into a test tube. This was shaken for 5 minutes then allowed to stand for 3 minutes to allow for separation. About 4 ml of the organic layer was transferred into a clean test tube and 4 ml of 0.1 M HCl added. The resultant mixture was shaken for 3 minutes. A UV/Vis spectrum of the aqueous layer was done (wavelength range: 225 nm and 350 nm). Presence of chloroquine

was evidenced by the characteristic absorption spectrum with peaks at 256, 329 and 343 nm. This DCT was cross-validated against the established Baselt UV/Vis spectrophotometric method. Detection limits (DL) for both the Dill-Glazko's test and DCT were found using a series of chloroquine spiked samples. *Result:* There was a significant difference between both the peak absorbances and the peak resolutions for the DCT and the Baselt method ( $p < 0.0001$ ). The DCT had significantly higher peak absorbances for concentrations greater than 25 mg/l ( $p < 0.01$ ). The DCT test had a sensitivity of 90% and specificity of 100%, versus sensitivity of 83.3% and specificity of 96.7% for the Baselt method. The limit of detection for the Dill-Glazko's test was 15 mg/l and for the confirmatory 5 mg/l. *Conclusion:* The simple qualitative procedure used very small quantities of readily available chemicals and showed appreciable sensitivity to be suitable for application in clinical toxicology in developing countries.

## 122. Markers of Adulteration in Nonoccupational Urine Toxicology Screens

Maloney GE,<sup>1</sup> Rosecrans R,<sup>2</sup> Leikin JB.<sup>2</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL, USA; <sup>2</sup>Evanston Northwestern Healthcare, Evanston, IL, USA.

*Background:* Data on markers of adulteration in occupational urine toxicology screens, where patients often have knowledge that the test is being performed beforehand, is well described with an rate of approximately 1%. We sought to determine the rate of markers of adulteration in a hospitalized population, where intentional adulteration would be less likely due to the unanticipated and unscheduled nature of the testing. *Methods:* We retrospectively reviewed the results of all urine toxicology screens, performed via homogenous immunoassay, for a 12 month period from March 2003–February 2004. Investigational criteria included tests with markers of adulteration identified by the lab. The markers were abnormal specific gravity (SG)-(low, high, or unspecified), abnormal urinary creatinine (Cr)-(low), presence of glutaraldehyde, or presence of nitrites. The cutoff values for SG were  $< 1.006$  or  $> 1.030$ , and creatinine  $< 5$  mg/L. Potential confounding factors, such as glucose, ketones, or suspected UTI, were noted. Positive test results for drugs of abuse, as well as location of the patient (ED, medical floor, or psychiatric unit) were also evaluated. *Result:* Of 1117 specimens, 114 (10%) had markers of adulteration. Of these, a low SG was most common ( $n=66$ ); high SG (20), SG abnormal-unspecified (6), glutaraldehyde (14), low Cr (4), low Cr and low SG together (3), and nitrite (1) comprised the remainder. 50/114 (47%) were positive for a drug of abuse, with opiates (16) and ethanol (14) most common. The patient locations were: ED, 36/114; psychiatric unit, 14/114; inpatient medical unit, 64/114. *Conclusion:* Markers of adulteration were present in 10% of nonoccupational specimens, a rate much higher than that quoted for occupational specimens. As these were unanticipated and unscheduled exams, the results are more likely due to the patient's underlying medical condition and not intentional tampering. Clinicians need to be aware of this fact when evaluating results of nonoccupational urine toxicology screens.

## 123. Endothelial Toxicity from Oxalate Crystal Deposition in Vasculature During Ethylene Glycol Poisoning

McMartin KE,<sup>1</sup> Crenshaw B,<sup>1</sup> Froberg K,<sup>2</sup> Dorion RP.<sup>3</sup> <sup>1</sup>LSU Health Sciences Center, Shreveport, LA; <sup>2</sup>UMD School of Medicine, Duluth, MN; <sup>3</sup>Geisinger Medical Center, Danville, PA.

*Introduction:* Ethylene glycol (EG) poisoning results from conversion of EG to toxic metabolites that in turn lead to metabolic acidosis, cardiopulmonary depression, acute renal failure and central nervous system deficits. Although a small number of fatal cases of EG poisoning have been reported in which oxalate crystal deposition has occurred in the small blood vessel walls of the CNS, heart or lungs, the prevailing view is that the associated organ damage (neuropathy) results instead from acidosis and/or production of aldehyde metabolites of EG. *Case Report:* We report the details of a case of fatal EG poisoning, where the development of rapid cerebral edema was documented by CT scan and was accompanied by definitive evidence of birefringent crystals within walls of CNS blood vessels, with associated inflammation and edema. To determine whether oxalate crystals can induce cytotoxic damage to endothelial cells, cultures of human umbilical vein endothelial cells (HUVECs) were treated with calcium oxalate monohydrate (COM) suspensions from 0–10 mM in physiologic buffer at pH 7.4 for up to 6 hours at 37°C. *Case Discussion:* COM induced a time- and dose-dependent increase in cytotoxicity, as indicated by increased release

of lactate dehydrogenase and uptake of ethidium homodimer. These effects were blocked by co-treatment with aluminum citrate, which has been shown to protect against the renal cytotoxicity of COM. *Conclusion:* These results suggest that EG-induced cerebral edema, and perhaps injury to the endothelium of other organs, could result from oxalate crystal-induced damage to endothelial cells in small blood vessels in the brain and other organs.

#### 124. Hyperammonemia: A Possible Marker for Methanol and Ethylene Glycol Intoxication

Haroz R, Salzman MS, Greenberg MI. *Drexel University College of Medicine, Philadelphia, PA, USA.*

*Introduction:* Hyperammonemia associated with methanol ingestion has been reported only once and never reported in association with ethylene glycol ingestion. We are reporting an additional case of hyperammonemia associated with methanol ingestion as well as 2 cases associated with ethylene glycol ingestion and one case demonstrating a normal ammonia level after isopropanol ingestion. Since serum ammonia is not routinely measured after toxic alcohol ingestions and since a plausible mechanism exists for the production of elevated levels of ammonia we raise the possibility of a previously unrecognized association. *Case Report:* A 46 year-old-male was unresponsive on presentation with a pH of 6.93, osmolar gap of 402, normal liver functions (LFTs), a serum ammonia level (SAL) of 163 mmol/L and a methanol level of 570 mg/dL. A 55 year-old-male was unresponsive on presentation with a pH of 6.73, anion gap of 30, a SAL of 1100 mmol/L and ethylene glycol level of 38 mg/dL. A 43-year-old-female, unresponsive on presentation after ingesting ethylene glycol had a pH of 6.94, osmolar gap of 60, and a SAL of 158 mmol/L. A 65-year-old female presented, after ingesting isopropanol, with normal LFTs and a SAL of 24 mmol/L. *Case Discussion:* N-acetylglutamate is necessary for the efficient incorporation of ammonia into the urea cycle. Organic acids inhibit the synthesis of N-acetylglutamate. When N-acetylglutamate synthesis is inhibited, ammonia, in turn accumulates. This occurs with certain in-born errors of metabolism and may result as well from the accumulation of acids produced from the metabolism of methanol and ethylene glycol. Hyperammonemia would thus be expected after ethylene glycol and methanol ingestion, but not after isopropanol ingestion. The cases presented corroborate this proposed mechanism for elevation of serum ammonia in the face of methanol or ethylene glycol ingestion. *Conclusion:* Hyperammonemia may be a previously underrecognized finding in methanol and ethylene glycol intoxication. Ammonia levels are readily obtained and may represent a surrogate marker for methanol or ethylene glycol intoxication.

#### 125. Intra-Subject Variability of the Baseline Serum Osmolal Gap

Suchard JR. *University of California Irvine Medical Center, Orange, CA, USA.*

*Background:* Clinical application of the osmolal gap (OG) as a screening tool for toxic alcohol poisoning is limited by variations in the baseline OG. Prospective case series of adult and pediatric emergency department (ED) patients report that the baseline OG has a standard deviation of 5.5–6.1 mOsm/kg, making the presumptive diagnosis or exclusion of toxic alcohol poisoning problematic in the absence of a very large OG. This variability may be due to the presence of multiple disease states affecting the OG in ED patients, inter- and intra-subject variability in the OG, and/or to precision limits of laboratory analytical techniques. This study attempts to determine if the standard deviation of the baseline OG of a single healthy subject can account for the degree of variability seen in groups of patients. *Methods:* Blood samples were obtained from a healthy adult volunteer who abstained from alcohol for at least 24 hours, and remained NPO since midnight, prior to phlebotomy on twelve separate days over a six week period. The serum from each sample was analyzed for a concurrent basic metabolic profile and osmolality, and a baseline OG was calculated for each sample. The standard deviation of the baseline OG was compared to published baseline OG standard deviations from prior studies (Hoffmann RS, et al. *J Toxicol Clin Toxicol* 1993; 31:81–93; McQuillen KK, et al. *Acad Emerg Med* 1999; 6:27–30.) using a likelihood ratio test. *Result:* The mean baseline OG in the single subject was 3.8 mOsm/kg, with a standard deviation of 4.9 mOsm/kg. Statistically, this standard deviation was not significantly different from those reported by Hoffmann (6.1 mOsm/kg;  $p=0.24$ ) or McQuillen (5.6 mOsm/kg;  $p=0.42$ ). *Conclusion:* Even within a single healthy subject under conditions designed to limit confounding factors, the serum OG is not a tightly-controlled variable. Intra-subject variability accounted for 80–90% of the reported variability in the baseline serum OG among large

groups of ED patients. This pilot study had limited power to detect differences in the variability of the baseline OG between groups, based on its small number of observations.

### 126. Multi-Organ Effects After Intentional Diethylene Glycol Ingestion

Marraffa JM,<sup>1</sup> Holland MG,<sup>1</sup> Stork CM,<sup>1</sup> Hoy CD,<sup>2</sup> Hodgman MJ.<sup>1</sup> <sup>1</sup>Central New York Poison Center, SUNY Upstate Medical University, Syracuse, NY, USA; <sup>2</sup>Saratoga Hospital, Saratoga Springs, NY, USA.

*Introduction:* We describe a case of intentional ingestion of a readily available wallpaper stripper containing diethylene glycol (DEG) resulting in severe multi-system organ failure and neuropathy. *Case Report:* A 27 year old healthy male presented to the ED complaining of nausea and vomiting 1 day after ingesting 16 oz of wallpaper stripper containing diethylene glycol. Emergent hemodialysis was performed and continued for acute renal failure, with hypertension and acidosis. Hospital course: Hospital day (HD) 1: Acute renal failure; HD 2: Hepatocellular necrosis; HD 4: Cranial neuropathies with visual and auditory loss; HD 6: Acute encephalopathy; HD 8: Bulbar palsy with dysphagia requiring feeding tube; HD 12: Respiratory failure requiring intubation; HD 13: Peripheral demyelinating sensori-motor polyneuropathy with quadriparesis; HD 20: Tracheostomy due to prolonged ventilator dependence. Despite daily hemodialysis he progressed to complete anuria. Renal US at 10 weeks showed complete cortical necrosis. Currently, after five months, he is on chronic hemodialysis, remains deaf with limited manual dexterity, but is able to walk a few steps with assistance. *Case Discussion:* Our case demonstrates the severe toxicity of DEG. Similar cases of severe toxicity due to DEG have been reported, complete with cortical necrosis, renal failure, cranial and peripheral demyelinating sensorimotor polyneuropathies, and encephalopathy. In our case, hemodialysis 24 hours after ingestion was ineffective in preventing any of the severe multi-organ toxicities. *Conclusion:* DEG is a common solvent found in numerous consumer and industrial products. Historically, numerous deaths have been reported when it was used inadvertently as a solvent in pharmaceuticals. Fomepizole use followed by hemodialysis was reported to be effective in two cases. However, as illustrated by our case, delays in treatment can have devastating results. Recovery is often incomplete and permanent disability may result. The pervasive use of this compound makes further human exposures likely, and knowledge of its toxicology and the need for emergent dialysis are essential.

### 127. An Economic Analysis: Is Fomepizole Really More Expensive Than Ethanol for the Treatment of Ethylene Glycol Poisoning?

Shiew CM, Dargan PI, Greene SL, Jones AL. *National Poisons Information Service, London, United Kingdom.*

*Background:* Fomepizole offers many potential advantages over ethanol as an antidote for ethylene glycol (EG)/methanol poisoning. It is expensive and so hospitals can be reluctant to stock it. Ethanol therapy requires critical care nursing and frequent ethanol assays, which also have associated costs. This study aims to compare the real costs of these two antidotes in the management of EG poisoning. *Methods:* Costs were based on treating a patient at a teaching hospital in central London (UK). These include the costs of ethanol, a critical care bed and 2 hourly ethanol assays for a patient treated with ethanol vs. the costs of fomepizole and a general medical (GM) ward bed for a patient treated with fomepizole. These cases can be complex with a number of variables including treatment duration and patient weight, which greatly influence costs, we have therefore included two recent real case examples. *Result:* A critical care bed day costs US\$3093 compared to a GM ward bed day cost of US\$468. Ethanol assays cost US\$45 per assay. A box containing 5 × 100 mg vials of Fomepizole Opi is \$667. Thus a 3 day course of fomepizole for a 70 kg adult on a GM ward would cost \$7673 vs. 3 days ethanol therapy on ICU costing \$10367. Two recent case examples: A 2 year old child weighing 14 kg who ingested methanol was treated with 390 mg of fomepizole over 50 hours on a GM ward, the total cost was \$1469. Ethanol therapy on PICU would have cost \$7092. A 27 year old female weighing 65 kg with EG poisoning was treated with IV ethanol on ICU for 44 hours, costing \$7092. Fomepizole therapy on a GM ward would have cost \$4937. *Conclusion:* Despite the higher drug cost of fomepizole vs. ethanol, the additional expenses associated with ethanol therapy mean that fomepizole is often cheaper, particularly in pediatric patients due to the lower total doses of fomepizole. The overall costs of both therapies should be considered and not just the upfront drug costs. Additionally, fomepizole is well tolerated, easy to administer and has predictable kinetics. Clinical toxicologists need to reconsider which of these two agents should be the antidote of choice for EG and methanol poisoning.

**128. Cost-Effectiveness of Fomepizole Versus Ethanol in the Management of Acute Ethylene Glycol Exposure**

Marraffa JM,<sup>1</sup> Stork CM,<sup>1</sup> Medicis JJ.<sup>2</sup> <sup>1</sup>SUNY Upstate Medical University, Central New York Poison Center, Syracuse, NY, USA; <sup>2</sup>SUNY Upstate Medical University, Syracuse, NY, USA.

*Background:* Many hospital pharmacies do not stock fomepizole due to the high drug acquisition cost and lack of consensus as to whether ethanol or fomepizole is preferred for the treatment of methanol and ethylene glycol poisoning. The objective of this study is to determine the cost per ADE (adverse drug event) avoided when using either intravenous fomepizole or ethanol in the treatment of acute ethylene glycol exposure; over a 24-h period. *Methods:* Using decision tree pharmacoeconomic analysis, our model used a hypothetical cohort of ethylene glycol exposed patients and considered comparative costs between fomepizole and ethanol as well as a breakdown of the occurrence of incidences of ADEs within the adult and pediatric population over a 24 hour period. The probability of occurrences of ADEs was determined from literature-based references. The outcome costs of each ADE was calculated by multiplying the direct/indirect cost (the cost of no ADE plus cost of ADE) with the probability associated with the respective ADE. We compared direct costs, indirect costs and costs related to treating the ADEs for each line of therapy. *Result:* Direct/Indirect costs for ethanol therapy and fomepizole therapy within the reference case were \$1,272.20 and \$4,605.50, respectively. Effectiveness in preventing ADEs between ethanol and fomepizole was 0.061 and 0.813. We observed a lower cost per ADE avoided in our model (Fomepizole \$5,413 per ADE avoided versus Ethanol \$10, 775 per ADE avoided). *Conclusion:* Despite the higher acquisition cost of fomepizole compared to ethanol, the frequencies of ADEs are considerably lower resulting in a more cost-effective model for fomepizole compared to ethanol in the management of acute ethylene glycol exposure.

**129. Treatment of Severe Ethylene Glycol Poisoning Without Hemodialysis**

Spivak LA, Horowitz BZ. Oregon Poison Center/Oregon Health and Science University, Portland, OR, USA.

*Introduction:* We report a case of massive ethylene glycol poisoning treated solely with 4-methylpyrazole. *Case Report:* An 80-year old man was witnessed drinking from a bottle of antifreeze in a self-harm attempt. He lost consciousness approximately 15 minutes post-ingestion. His blood pressure on arrival to the ED was 95/42, with a heart rate in the 30 s, and he had a venous pH of 7.30. Serum lactate was 1.6 mmol/L. His serum osmolality was 399 mOs/kg, and his creatinine was 1.3 mg/dL. Fomepizole was started in the ED. The ethylene glycol level was misreported as 42 mg/dL thus hemodialysis was not initiated. The actual ethylene glycol level was 429 mg/dL. Within ten hours of admission the patient's initial hypotension and bradycardia resolved and he regained consciousness. He admitted to also drinking brake fluid. Two days after ingestion the patient's ethylene glycol level was 170 mg/dL. He remained awake and oriented, with normal renal function, and no metabolic acidosis. Fomepizole treatment was continued until the ethylene glycol level fell to 25 mg/dL at 116 hours post-ingestion. *Case Discussion:* Inhibition of alcohol dehydrogenase by 4-methylpyrazole blocks the conversion of ethylene glycol to its deleterious metabolites. Hemodialysis is used in the setting of elevated ethylene glycol concentrations (with >50 mg/dL being the established threshold to initiate dialysis), renal failure, and severe metabolic acidosis. Early treatment with 4-methylpyrazole in the setting of normal renal function may eliminate the need for hemodialysis. *Conclusion:* In the absence of renal failure and metabolic acidosis, acute ethylene glycol intoxication was effectively treated by fomepizole alone.

**130. Role of the GABA<sub>B</sub> Receptor in Audiogenic Withdrawal Seizures from 1,4-Butanediol (1,4-BD) in Sardinian Alcohol-Preferring (SP) Rats**

Quang LS,<sup>1</sup> Carai MAM,<sup>2</sup> Atzeri S,<sup>3</sup> Lobina C,<sup>2</sup> Maccioni P,<sup>2</sup> Orrù A,<sup>2</sup> Gessa GL,<sup>2,4</sup> Maher TJ,<sup>5</sup> Colombo G.<sup>4</sup> <sup>1</sup>Division of Pediatric Pharmacology and Critical Care, Rainbow Babies and Children's Hospital, Cleveland, OH, USA; <sup>2</sup>University of Cagliari, Cagliari, Sardinia, Italy; <sup>3</sup>University of Cagliari, Cagliari, Sardinia, Italy; <sup>4</sup>C.N.R. Institute of Neuroscience, Section of Cagliari, Cagliari, Sardinia, Italy; <sup>5</sup>Massachusetts College of Pharmacy and Health Sciences, Boston, MA, USA.

*Background:* We have developed a GHB withdrawal syndrome rat model, characterized by the occurrence of audiogenic seizures after abrupt cessation of chronic GHB and 1,4-BD administration in SP rats. The GABA<sub>B</sub> receptor is a major element of

the neural circuitry mediating the toxic effects of GHB and its precursors. We hypothesized that the GABA<sub>B</sub> receptor-selective antagonist SCH 50911 may precipitate or exacerbate audiogenic seizures after cessation of chronic 1,4-BD dosing in SP rats. *Methods:* Male SP rats (425–475 g) from the 58th generation were treated with escalating doses of 1,4-BD 500–1000 mg/kg i.g. BID (N=10) or control injections of distilled water (N=10) for 9 consecutive days. 18–24 h after the last dose, SCH 50911 50 mg/kg i.p. was administered to all rats. 30 min later, rats were tested for audiogenic withdrawal seizures by exposure to manual key-shaking [ring of 10 metal keys; sound pressure level: 102 dB<sub>re20Pa</sub>, with acoustic energy (99.99%) concentrated in the high frequency range (>2 kHz)] for 60 consecutive sec. Data were evaluated by the Fishers Exact Test. *Result:* Acute administration of SCH 50911 did not cause seizures in any control rat but produced audiogenic seizures in 8/10 1,4-BD-withdrawn rats ( $P=0.0007$ ). *Conclusion:* SCH 50911 appeared to precipitate or exacerbate the 1,4-BD withdrawal syndrome by significantly increasing seizure occurrence in 1,4-BD-withdrawn rats. These results suggest that GABA<sub>B</sub> receptor antagonists may constitute a powerful pharmacologic tool for precipitating the GHB withdrawal syndrome, and confirm previous data reporting the GABA<sub>B</sub> receptor to be a major part of the neural substrate mediating the toxic effects of GHB and its precursors.

### 131. Audiogenic Withdrawal Seizures from GHB and 1,4-Butanediol (1,4-BD) in Sardinian Alcohol-Preferring (SP) Rats

Quang LS,<sup>1</sup> Carai MAM,<sup>2</sup> Atzeri S,<sup>3</sup> Lobina C,<sup>2</sup> Maccioni P,<sup>2</sup> Orrù A,<sup>2</sup> Gessa GL,<sup>2,4</sup> Maher TJ,<sup>5</sup> Colombo G.<sup>4</sup> <sup>1</sup>*Division of Pediatric Pharmacology and Critical Care, Rainbow Babies and Children's Hospital, Cleveland, OH, USA;* <sup>2</sup>*University of Cagliari, Cagliari, Sardinia, Italy;* <sup>3</sup>*University of Cagliari, Cagliari, Sardinia, Italy;* <sup>4</sup>*C.N.R. Institute of Neuroscience, Section of Cagliari, Cagliari, Sardinia, Italy;* <sup>5</sup>*Massachusetts College of Pharmacy and Health Sciences, Boston, MA, USA.*

*Background:* The clinical literature is reporting an alarming increase of GHB withdrawal cases. An animal model of GHB withdrawal that includes withdrawal seizures is presently lacking. SP rats are a selectively bred strain which exhibit high alcohol preference/consumption and high sensitivity to the toxic effects of GHB. We hypothesized that the genetically predetermined sensitivity of SP rats to GHB can result in audiogenic seizures after the abrupt cessation of chronic GHB and 1,4-BD administration. *Methods:* Male SP rats (425–475 g) from the 58th generation were treated with escalating doses of GHB 1.5–3.5 g/kg i.g. BID (N=15) or 1,4-BD 500–1000 mg/kg i.g. BID (N=40) for 9 consecutive days. Control rats (N=10 and 30, respectively) received an equal volume of distilled water. 18–24 h after the last GHB or 1,4-BD dose, rats were tested for audiogenic withdrawal seizures by exposure to manual “key-shaking” [ring of 10 metal keys; sound pressure level: 102 dB<sub>re20Pa</sub>, with acoustic energy (99.99%) concentrated in the high frequency range (>2 kHz)] for 60 consecutive sec. Data were evaluated by the Fisher's Exact Test. *Result:* 5/15 GHB-treated rats died during the intoxication phase. No control rat had seizures after delivery of the auditory stimulus; audiogenic seizures occurred in 6/10 GHB-withdrawn rats ( $P=0.01$ ). 10/40 1,4-BD-treated rats died during the intoxication phase. No control rat had audiogenic seizures, which occurred in 6/22 1,4-BD-withdrawn rats ( $P=0.02$ ). *Conclusion:* SP rats constitute a useful animal model for investigating the neurobiology of the GHB withdrawal syndrome and may represent a model of a subpopulation of human GHB addicts particularly prone to developing withdrawal.

### 132. Efficacy of Hydroxocobalamin in a Canine Model of Cyanide Poisoning: A Pilot Study

vonLandenberg F,<sup>1</sup> Stonerook M,<sup>2</sup> Judge K,<sup>3</sup> Borron S.<sup>4</sup> <sup>1</sup>*Merck KgaA, Darmstadt, Germany;* <sup>2</sup>*Battelle Science and Technology International, Columbus, OH, USA;* <sup>3</sup>*EMD Pharmaceuticals, Durham, NC, USA;* <sup>4</sup>*International Toxicology Consultants and The George Washington University, Washington, DC, USA.*

*Background:* Hydroxocobalamin (OHCo) is approved in France for the treatment of cyanide poisoning (CP) and used routinely in the treatment of possible CP resulting from smoke inhalation. While not currently approved in the United States, studies of OHCo are under way in preparation for submission of a New Drug Application (NDA). It is ethically impossible to perform a standard efficacy trial in humans for the treatment of CP. However, under the FDA animal rule, antidote efficacy may be demonstrated in a suitable animal model. The purpose of the present study is to prepare an intravenous poisoning model that allows the assessment of OHCo efficacy in beagle dogs. *Methods:* Six isoflurane-anesthetized, intubated adult beagle dogs

were administered IV potassium cyanide (KCN) at 0.4 mg/kg/min. KCN infusion was continued until 3 minutes after the onset of apnea. Either vehicle (n=2) or OHCo (75 mg/kg, n=2; 150 mg/kg, n=2) was subsequently administered IV over 7.5 min, and mechanical ventilation with supplemental 100% oxygen was simultaneously applied. After 15 min, mechanical ventilation was stopped and subsequent survival was measured. Cardiac rhythm, arterial blood pressure, arterial blood gases, lactate, hydrogen cyanide, OHCo, and cyanocobalamin were measured throughout. *Result:* Both animals receiving vehicle alone expired within minutes after the cessation of CN infusion. All 4 of the animals treated with OHCo survived, awoke spontaneously, and were subsequently returned to their cages. Initiation of hemodynamic recovery began within 2 minutes after the onset of OHCo infusion. *Conclusion:* In this IV KCN infusion model, OHCo appears to be effective in preventing death. This model will be used in a definitive efficacy trial under the FDA animal rule.

### 133. Preliminary Report: Toxicity of Chronic Low-Level Exposures to Organophosphorus Insecticides

Meggs WJ, Means L, Brewer KL, Hack JB. *Brody School of Medicine at East Carolina University, Greenville, NC, USA.*

*Background:* Organophosphorus compounds are associated with acute toxicity from cholinesterase inhibition, delayed peripheral neuropathy, and delayed encephalopathy. Whether or not delayed neuropathies can occur in the absence of acute toxicity has been controversial. Studies of chronic low level exposures of rats to the organophosphorus nerve gas sarin demonstrated chronic toxicity in the absence of an acute cholinergic toxidrome and motivated this study of chronic low-level exposures to organophosphorus insecticides. *Methods:* Study design was a randomized controlled trial. Setting was a university research laboratory. Subjects were 30 Long-Evans rats weighting 250 to 300 grams. *Materials:* chlorpyrifos (SigmaAldridge) was dissolved in DMSO and resuspended in normal saline for injection. *Interventions:* Rats were randomized to 3 groups that received daily subcutaneous injections of chlorpyrifos or vehicle on five days each week for six months. Group 1 received chlorpyrifos 5 mg/kg subcutaneously. Group 2 received chlorpyrifos 1 mg/kg daily. Group 3 received vehicle, consisting of DMSO and saline. *Data collected:* Peripheral neuropathy was assessed with grip strength, measured by a rat grip strength meter. Memory and cognition was assessed with a water maze. *Data analysis:* Chi-square, Wilcoxon Rank sum, and ANOVA as appropriate. *Result:* At the end of one month, there were no acute reactions to injections. Neurological assessments were negative for any impairment. Data collection is ongoing. *Conclusion:* Chronic exposure to chlorpyrifos at 1 and 5 mg/kg did not produce neurotoxicity in Long-Evans rats at one month. Results of longer periods of exposure are pending.

### 134. Multiple Centrally-Acting Antidotes Protect Against Severe Organophosphate Toxicity

Sivilotti MLA, Bird SB, Lo JCY, Dickson EW. *U Iowa, Iowa City, IA, USA.*

*Background:* Accumulation of acetylcholine in the central nervous system is believed to account for the rapid lethality of organophosphate and nerve agent poisoning. Diazepam is typically recommended to supplement antimuscarinic and oxime therapy, but its specific mechanism of action is uncertain. To identify critical steps amenable to prophylaxis or treatment, we tested several centrally-acting agents for early antidotal efficacy in a model of severe dichlorvos poisoning. *Methods:* Unsedated adult Sprague-Dawley rats were pretreated with 3 mg/kg glycopyrrolate IP followed by varying doses of test antidotes SQ. All animals received 20 mg/kg dichlorvos SQ 5 minutes later. The up-and-down method using a dose-progression factor of 2 was used to test four candidate antidotes: diazepam, the  $\alpha_2$ -agonist xylazine, morphine and ketamine. The primary and secondary outcomes were 10-minute mortality and survival time, respectively, adjudicated by a blinded observer. *Result:* All animals pre-treated with either no antidote (8/8 deaths) or glycopyrrolate alone (8/8) died within 10 minutes of dichlorvos injection. Pretreatment with diazepam (3/9 deaths) or xylazine (3/9) decreased lethality substantially (Fisher  $P=0.007$  for each), with all deaths occurring at the lowest doses tested and a median effective antidotal dose of 0.12 mg/kg and 3.0 mg/kg respectively. Intermediate doses of morphine (3.1 to 5.5 mg/kg) resulted in survival, but higher doses did not, presumably due to excessive respiratory depression (7/11 deaths overall;  $P=0.09$ ). Ketamine (7/8 deaths) was ineffective as an antidote. Survival times were also prolonged in the diazepam and xylazine groups (log-rank exact  $P<0.001$  for each) and, to a lesser degree, the morphine group ( $P=0.07$ ). *Conclusion:* Doses of diazepam, xylazine and morphine below those used for deep sedation protect against severe dichlorvos poisoning, suggesting several distinct central mechanisms are operative and necessary for lethality.

These findings are consistent with the hypothesis that over-cycling of respiratory oscillators causes terminal phrenic nerve dysfunction, and suggest new possibilities for prophylaxis or therapy.

### 135. Efficacy of an Adenosine A<sub>1</sub> Receptor Agonist Compared with Atropine and Pralidoxime in a Rat Model of Organophosphate Poisoning

Kalkan S,<sup>1</sup> Ergur BU,<sup>2</sup> Akgun A,<sup>1</sup> Kaplan YC,<sup>1</sup> Kinay AO,<sup>3</sup> Tuncok Y.<sup>1</sup> <sup>1</sup>Dokuz Eylul University School of Medicine, Izmir, Turkey; <sup>2</sup>Dokuz Eylul University School of Medicine, Izmir, Turkey; <sup>3</sup>Dokuz Eylul University Faculty of Arts and Sciences, Izmir, Turkey.

**Background:** The study was to evaluate the effects of an adenosine A<sub>1</sub> agonist, phenylisopropyl adenosine (PIA), on metamidophos poisoning compared to specific antidotes. **Methods:** This randomised and controlled experimental study was performed on adult male Wistar rats. Rats were poisoned with metamidophos (30 mg/kg, oral) and observed for 24 hours. While the first group received sodium chloride (1 ml/kg, n=8); 4 experimental groups received atropine (5 mg/kg, n=8), pralidoxime (PAM, 20 mg/kg, n=8), atropine/PAM (5 mg/kg/20 mg/kg, n=8) or PIA (1 mg/kg, n=8) intraperitoneally. Presence or absence of clinical symptoms, serum cholinesterase activity and histopathological findings in the diaphragm muscle were recorded during 24 hours. Statistical analysis were performed using Kruskal-Wallis Nonparametric Analysis of Variance (ANOVA). Comparison of occurrence of clinical signs between groups was analyzed using Fisher's Exact Test. Duration of survival was compared using survival analysis based on the Kaplan Meier procedure. **Result:** Atropin reduced salivation and prevented respiratory distress when compared to sodium chloride-treated rats. Treatment with PAM did not cause any suppression of cholinergic signs. Atropin and PAM combination prevented salivation, convulsion and respiratory distress. PIA delayed initial time of the salivation, convulsion and time to death. However, PIA was found ineffective agonist the metamidophos-induced cholinergic symptoms and mortality. All treatments but not PIA lead to survival of these animals. Acetylcholinesterase activity was not normalized by PIA or PAM. PIA prevented metamidophos-induced diaphragmatic muscle necrosis as much as PAM. **Conclusion:** A single dose PIA administration was not able to protect the rats from metamidophos toxicity. Further studies are needed involving a combination of PAM and/or atropine with repeated doses of PIA to clarify efficacy of adenosine agonists in OP poisoning.

### 136. Intramuscular Ophthalmic Homatropine vs. Atropine to Prevent Lethality in Rats with Dichlorvos Poisoning

Bryant SM,<sup>1,2,3</sup> Wills BK,<sup>2</sup> Rhee J,<sup>2</sup> Aks SE,<sup>1,2</sup> Maloney G.<sup>2</sup> <sup>1</sup>Cook County-Stroger Hospital; <sup>2</sup>Toxikon Consortium; <sup>3</sup>Illinois Poison Center, Chicago, IL.

**Background:** Atropine is essential for treating patients with severe cholinergic symptoms secondary to acute organophosphorous compound (OC) or nerve agent poisoning. Because most hospitals lack a sufficient supply of atropine to treat multiple poisoned patients simultaneously, the presence of a ubiquitous alternate antidote would prove useful if mass poisoning occurred. Our objective was to evaluate the effect of ophthalmic homatropine (Isopto Homatropine 5%) on survivability in a rat model of significant, acute OC poisoning. **Methods:** Sprague-Dawley rats were randomized to one of five pre-treatment groups (n=10 per group). Prior to experimentation, animals received intramuscularly either 1) 0.3 mL normal saline (NS), 2) atropine 5 mg/kg, 3) atropine 10 mg/kg, 4) homatropine 10 mg/kg, or 5) homatropine 20 mg/kg. Five-minutes following pre-treatment, 25 mg/kg of dichlorvos was administered subcutaneously. Mortality rates and time to death were compared using Fisher's Exact test and Kaplan-Meier analysis respectively. If alive at 120 minutes, survival was assumed and the study was terminated. **Result:** Survival for rats in the homatropine (20 mg/kg) and atropine (10 mg/kg) groups were 30% (p=0.105; 95% CI 0.02, 0.58) and 40% (p=0.043; 95% CI 0.10, 0.70) respectively compared to controls (95% CI 0.00, 0.28). All rats pre-treated with normal saline, atropine (5 mg/kg), and homatropine (10 mg/kg) died. Time of death ranged between 4 and 12 minutes in all groups. Overall comparison via Kaplan-Meier with log-rank analysis revealed a statistically significant improvement in survival for groups pre-treated with homatropine (20 mg/kg) and atropine (10 mg/kg) (p<0.001). **Conclusion:** Pre-treatment with homatropine (20 mg/kg) was comparable with atropine (10 mg/kg) in preventing lethality in this rat model of acute OC poisoning.

### 137. Attenuation of Tilmicosin Cardiotoxicity with Calcium Chloride Infusion in Conscious Beagle Dogs

Main BW, Clark JO, Tucker TJ, Bricker GG, Miller CD, Holdsworth DL, Adams ST, Strnat CA. *Eli Lilly and Company, Indianapolis, IN, USA.*

*Background:* Tilmicosin injection is an injectable veterinary antibiotic approved for use in cattle for the treatment and control of respiratory disease. In a previous study, tilmicosin exposure in dogs resulted in tachycardia, decreased left ventricular inotropic state (dP/dtmax) and decreased blood pressure. Infusion of a positive inotrope (dobutamine) improved cardiac function, but did not completely restore hemodynamic and function to control levels. *Methods:* In vitro testing (human atrial myocytes and canine Purkinje fibers) has demonstrated tilmicosin to have substantial calcium channel antagonist activity. In the present study, tilmicosin was administered intravenously (IV) to 8 dogs at a dose of 2.5 mg/kg. A subset of 3 dogs was treated 10 minutes after tilmicosin administration with 50 mg/kg CaCl<sub>2</sub> infused IV over 5 minutes. *Result:* Tilmicosin alone caused a rapid decrease in left ventricular inotropic state (dP/dtmax), a marked increase in heart rate (HR) and drop in arterial pulse pressure. Subsequent treatment with CaCl<sub>2</sub> restored all of these parameters to control values within 20 minutes of administration. *Conclusion:* These data provide evidence that the cardiotoxicity associated with tilmicosin exposure may be the result of antagonism of the L-type calcium channel and that providing calcium chloride after the administration of tilmicosin can reverse the toxicity observed under these conditions in dogs.

### 138. The Radiopacity of Ingested Transdermal Medicinal Patches in a Simulated Human Model

Rowden AK, Buck ML, Eldridge DL, Holstege CP. *Division of Medical Toxicology/University of Virginia, Charlottesville, VA.*

*Background:* Transdermal Medicinal Patch (TMP) ingestion has been reported with numerous different products. The radiopacity of various TMPs is unknown and therefore the utility of abdominal flat plate radiographs in the management of TMP ingestion remains unknown. The following study was designed to assess the radiopacity of various TMPs. *Methods:* All TMPs on formulary at a university hospital pharmacy were studied and included: estradiol 0.05 mg/day, nitroglycerine 0.3 mg/hr, clonidine 0.2 mg/day, lidocaine 5%, fentanyl 2.5 mg, and nicotine 21 mg. Based on a previously validated cadaver model, a radiolucent acrylic container filled with 15 cm of water was obtained to simulate the density of the human body. The TMPs were placed on the bottom of this container using the adhesive mechanism supplied in each product package. Standard abdominal flat plate radiographs were then taken with an exposure of 60 mAs 77 KVp. The films were then reviewed by three blinded physicians (two emergency physicians and a pediatrician) to determine if the patches were either visible or not visible. *Result:* None of the TMPs studied were found to be radiopaque by any of the reviewers. *Conclusion:* Clonidine, fentanyl, estradiol, nitroglycerine, lidocaine, and nicotine TMPs are not radiopaque. Abdominal flat plate radiographs are not useful in excluding the presence of TMP ingestion.

### 139. The Effect of Amifostine, a Cytoprotective Agent, on Paraquat Toxicity in Mice

Wills BK,<sup>1</sup> Aks SE,<sup>1</sup> Maloney GE,<sup>1</sup> Rhee JW,<sup>1</sup> Brand R,<sup>2</sup> Anderson M,<sup>3</sup> Sekosan M.<sup>4</sup> <sup>1</sup>*Toxikon Consortium, Chicago, IL;* <sup>2</sup>*Division of Emergency Medicine, Evanston Northwestern Hospital, Evanston, IL;* <sup>3</sup>*University of Illinois, School of Medicine, Chicago, IL;* <sup>4</sup>*Cook County Hospital, Chicago, IL.*

*Background:* Paraquat (PQ) is a highly poisonous herbicide with a variety of toxic effects, most notably pulmonary fibrosis. In alveolar epithelial cells it is converted to a PQ radical and subsequently generates other reactive species resulting in lipid peroxidation and cell destruction. Amifostine is a thiophosphate prodrug which is FDA approved for the prevention of toxicities associated with cisplatin and therapeutic radiation. Amifostine is converted to an active metabolite (WR-1065) which functions as an oxygen and DNA radical scavenger and has been shown to protect against lipoperoxidation. The aim of this study was to determine whether amifostine improves survival or lung injury resulting from PQ toxicity. *Methods:* Swiss mice (n=23 per group) were given an approximate LD75 dose of PQ intraperitoneal. Group 1 was pretreated with 200 mg/kg of amifostine subcutaneously (s.c.) 30 minutes prior to PQ injection, with subsequent doses of 75 mg/kg beginning 4 hours after PQ injection

and given every 8 hours for a total of 6 doses (cumulative dose: 575 mg/kg). Group 2 received 200 mg/kg of amifostine s.c. 4 hours after PQ injection, with subsequent doses of 75 mg/kg given every 8 hours (cumulative dose: 575 mg/kg). Group 3 received 100 mg/kg amifostine s.c. 4 hours after PQ injection, with subsequent doses of 30 mg/kg, given every 8 hours (cumulative dose: 250 mg/kg). Group 4 received equivolume injections of sterile 0.9% saline s.c. at the same time intervals. Lungs were removed from all mice for histologic analysis and injury scoring. *Result:* The number of surviving mice in groups 1, 2, 3, and 4 were 17, 18, 17, and 17 respectively. There were no differences in survival using Kaplan-Meier with log rank analysis. Ordinal logistic regression of lung injury scores revealed no differences between treatment groups compared to the control group for either dead or surviving mice. *Conclusion:* Amifostine does not appear to improve survival or lung injury due to PQ toxicity at the doses administered.

#### 140. Analysis of Suspicious Powders in Northern Illinois Following the Post 9/11 Anthrax Scare

Wills BK,<sup>1,2</sup> Leikin J,<sup>3</sup> Weidner K,<sup>2</sup> Rhee J,<sup>1,2</sup> Tameling C,<sup>4</sup> Saeedi B.<sup>4</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL; <sup>2</sup>University of Illinois, Chicago, IL; <sup>3</sup>Evanston Northwestern Healthcare, Evanston, IL; <sup>4</sup>SET Environmental, Inc., Wheeling, IL.

*Background:* Following the 9/11 terrorist attacks and initial reports of confirmed inhalational anthrax, there was a surge in phone calls to poison centers and other government agencies regarding concerns over suspicious powders. SET Environmental, Inc., a Chicago-based environmental and hazardous materials management company received a large number of suspicious powders to analyze during this period. *Methods:* Samples of powders were submitted to SET for either anthrax screening and/or unknown identification (UI). Anthrax screening was performed on-site using a ruggedized analytical pathogen identification device (R.A.P.I.D) (Idaho Technologies, Salt Lake City, UT). UI was performed at SET headquarters (Wheeling, IL) utilizing a combination of wet chemistry techniques, infrared spectroscopy and gas chromatography/mass spectroscopy. Turnaround time

TABLE 1  
Unknown identification

Detergents	16
Inorganic salts	13
Sugars	13
Cellulose	10
Plastics	10
Silica	7
Talc	5
Cyanide	4
Protein	4
Starch	4
Plaster	3
Coffee creamer	2
Clay	1
Mercuric sulfate	1
Mica	1
Mold	1
Paraffin	1
Phenolphthalein	1
Phosphoric acid	1
Polyaryl sulfonate	1
Potassium chlorate	1
Propylamine	1
Saffron	1
Salicylic acid	1
Silver nitrate	1

was approximately 2–3 hours for either anthrax or UI. *Result:* Between 10/10/01 and 10/11/02, 161 samples were analyzed. Of these: 57 were for anthrax screening only, 78 were for anthrax and UI, and 26 were for UI only. Sources of suspicious powders included industries (66%), US Postal Service (19%), law enforcement (9%), and municipalities (7%). There were 0/135 anthrax screens which were positive. Table 1 lists type and number of substances identified (UI). *Conclusion:* There were no positive anthrax screens performed by SET in the Chicago area following the post 9/11 anthrax scare. The only potential biochemical warfare agent identified (cyanide), was provided by law enforcement. Rapid anthrax screening and identification of unknown substances are useful to prevent costly interruption of services and potential referral for medical evaluation.

#### 141. Evaluation of Plasma Levels for Predicting Clinical Outcomes in Tricyclic Antidepressant Overdose

Fukumoto M,<sup>1</sup> Udagawa R,<sup>1</sup> Yoshimura K,<sup>2</sup> Kamijo Y,<sup>2</sup> Soma K,<sup>2</sup> Kondo R,<sup>2</sup> Mizumoto K.<sup>1</sup> <sup>1</sup>*Division of Toxicology, School of Pharmaceutical Sciences, Kitasato University, Tokyo, Japan;* <sup>2</sup>*Kitasato University Medical Center, Kanagawa, Japan.*

*Background:* Several prognostic indicators have been recommended to predict clinical complications in tricyclic antidepressant (TCA) overdose. Although the plasma level has been considered as one of toxicity predictors, TCA cannot be measured routinely on an emergency basis in Japan. The aim of this study was to evaluate TCA plasma levels for correlations with ECG findings or complications. *Methods:* Fifteen patients were studied after overdosing with tricyclic antidepressants. On admission a blood sample was taken for determination of plasma TCA levels using HPLC and GC/MS. When tertiary amine TCA (amitriptyline or imipramine) was ingested, its desmethyl metabolite (nortriptyline or desipramine) was also measured. Initial ECG findings, results of toxicologic screening (Triage<sup>®</sup>), heart rate, blood pressure, level of consciousness, pupil size and anticholinergic signs are evaluated. Analysis of different groups was carried out using Pearson's r and the Student t test. *Result:* Of the 15 patients studied, 13 were female aged 17–49 years (mean age 30.6 years) and two were male aged 47–54 years. Six overdosed with amitriptyline, 2 each with amoxapine and nortriptyline, 1 each with mianserine, clomipramine, imipramine, and amitriptyline plus amoxapine. Total TCA (parent drug and active metabolite) levels within 24 h of drug ingestion ranged from 78 to 3596 ng/mL. Amoxapine levels in two patients ranged from 2281 to 3596. TCA levels were higher in patients who were unconscious, had seizures, QTc interval  $\geq 440$  msec, or QRS duration  $\geq 100$  msec. *Conclusion:* Our study suggested that TCA plasma levels correlated with clinical outcome after overdose. A larger sample size will be required to confirm this result.

#### 142. Creatinine Elevation Associated with Nitromethane Exposure: The Experience of One Poison Control System

Cook MD, Clark RF. *Division of Medical Toxicology, University of California, San Diego, San Diego, CA, USA.*

*Background:* Nitromethane, methanol, and oil are the common components of radio-controlled (R/C) vehicle fuels. Nitromethane can interfere with widely used laboratory serum creatinine assays that employ the Jaffe colorimetric method. The less commonly used enzymatic method of serum creatinine determination is not affected by nitromethane. *Methods:* The California Poison Control System (CPCS) computerized database was queried for cases of human exposure to nitromethane or R/C vehicle fuel reported between December 1, 2002 and December 1, 2004. For all cases in which a serum creatinine was recorded, the reporting hospital laboratory was contacted by telephone to ascertain the method used to determine serum creatinine concentration. *Result:* The results of the study are summarized in Tables 1 and 2. All exposures in which a serum

TABLE 1  
Cases of nitromethane exposure reported to the CPCS 12/1/02 to 12/1/04

Total cases	Male	Age <6 years	Age 6–19 years	Age >20 years	Ingestions	Dermal/ocular exposure	Inhalational exposure
26	23	9	4	13	19	5	2

TABLE 2  
Cases of R/C vehicle fuel ingestion reported to the CPCS 12/1/02 to 12/1/02 in which a numerical serum creatinine concentration was recorded

Patient age in years/sex	Initial and subsequent serum creatinine (mg/dL)—method used	Serum methanol (mg/dL)
2/male	11.0—Jaffe, 8.7—Jaffe, 0.4—Enzymatic	5.0
4/female	1.9—Jaffe, 1.1—Jaffe	0.0
5/male	11.5—Jaffe, 10.9—Jaffe, 0.5—Enzymatic	24.0
26/male	8.0—Jaffe	NR
39/male	1.1—Enzymatic, 1.0—Enzymatic	0.0
45/male	3.8—Jaffe, 3.9—Jaffe, 3.3—Jaffe, 2.9—Jaffe	NR
45/male	8.4—Jaffe, 8.1—Jaffe, 7.7—Jaffe	NR

NR=not reported.

creatinine was recorded involved ingestion of R/C vehicle fuel. *Conclusion:* Physicians should be aware of the components of R/C vehicle fuel to better manage cases of human exposure. It is important to be familiar with the different methods used to determine serum creatinine, and of the shortcomings of the Jaffe method in cases of nitromethane ingestion. Methanol poisoning is the true danger following R/C vehicle fuel ingestion, not a spuriously elevated serum creatinine.

#### 143. Techniques in Education: A Medical Toxicology Fellowship Education Survey

Bryant SM,<sup>1,2,3</sup> Aks SE.<sup>1,2</sup> <sup>1</sup>Cook County-Stroger Hospital; <sup>2</sup>Toxikon Consortium; <sup>3</sup>Illinois Poison Center, Chicago, IL.

*Background:* Successful fellowship training in medical toxicology demands concerted education in the realms of statistics/research design, occupational/environmental toxicology, and pharmacology/kinetics. Our aim is to report the various means of accomplishing these goals by current fellowship programs. *Methods:* An IRB-approved 12-question educational survey was emailed to 22 fellowship directors of U.S. medical toxicology programs. Sample yes/no questions included: Are formal classes taken or audited? Is the fellow solely responsible for the material via self-learning? Is the education primarily provided by toxicology faculty? Proportions are used to describe the data. *Result:* 18/22 (82%) fellowship directors responded to the survey. Organized course work in statistics/research design occurs in 12/18 (67%) programs: courses are university-based in 11 programs, and one program sends trainees to an off-sight research course. University-based coursework in occupational/environmental toxicology occurs in 6/18 (33%) programs, and one program sends trainees to a national medical review officer (MRO) course. Only 2/18 (11%) require fellows to attend formal pharmacology/kinetics courses. Education of fellows is *not* exclusively the responsibility of toxicology faculty. Non-toxicology faculty are used to instruct fellows in the area of statistics/research design in 13/18 (72%) programs, occupational/environmental toxicology in 5/18 (28%), and pharmacology/kinetics in 8/18 (44%). *Conclusion:* Educating fellows in statistics/research design, occupational/environmental toxicology, and pharmacology/kinetics is a high priority. Medical toxicology fellowship programs, however, vary in their approach to educating trainees.

#### 144. Mixed-Up Message? Utilization Patterns for Use of Emetics to Treat Poisonings in the Home

Barker KA, Haynes ML, Teichrow AT, Grant MF, Seger DL. *Tennessee Poison Center, Nashville, TN, USA.*

*Background:* In 1997 the AACT and EAPCCT published the Position Statement regarding Syrup of Ipecac (SOI). A literature review did not conclude that SOI administration improved outcome. In 2003, the American Academy of Pediatrics issued a consensus guideline stating that parents did not need to keep SOI in the home or administer SOI following potential

poisoning. In 2005, the AAPCC issued a consensus guideline stating SOI should be rarely administered in the case of potential poisoning. Recent articles in national magazines and newspapers have advised the public that SOI is no longer recommended. *Methods:* A review of data from the Tennessee Poison Center (TPC) from 1995–2004 and from the Toxic Exposure Surveillance System (TESS) from 1995–2003 evaluated the use of emetics. Search criteria included all human exposure cases with administration of SOI (all cases, whether recommended or not) or the use of “other emetics” (all cases, whether recommended or not). For TPC data, further analysis was done for years 1999 and 2004 to determine the method employed as “other emetic.”

TESS data

Year	SOI administration	Other emetic
1995	47,359 (2.3%)	9,977 (0.5%)
2000	19,770 (1.2%)	7,066 (0.4%)
2003*	9,977 (0.5%)	8,405 (0.4%)

\*Most recent year data available.

TPC table

Year	SOI administration	Other emetic
1995	495 (2.0%)	90 (0.3%)
2000	86 (0.3%)	53 (0.2%)
2004	72 (0.1%)	169 (0.3%)

*Result:* Mechanical stimulation was the most frequent method of emesis induction in TPC records for 1999 and 2004. Other methods included administration of raw eggs, hydrogen peroxide or salt. These methods, like SOI, are not without risk. *Conclusion:* Despite the increased public education that SOI is no longer being recommended, the message has caused confusion. The use of “other emetic” has stayed consistent, as the use of SOI has decreased. This indicates the public may conclude that emesis is indicated, just not by SOI administration. Public education efforts should focus on the lack of benefit of inducing emesis and not just that SOI is no longer recommended.

#### 145. Development of Online Distance Education Program and Electronic Resource Center for Volunteer Poison Prevention Educators

Dance V,<sup>1</sup> Antognoli R,<sup>1</sup> Lemaster J,<sup>2</sup> Wahl M.<sup>1</sup> <sup>1</sup>Illinois Poison Center, Chicago, IL, USA; <sup>2</sup>St. John's Hospital, Springfield, IL, USA.

*Background:* As poison centers close and consolidate, remaining centers are faced with providing poison prevention education to increasingly large geographic areas, often to difficult to reach areas, such as rural and underserved communities. To address this issue, a poison center developed an online educator training program and resource center. *Methods:* The poison center received grant funding from the National Library of Medicine (NLM), National Institutes of Health to develop a distance education course to train community members in poison prevention education. Existing train-the-trainer materials were revised and adapted to an online format. Sixty health and poison prevention educators throughout the state tested the educational modules for content, usability and consistency; appropriate changes were made based on their feedback. An online password-protected poison prevention education resource center also was created to allow registered volunteers to download training and educational materials, as well as to link to other resources such as Toxtown on the NLM Web site. Registered educators are able to order materials online and report on events, locations, people reached and demographics of target audiences. The site was promoted prior to National Poison Prevention

Week (March 20–26, 2005) through tool kits and promotional e-mails. *Result:* The online training program for volunteer poison prevention educators was launched on January 31, 2005. Within 8 weeks, 148 new volunteer poison prevention educators were registered after completion of the module (compared to 74 volunteers trained in-person during the same time frame), and 35 of the poison center's 500+ previously trained volunteers registered for the resource center. Between January 31 and March 26, 2005, these volunteer educators were able to conduct 41 outreach events, helping to reach approx. 8,150 people, by using the online system. *Conclusion:* Online volunteer educator education, ordering and reporting is an effective strategy to expand and record community poison prevention education efforts over a wide geographic area.

#### **146. Effects on Learning Using Human Patient Simulation in Teaching Pharmacology Principles**

Kell SO, Kirk MA, Rowden AK, Holstege CP, Asarkaya Y. *University of Virginia Health System, Charlottesville, VA, USA.*

*Background:* Many university hospitals are purchasing human patient simulators (HPS) to enhance the clinical and emergency response skills of health care students. HPS are computer-driven, life-sized mannequins, programmed to respond to medical situations and procedures, giving students a chance to respond and learn in close-to-real-life scenarios. However, there is little research showing the effectiveness of HPS in learning, retention and skill transfer over traditional methods of training. The purpose of the study was to measure and compare the effects of two teaching methods: 1) HPS and 2) lecture, on learning, application and retention of pharmacology principles. *Methods:* Twenty first year medical students were recruited to participate and were assigned to either HPS or lecture groups. All participants completed a pre-test containing multiple-choice items addressing knowledge or application of pharmacology principles. HPS and lecture programs were conducted and participants took a post-test containing items matched for content and difficulty with the pretest. All participants returned two weeks later for retention testing, which used items split-half from the pre and post tests. *Result:* Scores on pre, post and retention tests were analyzed by group using SPSS software to perform repeated measures analyses of variance. Retention scores were not significantly different across the lecture and HPS groups. Similarly, pre and post application scores were not significantly different across the two groups. A statistically significant difference was found in knowledge gains across groups from pre to post experiment ( $p$ -value=0.02). The pre to post increase in knowledge scores is 13 points higher in lecture than in HPS groups. *Conclusion:* Future research should employ a scoring rubric and hands-on testing using with the HPS to measure application and retention with a minimum of 30 study participants. In this study, the HPS format offered no statistically significant learning benefit over the lecture format regarding knowledge. Further, there were no statistical differences in application and retention of pharmacology principles by learning format.

#### **147. Use of Translator Services for Poison Center Calls by Ethnic Populations**

Alsop JA, Cantrell FL. *California Poison Control System, Sacramento, CA, USA; California Poison Control System, San Diego, CA, USA; University of California San Francisco, School of Pharmacy, San Francisco, CA, USA.*

*Background:* To determine if the number of poison center calls requiring the use of a translator is effectively meeting the needs of the ethnic populations in the state. *Methods:* The California Poison Control System (CPCS) subscribes to a language line to provide translation services for up to 100 languages. The annual number of CPCS calls that required use of the interpreters over a 4-year period was compared to the number of people in the state ethnic populations. *Result:* Spanish translation was most frequently requested. Combined Asian languages equaled the 2nd largest category requesting a translator. Data does not reflect whether these languages are the only language spoken at home or if other family members are available to translate (Table 1). *Conclusion:* While 12.5% of the state ethnic population (about 3 million people) speaks a language other than Spanish, 97% of the translation calls required a Spanish translator. More poison center outreach into the other ethnic communities is needed to reach those populations as well.

TABLE 1  
PCC translator calls by populations

Language spoken at home	# of people >18 yrs speaking this language	% of population >18 yrs speaking this language	Year 2000	Year 2001	Year 2002	Year 2003	Total
Spanish	5,917,071	25.03%	1069	1425	1737	1684	5915
Chinese	686,387	2.90%	6	8	14	14	42
Tagalog	558,639	2.36%			3		3
Vietnamese	323,869	1.37%	9	6	10	7	32
Korean	243,832	1.03%	4	9	5	7	25
Japanese	138,761	0.59%	4	6	3		13
German	130,010	0.55%	1			2	3
Farsi	128,837	0.55%				1	1
Armenian	124,475	0.53%			1	2	3
French	118,558	0.50%	2		2	1	5
Russian	99,058	0.42%	5	2	6	4	17
Indic/Punjabi	90,433	0.38%	1		2	1	4
Arabic	87,608	0.37%	1	2			3
Portugese	68,471	0.29%	1				1
Hindi	64,152	0.27%			2		2
Cambodian	46,651	0.20%				1	1
Hmong	32,273	0.14%				1	1
Hungarian	17,903	0.08%				1	1
Totals	8,876,988	37.56%	1103	1458	1785	1726	6072

2000 Census.

#### 148. Utility of Outreach Education Tool Kits in the Promotion of National Poison Prevention Week

Antognoli R, Dance V, Ocampo P, Cox K, Wahl M. *Illinois Poison Center, Chicago, IL, USA.*

**Background:** Tool kits are used by communications specialists to encourage organizations to participate in programs of common interest. In its study on poison centers, the Institute of Medicine (IOM) recommended that poison centers partner with public health agencies, associations and professionals to provide poison prevention education to communities in the poison center service areas. A regional poison center developed targeted community action tool kits to encourage varied audiences to participate in National Poison Prevention Week (NPPW). **Methods:** Tool kits were developed specifically to promote NPPW and were sent to 90 public health departments, 538 school nurses and 35 retail pharmacies 7 weeks before the start of NPPW. The tool kits included: NPPW background; activity recommendations tailored to each audience; fact sheet promoting online training for volunteer educators; listing of poison center materials such as brochures and facts sheets; satellite center contact list, details on services provided to pharmacists (pharmacy tool kit only) and special offer for free education materials. **Result:** This initiative was the first of its kind for the poison center, reaching wider audiences than previously targeted. Approximately 17.5% of those contacted with NPPW tool kits requested the free materials. Responses were received from throughout the state, including some very remote parts of the poison center service area (one location was 319 miles from the regional poison center location). The following materials were distributed to the respondents: 22,409 stickers, 10,144 magnets, 10,346 poison prevention brochures (3,060 Spanish), 8,297 toxic plant lists (2,427 Spanish), 8,948 medicine safety brochures (2,797 Spanish) and 9,285 first aid cards (3,150 Spanish). **Conclusion:** Targeted tool kits are a valuable strategy for promoting poison prevention and education activities during NPPW. They help a regional poison center create linkages, provide needed materials and expert guidance to public health institutions and professionals, and encourage participation in NPPW. These linkages can provide a basis for ongoing collaboration in poison prevention activities.

#### 149. Low Utilization Does Not Indicate Low Awareness

Banach GP, Livermore LW. *CNY Poison Center, SUNY Upstate Medical University, Syracuse, NY, USA.*

*Objective:* To determine relationship between utilization and awareness of a Poison Center (PC) using a telephone survey. *Methods:* A telephone survey was conducted in 4 randomly selected counties in our call center's service area, two of high (HP) and two of low penetrance (LP), grouped for comparative purposes. Over 18 months, students made calls between 3 pm–8 pm. Telephone numbers were randomly selected from telephone books. Students read a general statement of purpose with no mention of poisoning or a PC. Directions instructed students to read all possible answers to each question before respondents replied. Responses were compared using chi-square analysis. A  $p < 0.05$  was considered significant. *Result:* 5,579 telephone calls made resulted in 946 completed surveys. Most respondents (67%–96%) correctly identified five hypothetical situations as poisonings. 63% of HP responded they would call a PC if they had a poisoning or a question about poison compared to 61% of LP. ( $p = .99$ ). 22% of HP answered that they had previously called a PC compared to 11% of LP ( $p = .07$ ). When asked if respondent had attended a presentation on poison prevention 24% of HP and 29% of LP said they had ( $p = .85$ ). 30% of HP respondents would find the number for a PC on a magnet, sticker or other product compared to 30% of the LP group ( $p = .99$ ). 35% HP would find the number for the PC in the phonebook, compared to 35% for LP ( $p = .99$ ). Few correctly named the PC serving their area (HP 7.6%, LP 2.2%,  $p = .26$ ). *Conclusion:* There were no differences seen when comparing areas of HP and LP as related to identified markers for poison awareness. High penetrance does not appear to be associated with higher awareness of poisonings or of a PC. These findings may have implications for education and outreach programs.

### 150. Availability of Mercury in High Schools and Awareness of Clean-Up Procedures by School Nurses

Gaffney W,<sup>1,2</sup> Caraccio TR,<sup>1,2</sup> McGuigan MA.<sup>1,2</sup> <sup>1</sup>L I Regional Poison and Drug Information Center, Mineola, NY, USA; <sup>2</sup>Winthrop University Hospital, Mineola, NY, USA.

*Background:* High School (HS) nurses (RN) play a vital role in maintaining the health of adolescents. HS may be considered a potential source of elemental Hg poisoning from spills in science classes and in an RN office that has thermometers (TM) or sphygmomanometers (SP). The PCC had no baseline knowledge of which HS in our service area would be at risk for Hg poisoning if there was a spill and what procedure would a HS RN follow in an event. We present the results of a survey of HS RN to establish a baseline of Hg sources and awareness of procedures for handling an event. *Methods:* The PCC conducted a survey in the fall of 2004 to determine how many HS have Hg present on its premises and what procedures a HS RN would follow if a spill was reported. A questionnaire of 4 questions was used to survey 90 HS RN in a suburban bicounty area. The first 3 questions asked if they had Hg TM (1); if used Hg in any science lab (2); or had a SP in their office (3). The 4th question asked what procedure would they followed if a spill occurred with 4 possible choices. *Result:* 37 (41%) responded. Answers: 1) None had Hg TM; 2) 2 (5%) used Hg in a science lab but 17 (46%) didn't know; 3) 36 (97%) had a SP available; 4) Only 15 (41%) would contact the PCC for clean up information; 15 (41%) would call the custodial staff and 3 (8%) would evacuate and notify an outside agency. *Conclusion:* Hg is used in HS. RN do not have a consistent approach to managing a Hg spill. RPC have an opportunity to provide HS RN with education on the risks, triage and clean-up of Hg spills in HS.

### 151. Capitalizing on a Current Fad to Promote Poison Help (1-800-222-1222)

Krenzelo EP,<sup>1,3</sup> Klick R,<sup>1,2</sup> Burke T,<sup>1,2</sup> Mrvos R.<sup>1</sup> <sup>1</sup>Pittsburgh Poison Center, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA; <sup>2</sup>WL Associates, Inc., Pittsburgh, PA, USA; <sup>3</sup>Schools of Pharmacy and Medicine, University of Pittsburgh, Pittsburgh, PA, USA.

*Background:* Pet rocks, pogs and tamaguchi's were tremendously popular at times over the last two decades. They provided fun, intense interest and media coverage, but had little, if any public benefit. To the contrary, the distinctive yellow Lance Armstrong 'Live Strong' silicon wristbands, which support cancer research, reached iconic status while spawning substantial interest from other organizations seeking to capitalize on the same awareness opportunity and financial support. To promote the national toll-free Poison Help telephone number, a RPIC developed and introduced a Poison Help wristband. *Methods:* The RPIC worked with a marketing firm to design the Poison Help wristband, conduct a feasibility analysis to determine the financial viability of the project and develop a plan to market and sell the wristbands. The wristbands were a unique color, contained the words Poison Help and the national toll-free telephone number. The RPIC's institutional public relations department developed and distributed a press release to announce the innovative Poison Help wristbands and organized a press conference. The

wristbands were introduced in March to coincide with National Poison Prevention Month 2005. They were distributed to the public through pharmacies located in large corporate retail/grocery outlets, selected retail outlets, the RPIC website and other poison centers. An attractive point-of-sale carton was designed to facilitate retail sales. This was a cost-neutral public service project for the pharmacies—they purchased the wristbands from the RPIC for \$1 and sold them for the same price. *Result:* In the first 30 days more than 48,000 wristbands were distributed. Internet requests have come from multiple states. *Conclusion:* By developing a practical application for a popular item, the RPIC increased poison center awareness and, as a secondary benefit, generated revenue to support other poison prevention education endeavors.

### 152. An Evaluation of a Carbon Monoxide Poisoning Education Program

Schwartz L,<sup>1</sup> Martinez L,<sup>1</sup> Louie J,<sup>1</sup> Mercurio-Zappala M,<sup>1</sup> Howland MA,<sup>2</sup> Nokes K,<sup>3</sup> Hoffman RS.<sup>1</sup> <sup>1</sup>NYC Poison Control Center, New York, NY, USA; <sup>2</sup>St. John's University College of Pharmacy, Jamaica, NY, USA; <sup>3</sup>Hunter College, New York, NY, USA.

*Background:* Carbon monoxide (CO) is the leading cause of poisoning deaths in the US. Although CO detectors reduce the risk of morbidity and mortality associated with unintentional CO poisoning, the number of exposures remains high. We developed an evaluation of a CO poisoning workshop that included distribution of free CO detectors. *Methods:* Using Census 2000 data, three zip codes were targeted based on lower income, low call rates to the poison center (<3 per 1,000 population), small housing units (<4), and a significant Latino population. A pre-test consisting of 6 knowledge and 2 behavior-based questions was completed in English or Spanish. At the end of the workshop, each household received a free CO detector and poison center materials. Follow up telephone surveys conducted one month later measured knowledge and behavior. *Result:* In December 2004, three CO workshops were held at community agencies. There were 133 attendees with a total of 129 CO detectors distributed; 121 participants completed pretests and 80 (62%) were reached for follow-up. More than half (65%) reported living in small housing units. The average participant age was 39 years old. Ethnicity was identified as Latino (65%), African American (32%), and White (3%). Statistically significant increases in knowledge were found on 3 of the knowledge items (using kitchen stove for heat, improper heating systems, and sitting in a car with engine running). There was not significant gain in knowledge of the poison center telephone number. The majority of participants (91%) reported installing the CO detector. *Conclusion:* A workshop distributing CO detectors led to an increase in knowledge and detector installation. Follow-up calls provided an opportunity to clarify information and reinforce the poison center telephone number.

### 153. Effect of Mandated Residential Carbon Monoxide Detector Use on the Morbidity of Reported Cases

Hoffman RJ,<sup>1</sup> Hoffman RS.<sup>2</sup> <sup>1</sup>Beth Israel Medical Center, New York, NY, USA; <sup>2</sup>New York City Department of Health Poison Control Center, New York, NY, USA.

*Background:* On 11/1/2004, a new law requiring installation of carbon monoxide (CO) detectors in residential dwellings in our city took effect. Simultaneously, a law mandating reporting of CO poisoning by health care facilities took effect. We sought to determine the law's influence on the: 1) total number of CO reports made to our Poison Control Center 2) total number and percentage of CO exposures with any clinical effect. *Methods:* This descriptive study assessing the impact of the new law used poison center data (Toxicall, Aurora, Colorado) from the three previous winter periods (defined as November 1st–March 31st) of 2001–2002, 2002–2003, and 2003–2004 as historical controls. Statistical analysis was performed to determine if the law affected the number of reported CO exposures or altered the morbidity or mortality associated with exposure. Analysis was performed using both the total number of reports of CO exposure as well as reports associated with any clinical effect (no effect, minor effect, moderate effect, major effect, or death). *Result:* A statistically significant increase in total number of reported CO exposures occurred after the law took effect. There was no apparent increase in exposures resulting in no clinical effect nor increase in exposures with any clinical effect or death. *Conclusion:* During the first winter when a law requiring CO detectors in residential dwellings was effective, an increase in the total number of reported CO exposures occurred. From this preliminary data, there is no discernable change in CO exposures in any given category of clinical effect. At this time no conclusion can be drawn regarding the effect of mandated residential CO detector use on CO morbidity or mortality.

## CO exposures reported to the Department of Health Poison Control Center

	Winter 2004–2005	Winter 2003–2004	Winter 2002–2003	Winter 2001–2002
Total reported CO exposures	990	685	421	228
Total ‘‘No effect’’ CO exposures	546	284	102	114
Percentage of ‘‘No effect’’ CO exposures	55.1%	41.5%	24.2%	50%

**154. Curandismo: Consequences of Folk Medicine**

DeBellonia RR, Marcus S, Ruck B, Rella JG, Shih RD. *New Jersey Poison Information and Education System, University of Medicine and Dentistry of New Jersey-Medical School, Newark, NJ, USA.*

*Introduction:* Health professionals in the United States often take care of patients who believe in the use of folk medicine. This includes care of the sick by healers who practice herbal and magical medicine. *Case Report:* A 4 year old Mexican child was bathed in isopropyl alcohol and a chamomile preparation, wrapped in a blanket, and put to sleep. The family was trying to cure the child of espanto, evil spirits the family believed plagued her after an automobile accident. After a 3 hour nap, her mother was unable to awaken the child. The patient’s mother also reported she saw some generalized motor activity that may have been a seizure. In the emergency department, the patient was unresponsive but breathing on her own. Vital signs were: blood pressure 83/43 mmHg, heart rate 132 beats per minute, respiratory rate 24 breaths per minute, temperature 98 F, O<sub>2</sub> saturation 98% on room air. The pupils were midsize and sluggishly reactive to light. The rest of the physical examination was normal. Initial laboratory values included: sodium 141 mEq/L, potassium 3.2 mEq/L, chloride 108 mEq/L, bicarbonate 20 mEq/L, blood urea nitrogen 17 mg/dl, creatinine 0.9 mg/dl, glucose 130 mg/dl, serum osmolality 356 mOsm, calculated serum osmolarity 295 mOsm. The child’s isopropyl alcohol level was found to be 9 mg/dl and the serum acetone level 146 mg/dl. A CT of the brain did not reveal any intracranial pathology. The child was admitted to the hospital and received supportive care. Over the next two days she improved and was discharged. *Case Discussion:* In 2004, our poison center received 476 calls involving some form of cultural medicines, botanical and homeopathic products. Toxicity can occur related to toxicity of the product itself, the vehicle used to solubilize the product and or to the mode of application. Dermal absorption and inhalation are routes of exposure not to be overlooked. *Conclusion:* This case highlights how folk medicine can bring unusual chemical exposures to medical attention. Folk medicine or curandismo, was the factor that led to toxicity. These beliefs and actions are what create a challenging problem for health professionals to solve.

**155. Poison Prevention Education Effects in the Elderly**

Kell SO, Holstege CP. *University of Virginia Health System, Charlottesville, VA, USA.*

*Background:* There is limited published research demonstrating the efficacy of poison education programs (PEP) for the public. Available data does not definitively demonstrate that knowledge and intended safety behaviors improve following PEP attendance. This pilot study measures the impact of PEP on senior citizen’s knowledge and intended safety behaviors. *Methods:* A 45-minute PEP and a 10-question pre and post program survey to evaluate knowledge and intended safety behaviors were developed. A total of 68 members of three senior citizen independent living centers participated. Two centers received a pre-program survey and PEP (21 participants); one center received PEP and a post-program survey six months later (47 participants). Differences in pre- and post-survey results were compared. *Result:* Participant’s post-survey results six months after PEP found that 62% would call the poison center in a poison emergency as compared to 24% of the pre-survey participants. Only 19% of those pre-surveyed responded that they would find the poison center number on a sticker or magnet, as opposed to 51% of the post-surveyed participants. Approximately 50% of respondents of the pre- and post-survey groups reported that they do not think poison center phone operators are medical experts. Greater than 75% of all groups do have a method to remember to take medicines, store medicines in a safe place, understand the basic services of the poison center and have a primary physician who knows all the prescription and over-the-counter medicines they take. *Conclusion:* The PEP for seniors improved their knowledge and intended safety behaviors regarding who to call in a poison emergency and where to find the phone number. Improvements still need to be made regarding the perception of poison center staff as medical experts.

### 156. Evaluating a Community Health Worker Training Program Focused on Latinos

Giraldo GP, Torres N, Simeonov I. *University of California, San Francisco, San Francisco, CA, USA.*

*Background:* The 2002 IOM report “Unequal Treatment: Confronting Racial and Ethnic Disparities in Health” concluded that Community Health Workers (CHWs) offer promise as a means of increasing racial and ethnic minorities’ access to healthcare. Evaluation of CHW use was also recommended. Eight community-based organizations (CBOs) employing CHWs to serve low-income Latinos received a 6 hour basic poison prevention training. Training evaluation objectives were: To assess effectiveness of teaching methodology; and to measure CHWs knowledge change. *Methods:* CBOs already serving low-income Latinos parents with children <5 years were invited to become poison prevention partners. Four standardized training sessions with 68 participants were held in 3 counties led by a master’s level bilingual/bicultural educator. A non-standardized instrument (6 open-ended/ 2 multiple choice questions) was developed in Spanish and English to capture base knowledge in poison prevention. Systematic content analysis identified common themes in 3 categories: Understanding of terminology, prevention knowledge, and awareness of PCCs. *Result:* Prior to training, participants were unable to articulate a definition of poisoning. Less than half of respondents were aware of top 3 exposures. Of 68, 48% would contact a PCC in case of poisoning, 87% would call 911, 51% would induce vomiting, give milk or Ipecac, provide CPR or call “someone” for help. 29% were uncertain of PCC function, 25% were completely unfamiliar. After training, of 62, 93% would contact the PCC in case of poisoning, 83% stated PCCs had a free, expert phone service available to everyone. Post tests revealed improved knowledge regarding exposure, prevention and PCC function. Additionally, participants demonstrated a new conceptual awareness of poisoning and precise use of terms. *Conclusion:* Findings revealed training participants increased knowledge of risk, prevention, PCC function and use. Respondents’ vocabulary and use of terms to explain poisoning was more sophisticated and consistent after training. Participants indicated increased likelihood of PCC use and confidence in explaining it to others. Learning objectives were achieved, supporting the teaching methodology.

### 157. Analgesic Poisonings Reported to the Drug and Poison Information Center in Izmir, Turkey

Hocaoglu N,<sup>1</sup> Kalkan S,<sup>1</sup> Akgun A,<sup>1</sup> Capar S,<sup>2</sup> Tuncok Y.<sup>1</sup> <sup>1</sup>*Dokuz Eylul University School of Medicine, Izmir, Turkey;* <sup>2</sup>*Dokuz Eylul University Faculty of Arts and Sciences, Izmir, Turkey.*

*Background:* Poisonings concerning analgesics that were reported to Drug and Poison Information Center (DPIC), in Izmir between 1993 and 2004 was analyzed in our retrospective study. *Methods:* Age, sex, analgesic type, route and reason for the exposure, clinical effects and outcome of the poisoned patients were recorded on standart data forms, then entered into a computerized database program. The severity of clinical manifestations were graded and assessed according to the EAPCCT/ IPCS Poisoning Severity Score. Statistical analysis was performed by using the chi-square test. *Result:* The DPIC recorded 55,962 poisoning calls, 48,654 (86.9%) of them related to medicines. Analgesics accounted 16.3% (7,939 cases) of all medicine-related poisonings. More than half of the calls involved adults (55.9%, 4,440) and females dominated both in adults and in children (70.3%, 5,578). Mean age of adults and children were 27.7±0.1 and 10.6±0.1 years, respectively. The most involved analgesics were paracetamol (47.9%), propionic acid derivatives (16.1%), salicylates (13.7%) and acetic acid derivatives (10.3%). Combined agents accounted of more than one third of the poisonings (37.5%). Most of the poisonings were intentional (75.1%), especially in 19–29 age group of adults (p<0.001) and 13–18 age group of children (p<0.0001). At the time of telephone inquiry, 84.4% of the patients had no symptoms of toxicity. Clinical effects were graded as (14.0%) mild, (1.0%) moderate or (0.5%) severe poisoning. Observation alone was recommended in 63.2% of cases. Gastric lavage (0.9%) activated charcoal (15.6%) and gastric lavage with activated charcoal (11.5%) were other recommended gastrointestinal decontamination methods. Five patients died (1.6%) from paracetamol and/or salicylate ingestion. *Conclusion:* Although poisonings concerning analgesic ingestion reported to our DPIC were common, most of them were asymptomatic or mild. DPICs have an important role for the management and referral of these analgesic ingestions without invasive treatment modalities.

### 158. Development of Poison Center Education Program Evaluation

Gracia R,<sup>1,2</sup> Yudzky M,<sup>1</sup> Rios J,<sup>1</sup> Garrison J.<sup>1</sup> <sup>1</sup>*The North Texas Poison, Dallas, TX, USA;* <sup>2</sup>*The University of Texas Southwestern, Dallas, TX, USA.*

*Background:* The purpose of this study was to develop and validate a Poison Center education program evaluation tool. We present an empiric model for developing, validating and implementing a student focused and needs based evaluation tool. *Methods:* The model presents a five component pathway consisting of idea generation, planning, preparation, execution, and evaluation to create the pre test/post test Child Poison Awareness Inventory (CPAI). Five expert panel focus groups of 30 educators were conducted to develop and assess the reliability and validity of the CPAI. This panel reviewed the CPAI for age appropriateness, feasibility, and aesthetics. Qualitative data was collected from open ended question assessment forms and quantitative data was generated from a standardized rubric. Five classes of students from a variety of demographic backgrounds were selected for group field tests of the CPAI. The CPAI was designed to assess poison recognition, appropriate use of the Poison Center, immediate recall of the Poison Center number, and a general understanding of where to locate the Poison Center number. Activities were administered during a poison lecture by trained Poison Center educators. *Result:* Qualitative results from the panel showed that the program was likely to be successful. The CPAI scored likely to be successful with an average score of 3.0 on the 4 point scale. The aesthetic components scored 2.8 and the functional components scored 3.2. Field testing of the evaluation revealed that students responded positively to the activity and it required 10 minutes to complete. Validity of the model was assessed in the expert panel focus groups. Descriptive statistics were used to compare pre/post test scores. *Conclusion:* Results suggest that the content, materials, and methods developed and used as the CPAI can serve as a valuable supplement to Poison Prevention and Awareness education. A larger study is planned to assess generalizability and external validity. From our experiences, we would strongly recommend the five component model with expert panel focus groups and student field tests to evaluate validity, reliability, and feasibility of programs and evaluations.

### **159. Developing Culturally Relevant Consumer Education Materials in Chinese, Korean and Vietnamese**

Simeonov IM, Giraldo GP, Heard SE. *California Poison Control System, UCSF School of Pharmacy, San Francisco, CA, USA; California Poison Control System, UCSF School of Pharmacy, San Francisco, CA; California Poison Control System, UCSF School of Pharmacy, San Francisco, CA.*

*Background:* Demographic information shows Chinese, Korean and Vietnamese among the top 5 languages spoken in the poison control center's service area. PCC data indicates few requests for interpreters in these languages despite the presence of significant immigrant populations. To encourage use, apply a successful model of partnering with community-based organizations to customize poison prevention materials and information on services for non-English speaking Asian parents. Develop a culturally relevant message and provide a context for poison control services through feedback from target consumers and health educators serving low-English proficiency immigrant families. Design cost-conscious, appealing, and informative education products that address the communication needs of this group. *Methods:* Collaborate with community-based organizations serving target groups to survey consumers and gain insight on knowledge, attitudes, perceived barriers and relevant attributes of PCC services. Use research to adapt existing content and customize images for language-specific product line. *Result:* Findings indicated importance of self-reliance and deference towards older family members unfamiliar with PCC resources limited use of the hotline. After detailed service description, target consumers indicated they considered PCC's a credible and useful service, but required materials reflecting cultural principals and familiar faces. Feedback guided content and design for 3 Asian-language products. *Conclusion:* Culturally insightful messages, whether reflective of race, ethnicity, socio-economics, language or shared values, positively affect consumer choices. Poison prevention and service promotion messages are not universal across cultures, but constructive and positive messages of self-determination coupled with assurances of good customer service can be adapted to promote PCC use. When limited resources prohibit complete in-culture development of materials, a linguistic and cultural adaptation is a practical alternative.

### **160. Consumer Perception of Household Hazardous Materials**

Smolinske SC,<sup>1</sup> Kaufmann M.<sup>2</sup> <sup>1</sup>*Children's Hospital of Michigan Regional Poison Control Center, Detroit, MI;* <sup>2</sup>*University of Michigan, Flint, MI.*

*Background:* To collect data about consumer's perception of household hazardous materials (HHM); to identify any linkages between storage and use of HHM. *Methods:* A focus group-refined telephone survey was conducted within a county (pop

437,000) to determine storage location in the home of 10 substances commonly involved in pediatric poisoning. Elevation was coded as high (>4 ft above ground), low, or unknown. Other questions addressed perception of look-alike products, knowledge of resources to call for poison information, disposal practices for HHM, safety practices regarding transfer of cleaning products to another container, and recycling practices. **Result:** 357 surveys were completed. More prescription medications were stored in lower elevations (7.3%) compared to vitamins with iron (5.6%;  $p < 0.0001$ ), and OTC ibuprofen or acetaminophen (3.4%;  $p < 0$ ). HHM commonly involved in poisoning (bleach, cosmetics, peroxide) were often stored in low elevations (22%, 17%, 15%). Awareness of the poison center (PCC) as a first responder for poisoning emergencies was modest; 35% chose the PCC as first choice; 43% 911, 9% hospital, 5% doctor, and 2% relative. 19% had transferred a cleaning item to another container; most commonly bleach (6.7%) and glass cleaner (2.8%). 29% transferred a prescription medication to another container; reasons given were convenience (14%), travel (12%), and work supply (1%). The most common sources of HHM information were product labels (12%), TV (10%), Internet (8%), newspaper (6%), work (6%), and magazines (6%). Recycling of HHM was used by 10%, with paint being most common (10%), then batteries (3.4%) and oil (1.4%). A composite score from 4 questions addressing hazard awareness showed no difference between those with children and those without. A normalized elevation value (ratio of actual score/# items on hand) also showed no difference in respondents with children (ratio 0.91) and those without children (ratio 0.88). **Conclusion:** This survey will be used to develop a community-specific educational campaign targeted toward areas of concern, such as lack of awareness of the PCC as a resource, and encouraging proper HHM storage and disposal.

### 161. Red on Yellow Kill a Fellow, But Not in Texas: Five-Years of Texas Coral Snake (*Micrurus fulvius tenere*) Envenomations

Stanford RD,<sup>1,2</sup> Borys DJ,<sup>1,2</sup> Morgan DL,<sup>1,2</sup> Tobleman WR.<sup>2</sup> <sup>1</sup>Central Texas Poison Center, Scott and White, Temple, TX, USA; <sup>2</sup>Scott and White, Temple, TX, USA.

**Background:** Coral snake venom is neurotoxic and known to cause respiratory paralysis after envenomation. Early administration of antivenom is the recommended treatment for both the Eastern (*Micrurus fulvius fulvius*) and Texas (*Micrurus fulvius tenere*) subspecies. However, there is no published large case series of Texas coral snake bites. Our goal was to review victims of coral snake bites in Texas and describe their symptoms, treatment, and outcome. **Methods:** Retrospective case series by searching the Texas TESS database for all human exposures to coral snake envenomations from January 1, 2000 to December 31, 2004. **Result:** A total of 96 patients were found. Only 14 were female, and 59.3% were between 18 and 50 years of age. The average age was 34.6 years. The most common clinical effects were “swelling” in 33.3%, pain in 30.2%, “numbness” in 16.7%, and “redness” in 14.6%. Most (79.2%) patients had local symptoms only. Most (85.4%) patients were treated in a health care facility. Only 46 patients (47.9%) received coral snake antivenom, and about half of these received 3 vials or less. These patients were administered an average of 3.9 vials, and 13.0% of them had an adverse effect. For all patients, there were no reports of death, respiratory paralysis, permanent neurologic sequelae, or tissue loss. Patient outcome noted that 4.2% of the patients had no effect from the snakebite, 10.4% had an unknown effect, 65.6% had a minor effect, 17.7% had a moderate effect, and two patients (2.1%) had a major effect. Only one patient was intubated and that was for seizure after antivenom was administered. **Conclusion:** This is the largest case series of coral snake envenomations and the first case series report of bites by *Micrurus fulvius tenere*. The clinical effects were usually localized and not severe. Although only about half of the patients received antivenom, none of them required intubation for respiratory paralysis and none died. Early treatment with elapidae antivenom for all patients bitten by a Texas coral snake may not be warranted.

### 162. Measuring Pain Intensity in Patients with Latrodectism: The Visual Analog Scale (VAS)

Gonzales VA,<sup>1</sup> Vazquez IM,<sup>1</sup> Robles GD,<sup>1</sup> Stanford CF,<sup>2</sup> Bogdan GM,<sup>2</sup> Garcia-Ubbelohde W.<sup>3</sup> <sup>1</sup>Servicios Medicos Municipales de Guadalajara, Guadalajara, Jalisco, Mexico; <sup>2</sup>Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO, USA; <sup>3</sup>Instituto Bioclon SA de CV, Delegacion Tlalpan, Mexico DF, Mexico.

**Background:** Widow spider envenomation may cause an array of clinical effects, the hallmark of which is intense pain. Often, response to treatment must be judged by perceived changes in pain intensity due to lack of a reliable set of abnormal clinical findings. This study was conducted to quantify pain intensity in patients with latrodectism using the VAS. **Methods:** As part

of a clinical trial, adult patients diagnosed with latrodectism and not treated with analgesics received a 5 to 10-min infusion of investigational *Latrodectus* antivenom (AV). If sufficient clinical improvement was not achieved, additional doses were infused at 30 and 60 min. Patients completed a VAS for pain before AV (0 min), at the end of Dose 1 (30 min), and at the end of observation (240 min). VAS score was the distance along a 10 cm line to the patient's mark with left side="no pain" and right side="worst possible pain". Vital signs (SBP, DBP, HR, RR) were also measured. VAS scores and vital signs were compared across time using RM ANOVAs ( $p < .01$ ). **Result:** Twenty-one patients were treated with AV; 11 received only Dose 1. Before AV, mean VAS was  $8.2 \pm 2.1$  cm (severe pain). One or more abnormal signs were present in 18 patients; the other 3 had only minor or moderate pain (VAS=2–6). Abnormal signs included hypertension (SBP  $\geq 130$  or DBP  $\geq 90$ , 71%), elevated RR ( $>22$ , 48%), generalized diaphoresis (48%), nausea/vomiting (29%), and tachycardia (HR  $\geq 100$ , 19%). At the end of Dose 1, there were significant decreases in mean VAS ( $3.3 \pm 2.3$  cm=mild pain,  $p < .001$ ) and means for all vital signs ( $p < .001$ ). Abnormal signs resolved in 10 patients (56%). By 240 min, all signs were normal and VAS scores were zero in all but one patient (VAS=1). **Conclusion:** Decreases in VAS pain scores during therapy were dramatic and concurrent with normalization of clinical signs. VAS offers quantitative assessment of pain intensity in patients with latrodectism and is effective for evaluating response to therapy, particularly in absence of abnormal signs.

### 163. Complications of Crotaline Antivenom Therapy in the United States

Stanford CF, Olsen D, Bogdan GM, Dart RC. *Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO, USA.*

**Background:** Complications of therapy with CroFab and Antivenin Crotalidae Polyvalent (ACP) include recurrent venom effects and acute hypersensitivity reactions (AHRs). Reports on their incidences vary widely, due to limited samples and methodological differences. This study was undertaken to identify rates of recurrence (REC) and AHRs using treatment records from multiple poison centers (PC). **Methods:** Treatment and outcome data were systematically abstracted from PC cases involving Crotaline AV therapy in human patients during 2004. Initial control (IC) was defined as a trend toward normalization of all local and systemic venom effects. REC was defined as re-emergence of either swelling (SREC) or coagulopathy (CREC: PLT  $< 150$ , FIB  $< 150$ , or INR  $> 1.2$ ) after IC. IC, REC, and AHRs rates were compared between AV type (CroFab, ACP). Only cases following the patient for  $>24$  hrs post-AV were considered for REC. **Result:** Of 344 cases of Crotaline envenomation from 24 states, 243 (71%) patients were treated with AV. Over 90% (222) were given CroFab, 4% (9) received ACP, and 5% (12) received both AVs or unreported AV. IC was achieved in 83% of patients, after a median of one dose of CroFab or ACP. Rate of AHRs was significantly greater for ACP (33%) than for CroFab (7%,  $p = .03$ ). All AHRs responded to antihistamines and steroids. A total of 99 records qualified for REC. Despite 2 REC after ACP, there were insufficient data in this preliminary analysis to calculate REC rate for ACP ( $n = 4$ ). REC rate for CroFab was 22% (21/95): SREC was present in 14 of these patients and CREC in 9. One SREC/CREC was accompanied by abnormal bleeding. Median REC onset was  $< 12$  hours after IC; only two RECs (one SREC and one CREC) emerged  $> 72$  hours after IC. Of all cases, one patient developed persistent dysfunction (hemodialysis, no REC). **Conclusion:** IC of venom effects was often achieved with only one dose of AV. AHRs were more common with ACP than with CroFab. REC was observed with both AVs. REC after CroFab was less common than in pre-marketing trials (27–50%), more common than in other post-marketing studies (8–19%), and often with earlier onset (with or without maintenance doses). Medical risk associated with REC remains questionable.

### 164. Non-Bite Exposures to Rattlesnakes: A Retrospective Statewide Poison Center Study

Vohra RB,<sup>1,2</sup> Williams SR,<sup>1,2</sup> Cantrell FL.<sup>2</sup> <sup>1</sup>University of California San Diego Medical Center, San Diego, CA, USA; <sup>2</sup>California Poison Control System, San Diego Division, San Diego, CA, USA.

**Background:** Rattlesnakes live throughout California, and human exposure to them can occur in a variety of ways. The purpose of this study is to survey the non-bite routes of exposures called into a poison control system over a 4-year period. **Methods:** Calls made to a poison control system from 2000–2003 were retrospectively reviewed. Cases coded as a rattlesnake exposure where the route was something other than a bite were identified. Miscoded cases (cases with envenomation or dry bite) were excluded. Patient age, route of exposure, treatment site, symptoms, interventions and outcome were noted. **Result:** A total of 53 cases of non-bite exposures to rattlesnakes were identified. Patient ages ranged from 7 months to 64 years. Exposure routes were: 38 dermal, 7 ocular, 5 oral, 3 dermal and ocular. Rattlesnake parts involved (Table 1) were: 38

TABLE 1  
Non-envenomation rattlesnake exposures, 2000–2003

Snake part/tissue	Exposure route	Number of cases
Venom	Dermal	26
Venom	Ocular	10
Venom	Oral	2
Skin/rattles	Dermal	7
Skin/rattles	Oral	3
Blood/secretions	Dermal	5
Viscera	Dermal	2
Skeleton	Dermal	1

venom, 10 skin/rattles, 5 blood/secretions, 2 viscera, and 1 skeleton. Most exposures occur during the killing, skinning, decapitation, or transfer of animals or parts. 10 patients (19%) were evaluated in a health-care facility; the remaining 43 (81%) were managed on site. Recorded interventions were irrigation and washing only. Only patients exposed to venom developed any symptoms: 3/10 patients (30%) with ocular venom exposures reported transient irritation/tingling, as did 6/26 (23%) with dermal exposures and 1/2 (50%) with oral exposures. *Conclusion:* Poison centers may be called about a variety of non-bite exposures to rattlesnakes. None of our patients developed any symptoms more severe than transient discomfort, which is consistent with the few similar reports published previously. Based on this case series, non-bite exposures to rattlesnakes can be managed at home with basic decontamination, with referral to a health care facility reserved only for persistent symptoms.

#### 165. Is Antivenin Required for All Texas Coral Snake (*Micrurus fulvius tenere*) Envenomations?

Borys DJ, Tobleman WR, Stanford RD, Morgan DL. *Central Texas Poison Center, Department of Emergency Medicine, Scott and White, Temple, TX, USA.*

*Background:* Coral snake venom is neurotoxic in nature with a delayed onset and long duration of action. The current treatment for envenomation by either the Eastern (*Micrurus fulvius fulvius*) or Texas (*Micrurus fulvius tenere*) coral snake subspecies is early administration of Elapidae antivenom to prevent systemic and respiratory paralysis. Our goal was to determine if there is a difference in outcome between these Texas coral snake victims with only local effects who were treated with antivenom and those not treated. *Methods:* This was a matched, retrospective cohort study using the Texas TESS database. It was searched for all human exposures to coral snake envenomations from January 1, 2000 to December 31, 2005. Inclusion criteria included: human, coral snake envenomation, and local effects only. Statistical analysis of the antivenom (ATV) and no antivenom (N-ATV) groups was performed; chi-square test for the categorical variables and t-test for the continuous variables. *Result:* There were 76 patients that met our inclusion criteria, 38 in each group. In the ATV group the average number of vials administered was 3.8 ( $\pm 1.2$ ). There were 5 patients (13%) that developed an adverse reaction to the antivenom. No patient developed

Results of no-antivenom vs. antivenom groups

Variable	N-ATV	ATV	p-value
Age (years)	32.1 $\pm$ 17.2	36.9 $\pm$ 19.0	0.28
Range	5–73	8–81	
Gender			0.17
Female	3 (8%)	7 (18%)	
Male	35 (92%)	31 (82%)	
Treatment site			0.054
HCF	33 (87%)	38 (100%)	
Home	5 (13%)	0	
Outcome			0.044
minor	34 (89%)	27 (71%)	
moderate	4 (11%)	11 (29%)	

respiratory symptoms, no patient required intubation, and no patient died in either group. *Conclusion:* For patients with coral snake envenomation presenting with only local effects, those who received antivenom had somewhat worse outcome than those who did not receive antivenom. These results need to be confirmed with a prospective randomized clinical trial to determine whether the early use of elapidae antivenom in all patients is warranted.

### 166. Epidemiology of Centipede Exposures Reported to Poison Centers, 1998–2004

Forrester MB. *Texas Department of State Health Services, Austin, TX, USA.*

*Background:* Centipedes are found worldwide, including the southern United States, and their bites may cause pain. The objective of this study was to describe the pattern of human exposures to centipedes received by several poison centers. *Methods:* Cases were human exposures to centipedes received by six poison centers during 1998–2004. The distribution of exposures by various factors was determined. *Result:* There were 851 total cases. Among the cases with a known patient age, 16% were less than 6 years of age, 19% were age 6–19 years, and 65% were greater than 19 years of age. Females accounted for 55% of the patients with known gender. The reported centipede exposures were managed on site (outside of a health care facility) in 93% of the cases. Of the 305 cases with a known clinical outcome, 82% had minor effects. Cases exhibited a seasonal trend, with most of the reports occurring during July–September. Dermal irritation or pain was reported in 73% of cases and treatment by decontamination via irrigation was reported for 76% of cases during 2000–2004. *Conclusion:* The majority of centipede exposures reported to poison centers involve adults and females and can be managed outside of health care facilities. The most common treatment is decontamination by irrigation, and the outcome in the majority of cases is favorable.

### 167. A Deathstalker Scorpion Envenomation in Rhode Island

Babu KM,<sup>1</sup> Ganetsky M,<sup>1</sup> Sheroff AD,<sup>2</sup> Boyer EW,<sup>1</sup> Bird SB.<sup>1</sup> <sup>1</sup>*University of Massachusetts School of Medicine, Worcester, MA, USA;* <sup>2</sup>*Regional Center for Poison Control and Prevention MA/RI, Boston, MA, USA.*

*Introduction:* The importation of exotic arachnids has blurred natural geographic boundaries. The *Leiurus* species of scorpions, one of the world's deadliest, is native to the Middle East and Northern Africa. Envenomation by *L. quinquetriatus*, the Deathstalker scorpion, can cause significant toxicity and even mortality, especially in children. While most envenomations cause only local symptoms, death may occur from dysrhythmias and pulmonary edema. An antivenom is available in several countries where *Leiurus* envenomations regularly occur. *Case Report:* The patient is a 22-year-old man who is employed at an exotic pet store in Rhode Island. While feeding the scorpions, he was stung on the right thumb by a Deathstalker scorpion (*Leiurus quinquetriatus*). On presentation in the ED, he complained of severe burning pain in his thumb and hand radiating to his arm. His initial vital signs were within normal limits. His exam demonstrated no ecchymosis, erythema or edema at the envenomation site. After two hours, he began complaining of chest pain, and developed diaphoresis. An EKG revealed normal sinus rhythm without ectopy or conduction abnormalities. He was admitted to the hospital for analgesia and a telemetry observation. The patient did well overnight, and was discharged the following morning. This patient has previously been envenomated by other scorpions, including the Central American Bark scorpion (*Centruroides margaritatus*). This patient described this envenomation by *Leiurus quinquetriatus* as “far worse” than any of his prior envenomations. *Case Discussion:* The Regional Poison Control Center attempted to locate any available *Leiurus* species antivenom in the event that the patient deteriorated. Despite contacting several major zoos, other poison control centers, and other medical toxicology services, no *Leiurus* species antivenom could be found in the US. *Conclusion:* We report a case of Deathstalker scorpion envenomation that was successfully treated with supportive care. In the event of a severe *L. quinquetriatus* envenomation in the US, the antivenom may not be readily available.

### 168. Fasciculations After Rattlesnake Envenomation Are Not a Seasonal Phenomenon: A Statewide Retrospective Study

Vohra RB,<sup>1,2</sup> Cantrell FL,<sup>2</sup> Williams SR.<sup>1,2</sup> <sup>1</sup>*University of California, San Diego Medical Center, San Diego, CA, USA;* <sup>2</sup>*California Poison Control System, San Diego Division, San Diego, CA, USA.*

TABLE 1  
Distribution of cases with fasciculations

Month	2000	2001	2002	2003
February	1	0	0	0
March	0	0	1	1
April	3	0	5	1
May	1	1	0	1
June	1	1	3	1
July	3	0	4	3
August	2	1	2	3
September	0	1	2	4
October	0	0	0	1

*Background:* Rattlesnake venom is a complex mixture of cytotoxins, digestive enzymes, hemotoxins and neurotoxins. The content and potency of rattlesnake venom may vary depending on factors such as snake diet, age, size and the time of year. These variables may result in seasonal or temporal patterns in the occurrence of muscle fasciculations (myokymia) secondary to rattlesnake envenomations. *Methods:* Data was obtained from a poison system database for the years 2000–2003, inclusive, for rattlesnake envenomation exposures coded as having fasciculations. The day, month and year of the snakebite was recorded and used to tabulate the numbers of envenomations that resulted in fasciculations. *Result:* A total of 47 cases were identified. The number of cases with fasciculations coded was distributed by year as follows: 2000-11, 2001-4, 2002-17, 2003-15. The distribution by month is summarized in Table 1. *Conclusion:* We found no pattern in the incidence of fasciculations by month over four consecutive years. 2001 had fewer reported cases of fasciculations, but no trends were evident based on the total number of bites with fasciculations. More research is needed to confirm or clarify these findings. Future epidemiologic research may reveal whether patient age, anatomic location of the bite or size/age of the snake confers a risk for developing fasciculations after rattlesnake envenomations.

### 169. Gaboon Viper Envenomation in North America

Meggs WJ, Hack JB. *Brody School of Medicine at East Carolina University, Greenville, NC, USA.*

*Introduction:* Gaboon vipers are native to Africa and are considered by many experts to be the most dangerous viper in the world. Envenomations in North America are rare but can occur if these snakes are kept as pets or in zoos. *Case Report:* A 29 year old man with a long history of handling water moccasins, cobras, and other venomous snakes purchased a pair of Gaboon viper breeding hatchlings by mail order from an internet web site. After three years, the snakes were approximately three feet long. One evening he did not securely fasten the cage and a snake escaped. While lying in bed in the dark, he tried to locate an albuterol inhaler on the floor. He was bitten three times on the left hand. He presented with fang wounds on the left hand. There was severe pain, swelling, ecchymosis, and hemorrhagic bulla of the left hand extending up the entire left arm. PT and PTT were >100 sec. Horse serum antivenin was obtained from a zoo and administered intravenously. After receiving four vials, he developed urticaria and laryngeal edema. Infusion was stopped, and he was treated with epinephrine and diphenhydramine with resolution of symptoms. His INR transiently normalized but then increased to 3.2. The edema progressed onto his left upper chest. The patient was pre-medicated with prednisone and diphenhydramine. Anti-venin infusion was reinstated with a slow infusion rate and careful monitoring for symptoms. An additional 6 vials of antivenin were tolerated without adverse consequences. Coagulation parameters normalized but once again became abnormal. An additional 5 vials of antivenin were administered. He recovered without further difficulty. *Case Discussion:* Management of Gaboon viper envenomations can be complex. Available antivenins are horse serum-based and can present further difficulties. *Conclusion:* Though not native to North America, Gaboon viper envenomations can occur. Problems associated with these envenomations include severe toxicity, difficulty in obtaining antivenin, and allergic reactions to antivenin.

### 170. What a Bite—Review of Snakebites in Children

Feng S, Stephan M. *UT Southwestern Medical Center/Children's Medical Center of Dallas, Dallas, TX, USA.*

**Background:** Approximately 2000 children less than 17 years of age are victims of crotalid envenomation each year. Multiple controversies exist in the management of these bites. We present the largest pediatric review of snakebite envenomations. **Methods:** This is a 6 year retrospective chart review of pediatric patients presenting with venomous snakebites. Data was abstracted for; demographics, the severity of the bite, circumstances of the snakebite, lab values, method and dose of antivenom administered, vital signs, adverse outcomes, cost and disposition. **Result:** 49 patients were identified. Ages ranged 22 mos–16.8 years, 67.3% male. The envenomations consisted of: 65% copperheads, 8% cottonmouth, 27% unknown. 47% were moderate level 2 envenomations, 36.7% were mild level 1. Systemic symptoms were found in 26.8% with predominance of vomiting. Initial coagulation evaluation revealed 26.5% abnormal CBCs: 7 pts had WBC>15 K, 4 had thrombocytopenia. 30.6% had abnormal PT, 10.1% abnormal PTT. 1 patient had abnormal fibrinogen and d-dimer results (cottonmouth envenomation). 31.6% had other labs performed predominantly renal group(35%). Subsequent labs were significant for persistently abnormal percentage PTT and d-dimer (16.3%, 4.1%) Antivenin was used in 34.6%: 82.3% received CroFab<sup>®</sup> (CF) with 1 adverse reaction described as facial flushing. Vital signs remained stable during all infusions. 18.4% received subsequent CF dosing. No reactions were noted on subsequent dosing. 22% had progression of symptoms described as edema during hospitalization. 49% had a tox consult. Antivenin use in all snakebites with tox consult (62.5%) is statistically significant ( $p<0.004$ ) using Pearson Chi-Square. 50% of copperhead bites with tox consult received no antivenin. 43% had 2 day hospital stay. 59% received antibiotics. 2 patients were readmitted for surgical debridement of hemorrhagic blisters on digits. **Conclusion:** Copperheads envenomations are prevalent in Northeast Texas as reflected in our data. The use of Wyeth Polyvalent Antivenin<sup>®</sup> and CF appear to be safe and effective. Antivenom use still remains controversial in copperhead envenomations. We present the largest descriptive analysis of snakebite envenomations in the pediatric population.

### 171. Restricting Acetaminophen Pack Size—Does It Make a Difference?

Bateman DN,<sup>1</sup> Gorman DR,<sup>2</sup> Bain M,<sup>3</sup> Inglis JHC,<sup>4</sup> Murphy D.<sup>3</sup> <sup>1</sup>*NPIS Edinburgh, Edinburgh, United Kingdom;* <sup>2</sup>*NHS Lothian, Edinburgh, United Kingdom;* <sup>3</sup>*NHS Scotland, Information and Statistics Division, Edinburgh, United Kingdom;* <sup>4</sup>*NHS Health Scotland, Edinburgh, United Kingdom.*

**Background:** In 1998 the UK government introduced legislation restricting the size of acetaminophen-containing packs on general sale in pharmacies to 32 tablets (16 g), and in other outlets to 16 (8 g). The objective was to reduce incidence of acetaminophen-associated overdose and mortality. **Methods:** We have examined hospital death and discharge data, and death registration data for Scotland (pop~5.1 m) from 1995–2003, the former for all overdoses and those involving acetaminophen (APAP), the latter just for overdoses involving APAP. For deaths we have determined site of death (in- or outside hospital) and agents involved in four categories: APAP±ethanol (E); APAP with dextropropoxyphene (co-proxamol); APAP in combination with codeine or dihydrocodeine; APAP plus other drugs. Hospital discharge data do not allow these categories to be separated since they record only component ingredients of an overdose. **Result:** In 1995 30% of 19247 hospital poisoning death and discharges involved APAP and proportion increased to 34% in 1997. Rates fell to 30% in 1999 but rose to 37% of 18466 poisonings by 2003 (trend NS). In 1995 83 deaths included APAP in the overdose cocktail; this was 110 in 1997, falling to 79 in 1999 but by 2000 had risen again to 122. In order to evaluate the true impact of pack size restriction we examined in-hospital deaths, where deaths due to APAP itself predominantly occur due to the natural history of APAP poisoning. For APAP±E 76% of deaths were in-hospital; for other categories 77–81% of patients died outside. Overall in-hospital deaths showed no significant change over the time period, although the lowest total number (27) was in 1999. Similarly deaths involving only APAP±E were lowest in 1998 and 1999 (20 and 22) but in 1995, 96 and 97 (27, 28 and 31) numbers were similar to those in 2001, 02 and 03 (32, 28 and 28). **Conclusion:** Restrictions on pack sizes of APAP in the UK have not significantly reduced the proportion of overdose discharges involving APAP, nor the mortality rates from this agent in Scotland.

### 172. Adherence to Legislation Limiting Acetaminophen Availability in the United Kingdom

Greene SL,<sup>1</sup> Dargan PI,<sup>1</sup> Leman P,<sup>2</sup> Jones AL.<sup>1</sup> <sup>1</sup>*National Poisons Information Service, London, United Kingdom;* <sup>2</sup>*St Thomas' Hospital Emergency Department, London, United Kingdom.*

*Background:* Legislation limiting availability of over the counter (OTC) acetaminophen in the United Kingdom (UK) was introduced in 1998 in an attempt to limit severity of acetaminophen poisoning. Data published in 2004 show a decrease in suicide deaths attributed to acetaminophen overdose (OD) and a decrease in the number of patients requiring liver transplantation as a result of acetaminophen induced acute liver failure during 1999–2001. These results have been attributed to the legislation, however there is no published evidence that this legislation is being adhered to. We aimed to examine adherence to the legislation in an area of London. *Methods:* The authors posed as a patient with knee pain and attempted to purchase acetaminophen in a quantity (4 packets of 16 × 500 mg tablets) contravening legislation from 24 pharmacy and non-pharmacy outlets in South London. Patients presenting to an inner city Emergency Department (ED) who reported ingesting more than 16 × 500 mg acetaminophen tablets and had purchased them to OD were questioned to determine the source of the tablets. *Result:* We purchased acetaminophen in amounts contravening the legislation in 75% of outlets (4/8 pharmacies, 4/6 supermarkets, 9/10 convenience stores). In 54% of outlets we purchased more than 24 g of acetaminophen. Of 107 patients presenting to the ED with acetaminophen OD, 35 reported purchasing acetaminophen to OD (32 of these patients had acetaminophen serum concentrations requiring antidotal treatment, 2 were treated on the basis of a staggered ingestion). Acetaminophen was allegedly purchased in a manner contravening the legislation by 47% (16) of patients who reported purchasing the tablets to OD (and who had significant acetaminophen serum concentrations); 41% (14) had reported purchasing tablets from multiple outlets while 12% (4) obtained the tablets legally from a pharmacy. *Conclusion:* Legislation limiting availability of OTC acetaminophen is not being adhered to in London. Research is needed to determine the degree of national adherence. Measures to increase enforcement of the legislation may further reduce the severity of acetaminophen poisoning.

### 173. Novel Surveillance System Analyzes Poison Center Calls for Public Health

Casavant MJ, Ekleberry S. *Central Ohio Poison Center, Columbus, OH, USA.*

*Background:* Poison centers (PC) capture data from callers whose symptoms may not otherwise enter the health department's (HD) surveillance systems. We adapted a 911 dispatch center analysis tool, to allow HD to include PC data in their disease surveillance efforts. *Methods:* PC staff entered case demographics, symptoms, and treatments about all cases into Toxicall<sup>®</sup>. We built a system to extract call time, zip code, symptoms, and treatments, then securely to transmit that data in real time to a data analysis tool (FirstWatch<sup>®</sup>). The tool, already used for surveillance of 911 dispatch data, was adapted to accept our data and to perform geographic analysis by zip code. We created 16 syndromic clusters of symptoms and treatments. For each cluster, FirstWatch performed four statistical tests and compared results to 12 months of historical data: 1) case count per trigger was compared to expected value based on day of week and hour of day; 2) the ratio of cluster events to all events controlled for unrelated volume increase; 3) a modified Cumulative Sum Control Chart incorporated time-series analysis over a rolling 14-day calendar. Triggers alarmed when all of these tests were  $\geq 3$  standard deviations above expected. Finally, FirstWatch analyzed cases for geographic clustering. Inclusion criteria included all human exposure cases. A secure web page displayed a "dashboard" of the current status of each cluster, with password access given to HD surveillance staff. *Result:* During 112 days, public health data on 11,486 human exposures were entered. The system performed the four tests on each of the 16 triggers every 3–5 min, for  $\approx 19,000$  tests/day. We "detected" one food poisoning event involving >100 victims. There were 29 outliers on 19 days, vs. 82 outliers on 48 days in the AAPCC/CDC system. *Conclusion:* Poison centers collect valuable data, which could serve a greater public health good if properly analyzed and shared. This system securely and efficiently enables use of poison center data for disease surveillance. Further research is needed to define statistical parameters giving optimal sensitivity and specificity. Advantages over the AAPCC/CDC system include PC-customizable triggers and alert criteria, and fewer outlier alerts.

### 174. Do Hospitals in the 50 Largest Cities of the United States Carry Sufficient Supply of the Cyanide Antidote Kit?

Stanford CF, Ries NL, Bogdan GM, Dart RC. *Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO, USA.*

*Background:* In recent years, there has been growing concern for terrorism involving common industrial agents such as cyanide. Supply of the cyanide antidote kit (CAK) has not been reported in over 5 years and was limited to hospitals in one state or

region. A nationwide survey was conducted in the 50 largest U.S. cities to determine CAK supply in areas of greatest potential terrorist impact. *Methods:* Pharmacies in hospitals with emergency departments (n=1065) within the metropolitan statistical areas (MSAs) of the 50 largest cities (2000 Census) were contacted to provide CAK supply and stocking practices. Twenty-four poison control centers assisted with the survey. Supply and usage were compared between geographical regions (West, Midwest, South, Northeast) using non-parametric methods. *Result:* The overall response rate was 76% (n=806). Of all responding hospitals, 90% carried a supply of at least one CAK. The proportion of hospitals with supply was highest in the Northeast (97%) and lowest in the South (83%). CAK supply level was greater in the Northeast relative to hospitals in other regions (p<.001). There was no difference between regions in proportion of hospitals that dispensed the CAK over the past year. *Conclusion:* The proportion of hospitals that stock the CAK was markedly higher in this survey than previous statewide reports. Greater supply in densely populated urban areas may reflect recently published antidote stocking guidelines and increased concern for terrorist attacks, particularly in the higher profile cities of the Northeast. Existing guidelines recommend a supply of one CAK, which would be insufficient to manage a terrorist attack involving 100 or more exposures in an urban area. Results from this survey suggest that less than 10 MSAs (<20%) have a total supply of at least 100 CAKs.

CAK supply characteristics

	West	Midwest	South	Northeast	P-value
# MSAs (# hospitals)	16 (206)	11 (221)	17 (217)	6 (162)	–
# Hospitals with $\geq 1$ CAK (%)	192 (93)	194 (88)	181 (83)	157 (97)	<.001
Total CAK supply (median)	647 (1)	428 (1)	771 (1)	671 (2)	<.001
# Hospitals dispensing CAK, past year (%)	20 (11)	17 (9)	14 (8)	16 (11)	.794

### 175. Using TOXBASE and Hospital Admissions Data to Evaluate Trends in Drugs Abuse in Scotland 2000–2004

Laing WJ, Good AM, Bateman DN. *NPIS Edinburgh, Edinburgh, United Kingdom.*

*Background:* To examine trends in drugs of abuse in Scotland using poisons data. *Methods:* A retrospective analysis of access to our poisons information database, TOXBASE, from Scottish users regarding drugs of abuse, and comparison with trends in admissions data to a poisons treatment unit within a Scottish hospital for the same period. *Result:* During the period 2000–2004 (inclusive), there were 312016 product accesses to TOXBASE from Scotland; of these 2.7% were for drugs of abuse (amphetamines; cannabinoids; cocaine and crack cocaine; ecstasy; opiates—mainly heroin, morphine and methadone; ketamine; GHB/GBL and LSD). In the same period 13% of 12178 admissions to the Royal Infirmary Poisons Unit involved these drugs. The rank order of drugs of abuse about which TOXBASE enquiries were made in total is as follows: 1 ecstasy (MDMA) (2799 accesses, 33.2%) 2 heroin and morphine (1372, 16.3%), 3 amphetamines (1222, 14.5%), 4 cocaine/crack cocaine (810, 9.6%) and 5 cannabinoids (798, 9.5%). There was a 75% proportional increase in accesses on amphetamines 2000–2004; accesses regarding ecstasy declined by 33%. For hospital admissions the overall rank order was: 1 heroin and morphine (475 admissions, 30%); 2 ecstasy (353, 22.3%), 3 methadone (320, 20.2%), 4 amphetamines (130, 8.2%). 112 admissions (7.1%) were due to cocaine. Over the period 2000–2004 there was a proportional decrease of 22% in ecstasy admissions, and a 20% decrease in the proportion of methadone presentations. There was also a 19% increase in presentations with heroin or morphine. *Conclusion:* Routine emergency department and discharge data does not provide information that is easily accessible to public health use. Drug usage data is frequently dependant on seizure information from the police, or reported use by addicts. The use of poisons information data in the way we have described allows trends to be monitored. In contrast to many other developed countries, in Scotland amphetamine and ecstasy use continue to be a major component of hospital workload. Opioid use and cocaine use in Scotland appear stable as adjudged by in-patient activity and poisons enquiry data.

### 176. Socioeconomic Status and Psychiatric Referral Following Deliberate Self-Poisoning

Bischof D,<sup>1</sup> Sivilotti MLA,<sup>2</sup> Lam K,<sup>1</sup> Juurlink DN.<sup>1</sup> <sup>1</sup>University of Toronto, Toronto, ON, Canada; <sup>2</sup>Queen's University, Kingston, ON, Canada.

*Background:* Psychiatric consultation following deliberate self-poisoning (DSP) may decrease the likelihood of recurrence, but the factors that influence referral are largely unknown. We examined the relationship between SES and psychiatrist referral following DSP in a population of more than 14 million. *Methods:* Using provincial hospital records, we identified all DSP admissions in Ontario (ICD9 960.0 to 990.0 and ICD10 T36–T50) from 1993 to 2003. These were linked using anonymized identifiers to physician claims, vital statistics, and population census data. SES was indirectly imputed from the postal code of each patient, adjusted for household size and geographic location, and categorized into quintiles. We determined psychiatrist referral rates at 30 days and 1 year following first overdose. *Result:* We identified 32,806 patients hospitalized for DSP who survived to discharge. The majority (63%) were women, and acetaminophen poisoning was the most common diagnosis. Among patients for whom SES could be imputed, 8692 (30%) admissions were from the lowest quintile and 4113 (14%) from the highest. More than a third of patients (35%) had seen a psychiatrist in the preceding year, and 5% had a previous suicide attempt. Overall, 15,849 patients (48%) saw a psychiatrist within one year (median time to consultation 21 days; IQR 7 to 67). Referral was equally likely for men and women, but patients aged 40–59 years were more likely to be referred than patients younger than 20 (56% vs. 39% at 1 year;  $p < 0.0001$ ). Other characteristics associated with higher rates of referral were urban residence and admission to a teaching hospital. SES was directly related to referral rates. Within 30 days of admission, 25% of patients in the lowest SES quintile had seen a psychiatrist compared with 32% of patients in the highest quintile ( $p < 0.0001$ ); at 1 year the corresponding rates were 46% and 53% ( $p < 0.0001$ ). *Conclusion:* Low SES patients constitute a disproportionate number of DSP admissions. More than half of DSP patients in Ontario do not receive psychiatric consultation within 1 year. A direct relationship exists between SES and access to psychiatric care. Advancing age, admission to a teaching hospital, and urban residence are also associated with higher referral rates. The consequences of these findings require further study.

### **177. A Methodology for Creating a Web-Based Database of Hospital Antidote Par Levels for Local Disaster Triage Prior to Push-Pack Delivery**

Lai MW, Burns Ewald M, Shannon MW. *Harvard Medical Toxicology Fellowship, Boston, MA, USA.*

*Background:* In the event of a large-scale terrorist act or industrial mishap, local healthcare facilities will treat victims before Push-Packs (caches of pharmaceuticals deployed to arrive  $\leq 12$  hours after request) and supplies from the U.S. Strategic National Stockpile arrive. Using the Internet to access a database (DB) of available par levels of stocked antidotes at regional hospitals could help incident commanders (ICs) determine how best to organize, obtain, deploy, and distribute local resources as an interim measure. We describe a methodology for creating a DB of locally available antidotes for use after terrorist acts and other public health emergencies. *Methods:* An ACMT/ATSDR 2004 Fellows-in-Training grant funded a DB written in HTML to store par antidote level information. (# of par level adult doses) are recorded per hospital for:  $\text{NaHCO}_3$ /antivenins/atropine/chelators/digoxin antibody fragments/4-MP/methylene blue/naloxone/prussian blue/pralidoxime/pyridoxine. Other antidotes may be added to this list. Access is through a password-protected internet web page portal. Users must register as a Hospital Pharmacy or hospital/public health-affiliated IC to enter or search for information. Users input their zip code and a search radius (miles): the DB returns a list of hospitals within the search radius including phone numbers and list of par levels. ICs may use Wi-Fi technology for access from the field. *Result:* Programming is complete. U.S. PCCs will be solicited for their lists of local hospital phone numbers and zip codes found in DotLab<sup>®</sup>/PathTech<sup>®</sup>/CasePro<sup>®</sup>/Toxicall<sup>®</sup> data collection software to complete a national cohort. Enlisting hospital cooperation, data entry and IC registration/verification is ongoing in 2005.  $\beta$ -testing is with MA/RI PCC regional data. *Conclusion:* A web-based portal to access a DB of available antidotes stored at U.S. hospitals has been created. This DB is a simple tool for ICs to use during local disaster response in order to better triage victims to where there are sufficient antidote resources until Push-Packs arrive. It has the potential to serve as a model for internet-accessible DBs that can be used in interim disaster response.

### **178. Assessment of a Statewide Laboratory Network for Cholinesterase Screening: Can We Communicate in the Event of Chemical Terrorism?**

McKay CA,<sup>1</sup> Wu A,<sup>2</sup> Smith A,<sup>2</sup> Vena J,<sup>1</sup> Kristie V,<sup>3</sup> Butcher C,<sup>4</sup> Zibluk J.<sup>5</sup> <sup>1</sup>Hartford Hospital, Hartford, CT, USA; <sup>2</sup>University of California, San Francisco, CA, USA; <sup>3</sup>Yale New-Haven Health, New Haven, CT, USA; <sup>4</sup>Waterbury Hospital, Waterbury, CT, USA; <sup>5</sup>Griffin Hospital, Derby, CT, USA.

*Background:* While nerve agents suppress both plasma and erythrocyte cholinesterase, it is unknown if such assays may be used to mass-screen potential victims of a nerve agent attack. A rule-out procedure is desirable in unclear clinical presentations due to the sheer numbers of potential victims in an attack. Complicating the use of cholinesterase assays are an unknown inter-laboratory variance and difficulty in establishing networks to parallel process the large number of specimens anticipated. Our objective was to establish a voluntary network of laboratories across Connecticut, evaluate this process, and compare the results of known plasma samples for accuracy. *Methods:* IRB exemption was obtained prior to participation. Of 32 hospital labs, eight (25%) had capacity for an automated plasma cholinesterase assay; six (19%) volunteered and two (6%) have completed all required steps for inclusion. Convenience samples of fourteen de-identified plasma specimens were fractionated and distributed. Following calibration and control procedures, samples were analyzed at each institution and results compared to two runs on our VITROS<sup>®</sup> 950 instrument (Ortho-Clinical Diagnostics, Raritan NJ). *Result:* Calibration and performance validation revealed adequate linearity (1.09–1.13) and good within-run precision of <3.2%. Results of the deidentified specimens revealed a plasma cholinesterase activity range of 883 to 7,451 U/L, with a standard deviation across institutions of 1.4 to 9.7%. One aliquot could not be processed after shipment. *Conclusion:* The data provide a preliminary threshold for determining tolerances for a networked cholinesterase laboratory effort. In addition, the project demonstrates some of the challenges in establishing a voluntary multi-hospital laboratory network. Toxicologists have an important opportunity to develop hospital and state public health laboratory cooperative relationships in the area of biopreparedness.

### 179. Alternative Communication Tools for Poison Centers

Mrvos R, Krenzelo EP. *Children's Hospital of Pittsburgh, Pittsburgh, PA, USA; University of Pittsburgh, Pittsburgh, PA, USA.*

*Background:* Rapid alerting and dissemination of information during an emergency is paramount. The poison center plays an important role in the medical community as well as in the civilian population during a hazardous substance-related disaster. It is imperative that the poison center staff receive correct, current information regarding the incident. It is also equally important that they evaluate this information and give specific recommendations. Through local and state government agreements, a RPIC acquired numerous communications tools to assist the staff during a hazardous substance-related disaster. *Methods:* A RPIC collaborated with state and local governments as well as the state department of health to determine what communication technology was necessary to facilitate communication with the RPIC. The RPIC applied for a grant from the local emergency planning committee to purchase a city/county two-way alerting radio. Further requests were made to the appropriate government agencies to supply the remaining equipment. *Result:* Through grants the RPIC acquired three different emergency two-way radios that permits communication with all hospitals in the state, emergency operations centers, the department of health and emergency responders at the scene of an incident. An emergency email alert system was utilized by one of the agencies and a computer in the operations area of the poison center was dedicated 24/7 to receive these alerts. *Conclusion:* It is the responsibility of a poison center to be aware of any disasters in the communities it serves particularly if they are toxicology related. Communication is the key to this awareness and a method not only to receive pertinent information but to relay specific precautions and treatment recommendations to first responders, healthcare professionals and government staff. Telephones may not function or may be overwhelmed, depending on the type and location of the incident, making alternative communication tools imperative for all poison centers.

### 180. Age is Associated with Increased Risk of Death for Poisoned Patients

Rogers JJ,<sup>1</sup> Heard K,<sup>1,2</sup> Dart RC.<sup>1,2</sup> <sup>1</sup>Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO; <sup>2</sup>University of Colorado Health Sciences Center, Denver, CO.

*Background:* Previous research has suggested an age related difference in deaths for hospitalized poisoned patients. This research used older, regional poison center data, which may have been confounded by poly-substance poisoning. *Objective:* This study uses national poison center data from the Toxic Exposure Surveillance System (TESS) to compare the risk of death in geriatrics vs. young adults after single substance overdose of seven common medications. *Methods:* This is a retrospective analysis of TESS data from 1995–2002 of all adult patients ( $\geq 20$  yrs old) evaluated in a health care facility. Cases were restricted to single substance ingestions of aspirin, acetaminophen, cardiac glycosides, calcium channel blockers,

theophylline/aminophylline, benzodiazepines, and tricyclic antidepressants. The patients were classified as young adult (age 20–59) and geriatric (age  $\geq 60$ ) for unadjusted comparisons. The relative risks (RR; 95% CI) of death (vs. other outcome) for all poisonings combined and for the seven common poisons were determined for adult vs. geriatric groups. Logistic regression was performed to adjust for potential confounders. *Result:* 72,694 of the cases reported to poison centers over the study period met criteria; 11,373 (16%) were geriatric. The overall mortality was 1%; the mortality for geriatric patients was 2.6%. The geriatric group had a RR of death of 2.7 (2.4–3.1) vs. young adults when all seven poisons were considered together. The RR of death was also elevated for each of the seven poisons, ranging from 1.2 to 7.0. After adjustment for medication, intentional exposure, duration of exposure, and gender, each 10-year increase in age was associated with a 36% increase in the risk of death (95% CI of the OR 1.31 to 1.42). *Conclusion:* Elderly patients admitted for poisonings are at increased risk of death when compared to younger adults. This age related increased risk of death is present for each of the seven poisonings, and persists after adjustment for common confounders.

### 181. Unintentional Adult Medication Exposures: An Unrecognized Phenomenon

Fehr JM, Vicas IM-O. *Alberta Poison Centre, Calgary, AB, Canada.*

*Background:* Adults are increasingly recognized as being at risk for unintentional poisoning. In order to develop effective prevention strategies, our Poison Centre (PC) undertook to (1) ascertain the causal circumstances of unintentional adult medication poisoning, (2) determine the frequency of occurrence (3) identify specific age groups at risk (4) identify high risk circumstances. *Methods:* Retrospective review of adult (age  $>20$ ) unintentional exposures reported to our PC over a 12 month period were classified by circumstance of exposure, age group and medical effect. *Result:* Of 4760 eligible cases, 4092 cases had sufficient documentation for analysis. Unintentional medication exposures represented 30% (1252), with the balance being chemical exposures. 56% of adult medication errors were due to dosing errors (702) with 30%(371) due to inadvertent errors. Double dosing was the most common dosing error (354), consisting of errors made in the timing intervals between doses (34), instruction interpretation error (16), and forgetfulness (9). Superdosing (for therapeutic effect or otherwise) accounted for 50% (348) of dosing errors. Pain (102), especially dental pain (24), insomnia (20) and anxiety (18) were common causes for superdosing. Inadvertent errors consisted of taking someone else's medication (human-98, pet-20), and failing to differentiate between their medications (59). Needlestick errors comprised a specific subcategory (22%-80) due primarily to agricultural agents (43) followed by insulin errors(22) and epi-pen exposures (12). There were 38 cases identified as taking a medication by an incorrect route: ocular route instead of oral/dermal (19), oral instead inhalational (15), and miscellaneous (4). Double dosing is more likely in the 60+ year age group while superdosing for therapeutic effect is a more common practice in 20–39 year olds. Major clinical effects occurred in only 18 cases with superdosing (10) representing the majority. *Conclusion:* Potential prevention areas to address include (1) the dispensing practices of medications in the home, targeting the 60+ age group, and (2) education relating to the relief and management of pain with prescription and over the counter medications, targeted primarily to the 20–39 year age range.

### 182. Intentional Ethylene Glycol Poisonings Increase After Extensive Media Coverage of Alleged Antifreeze Murders

Cragin LS,<sup>1</sup> Geller RJ,<sup>1,2</sup> Morgan BW.<sup>1,2</sup> <sup>1</sup>Georgia Poison Center, Grady Health System, Atlanta, GA; <sup>2</sup>Emory University School of Medicine, Atlanta, GA, USA.

*Background:* Our poison center (PC) observed a steady increase in human exposures to ethylene glycol (EG) from 148 to 270 between 2000–2004. This occurred in a period of intense regional media coverage of the case of a local woman who allegedly used antifreeze to poison her police-officer husband and, years later, her fire-fighter boyfriend. Local coverage began in the summer of 2001 and continued sporadically, with the story receiving national attention in 2004 when one of the trials was broadcast live on national TV. This study describes the increase in EG poisonings and correlates the data with the media coverage timeline. *Methods:* Descriptive statistics, linear regression, and epi curves were used to describe and analyze the increase in EG poisonings over time. A search of the leading regional newspaper's archives established the media coverage timeline. *Result:* Between 2000 and 2004, our PC handled a steady volume of unintentional exposures to EG [range: 105–123

per year, standard deviation (SD): 7.22]. EG exposures thought to be suicidal in intent increased from 12 cases in 2000 to 121 cases in 2004. In the 19 months prior to the first media report of this story on July 29, 2001, our PC handled a mean of 1 EG case with suicidal intent per month [range: 0–2, SD: 0.69]. In the month after the first media report, our PC handled 5 EG cases with suicidal intent. When media coverage was most intense (2004), our PC received a mean of 10 EG suicidal-intent calls per month [range: 5–17, SD: 3.55]. Epi curves identified small, well-defined clusters of suspected suicide EG calls that correlated closely with media coverage of this story. Although uncommon, reports of malicious EG poisonings also increased during this same period from 2 in 2000 to 14 in 2004. *Conclusion:* Media coverage of stories involving poisonings may result in copycat events, applicable to both self-poisonings and malicious poisonings. As the media continues coverage of this story, poison centers should be aware of the copycat phenomenon. Moreover, the media should be more sensitive to the content of their coverage and avoid providing “how-to” poison information.

### 183. Carbon Monoxide Poisoning in Connecticut: An Analysis of Three Databases

Frankel J,<sup>1</sup> Delgado J,<sup>1,2,3</sup> Adamcewicz M,<sup>1</sup> Sangalli B,<sup>3</sup> Singh R,<sup>4</sup> Lewis S,<sup>5</sup> McKay C.<sup>1,2,3</sup> <sup>1</sup>University of Connecticut School of Medicine, Farmington, CT, USA; <sup>2</sup>Hartford Hospital, Hartford, CT, USA; <sup>3</sup>Connecticut Poison Control Center, Farmington, CT, USA; <sup>4</sup>Connecticut Department of Public Health, Hartford, CT, USA; <sup>5</sup>Connecticut Office of the Chief Medical Examiner, Farmington, CT, USA.

*Background:* Data on carbon monoxide (CO) exposure can be found in at least three distinct databases in Connecticut: the CT Poison Control Center (PCC), the Department of Public Health (DPH), and the Medical Examiner’s (ME) office. Although there is a CT statute mandating laboratory reporting of carboxyhemoglobin (COHb) levels >9%, we have previously shown that only 74% of hospitals in our state comply with this requirement. We sought to determine the degree of overlap between these databases by examining all CO cases reported to each one over a five-year period. Using the PCC dataset, we also examined the effect of carbon monoxide detectors on COHb level at the time of presentation to a health care facility. *Methods:* We conducted a retrospective analysis of the three databases examining all CO cases from the years 2000–2004. The degree of overlap was determined by matching name, age, gender, hospital site, and COHb level. We also reviewed the narrative portion of the PCC dataset for the presence or absence of a CO detector. Descriptive statistics were performed and COHb levels were compared with a 2-sample t-test corrected for unequal variances. *Result:* We identified 768 PCC cases, 498 DPH cases, and 183 ME cases. There were 79 shared cases between the PCC and DPH databases; 3 cases between the DPH and ME databases; and 1 case between the PCC and ME databases. The mean COHb concentration when a CO detector was mentioned in the narrative was 6.04% vs. 13.1% when there was no mention of a detector ( $p < 0.001$ ). *Conclusion:* The concordance between the PCC, DPH, and ME databases is low. Consistent with prior studies, the presence of a CO detector was strongly associated with a lower COHb level at the time of presentation to a healthcare facility. Our findings underscore importance of increasing CO detector use as a target for public health policy and education efforts.

### 184. Potential Carbon Monoxide Exposures: The Relationship Between Call Origin and Carboxyhemoglobin Levels

Delgado J,<sup>1,2,3</sup> McKay C,<sup>1,2,3</sup> Frankel J,<sup>2</sup> Sangalli B.<sup>3</sup> <sup>1</sup>Hartford Hospital, Hartford, CT, USA; <sup>2</sup>University of Connecticut School of Medicine, Farmington, CT, USA; <sup>3</sup>Connecticut Poison Control Center, Farmington, CT, USA.

*Background:* Most individuals who contact our poison center and express a concern for acute carbon monoxide (CO) exposure are referred for evaluation. We sought to determine the characteristics of calls that originated in a health care facility (HCF) compared to calls originating from home or other sites (non-HCF). *Methods:* We conducted a retrospective review of all poison center calls in Connecticut involving potential CO exposure from 2000 through 2004. Each identified case was then sorted according to origin of the call. A research assistant reviewed each case and abstracted the narrative. A co-investigator reviewed 20% of cases to ensure accuracy and uniform coding. Duplicate cases, miscoded cases, and cases that were identified by the information specialist as unrelated to carbon monoxide were discarded. Descriptive statistics were performed. Continuous variables and proportions were compared with 2-tailed t-test or Fischer’s exact test as appropriate. *Result:* There were 301 cases in the HCF group and 459 in the non-HCF group. Only 137 (29%) of individuals referred to a HCF arrived; of these 99

(21.6%) had COHb levels drawn. Nearly all calls from non-HCF (98.5%) were deemed unintentional exposures compared to 82.5% from HCF ( $p < 0.05$ ). Mean age was similar: 28.8 and 27.5 ( $p = 0.73$ ) for HCF and non-HCF, respectively but COHb was significantly higher 13.1% vs. 1.3% ( $p < 0.001$ ). PCC follow-up calls identified resolution of symptoms and alternative recommendations from heating company representatives, firefighters, or physicians as the main reasons for not going to HCF. *Conclusion:* The majority of individuals referred to HCF do not present to emergency departments for their suspected exposure. Those patients who present to a HCF for evaluation have a low COHb. Although time delay between exposure and presentation may account for a portion of this effect, we propose that selection for less seriously exposed patients is the dominant factor. Additional research is needed to determine if more of these patients may be safely managed without referral to a HCF.

### 185. Mandatory Reporting of Carbon Monoxide Poisoning by Health Care Providers: Effect on Poison Center Calls

Hoffman RJ,<sup>1</sup> Hoffman RS.<sup>2</sup> <sup>1</sup>Beth Israel Medical Center, New York, NY, USA; <sup>2</sup>New York City Department of Health Poison Control Center, New York, NY, USA.

*Background:* On 11/1/2004, a new law took effect mandating that health care providers in our city notify the Poison Control Center (PCC) within 24 hours of diagnosing carbon monoxide (CO) poisoning (defined as a COHb  $> 10\%$ ) in any patient. Concomitantly, a law mandating use of CO detectors in residential dwellings was enacted. The purpose of this study was to identify the effect of these laws on PCC CO reporting. *Methods:* This is a descriptive study using poison center data (Toxicall, Aurora, Colorado) from the three previous winter periods (defined as November 1st–March 31st) of 2001–2002, 2002–2003, and 2003–2004 as historical controls. Statistical analysis was performed to determine if a mandated reporting law affected actual CO reporting. Analysis was performed using both the total number of health care facility reports of CO poisoning as well as the proportion of all reports that came from health care facilities. *Result:* During the winter of 2004–2005, the existence of this law had no apparent effect on health care facility reporting of CO poisoning. There was a statistically significant decrease in the proportion of reports of CO poisoning that came from health care facilities. This decrease represents a stable number of health care facility reports (average 136) of CO poisoning with a concomitant increase in the total number ( $n = 990$ ) of CO poisoning reports. *Conclusion:* This preliminary data finds no apparent change in total number of health care facility CO reports. A striking decrease in the proportion of CO poisoning reports made from health care facilities has occurred due to increase in total number of CO reports from other sources. At this time no conclusion can be drawn regarding the effect of mandated health care facility CO reporting as the total number of CO exposures and poisonings in the population is unknown.

	Health care facility CO reports			
	2004–2005	2003–2004	2002–2003	2001–2002
Health care facility CO reports	111	238	141	53
Total CO reports from all sources	990	685	421	228
Percent of total CO reports	11.2%	34.7%	33.5%	23.2%

### 186. Mercury Contamination in a Rural Setting

Spiller HA, Thoroughman D, Kaelin C. *Ketucky Regional Poison Center, Louisville, KY, USA; Kentucky Dept. for Public Health, Div of Epidemiology and Health Planning, Frankfort, KY, USA; Div of Public Health Protection and Safety, Frankfort, KY, USA.*

*Introduction:* A 15-year-old student was found playing with mercury in a school cafeteria. There was initial isolation and remediation of the school setting. Approximately 50 students and staff were potentially exposed and remained asymptomatic. *Case Report:* Close cooperation between federal, state and local health officials and the poison center found mercury had contaminated the student's home for up to 15 months. This had allowed exposure to 12 family members and close acquaintances for various periods of time. *Case Discussion:* Air samples, using a Lumex RA-915 mercury vapor analyzer,

from the mobile home of the family were  $>50 \text{ ug/m}^3$ . Remediation was unsuccessful. Three cars were contaminated with air samples ranging from  $15 \text{ ug/m}^3$  to  $>50 \text{ ug/m}^3$ . Mercury blood concentration of 8 patients presently living in the home (4 days post-removal) ranged from 32 to 72  $\text{ug/L}$  ( $\text{nl} < 10$ ). However within 14 days of removal these levels had fallen to 9 to 18  $\text{ug/L}$ . Mean urine mercury concentration (24 hour sample, 14 days post-removal) from the 4 patients in the home for entire 15 months was 302  $\text{ug/L}$  (range 66 to 496). Mean urine mercury concentration for 4 patients living in the home for 10 weeks was 35  $\text{ug/L}$  (range 11–68). One patient with a 11-month exposure but out of the home for 12 weeks prior to mercury discovery had a urine mercury concentration of 241  $\text{ug/L}$ . Three patients with regular exposure to the contaminated cars had a mean urine mercury concentration of 5.5  $\text{ug/L}$  (range 3.8 to 8). Retrospective diagnosis of chronic mercury poisoning was made in a 13 YO female living in the contaminated home. Symptoms included unexplained tachycardia, hypertension, proteinuria, rashes, diaphoresis, anorexia, muscle pain, abdominal pain, insomnia, and behavioral/psychiatric changes. Five family members received chelation therapy using succimer. *Conclusion:* Close multi-organization cooperation allowed coordinated information sharing and advice to the community. It also supported coordinated advice to health professionals, and appropriate medical management for patients in a rural community with limited resources.

### 187. The Canary Database: Animals as Sentinels of Human Environmental Health Hazards

Wiley JF,<sup>1,3</sup> Dein JF,<sup>2</sup> Gordon ZJ,<sup>3</sup> Odofin LU,<sup>3</sup> Rabinowitz PM.<sup>3</sup> <sup>1</sup>University of Connecticut School of Medicine, Hartford, CT, USA; <sup>2</sup>USGS National Wildlife Health Center, Madison, WI, USA; <sup>3</sup>Yale University School of Medicine, New Haven, CT, USA.

*Background:* Wildlife and domestic animals may manifest signs of disease related to hazardous environmental exposures before it is noticed in human populations due to comparatively greater exposure and susceptibility. This concept of a “canary in a coal mine” suggests that animals may be useful sentinels for environmental exposures to toxic hazards. At the same time, there is a lack of evidence-based protocols for the incorporation of animal sentinel data into public health decision-making. We report on a National Library of Medicine-funded project to create a web-accessible database of studies of animals as sentinels of human environmental health hazards. *Methods:* A web-based interactive database has been created of studies of domestic animal and wildlife exposed to environmental chemical, biological, and physical hazards that have human health relevance. For each study, a curator determines linkages to human health, exposures and outcomes of interest, routes of exposure, and study methodology. The curator also identifies species used and geographic location. Linkages to human health include evidence for shared exposure with humans, interspecies susceptibility data, and evidence for linkage of human and animal outcome data. *Result:* Our work to date has identified significant differences in study methodologies between animal field studies and human epidemiology studies as well as study approaches used to investigate toxic versus infectious agents. These findings may indicate areas of potential development in the animal sentinel field. We have also identified a large number of models with which human health professionals may be unfamiliar, such as the use of dogs to monitor exposures at superfund sites, and cats as sentinels of indoor air pollution. *Conclusion:* There is a need for greater data sharing and cooperative research between human and animal health professionals regarding the assessment of environmental hazards relevant to both animals and humans. The Canary database presents a framework for such cooperation.

### 188. Animals as Sentinels of Chemical Terrorism Agents: An Evidence-Based Review

Wiley JF,<sup>1,3</sup> Dein JF,<sup>2</sup> Gordon ZJ,<sup>3</sup> Odofin LU,<sup>3</sup> Rabinowitz PM.<sup>3</sup> <sup>1</sup>University of Connecticut, Hartford, CT, USA; <sup>2</sup>USGS National Wildlife Health Center, Madison, WI, USA; <sup>3</sup>Yale School of Medicine, New Haven, CT, USA.

*Background:* Non-human animals are sensitive to many of the agents that are potential biological or chemical weapons and could therefore serve as “sentinels” for enemy attack. Animal populations live in close proximity to humans: approximately 50% of households have cats or dogs and human-wildlife interaction is increasing. The CDC Strategic Planning Working Group (MMWR, 2000) calls for “prompt diagnosis of unusual or suspicious health problems in animals” as part of planning for emergency response to terrorism.

Animals could be useful “sentinels” of specific chemical agents if:

1. Affected animals are easily recognizable, and
2. Clinical signs could be detected in an animal before the emergence of human illness

Reasons for this could include:

- a) Increased susceptibility and shorter incubation as well as
- b) Increased potential for exposure.

We therefore hypothesized that examples could be found in the biomedical literature that provide evidence in support of animals fulfilling the above criteria to be effective sentinels of potential chemical terrorism agents. *Methods:* We performed a systematic review of MEDLINE, AGRICOLA, the ProMed archives, and the Canary Database of Animals as Sentinels of Human Environmental Health Hazards for studies regarding animals as sentinels of chemicals listed as priority terrorism agents by CDC. For each class of chemicals, we assessed the strength of evidence that either companion, livestock, or wild animals would be more susceptible or at greater exposure risk than nearby human populations. *Result:* For a number of agents, there was evidence that pets, wildlife, or livestock could serve as useful ‘sentinels’ due to shared exposures, increased exposure risk, and increased susceptibility. There are also a number of anecdotal case reports of animals acting as sentinels for chemical releases. However, we also identified multiple data gaps. *Conclusion:* Despite some promising reports, there is a need for further research into the value of animals as sentinels of chemical terrorism agents.

**189. Epidemiology of Poisonings in an Emergency Department in Mexico City**

Castellanos JL,<sup>1</sup> Galicia GG,<sup>1</sup> Hexdall AH.<sup>2</sup> <sup>1</sup>Instituto Mexicano de Seguridad Social HR No. 25, Mexico, DF, Mexico; <sup>2</sup>New York University School of Medicine, New York, NY, USA.

*Background:* Little is known about the epidemiology of acute poisonings in Mexico. This study examines poisonings in large, urban, Emergency Department. *Methods:* A retrospective review of all Emergency Department records over two years was performed. Each chart was hand-searched for poisoning and these patients were analyzed in the study. Incomplete charts were excluded from analysis. Basic demographic information was abstracted, as well as the poison, route of exposure, nature of ingestion (intentional vs. unintentional), immediate complications and disposition. *Result:* 1489 cases were identified (0.76% prevalence): 79.85% were adults, patients 16–34 years old were most common (49.42%), males predominated (2.13: 1.00). Intentional ingestions predominated (84%). Overall, the most common agents were ethanol (58%), sedative-hypnotics (13%), anticholinergics (5.5%), caustics (4.9%), and sympathomimetics (3.8%). Oral route most frequent (94%). Complications were common (38.5%): gastritis (22%), upper GI bleed (15%) and associated trauma (11%) were most common. *Conclusion:* To our knowledge this is the first description of the epidemiology of poisoning in Mexico City. Poisoning patterns in Mexico City are similar to other urban areas, where ethanol and medications are common in adults, and caustics in children. Poisoning is a common problem in Emergency Departments in Mexico City. Public health efforts should be focused on further describing poisonings in Mexico and reducing intentional ingestions.

Most common intoxications by age at HR 25 Mexico City (abbreviated)

Age/poison class	Newborn/infant	5–15	16–34	35–54	55–64	>65	Total
Anticholinergic	62	10	11	0	0	0	83
Sedative-Hypnotic	10	11	113	50	6	4	194
Sympathomimetic	0	3	45	9	0	0	57
Cholinergic	3	0	22	15	3	0	43
Alcohol	0	6	486	2284	49	50	875
Analgesics	16	20	6	0	0	0	42
Anti-convulsants	11	16	12	0	2	3	44
Caustics	48	21	1	0	0	3	73
Other	3	0	40	8	12	15	78
Total	153	87	736	366	42	122	1489

**190. Unproven Ingestion—An Unrecognized Bias in Pre-School Children Toxicological Case Series**

Lévy A,<sup>1</sup> Bailey B,<sup>1</sup> Letarte A,<sup>2</sup> Dupuis C,<sup>1</sup> Lefebvre M.<sup>3</sup> <sup>1</sup>Hôpital Ste-Justine, Montréal, QC, Canada; <sup>2</sup>Centre Anti-Poison du Québec, Québec, QC, Canada; <sup>3</sup>Institut National de Santé Publique du Québec, Québec, QC, Canada.

**Background:** Ingestions in pre-school children are often un-witnessed. In such situation, one tends to rely on the circumstances of the ingestion to evaluate if the child was indeed exposed. This is a sound approach for clinical purposes. However, for research purposes this can introduce a serious bias in a study if patients with unproven ingestion are included without qualitative or quantitative confirmation of exposure, especially if they remain asymptomatic. **Methods:** We conducted a retrospective analysis of a PCC-based cohort of preschool children (<6 year) with a history of potentially toxic methanol or ethylene glycol ingestion between January 2000 and June 2004 in order to evaluate the unproven ingestion bias. **Result:** Over the 54 month period, 102 children aged 25±10 months had levels analyzed. Most of the children (63%) either ingested fondue fuel or nail polish remover. The ingestion was witnessed in 33 (32%) children; 18 (18%) and 13 (13%) had the smell of the product on their breath or on their clothes, respectively; and 12 (12%) had symptoms prior to obtaining the level (7 vomiting, 2 drowsy, 1 had a cough, 1 had burning sensation in the mouth and 1 had eye irritation). A total of 21/102 (20.6%) [95% CI 13.9, 29.4] patients had positive levels of methanol or ethylene glycol (range: below limit of detection—3.2 mg/dL to 33.6 mg/dL) done a median of 90 minutes post-ingestion (range 60 to 360 minutes). If we include all patients with either positive levels or systemic symptoms (vomiting and drowsiness), 25/102 (24.5%) [95% CI 17.2, 33.7] were believed to have been exposed. **Conclusion:** Our findings suggest that a significant fraction of purported cases were not confirmed. Had we not measured the substances we may have falsely concluded that 102 children were intoxicated when in fact only 21 cases (20.6%) were confirmed. Qualitative or quantitative measurements of xenobiotics should be required in any case series involving pre-school aged children with suspected ingestion when the study aims at determining the toxicity of the substance.

### 191. The Epidemiology of Poisonings in Infants <6 Months of Age

Kuspis DA,<sup>1</sup> Mrvos R,<sup>1</sup> Krenzelok EP.<sup>1,2</sup> <sup>1</sup>Pittsburgh Poison Center, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA; <sup>2</sup>Schools of Pharmacy and Medicine, University of Pittsburgh, Pittsburgh, PA, USA.

**Background:** In human development milestones, infants <6 months do not actively explore their environment by locomotion. Unlike the mobile child, the infant cannot seek out toxins but is often a poisoning victim. **Methods:** A retrospective review of all poisoning exposures for children <6 months old managed by a RPIC over a 2 year period was conducted. Data reviewed were patient demographics, type and site of exposure, management site and patient outcome. **Result:** The RPIC records of 2092 patients were identified and reviewed. The mean age was 4 months. Males accounted for 1087 (52%) and females 998 (47.7%) of exposures. The gender was unknown in 7 (0.3%). The majority of exposures 1992 (95.4%) occurred in the home. Of the remaining cases, 54 (2.5%) occurred in another residence, 15 (0.7%) in a public area, 13 (0.6%) in automobiles, 9 (0.4%) in healthcare facilities, 4 (0.2%) in daycare facilities, 2 (0.1%) in their parent's workplace and 3 (0.1%) in unknown locations. The reasons for exposure were classified as unintentional general 1183 (56.5%), therapeutic errors 598 (28.6%), environmental 158 (7.6%), food poisonings 55 (2.6%), adverse reactions 41 (2.0%) misuse of substances 33(1.6%) and others 1.1%. Some form of treatment intervention was performed in the home on 1912 (91%) exposures. The remaining patients were treated in a health care facility. In most cases, outcomes were nontoxic/no effect 52.2% to minimal toxicity 45.8%. Moderate to major effects accounted for 1.2%, 0.8% were unknown or could not be followed and there were no fatalities. **Conclusion:** Most poisoning exposures in infants occur in the home and while they are under parental control. By educating parents about the vulnerability of infants to potential poisons before they are mobile, parents can become more vigilant about the poisoning risks to infants. Pharmacists and medical professionals need to educate parents why medications are prescribed and their correct dosing. This heightened awareness and education may prevent or reduce the incidence of toxic exposures in this age group.

### 192. National U.S. Trends in Brimonidine Exposure 1997–2004

Lai MW,<sup>1</sup> Woolf A.<sup>2</sup> <sup>1</sup>Harvard Medical Toxicology Fellowship, Boston, MA, USA; <sup>2</sup>Program in Environmental Medicine, Children's Hospital, Boston, MA, USA.

**Background:** Brimonidine tartrate is a centrally-acting  $\alpha_2$ -adrenergic agonist used as a topical ophthalmic agent to lower intraocular pressure. It is packaged in a screw top squeeze bottle without child resistant features. Toxicity and treatment of brimonidine exposure are often compared to clonidine. We characterized poisonings with this drug nationally since the drug's marketing launch in 1997. **Methods:** Data on brimonidine exposure in the categories "unintentional general" or "therapeutic

error” were retrieved from the AAPCC TESS database from 1997–2004 and analyzed using univariate statistics. *Result:* There were 287 unintentional exposures/therapeutic errors from brimonidine over the 9 year period. Poisonings increased 5-fold the first 4 years post-marketing, plateauing at 43–50 exposures/year since 2000. 150 (52%) exposures occurred in children  $\leq 5$  years old (of whom 131 ingested the drug). 118 (41%) exposures occurred in patients  $\geq 50$  years old (of whom 77 had ocular exposure). Most patients were treated at home (168 or 59%) or treated and released from a health care facility (75 or 26%). 27 (9.4%) were admitted; 19 (6.6%) to a critical care unit. 22 (7.6%) received charcoal; 16 (5.6%) received naloxone; 1 was treated with atropine. Major clinical effects were bradycardia (9 occurrences), hypotension (9), vertigo (7), and drowsiness (60). No deaths were reported. *Conclusion:* This analysis is the first national study of a new centrally-acting  $\alpha$ -adrenergic agonist: brimonidine. Toxic exposures showed a bimodal age distribution: unintentional ingestions in the very young and therapeutic errors in older adults. Its toxicity profile is consistent with its drug class, primarily affecting cardiovascular and central nervous systems. Appropriate triage of exposures to this drug remains unclear. Many exposures were managed by poison centers at home, but the outcomes were often unreported or unknown. Since the drug’s pharmacology, potency and treatment have been compared to that of clonidine, more aggressive triage to a health care facility may be prudent. Further studies of appropriate triage of cases of brimonidine exposure and how to prevent inadvertent childhood exposures are warranted.

### 193. Regional Poison Center (RPC) Plays Key Public Health Role in Oral Rabies Vaccine (ORV) Baiting Program

Caraccio TR,<sup>1,2</sup> Rahman F,<sup>1,2</sup> Carbain AF,<sup>1,2</sup> Mestel R,<sup>1,2</sup> McGuigan MA.<sup>1,2</sup> <sup>1</sup>Long Island Regional Poison and Drug Information Center, Mineola, NY, USA; <sup>2</sup>Winthrop University Hospital, Mineola, NY, USA.

*Background:* The first confirmed case of raccoon rabies was reported in a suburban county of 1.4 million people on 8/6/04. By 9/9/04, 5 additional cases were identified within a few mile radius. The local DOH instituted an emergency ORV baiting program that works orally in raccoons and is not available for home use. The DOH asked the RPC to help field any calls about the bait. Although similar programs have been conducted in the country, there are no publications describing the role of a RPC in this type of event. This study describes the role of a RPC in this unique program. *Methods:* The RPC staff received special training by the DOH. The program was announced by a joint press release on 9/8/04. Phase 1 began with distribution of the baits by hand on 9/10/04. Phase 2 began on 9/14/04 by aerial distribution of bait by helicopter over a 32 square mile area and finished on 9/15/05. All information and potential exposure calls received 1 day prior to start, during, and up to 5 days post-distribution of bait were included in this to provide a descriptive analysis. *Result:* 72 calls recorded from 9/8/04–9/20/04: 56 information calls and 16 potential exposures to the bait. No adverse effects were documented from exposure. Information calls consisted of queries regarding rabies effects (n=32), oral bait toxicity (n=17), and related use (n=7). Most frequent call days were during distribution of bait: 9/15 (n=13), 9/14 (n=11) and 9/10/04 (n=9). No additional staff was required during the study period. *Conclusion:* This study provides documentation for RPC to participate in an unforeseen raccoon rabies threat in their community in a cost effective manner.

### 194. Taking the Bite Out of Rabies: A Poison Center’s Experience

Ragone SP, Webster SS, Cragin LS, Lopez GP. *Georgia Poison Center, Atlanta, GA, USA.*

*Background:* Since 1994 this Regional Poison Center (RPC) has been responsible for making recommendations to the medical community as well as the general public regarding the risk of rabies from animal bites. The clinical role of the poison center is to assess the situation and recommend physician-directed wound care as well as rabies prophylaxis when appropriate. Toxicologists and specialists in poison information (SPI) at this RPC are trained using protocols developed by the state’s Epidemiology Division. Given the high cost of rabies treatment, state funding has been allocated to this RPC for their assistance to the medical community and the public regarding prophylaxis. *Methods:* Cases were reviewed retrospectively from calls received by the RPC and included all human exposures from 2000–2004 with animal bites. *Result:* There were 8083 animal bite calls reported from 2000 to 2004. Of the cases with known patient gender, 51% were males and 47% female. Of the cases with known patient age, 21% were 0–5 yrs, 30% were 6–12 yrs, 10% were 13–19 yrs, and 35% were  $>20$  yrs. The remaining

3% fell into the unknown age category. High risk vectors reported included foxes (1.6%), raccoons (4%), and bats (5%). Intermediate vectors reported were dogs (51%) and cats (21%). Rabies post exposure prophylaxis (RPEP) was recommended in 19% of the cases and 32% of the cases did not fall within the established guidelines. The remaining 48% of the cases were pending lab results, search for the animal, or had no RPEP upon initial consultation. *Conclusion:* Animal bite calls reported to this RPC were more likely to involve male children under the age of 12 yrs, with dogs being the most common animal causing the exposure. The costly RPEP was avoided in >32% of the reported cases. This non-traditional service offered by the RPC has provided a cost effective means for health care professionals and the public to receive prompt, accurate recommendations for rabies prophylaxis.

### 195. Accidental Exposure to Oral Rabies Vaccine

Mrvos R, Krenzelok EP. *University of Pittsburgh, Pittsburgh, PA, USA.*

*Background:* Raccoon rabies is found throughout the United States, spreads rapidly and can be fatal to both humans and animals. In an attempt to address this problem, various government agencies have developed and implemented a plan to distribute oral rabies vaccine (ORV) in block form in wooded areas via airdrop or vehicle distribution. These blocks are made up of a compressed mixture of fishmeal and fish oil with the pink colored vaccine inside a plastic packet inserted in the center. This leaves the bait blocks available not only for its intended population but also for domestic animals in the area as well as humans. *Methods:* A RPIC identified all cases of exposure to ORV bait blocks from 2002–2004 reported to the center. Age, route, gender, exposure scenario, symptoms and treatment were reviewed and analyzed. *Result:* Twenty two accidental exposures to the ORV were reported. 8 (36%) of the exposures were human and 14 (64%) were domestic animals (13 canine, 1 feline). All of the animal exposures were oral while the human contaminations were oral (1), dermal (6), inhalation (1) and ocular (1). In the humans, ages ranged from 40–62 years of age (M=49) and gender was evenly distributed, 4 males and 4 females. 8 of the cases involved multiple victims (pet and owner). No symptoms were reported in the humans or canines although the feline died (unsubstantiated if related). Treatment consisted of irrigation/dilution and in one instance emesis was induced in a canine. *Conclusion:* In this case series, accidental exposure to ORV used in wild animal baiting posed no hazard to domestic animals or humans.

### 196. Clinical Botulism Syndrome in a Patient Receiving Unlicensed Botulinum Type A Toxin

Marcus SM. *New Jersey Medical School-University of Medicine and Dentistry of NJ, Newark, NJ, USA.*

*Introduction:* Botulism seen in the United States is the result of contamination of wounds, particularly related to contaminated drugs of abuse, infant botulism from ingestion of spores and ingestion of toxin-contaminated food. Recently a cluster of 4 cases of clinical botulism presented which resulted from the use of an unlicensed preparation of botulinum toxin. These cases presented earlier than the usual cases and resulted in the ability to observe the chronological events in a severe case of botulinum poisoning. *Case Report:* A 34 year old female presented to EMS with difficulty breathing and was transported to the emergency department. She was administered bronchodilators en route and when received in the ED was intubated because of respiratory distress. The history of having received a cosmetic dose of botulinum toxin was given by the patient's boyfriend who accompanied her to the ED. The clinical appearance was not typical of botulism at the time but developed over the next 24 hours. She demonstrated several previously either unreported or underreported clinical findings over the course of her illness. Initially she retained reflexes and demonstrated intermittent opisthotonic-like posturing. Later she developed total muscle paralysis. Electromyography revealed total denervation with totally absent action potentials even at maximal voltage and frequency stimulation. She also developed gastroparesis, a totally patent pylorus, total paralysis of small and large bowel and urinary bladder. She also manifest disturbance in Eustachian tube patency with resultant serous otitis media. During her entire stay, she never lost consciousness and was able to communicate with staff with rudimentary movements. When she regained activity of her extra-ocular muscles they returned asymmetrically, that is she regained her downward gaze well after regaining all other motions. *Case Discussion:* The patient received an extraordinary dose of botulinum toxin. Early presentation in a health care facility enabled close monitoring of adverse events. Much can be learned about modalities and pitfalls of therapy from this case. *Conclusion:* We describe the clinical course of botulism intoxication from administration of an unlicensed product.

**197. Respiratory Arrest and Generalized Paralysis Secondary to Therapeutic Misadventure with Epsom Salts**

McGoodwin PL, Schaeffer SE, Banner W, Badillo RB. *Oklahoma Poison Control Center, The University of Oklahoma College of Pharmacy, Oklahoma City, OK, USA.*

*Introduction:* Magnesium sulfate heptahydrate (Epsom salts) is a saline cathartic which can be used for the treatment of occasional constipation. Oral bioavailability is 33%. Excessive administration may result in hypermagnesemia with resultant respiratory depression and apnea, heart block, and cardiac arrest. *Case Report:* A 17 year old female with a history of chronic constipation routinely took therapeutic doses of Epsom salts, following the advice of her physician. After a physician's appointment in which she was advised to lose some weight, the patient ingested approximately six ounces of Epsom salts. Within minutes of ingestion, she developed a rapid progression of muscle weakness and apnea. Family members, unaware of the ingestion, transported her to the ED where she presented with fixed and dilated pupils, lack of spontaneous respiratory effort, cyanosis, and complete muscle flaccidity. GCS on arrival was 3. She was intubated and mechanically ventilated. ECG was normal; BP was 110/60mm Hg with good peripheral pulses and perfusion. Abnormal lab values included magnesium 33.7 mEq/L, potassium 2.2 mEq/L, and phosphate <0.9 mg/dL. The poison center was consulted, and immediate hemodialysis was advised. The patient was transported to a tertiary care facility and hemodialysis was initiated on arrival. Intravenous potassium and phosphate supplementation therapy was provided. Within thirty minutes she was able to shake her head and move her extremities, bilateral grips were equal and appropriate. Ocular movement and pupillary response returned to normal. The patient was extubated 2½ hours after arrival; hemodialysis was continued for three hours. She was discharged the following day with no apparent sequelae. *Conclusion:* Severe hypermagnesemia may mimic brain death. Hemodialysis effectively and rapidly corrects hypermagnesemia, and is indicated as a first-line therapy in the treatment of severe magnesium toxicity.

**198. Development and Implementation of an Emergency Department Observation Unit Protocol for Acute Ingestions**

Sztajnkrzyer MD,<sup>1</sup> Mell HK,<sup>1</sup> Melin GJ.<sup>2</sup> <sup>1</sup>*Mayo Clinic, Rochester, MN, USA;* <sup>2</sup>*Mayo Clinic, Rochester, MN, USA.*

*Background:* Poisoning accounts for 1–3% of all emergency department visits. While there is frequently a need to observe these patients for development of toxicity, they are typically precluded from admission to traditional emergency department observation units (EDOU). The purpose of this study was to describe the initial experience with an EDOU overdose protocol. *Methods:* Retrospective chart review of all individuals presenting between 7/1/2004 through 12/24/2004 with a chief complaint of overdose or intoxication. EDOU admission criteria included asymptomatic patients aged >15 years presenting after known or suspected potentially toxic exposure. Exclusion criteria included isolated ethanol intoxication, presence of persistent self-injurious or violent behaviors, chronic intoxication, ingestion of sustained release preparations, and presence of previously defined high-risk criteria based upon ECG, hemodynamic and neurologic findings. *Result:* Six patients were admitted to the EDOU. Of these, 2 were subsequently admitted to a medical service, 1 was admitted to psychiatry, and 3 were discharged to home with psychiatric follow-up. No patient eloped nor attempted further self-harm. No clinical decompensation occurred. Retrospective chart review demonstrated that 176 patients presented to the ED after ingestion during this time period, of which 14 were excluded secondary to age. 70 patients were admitted to a medical service and 78 patients were medically cleared for psychiatric evaluation. 29 patients were retrospectively identified as EDOU candidates, 9 of whom were actually admitted to the MICU. 18 additional patients would have been excluded from the EDOU protocol due to slightly decreased level of consciousness, but might otherwise have been candidates. 13 patients remained belligerent or otherwise uncooperative. *Conclusion:* Although initial numbers are too small for meaningful analysis, the results suggest that prolonged observation of this problematic patient subset within an EDOU is feasible, and may result in cost-savings versus ICU admission.

**199. Poison Severity Score: Does it Add Up?**

Braitberg G, Alam F. *Austin Health, Melbourne, Victoria, Australia; University of Melbourne, Melbourne, Victoria, Australia.*

*Background:* In 1998 Persson et al published a standardised scale, the Poisoning Severity Score (PSS) for grading poisoning severity and provide a qualitative evaluation of the morbidity caused by poisoning. This study evaluates the association between

the PSS and patient outcome in an Australasian setting. *Methods:* A retrospective study of 204 consecutive patients was conducted between January and June, 2003, using a purpose designed data sheet. The PSS was tabulated and data completed on 163 patients. The main outcome measures were Emergency Department length of Stay (EDLOS), discharge destination and Inpatient Length of Stay (IPLOS). *Result:* The PSS was found to be significantly associated with both EDLOS and IPLOS. The mean EDLOS was 6.84 hours (SD 5.04). An EDLOS greater than 16 hours is 4.86 times as likely if the PSS is 2 or 3) (OR 4.86, 95%CI 1.40,16.83 p=0.0058). As the PSS increased patients were 3.6 times more likely to be admitted (OR 3.62, 95%CI 2.27, 5.80, p<0.001). The mean IPLOS was 0.58 days (SD 1.36). The relationship between IPLOS and PSS is positive with a regression coefficient of 0.36 (95% CI 0.21, 0.50 p<0.001). For a one unit increase in the PSS, there is almost a half day increase in IPLOS. The most common poisons were alcohol and benzodiazepines (25.46% and 12.42% respectively) and the most common comorbidities were depression and intravenous drug usage (37.31 and 15.67% respectively). *Conclusion:* The PSS is useful in predicting hospital based outcome measures. We recommend that all patients with poisoning are scored on presentation for better identification, risk stratification and comparability of toxicological data. Sample size limitations prevented meaningful analysis on clinical outcome parameters. A multicentre prospective observational study would address this.

	Results	
	Mean	Standard deviation (SD)
Age (years)	36.77	17.87
Gender	99 female	64 male
Smoking	146 smokers	17 non smokers
Alcohol	142 drank alcohol	21 abstained from alcohol
Recreational drugs	71 used drugs	92 did not use drugs
Emergency department length of stay (EDLOS) in hours	Mean 6.77	SD 5.04 (0, 29)
Inpatient length of stay (IPLOS) in days	Mean 0.58	SD 1.36 (0–15)
Poison severity score (PSS)	Mean 1.07	SD 0.74

#### Demographics

## 200. Glyphosate Surfactant Herbicide-Induced Acute Renal Failure

Matteucci MJ, Clark RF. *UCSD Medical Center, San Diego, CA, USA.*

*Introduction:* Within the United States, in 2003, 4,420 glyphosate surfactant herbicide (GSH) exposures were reported to Poison Control Centers with 109 moderate to major effects and 4 deaths. This is a case of GSH-induced acute renal failure. *Case Report:* A 51 y/o male drank 4–5 large gulps of Roundup Weed and Grass Killer Super Concentrate in a suicide attempt. He immediately began vomiting and complaining of oral pain. Three hours later, he was alert, but diaphoretic, with profuse vomiting and watery diarrhea. His initial vital signs were pulse of 72, respiratory rate of 22, blood pressure of 159/74 with a pulse oximetry reading of 92% on room air. Laboratory studies were significant for a white blood cell count of 25.5 cells/mm<sup>3</sup>, hemoglobin of 16.7 gm/dl, and a creatinine of 1.8 mg/dl (his baseline was 1.0). Approximately 24 hours after his ingestion, his creatinine increased to 4.9 and his urine output became negligible. The nephrology service was consulted and he underwent one 4-hour course of hemodialysis. His urine output improved, as did his creatinine to 2.7. He was discharged to a psychiatric facility on hospital day 7. *Case Discussion:* Initial symptoms of GSH poisonings include vomiting and diarrhea, as well as mucosal irritation. Hypoxemia and tachypnea are frequent with normal chest radiographs, but non-cardiac pulmonary edema has been reported and is thought to be due to increased pulmonary vascular resistance caused by the surfactant component. Acute renal failure following GSH ingestion is rare, but when present, has an almost 100% rate of mortality. Treatment is generally supportive. Aggressive fluid rehydration is indicated for the severe gastrointestinal losses. Hemodialysis has not been proven to be of benefit for removal of GSH, but may be required for acute renal failure and electrolyte disbalances. Symptomatic patients should be observed for a minimum of 12 hours. Fatalities occur usually within 72 hours of ingestion. Respiratory distress, pulmonary edema, renal failure, or acidosis requiring hemodialysis are poor prognostic signs. *Conclusion:* While GSH is generally thought of as safe, large ingestions can result in severe toxicity and death. Physicians need be aware of the potential severity and complications associated with these ingestions.

## 201. The Clearance of Metformin and Lactic Acid Via Hemodialysis

Spivak LA,<sup>1</sup> Coopes BJ,<sup>2</sup> Horowitz BZ,<sup>1</sup> Dudley M,<sup>2</sup> Gitomer J. <sup>1</sup>Oregon Poison Center Oregon Health and Science University, Portland, OR, USA; <sup>2</sup>The Children's Hospital/Providence Alaska Medical Center, Anchorage, AK, USA.

*Introduction:* Metformin causes a type-B (non-hypoxic) lactic acidosis in overdose via increased peripheral lactate production and decreased hepatic and renal clearance. Hemodialysis with bicarbonate replacement fluid removes lactate and metformin from the plasma and corrects the acidosis. *Case Report:* Case 1: A 15-year old male ingested 20 to 40 grams of metformin. Four hours post-ingestion his BP was 93/43, HR: 116, RR: 32. He responded only to pain. Lactate was 33 mmol/L, and serum pH was 6.8 prior to dialysis. Inflow lactate was 29 mmol/L, outflow 2.6 after five hours on dialysis. Lactate was 49 mmol/L one hour post-HD and then fell to 6.7 mmol/L with both continuous HD and CRRT for the remainder of the hospitalization. Serum pH was 7.3. He developed multi-system organ failure, expiring 48 hours after admission. Case 2: A 26-year old male ingested approximately 40 grams of metformin. He was minimally responsive on arrival, with a RR of 33 and a temperature of 93.9. His pH was 6.94, lactate 21.1 mmol/L, and serum metformin level 19 mcg/mL prior to HD. Metformin was measured at 6.1 and then 3.7 mcg/mL from the outflow port during dialysis. The post-HD metformin level was 1.2 mcg/mL and lactate was 4.8 mmol/L. He was continued on CVVH with resolution of his acidosis. He was discharged three days later. *Case Discussion:* Therapeutic metformin doses cause small increases in basal and post-prandial blood lactate concentration possibly due to metformin-induced conversion of glucose to lactate in the intestinal mucosa. Lactic acidosis with therapeutic metformin concentrations is seen in approximately 9/100,000 patient-years of exposure. However, in overdose severe lactic acidosis commonly occurs. Metformin is not protein-bound and has a large volume of distribution. The salivary glands and intestinal wall contain the highest metformin concentrations. It is not metabolized and undergoes renal excretion. *Conclusion:* Both lactic acid and meformin are effectively cleared by hemodialysis. Prolonged dialysis may be necessary to remove the large amount of metformin in the interstitial fluid and intracellular space.

## 202. Safety of Medications in Lactation

Ternullo SR, Lawrence RA. *Finger Lakes Poison and Drug Information Center, Rochester, NY, USA.*

*Background:* Evidence has accumulated over the last 3 decades regarding short and long term benefits of breastfeeding to both mother and child. Healthy People 2010 Goals from the US Department of Health include goals that by 2010, 75% of mothers leaving the hospital should be breastfeeding, 50% continuing at 6 months, and 25% at one year. Due to increased awareness of the benefits of breastfeeding, there has been an increase in the number of calls from health care providers on the effects of medications during lactation. *Methods:* The poison center database was reviewed from January 1, 2004 through December 31, 2004 for calls requesting information on medication safety during lactation. Cases in which the specialist recommended discontinuation of breastfeeding were further analyzed. *Result:* Due to the relationship between our PC and the National Breastfeeding and Human Lactation Study Center, our PC received 2400 calls from health care professionals during 2004 requesting information on medication use during lactation. Requests covered herbal, prescription, and OTC drugs and cosmetics. The risks of therapy were compared to the risks of not breastfeeding or of temporary cessation of breastfeeding. In 40 cases (1.7%) the recommendation not to breastfeed was made. It was based on infant factors (6), Drug abuse (3), amphetamine-like drug use (3), multiple psychoactive drug regimens (11), and the medication itself (17). *Conclusion:* Knowledge of the drug, infant factors such as age, health, and feeding pattern, and adult pharmacotherapy are all required to adequately answer lactation questions. No single database, either electronic or paper-based, can be used to answer inquiries with certainty. The individualized assessment of the compatibility of a specific drug therapy should rely on available data and assessment of the reliability and limitations of that data. Frequently the most useful information is the suggestion of alternative medications that would be expected to be therapeutically equivalent but with a greater estimate of safety in terms of the child's exposure. By using an assessment based on multiple factors, only 40 calls resulted in a recommendation that breastfeeding should be discontinued while on the medication(s) in question.

## 203. Somnolence, Metabolic Acidosis and Rapid Rise in Serum Transaminase Level After Acetaminophen Ingestion in a Toddler

Manning BH, Wiegand TJ, Wu L. *California Poison Control System (CPCS)-San Francisco Division, Department of Clinical Pharmacy, School of Pharmacy, University of California, San Francisco, CA, USA.*

*Introduction:* Transaminase elevation and acidosis following acetaminophen (apap) poisoning is typically delayed. We report an unusual case of early transaminase elevation and the second case of acidosis in a pediatric patient following massive apap ingestion. *Case Report:* An 18 month-old female was brought to the ED 3.5 hours after being found with an open bottle of apap, 500 mg tabs. It was unclear, initially, if any were missing. At presentation the patient was somnolent and difficult to arouse. VS: HR 130, rr 22, o<sub>2</sub> sat 99% room air. Her eyes deviated right and were ‘‘minimally reactive’’. Bowel sounds were undetectable. Laboratory results 4 hours post ingestion demonstrated: apap 650 mcg/ml, ast 128, alt 302, ALP 295, T bili 0.2, Na 141, K 2.9, Cl 105, HCO<sub>3</sub> 14, BUN 17, Cr 0.3, Glucose 211. Urine toxicology was negative. The patient’s other medications included: isoniazid, rifampin, and clarithromycin; none of these medications were reported missing. Early treatment with n-acetylcysteine (NAC) via nasogastric tube was administered every 4 hours for 17 doses. Liver enzymes peaked at AST 164 ALT 356 approximately 16 hours post ingestion and declined to AST 87 and ALT 271 by 3 days post ingestion. Acidosis and mental status changes resolved without treatment. *Case Discussion:* Prior to early treatment with NAC the patient showed signs of significant toxicity. Our patient likely had P450 induction from her ongoing treatment for tuberculosis and thus was more susceptible to apap toxicity via increased formation of toxic metabolite (NAPQI). This case also serves as a reminder to the broader toxicity which apap ingestion may manifest. Additionally, a paucity of data exists regarding time course of transaminase elevation after hepatic insult. *Conclusion:* We present a case in which the time of ingestion was clear and hepatotoxicity occurred sooner than anticipated during the ‘normal’ course of apap poisoning.

#### **204. Retrospective Review of Exposures to Tiagabine as Reported to a Regional Poison Center**

Kazzi ZN,<sup>1</sup> Jones CM,<sup>2</sup> Cragin LS,<sup>2</sup> Morgan BW.<sup>1</sup> <sup>1</sup>*Emory University, Atlanta, GA, USA;* <sup>2</sup>*Georgia Poison Center, Atlanta, GA, USA.*

*Background:* Therapeutic use of tiagabine (TGB) in non-epileptic patients has been associated with the occurrence of seizures. TGB has also been reported to cause convulsive status epilepticus in overdose situations. *Methods:* We conducted a retrospective chart review of all human exposure calls for TGB ingestion reported to our poison center from April 2001 to March 2005. *Result:* One hundred seventy exposures involving TGB were found. Of the 170 cases, 73 were solely TGB ingestions, 14 were between the ages of 0–12 years old and 59 were in patients >13 years old. In the patients ≤12 years old, 3 had seizure activity. Tachycardia, sedation and agitation were also noted. Cardiac monitoring did not show any abnormalities and they were symptom free at 24 hours. Four other patients were observed in the Emergency Department (ED) for 2–12 hours after ingestions of 4–40 mg of TGB. The remaining 7 patients were observed at home. Among the 59 patients ≥13 years old, 35 patients intentionally ingested TGB and 24 were unintentional ingestions, adverse drug reactions or therapeutic errors. Of the 35 intentional ingestion patients 33 were treated in the ED and 2 were lost to follow-up. Eight of the 33 patients developed seizures, were admitted to the hospital and were symptom free at 48 hours. Cardiac monitoring did not show any abnormalities. The remaining 25 intentional ingestion patients were estimated to have ingested between 16–1440 mg of TGB. Drowsiness, lethargy, agitation and tachycardia were the most common symptoms. Confusion, ataxia, tremor and hypertension were also noted. Of the adult unintentional ingestions 14 out of 24 were treated in the ED with ingestions of 8–144 mg. No seizures were seen and the most common symptoms were drowsiness, confusion and agitation. The remaining 10 patients ingested between 2–32 mg of TGB and were monitored at home with minimal symptoms. *Conclusion:* TGB overdose may cause status epilepticus. Central nervous system findings predominate with altered mental status and seizures being the most significant. Further studies need to be performed to better define the dose-toxicity relationship.

#### **205. Lack of Significant Toxicity After Mirtazepine Overdose: Five-Year Review of Cases Admitted to a Regional Toxicology Unit**

Waring WS, Good AM, Bateman DN. *Scottish Poisons Information Bureau, Royal Infirmary of Edinburgh, Edinburgh, Scotland, United Kingdom.*

*Background:* Mirtazepine has been increasingly used as a treatment for depression, however, comparatively little information is available regarding the potential effects associated with overdose. This study sought to identify features of toxicity and clinical outcomes. *Case Report:* Case notes were examined retrospectively for all patients admitted to the Toxicology Unit of the Royal Infirmary of Edinburgh between 1st January 2000 and 31st December 2004 after mirtazepine ingestion. ECG, laboratory

and clinical safety variables were obtained from the medical records for each patient. *Case Discussion:* Data are presented as median and interquartile range. 117 cases were identified, involving 71 women and 46 men, aged 35 y (26–46 y). The stated amount of ingested mirtazepine was 450 mg (240–785 mg); alcohol was co-ingested in 60% and other drugs were co-ingested in 60%. Time to presentation was 1.6 h (1.1–3.2 h) after ingestion. 73% were asymptomatic, 15% were drowsy, 8% reported nausea, 3% were suspected of having had a self-limiting seizure, and 2% had collapsed. Two patients required critical care; one had co-ingested a large quantity of chlorpromazine, and one had co-ingested carbamazepine, promethazine and a large quantity of diazepam. One patient with a severe pneumonia had co-ingested amitriptyline and temazepam, and was found to have a high serum creatinine kinase concentration. No exposure-effect relationships could be found for any haemodynamic variable, electrolyte, liver biochemical variable, creatinine kinase or electrocardiographic interval across the study population. After ingestion of mirtazepine alone, stated amount 630 mg (390–870 mg), there were no significant electrocardiographic, laboratory or clinical features of toxicity. Median hospital stay was 1 day; 11% of patients were transferred to a psychiatric facility, and the remainder were discharged home. *Conclusion:* Mirtazepine overdose is rarely associated with significant toxic features, and these appear to be attributable to co-ingested drugs. These data are reassuring given the increasing use of mirtazepine treatment among patients at high risk of self-harm.

## 206. The Effect of Amiodarone on Fluoride-Induced Ventricular Tachycardia

Chu J,<sup>1</sup> Bania TC,<sup>1</sup> Su M,<sup>2</sup> Hoffman RS.<sup>3</sup> <sup>1</sup>St. Luke's-Roosevelt Hospital Center, NY, NY, USA; <sup>2</sup>SUNY-Downstate Medical Center, Brooklyn, NY, USA; <sup>3</sup>NYC Poison Control Center, NY, NY, USA.

*Background:* Systemic fluoride toxicity results in cardiac dysrhythmias and death from hypocalcemia, hypomagnesemia, and hyperkalemia. Prior work demonstrated that amiodarone attenuated fluoride-induced hyperkalemia in vitro using human erythrocytes and improved survival in a mouse model of systemic fluoride toxicity. Based on these findings, we hypothesized that IV amiodarone pre-treatment will decrease the incidence of ventricular tachycardia (VT) in a rat model of gastric sodium fluoride (NaF) toxicity. *Methods:* We performed a randomized, blinded, placebo-controlled trial using 19 rats. The rats were anesthetized with 1.75% isoflurane via a tracheostomy and instrumented to measure mean arterial pressure (MAP) and to continuously measure the electrocardiogram. The rats were randomized to pre-treatment with intravenous amiodarone (n=10) as a 5 mmol/kg bolus followed by a 15 mmol/kg/hr infusion or an equivalent volume of 5% dextrose (n=9). After 30 minutes, the rats received 6 mmol/kg of NaF via an orogastric tube and were continuously observed for 2 hours. Time to onset of VT and time to death was compared using the Kaplan-Meier method and incidence of VT was compared using Chi Square. Change in MAP, HR and QRS duration from baseline were compared at 30 min using a t test. *Result:* One of nine rats in the amiodarone group and 8 of 10 rats in the control group had VT (p=0.004). One rat in each group survived past the 2 hour observation period. Thirty minutes after NaF administration, the amiodarone group had a mean increase in HR of 12 beats/minute compared to a decrease of 23 beats/minute in the control group (p=0.024), but the change in MAP and QRS durations was not significant between the 2 groups. *Conclusion:* Amiodarone pre-treatment decreased the incidence of ventricular tachycardia in this model of systemic fluoride toxicity. Further research is ongoing.

	Results		
	Amiodarone	Control	p value
Median time to VT (min)	>120	72	0.005
Median time to death (min)	48	73	0.31

## 207. Insulin Versus Vasopressin and Epinephrine to Treat Beta-Blocker Toxicity

Holger JS, Engebretsen KM, Fritzlar SJ, Patten LC, Harris CR. *Regions Hospital, St. Paul, MN, USA.*

*Background:* We compared insulin (IN) to vasopressin plus epinephrine (VE) in a pig model of beta-blocker toxicity. Primary outcome was survival over 4 hours. *Methods:* We estimated 20 pigs were needed to detect a 50% survival difference between groups with an 82% power. Pigs were anesthetized with isoflurane and nitrous oxide, underwent tracheostomy, placement of a

Swan-Ganz catheter and an arterial line. Each pig received a 1 mg/kg bolus of propranolol followed by a 0.25 mg/kg/min drip until toxicity occurred, defined as a 25% decrease in the product of heart rate (HR) and mean arterial pressure (MAP). A 20 ml/kg bolus of saline was infused and the propranolol drip continued at 0.125 mg/kg/min over a 4 hour resuscitation phase. Each pig was randomized to receive IN or VE after the saline bolus. The IN group began with a 2 units/kg/hr drip and increased by 2 units every 10 min to 10 units/kg/hr or until baseline HR  $\times$  MAP. The VE group began with epinephrine at 5 mcg/min titrated up by 5 mcg every 10 min to 25 mcg/min or until baseline obtained. Simultaneously these pigs received vasopressin at 0.0028 units/kg/min, titrated upwards every 10 min to 0.014 units/kg/min or until baseline obtained. Cardiac output (CO), systemic vascular resistance (SVR), systolic blood pressure (SBP), HR, MAP, glucose, and potassium were monitored. Glucose was given for values  $<60$ . *Result:* Study was terminated early due to marked survival differences. There were 5 pigs in each group. Time to toxicity by group was not different. All IN group pigs survived 4 hours. All VE group pigs died within 90 min. CO in the IN group increased throughout the 4 hours, rising to above pre-propranolol levels, while MAP, SBP and SVR all trended slightly downward. CO in the VE group dropped until death, while MAP, SBP and SVR rose precipitously until a point 30–60 minutes into resuscitation when these dropped abruptly until death. Glucose was required in the IN group only. *Conclusion:* IN is clearly superior to VE to treat beta-blocker toxicity in this model. IN has marked inotropic properties while VE cause significant vasopressor effects that depress CO and contribute to death. Increasing SVR in this condition is detrimental to survival.

### 208. Effect of Subacute Ziprasidone Administration and Withdrawal on Acute Cocaine Intoxication

Krier S,<sup>1</sup> Heard K,<sup>1,2</sup> DeWitt C,<sup>1,2</sup> Cleveland N.<sup>1</sup> <sup>1</sup>University of Colorado School of Medicine, Denver, CO; <sup>2</sup>Rocky Mountain Poison and Drug Center, Denver, CO.

*Background:* Patients that have serious psychiatric disorders have a high prevalence of drug abuse. Chronic neuroleptic drug administration alters receptor density of several neurotransmitter systems. These receptor systems also mediate the toxic effects of cocaine. **OBJECTIVES:** To determine the effects of subacute ziprasidone administration and withdrawal from ziprasidone on acute cocaine toxicity in a mouse model. *Methods:* Male CF-1 mice were randomly assigned to 3 groups: 1) Chronic treatment (CT): 0.13 mg (0.1 cc) ziprasidone qd subcutaneous for 10 days (n=40); 2) Withdrawal (W): ziprasidone (as in #1) +2 days of no therapy to simulate medication withdrawal (n=45); 3) Control (C): 0.1 cc saline qd  $\times$  10 days (n=40). After these treatment regimens, all mice received 102 mg/kg cocaine HCl (estimated LD50) in saline by IP injection and a blinded observer recorded time to seizures and apparent lethality. Outcomes of interest were apparent mortality, incidence of seizures and time to apparent lethality. *Result:* Mortality (%;95%CI) was 15/40 (37%; 23–54%) for CT; 18/45 (40%; 26–56%) for W and 8/40 (20%; 9–36%) for C; seizure frequencies were 36/40 (90%; 76–97%) for CT; 38/45 (84%; 71–94%) for W and 29/40 (72%; 56 to 85%) for C. There was a significant trend for increased survival time: C>CT>W (p=0.049 log-rank test). *Conclusion:* This study suggests that subacute administration of ziprasidone increases the susceptibility of mice to cocaine toxicity. Our model was limited by lower than expected serum ziprasidone levels on this dosing schedule, and it is possible that an alternative dosing method would result in more consistent serum levels and increase the observed effects.

### 209. Effects of the Adenosine Receptor Antagonists on Amitriptyline-Induced Vasodilation in Rat Isolated Aorta

Kalkan S, Hocaoglu N, Akgun A, Gidener S, Tuncok Y. Dokuz Eylul University School of Medicine, Izmir, Turkey.

*Background:* Previously, we demonstrated that adenosine receptor antagonists prevented hypotension in an invivo rat model of amitriptyline toxicity. Activation of A<sub>1</sub> receptor produces negative chronotropic and inotropic actions, whereas activation of A<sub>2a</sub> receptor causes peripheral vasodilation. It is not clear that whether adenosine receptors in heart or in vasculature are dominant for amitriptyline toxicity. In this study, we investigated the role of A<sub>2a</sub> receptors on vasodilation induced by amitriptyline. *Methods:* Thoracic aortic rings obtained from rats were suspended in an isolated organ bath. EC<sub>80</sub> values of noradrenalin (NA) was obtained (10<sup>-9</sup>–10<sup>-5</sup> M, cumulatively). Tissues were first contracted with reference concentration of NA (10<sup>-5</sup> M). After the contractile response had been reached plateau, rings were washed and incubated with different concentrations of amitriptyline and NA was administered again. IC<sub>50</sub> values of amitriptyline was calculated as the drug concentration causing a half-maximal inhibition of contractile responses to NA. In experimental groups, tissues were contracted

with NA. Following the washout period, different doses of the DPCPX (a selective  $A_1$  antagonist,  $10^{-9}$ – $10^{-5}$  M) or CSC (a selective  $A_{2a}$  antagonist,  $10^{-9}$ – $10^{-5}$  M) or DMSO (solvent) were incubated before the amitriptyline incubation. NA was administered following incubation period. Amitriptyline-induced half maximal inhibition of contractile response to NA were compared in the presence of the DPCPX, CSC or DMSO. Student's t test was used for statistical analysis. *Result:* Amitriptyline ( $IC_{50}$  value:  $1.8 \times 10^{-5}$  M) inhibited contractile response of NA by  $49.9 \pm 3.7\%$ . DPCPX increased amitriptyline-induced inhibition on contractile response of NA in a concentration-dependent manner ( $53.7 \pm 2.4\%$   $p > 0.05$ ;  $59.7 \pm 3.3\%$   $p > 0.05$ ;  $70.6 \pm 4.6\%$   $p < 0.01$ ;  $70.5 \pm 2.7\%$   $p < 0.001$ ;  $71.9 \pm 3.7\%$   $p < 0.001$  respectively  $10^{-9}$ – $10^{-5}$  M). CSC decreased amitriptyline-induced inhibition on contractile response of NA at only a high concentration ( $10^{-5}$  M,  $39.2 \pm 1.7\%$ ,  $p < 0.05$ ). *Conclusion:* Adenosine  $A_{2a}$  receptor stimulation seems to be partly responsible for amitriptyline-induced vasodilation and hypotension.

## 210. Hydroxocobalamin for Poisoning Caused by Ingestion of Potassium Cyanide: A Case Study

Fortin JL, Waroux S, Ruttimann M, Astaud C, Kowalski JJ. *Emergency Medical Service of the Paris Fire Brigade, Paris, France.*

*Introduction:* Cyanide poisoning can arise from numerous sources including industrial accidents, food, pharmaceuticals, and fire smoke. The cyanide antidote hydroxocobalamin, a precursor of vitamin B12, has a history of use in the prehospital setting in France for cyanide poisoning associated with smoke inhalation. Because cyanide poisoning by ingestion is less common than smoke inhalation-associated cyanide poisoning, less information is available on prehospital use of hydroxocobalamin for cases of cyanide ingestion. This report describes a case of prehospital use of hydroxocobalamin for poisoning by ingestion of cyanide. *Case Report:* A 48-year-old male who worked as a biochemical engineer attempted suicide by ingesting approximately 25 g potassium cyanide at ~8 AM. His wife found him comatose in the garden of the family house at ~8:10 AM. Members of the Paris Fire Brigade initiated prehospital medical care at 8:15 AM, when the patient was comatose (Glasgow score=3) and gasping for breath with blood pressure of 160/80 mmHg and heart rate of 130 bpm. *Result:* An IV was immediately started, and blood samples were taken prior to the administration of hydroxocobalamin (10 g, IV). Subsequent laboratory analysis revealed that blood cyanide levels before administration of hydroxocobalamin were 3.64 mg/L, a value within the lethal range. During prehospital care, hemodynamic stability was regained. During transportation to the hospital after administration of hydroxocobalamin, the patient showed signs of awakening and required continuous sedation with midazolam and analgesia with fentanyl. The Glasgow score therefore remained at 3. The patient was hospitalized in the intensive care unit. The patient's metabolic acidosis gradually resolved over a period of 3 days. The patient was extubated on the third day of hospitalization and was discharged from the intensive care unit with no neurological sequelae on the sixth day. *Conclusion:* This case supports the antidotal efficacy of hydroxocobalamin for acute cyanide poisoning caused by ingestion of a cyanide salt.

## 211. Prognostic Factors and Toxicokinetic—Toxicodynamic Relationships in Flecainide Poisonings

Resiere D, Megarbane B, Guerrier G, Deye N, Baud FJ. *Service de Réanimation Médicale et Toxicologique, 2 rue Ambroise Paré, 75010, Paris, France.*

*Background:* Flecainide is a cardiotropic drug with a membrane stabilising effect, responsible of rare but severe acute poisonings. Prognostic factors were proposed but never validated. *Methods:* Prospective collection of clinical data, outcome, and plasma flecainide concentrations (determined using HPLC-REMEDIÆ) in severe acute flecainide poisonings admitted in our ICU during 6 years; comparisons between the patients who survived and those who died (Chi-2 and Mann-Whitney tests); study of the toxicokinetics and the toxicokinetic-toxicodynamic (TK-TD) relationships. *Result:* Fourteen patients (7M/7F, 40 yrs [31–56], median [10–90% percentiles]) were included. The ingested dose was 3.0 g [1.3–3.0] with a delay of 2.0 h [1.1–2.4] before admission. On presentation, the systolic blood pressure SBP was 80 mmHg [0–107], the heart rate HR 61/min [0–95] and the QRS duration 180 msec [140–230]. Patients were treated with 8.4% sodium bicarbonate (14/14), mechanical ventilation (11/14), epinephrine (10/14), defibrillation (7/14), pacing (3/14), hemodialysis (3/14) and ECLS (1/14). The mortality rate was 43%, related to a refractory asystole (3/14) or shock (3/14). Complications included: heart failure (10/14),

multiorgan failure (5/14), renal failure (2/14), disseminated intravascular coagulation (2/14), and hospital-acquired pneumonia (3/14). Comparisons between survivors and non-survivors showed significant differences on admission regarding HR (25/min [0–60] versus 88/min [15–112],  $p=0.04$ ), the ingested dose (3.0 g [3.0–6.0] versus 1.5 g [1.0–3.0],  $p=0.02$ ) and the plasma flecainide concentration (5.6 mg/l [4.1–7.1] versus 2.2 mg/l [1.4–2.8],  $p=0.01$ ). There was no significant differences regarding SBP, QRS duration, lactate concentration, and adrenaline infusion. Flecainide TK parameters were dose-dependent. TK-TD relationships were better regarding dobutamine (sigmoidal shape with C50: 0.8 mg/l) or epinephrine infusion rate (C50: 2.1 mg/l) and QT length (linear) than QRS duration. *Conclusion:* Flecainide poisoning-related mortality remains elevated (43%). The prognosis value of the plasma flecainide concentration on admission may be helpful to improve the management.

## 212. Terminal 40 ms R Wave Height vs. Serum Levels in Tricyclic Antidepressant (TCA) Overdose: Is There a Correlation?

Schaeffer TH,<sup>1</sup> Phillips SD,<sup>1,2</sup> Heard KJ,<sup>1,2</sup> Dart RC.<sup>1,2</sup> <sup>1</sup>Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO, USA; <sup>2</sup>University of Colorado Health Sciences Center, Denver, CO, USA.

*Background:* Even with the increased use of safer antidepressants, TCAs remain an important source of toxicity. The EKG is a useful prognostic tool to predict toxicity. Serum drug levels do not correlate with QRS duration, but the relationship between aVR height and serum tricyclic level has not been addressed. If a relationship were found, it would aid in the diagnosis and disposition of poisoned patients. Based on the dose response principle, we hypothesized that the height of the terminal 40 ms (T40) R wave in aVR would correlate with the serum tricyclic level. *Methods:* This was a prospective case series of 622 antidepressant poisonings. Cases were from patients presenting to 9 urban hospitals throughout the US over a 30-month period. Criteria included: single agent TCA ingestion with co-ingestants excluded by GC/MS, 12-lead EKG done contemporaneously with level draw, and TCA level assayed by GC/MS. Each level was compared to the mean measure of the height of the T40 wave in aVR by 5 physicians (EM/IM/Med Tox) who were blinded to drug levels. A Spearman correlation coefficient ( $r$ ) was determined for the entire group and individual TCA agents. *Result:* Of the 622 cases, 498 were excluded for co-ingestants and 26 were excluded for missing labs or unreadable EKGs leaving 98 cases. The range of TCA levels for the cohort was 0–2530 ng/ml. The mean T40 was 1.6 mm (range=0–6.7 mm). The  $r$  for the entire cohort was 0.44. Further analysis of specific agent correlation was done for amitriptyline ( $n=48$ ). The mean T40 was 1.3 mm (range=0–3.8 mm). Level range was 0–1930 ng/ml with  $r=0.42$ . Sample size for clomipramine, doxepin, desipramine, imipramine, nortriptyline, and trimipramine did not allow for meaningful statistical analysis. *Conclusion:* While there is a relationship between T40 and TCA serum level, only a small part of the variation in the height of the R wave can be explained by the variation in serum TCA levels. These results do not support the hypotheses of a strong dose response relationship between the T40 and serum TCA level.

## 213. Acute Renal Failure Following Acute Oral Valacyclovir Overdose

Katiyar A, Daubert GP, Aaron C. *Children's Hospital of Michigan Regional Poison Control Center, Detroit, MI, USA.*

*Introduction:* Valacyclovir (VC) is an effective treatment for adult herpes virus infections. It is actively metabolized to acyclovir, which has been implicated in renal tubular necrosis. We report a case of a man who ingested 14 grams of VC and developed reversible acute renal failure treated by hemodialysis. *Case Report:* A 55-year-old man weighing 190 lbs with a known history of diabetes and normal renal function presented for evaluation after ingesting 14 grams of VC. His renal studies at the time of presentation: BUN, 12 mg/dl; Cr, 0.8 mg/dl; and GFR 111 ml/min/1.73 m<sup>2</sup>. Within 24 hours his urine output fell and his renal function worsened with a BUN, 24 mg/dl; Cr 2.7 mg/dl; and GFR 28 ml/min/1.73 m<sup>2</sup>. His renal function during his course is shown in Table 1. The patient underwent hemodialysis on days 3–4. He never developed symptoms of neurotoxicity and was discharged on day 9 after near complete resolution of his renal failure. *Case Discussion:* VC is an L-valyl ester of acyclovir. It is metabolized by valacyclovir hydrolase to acyclovir. Complications with the use of acyclovir have been reported in patients with preexisting renal dysfunction and IV administration. Drug crystal formation in collecting tubules causing an obstructive nephropathy has been suggested as the mechanism for nephrotoxicity. The degree of renal impairment appears to correlate significantly with acyclovir dosing. Renal impairment is typically reversible and can often be treated with IV hydration

TABLE 1  
Daily laboratory values demonstrating renal insufficiency

Day	3	4	5	6	7	8
BUN	41	32	29	29	28	26
Cr	5.7	5.2	4.3	3.6	2.5	1.9
GFR	11	13	16	19	28	37

BUN (mg/dl), Cr (mg/dl), GFR ml/min/1.73 m<sup>2</sup>

and drug discontinuation. Hemodialysis is effective in reducing clinical toxicity. *Conclusion:* This appears to be the first case of renal toxicity associated with acute oral exposure to VC without neurologic involvement. Although a renal biopsy was not performed in this case the presumed cause is acute tubular necrosis secondary to its acyclovir metabolite.

#### 214. Isolated Atomoxetine Overdose Resulting in Seizures

Kashani JS, Ruha AM. *Banner Good Samaritan Medical Center, Phoenix, AZ, USA.*

*Introduction:* Atomoxetine (ATX) was approved for the treatment of ADHD in November 2002. ATX is a specific norepinephrine reuptake inhibitor marketed as a non-stimulant. ATX has little affinity for other noradrenergic receptors or for other neurotransmitter transporters or receptors. We report a case of large isolated ATX ingestion resulting in seizure and evidence of sodium channel blockade on ECG. *Case Report:* A 17 yo F presented to an ED 2–3 hours after ingesting 71 (40 mg) ATX tablets. Her PMH included only depression and headaches, for which she took ATX and naproxen. Her initial vital signs were BP 150/64, RR 20, HR 110, T 98.7 and O<sub>2</sub> sat 100% RA. She was alert and in no distress. Shortly after her arrival she had a tonic clonic seizure lasting 1 min. One mg of IV lorazepam was given and she was transferred to a toxicology referral center. Upon arrival her VS were: BP 131/72, RR 20, HR 117, afebrile, O<sub>2</sub> sat 100% RA. Her exam revealed diffuse tremor and profound lateral nystagmus. Two mg of IV lorazepam were given and she had progressive improvement in symptoms. Initial ECG showed SR at a rate of 94, QRS duration of 96 msec and QTC of 440 msec. GCMS of the urine revealed: ATX, naproxen, nicotine and cotinine. A quantitative serum ATX level was 1995 ng/ml and quantitative serum naproxen level was 12 mcg/l (therapeutic=30–90 mcg/l). All other lab values were within normal range. A second ECG done approximately eight hours following ingestion revealed narrowing of the QRS to 79 msec. The pt recovered from her ingestion within sixteen hours. *Case Discussion:* Although ATX is marketed as a nonstimulant alternative in the treatment of ADHD, it exhibits similar characteristics to traditional stimulant medications. *Conclusion:* Large ATX ingestions with documented serum levels have not previously been reported. We observed both CNS and cardiac toxicity following a single large ingestion of ATX demonstrated by seizure, tachycardia and evidence of sodium channel blockade on ECG. Co-intoxicants were not found on extensive urine and blood analysis. Although ATX is marketed as a non-stimulant, clinicians should be aware of its potential to cause seizures.

#### 215. Seizures Following Bupropion Ingestion

Stremski E, Uherick L. *Wisconsin Poison Center, Milwaukee, WI, USA.*

*Background:* Seizures are a known complication of Bupropion (B) toxicity. This study was completed to analyze the incidence and severity of seizures following reported B ingestion. *Methods:* Poisindex codes for all B products were used to search cases from 1 poison center over a 48-month period that were recorded as having B as the sole substance ingested. Those cases recorded with any related seizure were further reviewed. Inclusion into the SZ group required that seizures were witnessed by EMS or a healthcare provider and the case had documented poison center follow up to patient discharge. SZ cases were then examined for age, reason, B dose, severity and treatment. SZ cases were further excluded if history suspected B plus other drug

ingestion, reported cocaine positive screen, patient had a seizure disorder, or suspicion of ethanol withdrawal. *Result:* 433 cases met initial criteria, 28 (6%) were SZ cases.

Age group:	<=5 Y	6–12 Y	13–19 Y	>=20 Y	
SZ Cases/all	0/115	0/54	15/69	13/195	
Reason:	Unint_Gen	Med_Err	Suicidal	Mis_Abuse	Ad_Rxn
SZ Cases/all	0/145	0/146	26/112	1/23	1/7
# Seizures:	One	Two	Three or >		
SZ Cases only	15 (54%)	9 (32%)	4 (14%)		

The mean reported dose for all SZ cases=5200 mg (95% C.I. 2700–7500). Only three SZ cases had reported doses under 1400 mg (700, 1050, 1350 mg). 22 SZ cases received anticonvulsant meds (ACD) as: 17 cases with 1 or 2 IV benzodiazepine doses and 5 cases with IV fosphenytoin dose, all of which also had at least 1 IV benzodiazepine dose. All seizures stopped without need of EEG monitoring or need of continuous infusion ACD. Four individuals were intubated; all 4 of these individuals were given 2 or more IV benzodiazepine doses and fosphenytoin. There were no fatalities and all recovered for medical discharge. *Conclusion:* In an isolated Bupropion ingestion, seizures occurred almost exclusively in adolescents and adults with a suicidal ingestion, with doses exceeding 2700 mg. The number of seizures rarely exceeded 2 during the hospital course and responded well to either single or once-repeated IV benzodiazepine dosing.

## 216. Fatal Topiramate Overdose with Antemortem Cardiac Conduction Abnormality and Seizures

Cumpston KL,<sup>1,2</sup> Jones-Lovato H.<sup>2</sup> <sup>1</sup>Medicine, University of New Mexico, Albuquerque, NM, USA; <sup>2</sup>New Mexico Poison and Drug Information Center, Albuquerque, NM, USA.

*Introduction:* One fatality has been attributed to topiramate, but the details of the clinical toxicity are not well described. The data provided in the literature insufficiently describes the severe clinical toxicity of topiramate. We present a case of a critically ill topiramate overdose with cardiovascular instability, seizures, coma and death. *Case Report:* An 18 year old female, who had been hoarding her prescription medication with the intent of suicide, was found unresponsive with bottles of topiramate 200 mg, ranitidine 300 mg, bupropion 200 mg XR, near her. When paramedics arrived she had a seizure, agonal respirations, and bradycardia. The seizure was treated with a benzodiazepine and her cardiac rhythm deteriorated to asystole. The trachea was intubated and standard advanced cardiac life support was initiated. The cardiac rhythm converted to atrial fibrillation(140 bpm) and the systolic blood pressure (SBP) improved to 90 mm Hg. A prolonged QRS complex was noted on the cardiac monitor and three ampules of IV sodium bicarbonate was successful in narrowing the QRS width. She was also treated with epinephrine and dopamine to maintain her blood pressure (BP). Her BP eventually stabilized, but her two day hospital course involved an unknown number of possible seizures, pneumonia, and persistent coma. Finally, an EEG confirmed brain death and support was withdrawn. The urine drug screen was positive for only amphetamines and negative for all others including TCAs. The general serum drug screen on antemortem blood was positive for bupropion and topiramate, but confirmatory testing by National Medical Services confirmed that only topiramate had a detectable concentration (29 mcg/mL). *Conclusion:* The antiepileptic mechanism of action of topiramate involves direct sodium channel blockade and inhibition of the kainate glutamate receptor. With this concept in mind, one would expect to see the clinical manifestations described in our patient. A topiramate overdose may manifest itself with a prolonged QRS complex, seizure, coma, and death.

## 217. Seizures Associated with Tiagabine Overdose: A Case Series

Tsutaoka BT, Wiegand TJ. *California Poison Control System-SF Div. UCSF, SF, CA, USA.*

*Introduction:* Tiagabine (TG) (Gabitril™) was approved in 1997 as adjunctive therapy in the treatment of partial seizures. It has also been used to treat patients with bipolar disorder and other psychiatric illness. Recently there was a change in the labeling of

TG to warn prescribers of the risk of seizures in patients without epilepsy, treated with TG. This alert described seizures in patients in a non-overdose setting at doses as low as 4 mg/day. The therapeutic dose of TG is 32–56 mg/day for use as an antiepileptic agent. A previous retrospective review of 57 TG ingestions described seizure in 16, with status-epilepticus (SE) in 3. The mean dose for patients with seizure was 224 mg with the lowest dose for seizures 96 mg. We report 4 patients experiencing a seizure(s) with doses ranging from 36–480 mg. *Case Report:* Case 1: A 47 year-old female with bipolar disorder ingested a maximum of 36 mg of TG. She appeared to be post-ictal with tremor and flexure posturing of her upper extremities. Symptoms resolved after lorazepam 3 mg IV. Case 2: A 49 year-old female prescribed TG for insomnia experienced a self-limited seizure after ingesting a maximum of 68 mg of TG. Case 3: A 42-year-old male reported ingesting approximately 72 mg of TG. Shortly after presentation he developed convulsive SE refractory to lorazepam. The seizures were eventually terminated with additional phenobarbital (1600 mg bolus and 180 mg/2 hours  $\times$  3) and propofol. Case 4: A 45 year-old male ingested approximately 480 mg of TG and subsequently experienced a generalized seizure, which responded to midazolam. Later, the patient was found obtunded with “twitching eyelids.” Neurology diagnosed non-convulsive status epilepticus (NCSE). This patient required additional phenobarbital after lorazepam for termination of seizure. *Conclusion:* We describe four patients who experienced seizures of varying intensity and duration including SE and NCSE refractory to single agent treatment. Previous reports of TG ingestion suggest that SE was a strictly dose-dependent phenomenon that was easily avoided. Our experience suggests that further review of TG ingestion is warranted.

## 218. TESS-Based Characterization of Human Tilmicosin Exposures and the Parenteral Dose-Response Relationship

Seifert SA, Jacobitz K. *Nebraska Regional Poison Center, Omaha, NE, USA.*

*Background:* Human exposure to tilmicosin (Micotil 300<sup>®</sup>), a veterinary macrolide antibiotic, has not been systematically characterized and the dose-response relationship, particularly with parenteral exposure, has not been well-studied. *Methods:* Human, single-substance tilmicosin exposures in TESS from 2000–2003 were analyzed by patient age and gender, exposure route, exposure reason, substance amount, clinical effects, medical outcome, effects duration, and therapy. Parenteral exposures were analyzed in dose quintiles of 0.01–0.4 mL, 0.5–1 mL, 1.1–5 mL, 5.1–10 mL, and 10.1–15 mL. *Result:* Over

TABLE 1  
Effects by parenteral dose quintile

Dose quintile	No effect	Minor	Moderate	Major	Death
0.01–0.4 mL	1	36	–	–	–
0.5–1 mL	14	92	5	–	–
1.1–5 mL	1	6	4	–	–
5.1–10 mL	–	–	2	–	–
10.1–15 mL	–	–	1	1	2

# of cases.

TABLE 2  
Effects duration by parenteral dose quintile

Dose quintile	$\leq 2$ hrs	$\leq 8$ hrs	$\leq 24$ hrs	$\leq 3$ days	$\leq 1$ wk
0.01–0.4 mL	17	2	2	7	1
0.5–1 mL	23	19	22	12	1
1.1–5 mL	2	1	–	4	1
5.1–10 mL	–	1	–	–	–
10.1–15 mL	–	–	–	–	2

# of cases.

a 4 year period, there were 768 single-substance human exposures to tilmicosin reported to poison centers. The average age was 38 yr and 81% were male. By route there were 182 ingestion, 4 inhalation, 43 ocular, 165 dermal, 456 parenteral, 2 other, and 2 unknown. Most were unintentional-general or occupational, but 31 were misuse and 10 were suicide attempts. Most had no or mild effects by routes other than parenteral. Moderate effects were seen in 4 (2.4%) dermal and 5 (2.7%) ingestion exposures. With parenteral exposure, there was 1 (0.2%) major effect and 5 (1.1%) deaths, four by suicide. Parenteral effects and effect durations were stratified by dose quintile, when known (see Tables 1 and 2). *Conclusion:* Almost 200 cases of human tilmicosin exposure are reported to poison centers per year and over 100 of those are parenteral. Most exposures produce no or minor effects, but fatalities have occurred with parenteral exposure. Some adverse and prolonged effects are reported at parenteral doses below 0.5 mL, suggesting that all parenteral exposures should be referred for healthcare facility evaluation.

## 219. Survival After Intramuscular Self-Injection of Tilmicosin

DeWitt CR,<sup>1</sup> Inhaber N,<sup>2</sup> Bronstein AC,<sup>1</sup> Dart RC.<sup>1</sup> <sup>1</sup>*Rocky Mountain Poison and Drug Center, Denver Health Medical Center, Denver, CO, USA;* <sup>2</sup>*Samaritan Medical Center, Watertown, NY, USA.*

*Introduction:* Background: Tilmicosin is a veterinary macrolide antibiotic provided as a solution containing 300 mg/mL of tilmicosin in 25% propylene glycol (PG). Tilmicosin decreases cardiac inotropy. Cardiovascular collapse and death have been associated with intramuscular (IM) and intravenous (IV) injections in humans. We describe a case with the highest tilmicosin levels associated with survival, associated PG measurements, echocardiography findings, and effects of hemodialysis (HD). *Case Report:* A 46 y healthy male presented 1.5 h after intentional IM injection of 3.6 g (12 mL) of tilmicosin into his thigh. He was nauseated and diaphoretic with BP 79/53 and HR 112. ECG showed sinus tachycardia with nonspecific ST and T wave changes. In addition to IV fluids, norepinephrine and dobutamine were required for 1 and 3 days respectively to maintain blood pressure. In an effort to remove free drug, the patient underwent two 4 h HD sessions within 12 h of admission. HD resulted in no clinical improvement. Echocardiography 24 h after admission (while receiving dobutamine and norepinephrine) showed global left ventricular hypokinesis with an ejection fraction of 45%. Cardiac silhouette on x-ray was enlarged 16 h after injection, and normalized 24 h later. Serial troponin I measurements were negative. Serum tilmicosin levels 2.5 h, 7 h (just prior to 1st HD), and 11 h (just after 1st HD) after injection were 4.0 µg/mL, 10.5 µg/mL, and 7.2 µg/mL respectively (the bovine serum half-life is reported to be 4 h). PG in all samples was <5 mg/dL. No acidosis developed. The patient recovered completely and was discharged 6 d after admission. *Conclusion:* Intramuscular injection of 3.6 g (12 mL) of tilmicosin resulted in serious cardiovascular compromise without elevated PG levels. In this case cardiac hypokinesis and transient cardiac silhouette enlargement were observed. Inotropic support was required (the manufacturer recommends avoiding epinephrine). HD did not appear to be effective.

## 220. Acute Poisoning in Pregnancy: From Epidemiology to Fetal Risk Assessment

Finkelstein Y, Moretti ME, Koren G. *PregTox Network, Div. of Clinical Pharmacology and Toxicology, Hospital for Sick Children, Toronto, ON, Canada.*

*Background:* Acute poisoning during pregnancy (APP) is an important health concern worldwide. The outcome of these pregnancies, specifically fetal outcome (eg. birth defects), has not been routinely explored. The PregTox Network was established in 2004 as an initiative of the Motherisk Program, the Hospital for Sick Children. Our mission is to investigate pregnancy outcome in poisoned women, and provide evidenced-based support. As a first step in establishing PregTox we characterized the epidemiology of APP. *Methods:* We analyzed the Toxic Exposure Surveillance System data compiled by the American Association of Poison Control Centers for the years 1993–2003. *Result:* The rates of APP have been stable throughout the last decade (Table 1), despite widespread health education programs for pregnant women. About one third of cases occurred in the first trimester, during the vulnerable period of embryogenesis. This consistent rate suggests that suicide attempts following an unplanned pregnancy, and the abuse of medications to induce abortion, remain important issues. Due to fear of teratogenicity, pregnancy is also associated with high rates of untreated or sub-optimally treated depression, which may lead to suicide attempts. *Conclusion:* There is an urgent need for a prospective multi-center study to investigate pregnancy outcome following acute poisoning in pregnancy.

TABLE 1  
Rates of acute poisoning in pregnancy between 1993–2003

Year	# of acute poisonings in pregnancy	Total # of exposures	% of acute poisonings in pregnancy	% in 1st trimester	% in 2nd trimester	% in 3rd trimester
2003	7,949	2,395,582	0.33	32	38	30
2002	8,309	2,380,028	0.35	32	37	31
2001	7,588	2,267,979	0.33	32	38	30
2000	8,438	2,168,248	0.39	32	38	30
1999	8,980	2,201,156	0.41	32	38	30
1998	8,120	2,241,082	0.36	32	38	30
1997	7,250	2,192,088	0.33	31	38	31
1996	7,103	2,155,952	0.33	30	39	31
1995	6,484	2,023,089	0.32	30	39	31
1994	6,147	1,926,438	0.32	31	38	31
1993	6,443	1,751,476	0.37	32	38	30

## 221. Severe Hypokalemic, Hypochloremic Metabolic Alkalosis Following Ingestion of the Antacid Gaviscon®

Gawarammana IB, Greene SL, Dargan PI, Jones AL. *National Poisons Information Service, London, United Kingdom.*

**Introduction:** Life threatening metabolic alkalosis following intentional overdose is rare. Toxicological causes include increased urinary acid loss secondary to diuretic or liquorice abuse, administration of exogenous base (antacids, citrate in blood transfusions), and gastrointestinal (GI) acid loss secondary to agents causing protracted vomiting. We report a case of severe metabolic alkalosis following ingestion of Gaviscon®, a compound antacid preparation containing sodium bicarbonate 133.5 mg, sodium alginate 520 mg, and calcium carbonate 80 mg per 5 mls. **Case Report:** A 35-year-old male was found collapsed. On arrival in the ED: GCS 3/15, normal heart rate and blood pressure and mid-sized reactive pupils. Arterial blood gas analysis on 15 L O<sub>2</sub> by mask: pH 7.54, pO<sub>2</sub> 338 mmHg, pCO<sub>2</sub> 60 mmHg, bicarbonate 48.8 mmol/L, base excess +22. ECG showed normal QRS and QT durations, with inferior T wave inversion. Biochemistry revealed serum potassium 1.6 mmol/L, sodium 127 mmol/L, chloride 66 mmol/L, corrected calcium 2.25 mmol/L and normal creatinine and glucose. He was administered 240 mmol of potassium chloride in 0.9% normal saline over 24 hours with normalisation of serum bicarbonate and potassium. On recovery the patient admitted to developing epigastric pain and profuse vomiting for a 24 hour period after which he ingested 2 L of Gaviscon® in an attempt to relieve the pain. **Case Discussion:** Metabolic alkalosis in this case was caused by exogenous ingestion of bicarbonate and GI loss of hydrochloric acid through vomiting. The low serum chloride concentration and rapid clinical improvement after administration of sodium chloride highlights the significant role of protracted vomiting in the etiology of this patient's hypochloremic metabolic alkalosis. However vomiting alone is unlikely to produce such a severe metabolic alkalosis (bicarbonate 48.8 mmol/L). Hypocalcaemia normally associated with metabolic alkalosis caused through GI loss of acid may have been minimised in this case by the calcium carbonate within Gaviscon®. **Conclusion:** This case illustrates a severe metabolic alkalosis resulting from ingestion of Gaviscon®. Supportive care and correction of metabolic abnormalities led to a full recovery.

## 222. Deliberate Self-Poisoning in Ontario Following the Terrorist Attacks of September 11th, 2001

Detsky ME,<sup>1</sup> Sivilotti MLA,<sup>2</sup> Kopp A,<sup>1</sup> Austin PC,<sup>1</sup> Juurlink DN.<sup>1</sup> <sup>1</sup>University of Toronto, Toronto, ON, Canada; <sup>2</sup>Queen's University, Kingston, ON, Canada.

**Background:** The 9/11 terrorist attacks caused significant medical and psychiatric morbidity among survivors, particularly in Manhattan. However, little research has examined the effects of the terrorist attacks outside the United States. We conducted an

ecological study of the effects of the terrorist attacks on self-poisoning in a geographically removed population. *Methods:* Using population-based hospital admission records, we identified all hospitalizations for deliberate self-poisoning in Ontario, Canada, during the month of September from 1988 to 2003 (ICD-960.0 to 990.0 and ICD-10 T36–T50). The primary analysis focused on admissions during the 3-day period beginning on the second Tuesday in September of each year, corresponding to September 11th–13th 2001. Time series analysis of data from 1988 to 2000 was used to forecast the expected number of admissions during the corresponding 3-day periods in 2001, 2002, and 2003. *Result:* From 1988 to 2003, we identified 6,077 hospital admissions for deliberate self-poisoning during September. A linear downward trend in admissions was observed over the study period. A total of 614 admissions occurred during the second Tuesday, Wednesday, and Thursday of September from 1988 to 2003. In 2001, there were 13 admissions during this 3-day period, about 66% fewer than the predicted number of 38 (95% confidence interval 32 to 44;  $p < 0.0001$ ). No similar phenomenon was seen when the analysis was repeated using the 3-day period before (Saturday, Sunday, Monday) or after (Friday, Saturday, Sunday), or when we examined hospital admissions for pneumonia or unstable angina as tracer conditions. The number of poisoning admissions in 2002 and 2003 did not differ significantly from forecasted values. *Conclusion:* The 9/11 terrorist attacks were associated with a transient but dramatic reduction in deliberate self-poisoning in Ontario, indicate that some determinants of overdose behavior can be suppressed by major world events. These findings highlight the need for further research on the determinants of self-harm behaviour and the societal response to terror.

### 223. Repetition of Deliberate Self-Poisoning: A Longitudinal Population-Based Study

Finkelstein Y,<sup>1</sup> Sivilotti MLA,<sup>2</sup> Lam K,<sup>1</sup> Koren G,<sup>1</sup> Juurlink DN.<sup>1</sup> <sup>1</sup>University of Toronto, Toronto, ON, Canada; <sup>2</sup>Queen's University, Kingston, ON, Canada.

*Background:* Few studies have examined recurrence after deliberate self-poisoning (DSP). Most existing studies are small or involve limited follow-up periods. We conducted a longitudinal study of repeat DSP in a population of more than 14 million. *Methods:* Using provincial hospital records, we identified all admissions for a first episode of DSP (ICD9 960.0 to 990.0 and ICD10 T36–T50) in Ontario from 1993 until 2003. Records were linked with physician claims, vital statistics, and population census data using anonymized identifiers to ascertain demographics, medical and psychiatric history, and socioeconomic status (SES). Repeat DSP was identified from hospital records up to 11 years following the index admission. *Result:* Of 29,739 patients admitted with a first episode of DSP, 3799 (12.8%) were eventually readmitted for DSP, 1121 (3.8%) on two or more occasions. Acetaminophen, benzodiazepines, and antidepressants were the most commonly involved substances. The median time to readmission was 389 days (IQR 125–995 days), with 5% of episodes occurring 6 or more years after the initial admission. Women were slightly more likely to be readmitted for DSP than men (15.2% vs. 13.6%;  $p < 0.001$ ). Individuals in the lowest SES quintile were much more likely to be readmitted than those in the highest (16.9 vs. 11.7%;  $p < 0.0001$ ), while patients younger than 20 years at the time of first DSP admission were less likely to be readmitted (10.3%) than those aged 20–39 (17.1%) or 40–59 (16.3%). Patients with a recent psychiatrist visit ( $n = 10,046$ ), depression ( $n = 5111$ ) or substance abuse ( $n = 4228$ ) were 2 to 3 times more likely to be readmitted than patients without these characteristics. *Conclusion:* More than 1 in 8 patients hospitalized for DSP are eventually admitted with another episode, and about half of these occur more than a year after the index admission. Short-term studies of repeat DSP exclude a considerable proportion of events. Older age at first DSP, female sex, low SES, and several psychiatric comorbidities are associated with an increased risk of repeat DSP.

### 224. Prolonged Treatment with 2-PAM in a Large Amount of Organophosphate Insecticide Intoxication

Roh HK,<sup>1</sup> Um WH,<sup>1</sup> Kim JS.<sup>2</sup> <sup>1</sup>Department of Internal Medicine, Incheon, Korea; <sup>2</sup>Department of Emergency Medicine, Incheon, Korea.

*Introduction:* Although it is presumed that phosphorylated acetylcholinesterase (AChE) by organophosphate insecticide is aged within 1–2 days after exposure, the lipid soluble organophosphate compounds easily accumulate in fat tissue and are redistributed from it over time especially when a large amount is absorbed. Treatment with 2-PAM, a reactivator, may be necessary for a long period until the stored organophosphate insecticide is depleted. *Case Report:* Three cases of severe

organophosphate intoxication in suicide attempts are reviewed retrospectively. They ingested about 150–200 ml of organophosphate insecticides including EPN or fenitrothion. In the beginning they were all in excessive cholinergic states with AchE levels between 0.8–3.8 U/gHb. After continuous administration of atropine and 2-PAM, their AchE levels increased significantly 4–25 days after the treatment. The 2-PAM was then discontinued, but their AchE levels soon began to decrease dramatically showing excessive cholinergic signs. The 2-PAM had to be administered continuously again and the AchE levels increased gradually. However, 40 days after the ingestion, even when the AchE level recovered up to 18.0–22.1 U/gHb which is higher than half of the normal range, discontinuation of 2-PAM caused decreases in AchE levels again. On the other hand high doses of 2-PAM increased the AchE levels faster and more than low doses. *Case Discussion:* Severe intoxication with a large amount of organophosphate insecticide needs to be treated with 2-PAM much longer than we usually expect, because continuous release of organophosphate insecticide from the accumulated tissues can inactivate the recovered AchE and make the intoxication aggravated.

## 225. Metaraminol (Aramine®) in the Management of Significant Amlodipine Poisoning: A Case Report

Wood DM,<sup>1</sup> Dargan PI,<sup>1</sup> Greene SL,<sup>1</sup> Wright KD,<sup>2</sup> Jones AL.<sup>1</sup> <sup>1</sup>National Poisons Information Service, London, United Kingdom; <sup>2</sup>Royal Surrey County Hospital, Guildford, United Kingdom.

*Introduction:* Calcium channel blocker (CCB) overdose results in significant cardiotoxicity and patients can develop severe and resistant hypotension. We describe a patient with a significant amlodipine self-poisoning who failed to respond to conventional treatment who was managed successfully with the novel inotrope metaraminol. *Case Report:* A 43 year old male was brought to the ED having been found collapsed at home 3 hours after ingestion of 56 amlodipine 10 mg tablets. On arrival he was hypotensive: BP 67/43 mmHg, HR 69 bpm (EKG: sinus rhythm). He was given a 500 mL crystalloid fluid challenge and received 30 mL 10% calcium gluconate and 20 mg glucagon over the first 40 minutes but remained hypotensive (BP 65/40 mmHg) and anuric. Despite advice from the poisons center insulin-dextrose treatment was not commenced. He was transferred to ICU and started on inotropes but remained hypotensive (BP 68/34 mmHg) despite norepinephrine (9 µg/min) and epinephrine (13 µg/min) administration. Therefore at 3 hours post presentation, he was started on IV metaraminol. He was given a test dose of 25 µg/kg and subsequently an infusion of 83 µg/min. His blood pressure improved to 90/45 mmHg and his urine output resumed. The metaraminol infusion was continued for 36 hours, with continued improvement in his BP. He was discharged from hospital on day 4 with no chronic sequelae. *Case Discussion:* We report a patient with significant amlodipine poisoning with hypotension resistant to IV calcium, glucagon and conventional inotropes who responded well to treatment with metaraminol. Metaraminol is a potent peripheral vasoconstrictor but unlike norepinephrine does not increase myocardial oxygen demand. Its use has previously been described in the management of epidural and spinal anaesthesia related hypotension. *Conclusion:* There have been no previous human reports or animal studies investigating the use of metaraminol in the management of CCB poisoning. This report suggests that metaraminol should be considered in patients with CCB poisoning who are resistant to conventional therapy.

## 226. Massive Ibuprofen Overdose Associated with Electrocardiographic Changes

Eldridge DL, Holstege CP. *Division of Medical Toxicology/University of Virginia, Charlottesville, VA.*

*Introduction:* Ibuprofen overdoses rarely produce severe toxicity. We report a case of a massive ibuprofen overdose that developed severe toxicity associated with electrocardiographic changes. *Case Report:* A previously healthy 29 year-old male presented to the ED an hour after ingesting approximately 80,000 mg of ibuprofen. He initially experienced nausea and vomiting with scant pill fragments in his emesis. Upon arrival, he adamantly denied ingesting any other substance. His mental status declined over the ensuing 2 hours, requiring intubation for airway protection. He developed tonic-clonic seizure activity refractory to repetitive dose of lorazepam but controlled with phenobarbital. Prolongation of his QRS interval (117 msec) and QTc interval (467 msec) occurred approximately 3 hours after ingestion. He developed hypotension (BP=75/33) without tachycardia. His blood pressure normalized only after he received 300 mEq of sodium bicarbonate, 5 liters of normal saline, and a phenylephrine drip. Repeated questioning of his girlfriend revealed no other medications missing. Initial laboratory values were significant for a serum bicarbonate of 18 mmol/L with an anion gap of 13 and an arterial pH of 7.27. Renal function

remained normal. Approximately 20 hours after ingestion, he was extubated and his electrocardiogram (ECG) normalized. He repeatedly denied any other ingestion. Serum amitriptyline was negative. Urine toxicology screen was unremarkable. A 5-hour ibuprofen level was 832 mg/L. *Conclusion:* Rare reports of massive ibuprofen ingestions have been associated with altered mental status, hypotension, seizures and metabolic acidosis. This is the first report of a massive ibuprofen ingestion associated with ECG abnormalities. The patient's 5 hour ibuprofen level is the highest surviving level found in the medical literature.

## 227. Severe Lactic Acidemia and Systemic Toxicity Following Oral Propylene Glycol Ingestion: A Role for Fomepizole and Hemodialysis

Bouchard NC,<sup>1</sup> Abou Rjaili G,<sup>2</sup> Choufani D,<sup>2</sup> McGee MP,<sup>3</sup> Stajic M,<sup>3</sup> Hoffman RS,<sup>1</sup> Nelson LS.<sup>1</sup> <sup>1</sup>New York City Poison Control Center, NY, NY, USA; <sup>2</sup>Staten Island University Hospital, NY, NY, USA; <sup>3</sup>Forensic Toxicology Laboratory, Office of Chief Medical Examiner, NY, NY, USA.

*Introduction:* Although propylene glycol (PG) is marketed as a safer alternative to ethylene glycol containing antifreeze, rare reports describe transient CNS depression and lactic acidemia after very large oral ingestions. Severe and persistent systemic toxicity following oral PG ingestion is not reported. *Case Report:* A 32 year-old woman with known bipolar disorder and 3 previous suicide attempts was brought to the ED for lethargy. Initial vital signs were: P, 122/min; BP, 134/82 mm Hg; RR, 24/min; T, 97.0°F. She was intubated for worsening lethargy. Laboratory data showed: arterial pH, 6.93; PCO<sub>2</sub> 13 mm Hg; lactate, 10.7 mmol/L; HCO<sub>3</sub><sup>2-</sup>, 5.5 mEq/L; creatinine 1.3 mg/dL; anion gap, 18; osmol gap, 27, mildly elevated aminotransferases (~250 U/L); and an acetaminophen level of 152 mg/dL. She was treated with IV N-acetylcysteine, thiamine, pyridoxine, folic acid and serum alkalinization. Fomepizole was only available 18 hours later. Her lactic acidemia persisted for ~22 hours despite resuscitation and stable vital signs. On day 2 she was anuric, aminotransferases were ~4500 U/L and hemodialysis (HD) was performed. Pre-HD serum (48 h) showed PG level of 122 mg/dL and no ethylene glycol or methanol. Post-HD PG was 2 mg/dL. By day 6, her mental status and hepatic function were improved. A renal biopsy showed acute tubular necrosis with no crystals. Her creatinine was 3.7 mg/dL at discharge (day 22). *Case Discussion:* While severe systemic toxicity and nephrotoxicity is documented with parenteral PG, oral PG ingestions classically cause little long term morbidity and mortality. The relative severity of her renal dysfunction suggest a possible contribution of PG, especially to the nephrotoxicity. Lactic acidemia appeared to resolve following treatment with fomepizole. *Conclusion:* This case of presumed massive PG ingestion demonstrates marked lactic acidemia, reversible CNS depression and possibly hepatotoxicity and nephrotoxicity. Fomepizole and HD may be useful adjuncts in such cases.

## 228. AACT Recommendations for Antidotal Treatment of Ethylene Glycol Poisoning; Do We Have Enough Information?

Greene SL, Dargan PI, Shiew CM, Jones AL. *National Poisons Information Service, London, United Kingdom.*

*Background:* Antidotal treatment for ethylene glycol (EG) poisoning is most effective if commenced early after EG ingestion. Current AACT recommendations for treatment with an antidote are: plasma EG concentration >20 mg/dL, or recent history of toxic EG ingestion and osmolal gap >10 mosm/L, or clinical suspicion of EG ingestion and at least two of arterial pH<7.3, serum bicarbonate <20 mmol/L, osmolal gap >10 mosm/L, urinary oxalate crystals. *Methods:* We reviewed cases of suspected EG ingestion to determine the utility of current recommendations for antidotal treatment based on information available within 6 hours of the initial toxicology consult. *Result:* Between May 2004 and April 2005, the Clinical Toxicology team at one poisons center was consulted on 18 cases of possible EG ingestion. There was a positive history of EG ingestion in 9 cases, suspected in 7, no history available in 2. Within 6 hours of the initial toxicology consult arterial pH was available in 100% cases, osmolal gap was measured in 10 (56%) cases, but plasma ethanol concentration was unavailable in 5 cases making accurate interpretation of the osmolal gap impossible. Microscopy for urinary oxalate crystals and EG concentration results were not available in any case within 6 hours. Using information available within 6 hours of the toxicology consult and applying current recommendations, 9 (50%) cases did not meet the criteria for antidotal treatment. One of these (suspected ingestion, unknown osmolal gap, normal acid-base status) was subsequently found to have a significant EG concentration (>100 mg/dL).

Of the 9 cases where antidotal treatment was indicated, 6 had significant plasma EG concentrations (>20 mg/dL), 2 had high ethanol concentrations (>300 mg/dL), but no EG detected and 1 did not have an EG determination. *Conclusion:* In the UK all information needed to apply current recommendations for antidotal treatment in EG poisoning is unlikely to be available during the first 6 hours of patient presentation when this treatment is most effective. Delays in measuring osmolality, plasma ethanol and ethylene glycol concentrations may significantly delay initiation of antidotal treatment in suspected EG poisoning.

### 229. A Case of Diethylene Glycol Ingestion Treated Successfully with Blocking Therapy and Dialysis

Casas R, Ruck B, Marcus S. *New Jersey Poison Information and Education System at University of Medicine and Dentistry, Newark, NJ, USA.*

*Introduction:* Diethylene Glycol (DEG) is commonly found as a component in antifreeze, gas conditioning formulations, brake fluids, cosmetics, lubricants, inks, glues, dyes, packaging materials, sterno and many other products. *Case Report:* A 50 year old male consumed 9.9 ounces of Sterno, as well as, bleach, vodka, and also used cocaine. On presentation the patient was awake and alert. He was given activated charcoal on arrival. When it was confirmed that Sterno was ingested and that it contained diethylene glycol, fomepizole was recommended. Initial labs showed a serum ethanol level of 152 mg/dl, a creatinine of 0.9 mg/dl. His pH was 7.37, pCO<sub>2</sub> was 38 torr, pO<sub>2</sub> 72 torr. He had no anion gap but had an osmolar gap of 34 (the ethanol was included in the calculation). Three hours later his pH was 7.33, pCO<sub>2</sub> of 48.9, pO<sub>2</sub> of 90. His creatinine remained at 0.9 mg/dl, his ethanol dropped to 101.4 mg/dl and his osmolar gap was 40 mOsm/kg. Due to the potential for serious outcome, dialysis was started 8 hours after the initial dose of fomepizole was given. He was dialyzed for 4 hours. His post dialysis studies showed an anion gap of 8, an osmolar gap of 8.13, and a creatinine of 0.5 mg/dl. Lab studies for toxic alcohols showed that both methanol and ethylene glycol levels were negative while the diethylene glycol level performed by gas chromatography was 150 mg/dl. *Case Discussion:* Rats given fomepizole for DEG ingestion became lethargic and died, while the control group did well. One case report of a human ingesting butoxyethanol was found. In this case dialysis was performed because the patient was acidotic, fomepizole was not available and there were residual neurological deficits. Ethanol was not given because the patient was critically ill. In our case the patient did well with fomepizole and dialysis. He never became acidotic nor did his BUN or creatinine rise. *Conclusion:* Although there are a few cases in the literature regarding the separate use of dialysis or fomepizole, it appears that when confronted with DEG the use of fomepizole in conjunction with dialysis may prevent an otherwise potential acidosis and or death.

### 230. Significant Methemoglobinemia After Radiator Antifreeze Ingestion

Johnson-Arbor KK, McKay CA. *University of Connecticut/Hartford Hospital, Hartford, CT, USA.*

*Introduction:* Methemoglobinemia is a rare complication of antifreeze ingestion with only three previous case reports identified. The etiology of the methemoglobinemia was unknown in two of the cases, and attributed to well water dilution of the antifreeze in the other. We present a case of methemoglobinemia following antifreeze ingestion in which the source of the methemoglobinemia was a component of the antifreeze itself. This case also reports the highest methemoglobin (MetHb) level associated with antifreeze ingestion. *Case Report:* A 49 year-old man was brought to the hospital shortly after a witnessed ingestion of an unknown quantity of antifreeze. His past medical history was significant for depression and anxiety, and his medications included clonazepam (Klonopin), quetiapine (Seroquel), lamotrigine (Lamictal), and bupropion (Wellbutrin). Vital signs were initially reported to be stable. Initial laboratory results included: anion gap 10, osmolar gap 147, ethanol 130 mg/dL, ethylene glycol 519 mg/dL, and arterial blood gas 7.41/44/90/(28)/97% on 4LNC. The patient was treated with fomepizole and hemodialysis for his ethylene glycol intoxication. Nine hours after the ingestion, the patient was noted to be cyanotic; his pulse oximetry was 88% on 100% FiO<sub>2</sub>. A MetHb determination at that time was 26.9%. Analysis of the antifreeze Material Safety Data Sheets (MSDS) did not reveal any MetHb-inducing agents. Methylene blue was not administered, and the MetHb concentration decreased over the next several hours. The patient recovered uneventfully, and was discharged to a psychiatric facility three days after his ingestion. *Case Discussion:* The manufacturer of the antifreeze later confirmed that the brand

ingested by the patient was marketed for older cars, and contained nitrates and nitrites as corrosion inhibitors. The product contained up to 2800 ppm of nitrites (range 0.22–0.28% wt), and up to 1800 ppm of nitrates (range 0.13–0.18% wt). *Conclusion:* Some brands of antifreeze contain both nitrites and nitrates. MSDS may not list these ingredients as they are present in small amounts. Methemoglobinemia should be suspected in cases of antifreeze ingestion that present with cyanosis unresponsive to oxygen therapy.

### 231. Survey of Ethanol Assay Availability in the UK: Can We Cope with Ethylene Glycol/Methanol Poisoning?

Shiew CM, Dargan PI, Greene SL, Jones AL. *National Poisons Information Service, London, United Kingdom.*

*Background:* Intravenous ethanol is the recommended antidote for ethylene glycol and methanol poisoning in the United Kingdom (UK). Variable ethanol pharmacokinetics mean frequent serum ethanol measurements are crucial for effective treatment. Recent US Academy of Biochemistry guidelines recommend a turnaround time for serum ethanol measurement of 1 hour or less (UK guidelines within 2 hours). Serum ethanol measurement is also important in determination of the osmolal gap. We aimed to assess availability of routine serum ethanol assays in UK laboratories. *Methods:* A postal questionnaire survey was sent to 193 acute biochemistry laboratories in the UK (February 2005) asking if routine serum ethanol assays were available 24 hours a day. Routine assay was defined as an assay done by a resident technician without factors causing possible delay (the need for off-site personnel, case discussion with a biochemist, or transport of the sample elsewhere for analysis). If routine assays were not available 24/7, laboratories were asked to specify alternative arrangements. We also asked what units were used to report ethanol concentrations. Non-responders were sent another survey form after 4 weeks. *Result:* Information has currently been returned by 127 laboratories. Ethanol assays are available routinely 24/7 in 84 laboratories (66% of respondents). Of the 43 laboratories (34% of respondents) where ethanol assays are not routinely available: 16 require discussion with an on-call biochemist, 3 require a biochemist to travel to the laboratory, 17 send the sample to another laboratory, 5 have no alternative arrangements. The last 3 categories (22% of respondents) are unlikely to be able to determine a serum ethanol concentration within 2 hours. There was considerable variance in the units used for reporting: mg/dl (67%), mg/L (16%), mmol/L (9%), g/L (5%), mg% (0.1%). *Conclusion:* A significant number of UK laboratories are unable to provide serum ethanol concentrations within 2 hours which may lead to delays in diagnosis and effective treatment of methanol or ethylene glycol poisoning. The variable units used to report serum ethanol concentrations are a potential source of error.

### 232. Fulminant Liver Failure from Moderate Paracetamol (Acetaminophen), Ferrous Sulphate and Ethanol Overdose, Successfully Treated by Liver Transplantation: A Case Report

Spillum BJ,<sup>1</sup> Tosterud M,<sup>1</sup> Foss A,<sup>2</sup> Bjoro K,<sup>2</sup> Skattum M,<sup>3</sup> Froyshov S.<sup>4</sup> <sup>1</sup>*National Poisons Information Centre, Oslo, Norway;* <sup>2</sup>*Rikshospitalet, Oslo, Norway;* <sup>3</sup>*Innlandet Hospital, Gjøvik, Norway;* <sup>4</sup>*Ullevaal University Hospital, Oslo, Norway.*

*Introduction:* Hepatic failure in paracetamol poisoning is well known. How combined ingestion of moderate toxic amounts of potentially liver toxic agents may interact and cause severe liver damage is less studied. We present a patient who ingested a mixture that would be expected to give only a low to moderate intoxication if the drugs were taken separately. She developed a life-threatening liver failure. *Case Report:* A 19 year old woman was admitted to hospital after an intake of 8 g paracetamol, 3 g iron (sustained release ferrous sulphate), 10 g naproxene, 100 mg cetirizine and alcohol during the last four hours before admission. On admission, gastric decontamination with lavage and activated charcoal were given. S-paracetamol was 620 umol/L (94 ug/mL), S-iron 50 umol/L (282 ug/dL) and ethanol 40 mmol/L (180 mg/dL). Liver transaminase activities were within reference range. Initially deferoxamine (5 g PO and 1.5 g IV) and N-acetylcysteine (28 g IV during the first 3 days) were given. Laboratory tests two days after ingestion demonstrated severe hepatic injury: ASAT 14980 (10–35) U/L, ALAT 13760 (10–45) U/L, INR>8. 66 hours after ingestion the patient deteriorated with disorientation and restlessness. Cerebral CT scan revealed moderate to severe cerebral edema. She was transferred to the National transplantation centre, where she was treated with MARS while waiting for a liver transplantation, which was performed the following day. Four months later she is in healthy condition with normal liver function tests. *Conclusion:* The present case demonstrates severe liver cell necrosis and fulminant liver failure following exposure to a combination of low to moderate overdose of liver toxic substances, paracetamol, ferrous

sulphate and ethanol. The mechanism for this interaction remains unknown. Liver transplantation should be considered when signs of fulminant liver failure develops following intake of combination of hepatotoxic agents.

### 233. 42 Month Retrospective Review of Acute Aspirin Ingestions with Descriptive Features of All Cases, Fatal Cases, and Long-Hospital-Stay Cases

Camilleri CC, Offerman S, Albertson TE. *UC Davis Medical Center; California Poison Control System, Sacramento Division, Sacramento, CA, USA.*

**Background:** To describe pertinent clinical and demographic features of patients with acute aspirin overdose, and of patients within this group with fatal outcomes or prolonged hospital courses (>4 days). **Methods:** Case Series: This is a retrospective review all single agent, acute aspirin poisoning cases, coded as moderate effect, major effect, or death outcome, reported to the California Poison Control System, Sacramento Division, from January, 2001 through June, 2004. Data collected included: age, gender, salicylate levels, blood gas analysis values, reported symptoms, medical outcomes and length of hospital stay. **Result:** 441 cases were reviewed. 305 patients were female (69%). Patient ages ranged from 1 to 83 years with a mean of 25.9 years ( $\pm 13.8$ ). 9 patients died and 13 patients had hospital stays longer than 4 days. 30 patients had peak temperatures higher than 100°F. 183 patients had acidemia (blood pH < 7.32 at any time during their hospital course), and 111 patients had alkalemia (blood pH > 7.48 at any time during their hospital course). Mentation changes (confusion or altered consciousness) were reported in 93 patients.

Selected descriptive features were compiled for death and long-hospital-stay patients:

	All cases	Fatal cases	Cases >4 days
n	441	9	13
mean age, years	25.9 ( $\pm 13.8$ )	44.9 ( $\pm 28.2$ )	40.2 ( $\pm 15$ )
mean peak ASA level, mg/dL	57.7 ( $\pm 22.3$ )	124.6 ( $\pm 26$ )	90.2 ( $\pm 28.9$ )
mean lowest blood pH	7.44 ( $\pm 0.08$ )	7.24 ( $\pm 0.16$ )	7.39 ( $\pm 0.15$ )
mentation changes (%)	93/441 (21)	7/9 (78)	10/13 (77)

**Conclusion:** In this case series, patients with long hospital stays or death outcomes were older, had higher peak aspirin levels and had mentation changes in greater proportion in comparison to the group as a whole. Further analysis is needed to determine whether any of the measured variables have predictive value.

### 234. Isolated Mirtazapine Ingestions Typically Result in Altered Mental Status

Riley BD,<sup>1</sup> LoVecchio F,<sup>2</sup> Pizon AF,<sup>1</sup> Brown M.<sup>3</sup> <sup>1</sup>Banner Good Samaritan Regional Poison Center, Phoenix, AZ, USA; <sup>2</sup>Maricopa Medical Center, Phoenix, AZ, USA; <sup>3</sup>Arizona College of Osteopathic Medicine, Phoenix, AZ, USA.

**Background:** Mirtazapine (Remeron™) is a newly approved medication for the treatment of depression. It is an alpha<sub>2</sub>-adrenergic antagonist that causes increased levels of neuronal norepinephrine and serotonin. It is also believed to be an antagonist at the serotonin receptors 5-HT<sub>2</sub> and 5-HT<sub>3</sub>. Little is known about isolated mirtazapine ingestions. **Methods:** We conducted a retrospective chart review of mirtazapine ingestions reported to our Poison Center during 2004. A standardized data sheet was completed collecting information regarding demographic data along with co-ingestants, neurologic and cardiovascular symptoms, and disposition. Data collection was reviewed by a second investigator, and a kappa score was calculated. **Result:** Of 96 patients identified with mirtazapine ingestions, there were 23 isolated exposures that were further reviewed. A kappa score for inter-reviewer reliability was calculated and at 0.61, 95% CI [.56–70]. The average age of these patients was 27 years (range 6–82 years), with the mean ingestion 343 mg (range 15–1500 mg). The most common neurologic symptom was drowsiness seen in 8/23 patients, one patient became agitated, and 14 patients had no abnormal neurologic

findings. Cardiovascular effects were recorded in 4/23 patients with 3 patients exhibiting tachycardia and 1 patient with bradycardia and hypotension. Seven of 23 patients required admission, there were no deaths. *Conclusion:* Mirtazapine overdoses are generally very well tolerated, with the most common symptoms being drowsiness and lethargy.

### 235. Acute Mefenamic Acid Poisoning in Switzerland

Laredo P,<sup>1</sup> Kupferschmidt H,<sup>1</sup> Meier PJ,<sup>2</sup> Wilks MF.<sup>1</sup> <sup>1</sup>Swiss Toxicological Information Centre (STIC), Zuerich, ZH, Switzerland; <sup>2</sup>Div. Clinical Pharmacology and Toxicology, Univ. Hospital Zuerich, Zuerich, ZH, Switzerland.

*Background:* Mefenamic acid (MA) is a widely used non-steroidal anti-inflammatory drug in Switzerland. Based on earlier retrospective data we postulate that in acute MA poisoning severe symptoms may occur at doses of >3.5 grams. Aim of the study was to test this hypothesis and to establish the effect of early decontamination. *Methods:* This prospective study included all cases of oral MA poisoning recorded at the STIC between 1993 and 2003. Inclusion criteria were physician enquiry with completed follow-up, monointoxication with 500 mg MA tablets, established causality, known dose, and age. *Result:* We analysed 241 cases (24 children <5 years, 217 adults/adolescents >12 years, 48 males, 186 females, unknown gender 7). The children had ingested 0.5 to 3.5 g MA (median=1), 19 were asymptomatic, 5 showed minor symptoms. The age in the adolescent/adult group ranged from 12.5 to 88 (median 20) years, the median ingested dose was 6 g (range 0.5–50). 73 patients (34%) were asymptomatic, 104 (48%) showed minor symptoms (mainly abdominal pain, nausea, vomiting, somnolence, vertigo). There were 40 cases with moderate/severe symptoms, the most frequent being single and multiple seizures (n=34, 85%), followed by agitation/confusion (n=14, 35%), CNS depression (n=7, 18%), and metabolic acidosis (n=5, 13%). The lowest dose with moderate/severe symptoms was 3.5 g. In a logistic regression analysis increasing dose and young age were significantly associated with severity. Seizures were significantly (chi-square) less frequent in patients ingesting >5 g who had early (<1 h) decontamination (12/68) compared to those with no or late decontamination (19/55). *Conclusion:* Children ingesting small doses of MA tend to remain asymptomatic or may develop minor symptoms. This is also the case for the majority of adolescents and adults, but moderate/severe symptoms (mainly seizures) occur in a significant proportion of these patients. Although risk increases with dose, severe symptoms can occur following ingestion of as little as 3.5 g. Early decontamination appears to improve outcome and is recommended for patients ingesting >3.5 g mefenamic acid.

### 236. Suicidal Ingestions of Metal Polish Cleaner in the Hmong Community

Geller RJ, Alsop JA. California Poison Control System, Madera, CA, USA; California Poison Control System, Sacramento, CA, USA; University of California San Francisco, School of Pharmacy, San Francisco, CA, USA.

*Introduction:* There are two major Hmong populations in the US, located in California and in Minnesota. The California Poison Control System has been contacted in 3 cases of metal polish cleaner ingestions in the Hmong community that resulted in death. *Case Report:* Case 1) A 15 year old pregnant female ingested a jewelry cleaner after the father refused to marry her. She arrived at the ED with altered mental status, apnea, bradycardia, pH of 7.32. She was intubated, sodium nitrate and sodium thiosulfate was administered. A blood thiocyanate level was 38.6 mcg/ml (normal 1–4 mcg/ml in non-smokers, 3–13 in smokers). She died 72 hours after presentation. Case 2) A 72 year old female was found hypoxic at home after ingesting an unknown silver cleaner in a suicide attempt. She presented with hypotension, hypokalemia, atrial fib, pH of 6.9, HCO<sub>3</sub> 8, lactate 20. She was intubated and started on dopamine. She developed bradycardia of 50. Sodium thiosulfate was administered. She died 48 hours after presentation. A blood cyanide level was 5.6 mcg/ml (acutely toxic >1 mcg/ml). Case 3) A 16 year old female was found dead after she ingested a gold metal button cleaner. Her family opposed her romantic relationship. Her boyfriend said she vomited and stopped breathing. Analysis of the sample of the cleaner crystals revealed sodium cyanide. *Case Discussion:* Sodium and potassium salts of cyanide are estimated to be lethal to adults in doses of 200–300 mg. Cyanide salts are commonly used in the jewelry industry but are not commonly available by the general population in retail markets. However, in Southeast Asian markets, many substances are available that can be purchased only by ethnic community members. It is well known in the Hmong community that the crystalline metal polish can be lethal if ingested. Physicians should be aware that cyanide is available to potentially suicidal members of the Southeast Asia community. *Conclusion:* Cyanide intoxication

should be considered particularly in Southeast Asian patients who present with altered mental status and metabolic acidosis of unclear etiology.

### 237. Bowel Necrosis Following the Intentional Administration of an Ammonia-Containing Enema

Haroz R, Greenberg MI. *Drexel University College of Medicine, Philadelphia, PA, USA.*

*Introduction:* Colitis due to intentional rectal administration of various substances intended to induce defecation is common. A variety of chemicals have reportedly been administered rectally in gestures of suicide, homicide and in misdirected attempts at inducing abortion. We report a case of intestinal necrosis after administration of an ammonia-containing enema as a suicidal gesture. *Case Report:* A 23-year old Liberian female presented following the intentional rectal administration of 100 mL of household ammonia (2.2%, pH 11.8) in a suicidal gesture. The patient complained of rectal pain and bleeding, followed by a large bloody “jelly-like” bowel movement. The initial examination and lab data were normal except for gross blood on rectal exam. Sigmoidoscopy showed diffuse erythema with mucosal friability and inflammation. A CT showed no perforation. 24 hours following admission a fever developed (103F), abdominal pain increased, and the abdomen was rigid. At operation, diffuse bowel necrosis extending from the transverse colon to the rectum was identified and a left hemicolectomy, partial proctectomy and transverse colostomy were performed. The patient recovered and was discharged with psychiatric follow-up. *Case Discussion:* While caustic injury to the esophagus is well described, acute chemically-induced colitis is not commonly reported. Most reported cases are from African nationals where the rectal administration of caustic chemicals is prevalent. This practice is reportedly a culturally-based, self-injurious behavior. The extent of bowel necrosis in this case was notable given the relatively small amount of ammonia reportedly instilled. *Conclusion:* The rectal administration of caustic materials may present with minimal clinical findings that progress rapidly. With the trans-global migration of populations, cultural practices as illustrated by this case may become more commonly encountered in the U.S.

### 238. Normal LV Function and BNP Levels in a Case of Severe Verapamil Poisoning: Time to Look at the Role of Vasodilatation as the Cause of Toxicity

Rogers JJ,<sup>1</sup> Waksman JC.<sup>2</sup> <sup>1</sup>*Rocky Mountain Poison and Drug Center-Denver Health, Denver, CO;* <sup>2</sup>*University of Colorado Health Sciences Center, Denver, CO.*

*Introduction:* Traditionally, cardiac suppression is thought to be a major contributing factor of toxicity in verapamil poisoning. The left ventricle derived-Brain natriuretic peptide (BNP) is produced and released in left ventricular (LV) dysfunction and failure. We report a case of severe verapamil intoxication with hypotension in which normal cardiac output (CO), echocardiography findings, and BNP measurements were obtained. *Case Report:* A 55-yr-old male was found unresponsive in a hotel room after ingestion of an unknown amount of verapamil. Upon arrival to the emergency department the patient had agonal respirations, faintly palpable pulses, and an unobtainable blood pressure (BP). The patient was intubated, started on intravenous fluids, dopamine, and norepinephrine. He was transferred hemodynamically unstable to the catheterization-laboratory where a transvenous pacer, Swan-Ganz catheter, and an intra-aortic balloon pump (IABP) were inserted. He was started on a glucagon drip at 6 mg/hr and an insulin drip at 0.04–0.15 U/kg maintaining euglycemia. While in the ICU the patient’s BP stabilized over the next 2.5 days. Vasopressors, IABP, and cardiac pacer were discontinued at this time. During his symptomatic course he maintained a normal CO (4.31–8.79 L/min) and four normal consecutive serum BNP measurements. In addition, LV function as measured by serial echocardiograms was reported as normal. Measurement of the systemic vascular resistance in the first 24 hrs was low (605–730 dyne sec/cm<sup>5</sup>). His hospital course was complicated by aspiration pneumonia and multiple embolic strokes. He was discharged to rehabilitation on hospital day number 11. *Conclusion:* We present a case of severe verapamil overdose in which there was no objective evidence of myocardial impairment or decreased cardiac output. This suggests that the primary mechanism of toxicity in this patient was vasodilatation rather than decreased myocardial contractility. The use of BNP is novel and unreported, but its role in calcium channel blocker overdose still necessitates further investigation.

### 239. A Case Report and Laboratory Analysis of Fatal Methemoglobinemia After Ingestion of Nitrobenzene

Chang AS,<sup>1</sup> Morgan BW,<sup>1</sup> Birkholz DA,<sup>2</sup> Schwartz MD.<sup>3</sup> <sup>1</sup>Emory University Dept. of Emerg. Medicine/Georgia Poison Control Center, Atlanta, GA, USA; <sup>2</sup>Envirotest Laboratories, Edmonton, AB, Canada; <sup>3</sup>Centers for Disease Control and Prevention, Atlanta, GA, USA.

*Introduction:* Nitrobenzene is a strong oxidizing agent that is present in some cleaning solvents. Toxicity is characterized by severe, refractory methemoglobinemia. Metabolites include p-nitrophenol, aniline, and p-aminophenol which also have oxidative properties. *Case Report:* We report a case of intentional nitrobenzene poisoning in a 46 year old female who ingested a floor cleaning product from Mexico. On ED presentation, she was confused and cyanotic with a pulse oximetry of 78%. The patient was intubated and placed on mechanical ventilation. ABG revealed a PaO<sub>2</sub> of 537 mmHg and a methemoglobin level of 68%. After two doses of 1 mg/kg of methylene blue administered 18 hours apart, she had no clinical improvement and the methemoglobin level was still 51%. Hemodialysis and exchange blood transfusions were instituted. She was declared brain dead and expired on hospital day 5. A blood sample from her admission was submitted to EnviroTest (Edmonton, Canada) for attempted quantitative testing of nitrobenzene and metabolites. A novel, validated assay was designed specifically for this case. The analysis showed a nitrobenzene level of 6.2 mcg/mL, aniline of 0.9 mcg/mL, and 4-aminophenol of 3 mcg/mL by extracted ion-current profiles. *Case Discussion:* Literature review for the last 10 years yielded 4 case reports, including one fatal case of nitrobenzene poisoning. All 4 received methylene blue: 3 received ascorbic acid, and one received high-flux hemodialysis as adjunctive therapy. The volume of distribution and the clearance with hemodialysis of nitrobenzene is unknown. *Conclusion:* Nitrobenzene poisoning is rare and potentially fatal. Methylene blue, ascorbic acid, and exchange blood transfusions are considered first line therapy. It is unknown if hemodialysis can enhance elimination of nitrobenzene and its metabolites to produce any significant clinical improvement.

### 240. Arsenic Gas Poisoning After Occupational Exposure

O'Connor AD, Kao LW, Furbee RB. *Indiana University School of Medicine, Indianapolis, IN, USA.*

*Introduction:* Although arsine gas toxicity is extremely rare it is still on the differential diagnosis of abdominal pain and hemolysis. *Case Report:* A previously healthy 46 year old male presented for emergency care with nausea, vomiting, fatigue, paresthesias of his extremities, and dark-brown urine within 4 hours of leaving work at a silicon wafer manufacturing plant. His initial laboratory workup was remarkable for: WBC 22,170, hemoglobin 13 g/dL, creatinine 2.0 mg/dL, total bilirubin 10.3 mg/dL, direct bilirubin 2.8 mg/dL and LDH 10973 U/L. A urinalysis showed bilirubin without RBCs. He was admitted with a preliminary diagnosis of acute cholecystitis. Over the next 24 hours he developed worsening anemia (Hgb 9.7 g/dL) and oliguric renal failure (Cr 4.5 mg/dL). Because the patient reported working with arsenic (As) compounds, the Poison Center was contacted and arsine toxicity was diagnosed. He was transferred and received hemodialysis and exchange transfusion approximately 40 hours post exposure. He received 3 erythrocyte exchange transfusions and 2 runs of plasmapheresis, guided by evidence of ongoing hemolysis. Initial urine As level of 1470 mcg/L fell to 252 mcg/L after exchange transfusion. Blood As level on hospital day (HD) 4 was 115.8 mcg/L. No chelation was performed. The patient was discharged on HD 10 with a hemoglobin of 10.4 g/dL and creatinine of 10.7 mg/dL. Workplace investigation by the plant and OSHA confirmed an arsine exposure. Hemodialysis was discontinued approximately one month after hospital discharge. No persistent paresthesias were reported. *Conclusion:* We present a case of arsine toxicity managed with erythrocyte exchange, plasmapheresis, and hemodialysis resulting in full recovery.

### 241. Case Series: A New Source of Arsenic

Goetz R,<sup>1</sup> Sweeney R,<sup>1</sup> Snook CP,<sup>1,2</sup> Bond GR.<sup>1</sup> <sup>1</sup>Cincinnati Drug and Poison Information Center, Cincinnati, OH, USA; <sup>2</sup>Division of Toxicology, Department of Emergency Medicine, University of Cincinnati Medical Center, Cincinnati, OH, USA.

*Introduction:* Arsenic gas is a rare cause of poisoning in semiconductor workers. We report four cases from a new occupational source of exposure. *Case Report:* A silicon wafer manufacturer installed a new on-site wastewater treatment process. An electro-coagulation unit was opened for inspection. The workers did not recognize an exposure. All developed symptoms after a

delay of several hours. Two employees on an elevated catwalk next to the unit were the most affected, developing the classic symptoms of arsine poisoning including malaise, generalized discomfort, dark urine, nausea, vomiting, fever, and paresthesias. Two other employees further away and below the unit (arsine's vapor density 2.7) were less affected. The first to present was diagnosed with sepsis based on fever, WBC 36 K, anuric renal failure and bronze skin. Workplace exposure to arsine was recognized only when the two less affected employees presented to the same hospital 12 hours later. The initial patient's treatment included exchange transfusion and chelation with BAL. He required hemodialysis for weeks and has made a slow recovery. The fourth patient presented in another state and was initially diagnosed with cholecystitis, because of leukocytosis and abdominal pain. The two less ill employees had hemolysis without renal failure. Their spot urine arsenic levels were 2343 mcg/L and 2247 mcg/L; one was transfused. Both were chelated with DMSA. *Case Discussion:* Wastewater with arsenic or antimony is generated in the production of silicon wafers. On-site removal of these contaminants via an electro-coagulation process and transfer to settling tanks is relatively inexpensive compared to off-site treatment. The potential for arsine exposure was clearly not recognized as no detection system was in use and no PPE was required. Exposure presumably occurred when gases trapped in the tank's headspace were released. Because their symptoms were delayed, the workers did not associate them with work. *Conclusion:* A new source of occupational arsine exposure is identified. These cases highlight the need for monitoring, PPE and worker education.

#### 242. Arsine Gas Exposure Presenting as Back Pain and Hematuria: A Case Series

Skinner CG,<sup>1</sup> Kucewicz AA,<sup>2</sup> Coon TP,<sup>1</sup> Miller MA.<sup>1</sup> <sup>1</sup>Darnall Army Community Hospital, Ft. Hood, TX, USA; <sup>2</sup>Bethesda Trihealth Good Samaritan, Cincinnati, OH, USA.

*Introduction:* Arsine (AsH<sub>3</sub>) is a toxic substance that can be produced in when an acid is exposed to metals containing arsenic. A common source of Arsine is the computer industry where gallium arsenide is used in the manufacture of computer chips. Arsine is toxic to cells, producing fulminant hemolytic anemia and subsequent nephrotoxicity. We report a case series of three individuals exposed to arsine. All presented to the same hospital within 48 hours with back pain and hematuria, developed rhabdomyolysis but subsequently did well. *Case Report:* Case 1: A 55-year-old male arrived in an emergency department (ED) complaining of back pain and hematuria. He was presumed to be septic as he was febrile with a leukocytosis and hypotension. During his hospital stay it was revealed that he had been exposed to arsine gas at his job in the computer industry. He developed further hemolysis, rhabdomyolysis, and renal failure. He required blood transfusion and renal dialysis. His condition improved. He was discharged but still in need of dialysis. Case 2: A 38-year-old male who works in a decontamination job, presented to the ED complaining of back pain and dark urine. The spot urine arsenic level was 2247 ug/L. A blood level was 233 ug/L. He was started on succimer. He had evidence of hemolysis. His hospital course was uneventful and he was discharged on succimer. Case 3: A 46-year-old male mechanical engineer who works with arsenic presented to the ED complaining of back pain and dark urine over the previous day. He also had hemolysis and renal failure, and was admitted to the ICU. He received supportive care with IV fluid hydration and succimer. He required transfusion of two units of packed red blood cells. He improved and recovered his renal function. *Case Discussion:* We report three cases of arsine gas exposure that resulted in hemolytic anemia and rhabdomyolysis that resolved with supportive care and succimer therapy. Local surveillance for case cluster such as these is important and misdiagnosis is possible if a good exposure history is not taken. The relatively benign course experienced by these patients is noteworthy.

#### 243. Accidental Ingestion of Sodium Sulfur Arsenate Proves Rapidly Fatal

Sawyer TS,<sup>1</sup> Moran D,<sup>2</sup> Lowry JA.<sup>1</sup> <sup>1</sup>University of Kansas Hospital and Medical Center, Kansas City, KS, USA; <sup>2</sup>Wesley Medical Center, Wichita, KS, USA.

*Introduction:* A young adult student mistakenly ingested 48.6% w/w sodium sulfur arsenate pesticide rapidly progressing to his death. *Case Report:* A 23 yo student accidentally ingested an insecticide which contained sodium sulfur arsenate 48.6%. The product rapidly caused multiple episodes of emesis and the patient lost consciousness. The ingestion occurred 4 hours prior to when the paramedics were summoned, and patient transported to the hospital. Upon arrival the patient was tachycardic with a systolic blood pressure below 90 mmHg. Dopamine 10 mcg and vasopressin 5 mcg had little effect on his systolic blood

pressure. Fluids did increase the systolic blood pressure to 100 mmHg. He was given approximately 10 liters of fluids with no urine output. BAL in oil 225 mg of was given IM. An abdominal xray revealed the patient had an ileus. A haze of arsenic could be seen in the stomach, but no arsenic was seen in the colon. Ultrasound of the kidney showed significant changes. His BUN was 28 mg/dl and his creatinine was 4.2 mg/dl. He had electrolyte abnormalities, hypocalcemia (3.9 mg/dl ionized), hypomagnesemia (0.9 mEq/L) and hyperphosphatemia(5.4 mg/dl). Calcium gluconate and MgSO<sub>4</sub> were given. He was acidotic with a pH of 7.04, PCO<sub>2</sub> 16 mm Hg, PO<sub>2</sub> 151 mm Hg, HCO<sub>3</sub> 7.1 mEq/L and a base excess of 24.6 mEq/L. Initially he presented with a platelet count of 97 K/mm<sup>3</sup> which dropped to 51 K/mm<sup>3</sup>. He experienced respiratory difficulty and was intubated. He quickly developed pulmonary edema. Despite aggressive treatment the patient had a cardiac arrest and expired 5.5 hours after presentation to the ER. Post mortem arsenic level was 65,000 mcg/l (normal<25 mcg/specimen). *Case Discussion:* This case demonstrates that arsenic affects multiple organ systems. Arsenic poisoning starts initially with GI symptoms and rapidly progresses to all other organs. *Conclusion:* Arsenic once known as the “King of Poisons” is one of the most rapidly acting and fatal poisons known. As shown with this case, arsenic affects every organ system and can rapidly lead to death.

#### 244. Low Dose Arsenic Exposure and Urinary 8-OHdG in Arizona and Sonora

Burgess JL,<sup>1</sup> Josyula AB,<sup>1</sup> Montenegro M,<sup>1</sup> Kurzius-Spencer M,<sup>1</sup> Hysong TA,<sup>1</sup> Rowland H,<sup>1</sup> Sturup S.<sup>2</sup> <sup>1</sup>The University of Arizona, Tucson, AZ, USA; <sup>2</sup>Dartmouth College, Hanover, NH, USA.

*Background:* Although arsenic exposure at concentrations exceeding 100 µg/L in drinking water is associated with increased cancer incidence, information on the health effects of lower exposure levels is limited. Urinary 8-hydroxydeoxyguanosine (8-OHdG) is a biomarker of DNA oxidative damage and repair. The objective of this study was to determine whether arsenic exposure at concentrations below 50 µg/L is associated with oxidative damage to DNA. *Methods:* Tap water and urine samples were collected from nonsmoking adults residing in southern Arizona and northern Mexico (Sonora). Urine samples were analyzed for arsenic, 8-OHdG and creatinine levels. *Result:* The mean±standard deviation (S.D) of tap water arsenic concentrations (µg/L) were 4.0±2.3 in Tucson, Arizona (AZ), 20.3±3.7 in Ajo, AZ, 4.8±0.13 in Campo 47, Sonora, and 33.3±.6 in Esperanza, Sonora. The mean±S.D of total inorganic urinary arsenic (µg/L) was lower in Tucson (n=32, 11.00±12.0) than in Ajo (n=40, 29.13±20.4) (p<0.001), and lower in Campo 47 (n=11, 41.0±28.7) than in Esperanza (n=11, 93.5±44.6) (p=0.001). Urinary 8-OHdG concentrations did not vary significantly between the two sites in either Arizona or Sonora. In addition, after adjusting for potential confounders including urine creatinine levels, no significant association between 8-OHdG and urinary arsenic was observed. *Conclusion:* In the populations evaluated in this study, drinking water arsenic concentrations below 50 µg/L were not associated with changes in urinary 8-OHdG concentration.

#### 245. Illegal Mercury Containing Skin Creams Identified Through NYC HANES Participation

Kirrane BM,<sup>1,2</sup> Jeffery NL,<sup>2</sup> Kass D,<sup>2</sup> Leighton J,<sup>2</sup> Thorpe L,<sup>2</sup> Hoffman RS.<sup>1,2</sup> <sup>1</sup>New York City Poison Control Center, New York, NY, USA; <sup>2</sup>New York City Department of Health and Mental Hygiene, New York, NY, USA.

*Background:* Mercury (Hg) is a known component of many skin lightening creams manufactured outside of the US. The FDA prohibits sale of creams that contain >1 parts per million (ppm) Hg (0.0001%). Despite this, imported creams containing Hg continue to be sold in the US, placing consumers at risk for intoxication. The New York City Health and Nutrition Examination Survey (NYC HANES), modeled on the National HANES, was designed to ascertain the prevalence of health outcomes, risk factors, and environmental exposures in adults. We describe a case of an elevated urine Hg in a woman using a Hg-containing skin-lightening cream and subsequent investigation that was only recognized through her participation in the NYC HANES. *Methods:* A 22 year-old Dominican woman was randomly selected to participate in NYC HANES. Her spot urine Hg level was 96 mcg/L, and a follow-up 24-hour urinalysis revealed a Hg level of 205 mcg/L (normal<20 mcg/L). The patient complained of irritability, but was otherwise asymptomatic. An extensive phone interview failed to identify a source of her Hg exposure. *Result:* A skin-lightening cream was discovered on a subsequent home visit. This cream contained 6,190 ppm (0.62%Hg). The NYC Department of Health and Mental Hygiene collected 11 imported skin-lightening products (either

improperly labeled or listing Hg as an ingredient) from NYC stores and the FDA analyzed them for Hg content. Six of the products contained Hg above the FDA limit (range from 4,700 to 41,600 ppm). Following a press conference, numerous calls were received by the Poison Control Center about mercury in skin creams. Caller zip code data from these calls were used to help target public health actions to raise awareness and discourage importation of these products. *Conclusion:* Creams containing mercury continue to be sold in the United States despite FDA laws prohibiting their sale. Health surveys utilizing bio-monitoring, such as NYC HANES, are valuable tools in identifying public health risks.

#### **246. Massive Strontium Ferrate Ingestion Does Not Produce Acute Toxicity**

Kirrane BM, Hoffman RS, Nelson LS. *New York City Poison Control Center, New York, NY, USA.*

*Introduction:* Many flexible magnets contain cobalt, and as such have the potential for serious toxicity. Some magnets also contain strontium ferrate, the toxicity of which is largely unknown. We report an intentional ingestion of strontium ferrate magnets that did not produce toxicity despite significantly elevated strontium levels. *Case Report:* A 22 year-old man with a history of psychosis was brought to the ED after he was witnessed to pulverize and ingest flexible adhesive magnets. The patient reported auditory hallucinations upon presentation to the ED, but was otherwise without complaint. Vital signs were: BP, 120/78 mmHg; P, 76 beats/minute; RR, 14 breaths/minute; Temp, 98.6°F orally. His physical examination was unremarkable, as were his CBC, electrolytes, renal and liver function and coagulation tests. Urine toxicology was positive for tetrahydrocannabinol. An abdominal x-ray revealed radioopaque material throughout the GI tract consistent with a metal ingestion. The magnetic tape was identified by the manufacturer as containing strontium ferrate. The patient received whole bowel irrigation and a repeat abdominal film one day later showed clearing of the substance from the bowel. *Case Discussion:* His initial serum strontium level 2900 mcg/L, and a urine strontium was 15,000 mcg/L (reference range for blood and urine: <240 mcg/L, occupational threshold 800 mcg/L). A repeat urine level one week later was 370 mcg/L. He remained asymptomatic, and was discharged to a psychiatric unit on hospital day 7. *Conclusion:* Strontium is a group IIa metal that is currently used in the production of flexible adhesive magnets. Clinicians should attempt to identify the exact substance when magnets are ingested as different products pose significantly different risks. This is the first reported exposure to strontium ferrate and documents that although strontium absorption occurs following ingestion, there appears to be no acute toxicity.

#### **247. Mercury Absorption Following Elemental Mercury Ingestion**

Ginsburg BY, Greller HA, Freyberg C, Hoffman RS, Nelson LS. *New York University School of Medicine, New York, NY, USA.*

*Introduction:* Ingestion of elemental Hg is relatively common. Absorption is believed to be negligible in patients with normal GI function. We report a large intentional ingestion of elemental Hg that resulted in significant intestinal absorption. *Case Report:* A 62 year-old man with alcohol abuse and depression presented to the ED with abdominal pain that began after ingesting 180 mL of elemental Hg in a suicide attempt about 30 hrs earlier. Vital signs were: BP, 190/92 mm Hg; P, 121/min; RR, 16/min; and T, 97.4°F. On examination, mild suprapubic tenderness and a resting tremor were noted. The patient received benzodiazepines for presumed alcohol withdrawal with resolution of the tremor and restoration of normal vital signs. An abdominal x-ray revealed a large amount of radiopaque material in the right and sigmoid colon. Initial laboratory studies were unremarkable, except for a creatinine of 1.9 mg/dL, proteinuria, and hematuria, which resolved with IV fluid. The patient received several liters of WBI with PEG-ELS without benefit. Although a high fiber diet with IV metoclopramide and erythromycin, and oral sorbitol helped clear his gut, minimal punctate Hg densities persisted in the colon, that were not consistent with diverticular disease, one month after the ingestion. Serial blood Hg levels (in mcg/L) over the month following ingestion were 272.4, 454.0, 198.2, and 78. Urine Hg levels (in mcg/24 hrs) over this same time were 179, 548, 316, 238, 166, and 315. The patient never developed signs of neurotoxicity and did not receive chelation therapy. The patient was lost to follow-up. *Case Discussion:* Significant absorption of elemental Hg may occur following ingestion in patients with abnormal intestinal mucosa. This patient had no known GI pathology that would enhance absorption. Mercury may be absorbed by cells following vaporization, which readily occurs at body temperature, and subsequently converted to mercuric ion intracellularly. *Conclusion:* Significant absorption of elemental Hg can occur in normal patients following massive

ingestion. Although most small ingestions of elemental Hg require no follow-up, serial evaluations should be performed following massive ingestion.

#### 249. Use of Toxicity Data in Determining In-House Concentrations Following a Catastrophic Release of Ammonia in a Derailment of Tankcars

Cavender FL, Millner GC, Goad PT. *Center for Toxicology and Environmental Health, Little Rock, AR, USA.*

**Background:** On January 18, 2002, approximately 230,000 gallons of anhydrous ammonia were released in a tankcar derailment near Minot, SD. The resulting toxic, heavier-than-air cloud extended some 4.3 miles from the release site and hung over the town and valley for several hours. **Methods:** Atmospheric modelling of the release indicated that the outdoor concentration 1.2 miles from the release site was 4460 ppm four hours after the initial release. By that time, the indoor concentration was estimated to be 3500 ppm. An evaluation of the toxicity of ammonia leads one to predict that hundreds of residents would have died in an exposure of this magnitude. In reality, only one death occurred in this release and this person ventured out of his home into the toxic cloud. In addition, 300 residents reported to emergency rooms and 11 were admitted to the hospital. A reexamination of indoor concentrations was attempted using clinical symptoms reported by exposed residents. **Result:** Based on the reported symptoms, the indoor concentrations could not have exceeded 150 ppm for as much as one hour in most houses. **Conclusion:** Atmospheric models are currently inadequate to predict indoor concentrations in a catastrophic release; however, clinical toxicology provides an adequate basis for determining indoor exposure concentrations based on the symptoms reported.

#### 250. Deadly in a Drop (or a Few Drops): Chemicals That Can Kill Following Very Small Volume Skin Exposures

Greenberg MI,<sup>1</sup> Curtis JA,<sup>1</sup> Hendrickson RG.<sup>2</sup> <sup>1</sup>*Drexel University College of Medicine, Philadelphia, PA, USA;* <sup>2</sup>*Oregon Health Science University, Portland, OR, USA.*

**Introduction:** Considerable interest exists regarding chemicals that might be used by terrorists in attacks against military or civilian populations or following accidental environmental releases. Of special concern is the fact that many chemicals with the ability to kill or seriously injure humans are stored, used, and transported in or near a variety of U.S. population centers. These chemicals generally pose inhalational threats. There are, however, a variety of chemicals that may pose serious threats to human life secondary to dermal exposures. This study identified chemicals capable of lethality following very small volume skin exposures. **Case Report:** Candidate chemicals were ascertained from the OSHA list of so-called highly hazardous chemicals (1910.119 App A) and other sources. LC 50 and LD 50 data were sought for all candidate chemicals. Chemicals with efficient dermal absorption and indicting LC/LD data were identified and correlated with reports that documented the potential for lethality following dermal exposure. **Case Discussion:** Chemicals capable of lethality following very small volume skin exposure are listed in Table 1. **Conclusion:** These chemicals are important occupational hazards as well as potential threat

TABLE 1  
Chemicals capable of lethality following very small volume skin exposure

Dimethyl mercury	Tricothecene mycotoxin	Xylyl bromide
VX	Chloropicrin	Bromopicrin
Pentaborane	Sulfur mustard (H, not HD)	Cyanogen chloride
Decaborane	Tellurium hexafluoride	Phenylphosphine
Trimethyltin	Iron pentacarbonyl	Phenyldichloroarsine
Ethyl mercury	Sodium monofluoroacetate	Phosgene oxime
Methyl fluorosulfonate	Acetone cyanohydrin	Methyl chloroformate
Osmium tetroxide	Methyl vinyl ketone	Dichlorophenol

agents for terrorist use given the potential lethality following dermal exposure in very small volumes. Prehospital providers, emergency physicians and medical toxicologists must be made aware of the possibility of lethality following very small volume skin exposure to a wide variety of chemicals.

### 251. Cyanide Intoxication in an Acrylonitrile Chemical Accident

Hung D, Hsu C, Chen Y. *Division of Toxicology, Emergency Department, Taichung Veterans General Hospital, Taichung City, Taiwan, Taiwan.*

*Objective:* Acrylonitrile is widely used in the production of plastics, resins, and as a chemical intermediate in the synthesis of many other industrial products. Acrylonitrile is metabolized in humans and experimental animals via two pathways, glutathione dependent pathway and alternative oxidative pathway. In addition to the suspected carcinogenicity, acrylonitrile is a high-volume chemical and displays a very pronounced acute toxicity. The delayed occurrence of acute acrylonitrile intoxication in humans is largely determined by the metabolic formation of cyanide through alternative oxidative pathway. In literature, only few cases of occupational acrylonitrile exposure presented with significant cyanide intoxication. *Patients and Methods:* In April 2003, a chemical truck happened to a traffic accident on the road and led to about 35 tons of liquid acrylonitrile leakage. Most of the emergency responders, including the drivers, volunteer firemen and bystanders, didn't wear suitable personal protective equipments. There were 32 patients transferred to our emergency room due to varied clinical symptoms after 6 hours' exposure. We assayed the blood cyanide and plasma thiocyanate level of these patients. *Result:* Total 32 patients with complaints of dizziness, short of breath, chest tightness and thirsty were examined. The blood cyanide level was noted to be 8 ug/l to 227 ug/l and plasma thiocyanate 1.7 ug/ml to 11 ug/ml. Mild metabolic acidosis was noted in two cases. Only 10 patients received sodium thiosulfate injection therapy due to shortage of antidote. All of the patients discharged with stable condition after one night's observation. *Conclusion:* Minimal cyanide intoxication was noted in about 6 hours' acrylonitrile exposure. The rationale of antidote use in acrylonitrile intoxication needs more studies. The improvement of special antidotes storage is obligatory.

### 252. Delayed Partial Thickness Skin Burns Following Exposure to Carboquat (Didecyl Dimethyl Ammonium Carbonate and Didecyl Dimethyl Ammonium Bicarbonate)

Rowden AK, Eldridge DL, Holstege CP. *Division of Medical Toxicology/University of Virginia, Charlottesville, VA.*

*Introduction:* Carboquat (didecyl dimethyl ammonium carbonate and didecyl dimethyl ammonium bicarbonate) has never been reported to cause human toxicity. We report the first case of human partial thickness dermal burns following topical exposure. *Case Report:* A previously healthy 48 year old male was repairing storage tanks containing Carboquat 150 T. He was not wearing personal protective equipment. His clothing in the region of the right buttock and his left forearm became partially saturated with Carboquat resulting in skin contact for approximately 8 hours. He noted progressive discomfort in those areas and noted skin erythema. The following day, he presented to his doctor with progressively worsening pain and erythema in the same regions of contact, was diagnosed with cellulitis, and placed on cephalexin. Over the ensuing 3 days, his pain increased and his skin lesions progressed from simple skin erythema, to multiple bullae, to open wounds prompting him to again seek medical attention. His physical exam was significant for a 5 × 10 cm circular eschar on his right buttock and a 2 × 2 cm eschar on his anterior left forearm, both with minimal surrounding erythema. Both skin lesions corresponded to the regions where he was in contact with his Carboquat saturated clothing. His basic metabolic profile, complete blood count, and blood culture were all unremarkable. He was discharged with the diagnosis of Carboquat-induced second degree chemical burns. *Case Discussion:* Carboquat is utilized as a wood preservative. Animal studies demonstrate it has potential to cause skin burns, but no human case reports exist. *Conclusion:* We report the first case of Carboquat induced second degree burn in a human following prolonged skin exposure. Skin contact with Carboquat should be avoided.

### 253. Iron Deficiency and Blood Cd, Pb, and Hg Levels in Pregnant Women in the United States

Wang RY, Jain R, Pfeiffer CM, Jones RL, Needham LL, Sampson EJ. *National Center for Environmental Health/Centers for Disease Control and Prevention, Atlanta, GA, USA.*

**Background:** To evaluate the contribution of iron deficiency to blood levels of metals in pregnant women. **Methods:** Cross sectional design consisting of 558 pregnant and 1901 non-pregnant women participating in NHANES (1999 to 2002), who ranged in age from 17 to 39 years. Iron storage status was assessed by serum ferritin (SEFR) measured by radio immunoassay: depleted (<12 µg/L), deficient (12 µg/L to ≤20 µg/L), and replete (>20 µg/L). Whole blood cadmium (Cd), lead (Pb), and total mercury (Hg) were measured by atomic absorption spectrometry. Data analysis included linear regression and ANCOVA. Covariates included age, smoking status, BMI, SEFR level, race/ethnicity, and dietary fish and shellfish intake. Alpha was set at 0.05. **Result:** In pregnant women, the mean duration of gestation was 5.4 months (range 1 to 10), and blood levels (geo. mean, 95 CI) for metals were: Cd (0.35 µg/L, 0.31–0.38), Pb (0.80 µg/dL, 0.71–0.90), and Hg (0.71 µg/L, 0.57–0.87). Pregnant women had lower SEFR levels and the effect was progressive during the gestational period. Low iron storage was associated with a higher blood Cd level, regardless of pregnancy. Pregnant women with absent iron storage had a 1.2-fold higher blood Cd level than women with replete iron storage. For Pb, this effect was observed only in non-pregnant women. In pregnant women with low iron storage, blood Pb level decreased. Blood Hg level decreased in non-pregnant women with low iron storage. **Conclusion:** Low iron storage status is associated with higher blood levels of certain metals in women, depending on pregnancy status. For cadmium, blood level increases with low iron storage, and this effect becomes more pronounced in pregnant women at term. Increased dietary uptake of divalent cations can contribute to this effect. Alternative mechanisms need to be sought to explain the effects observed for mercury and lead.

#### 254. Persistent Organochlorine Chemicals in Pregnant Women in the United States

Wang RY, Jain R, Turner WE, Cash T, Patterson DG, Needham LL. *National Center for Environmental Health/Centers for Disease Control and Prevention, Atlanta, GA, USA.*

**Background:** Characterization of the exposure to persistent organochlorine chemicals in pregnant women in the United States. **Methods:** Levels (lipid-adjusted) for 25 PCBs, 6 PCDDs, 9 PCDFs, and 9 organochlorine pesticides were measured by GC/HRMS in serum from 74 pregnant and 196 non-pregnant women, from 20–39 years of age and participating in NHANES (1999–2000). Data analysis included linear regression and ANCOVA. Covariates included age, smoking status, BMI, race/ethnicity, and location of US birth. Alpha was set at 0.05. **Result:** The mean duration of gestation in pregnant women was 5.5 months (range 2 to 9), and mean ages (yrs.) of pregnant and non-pregnant women were 27.0 and 30.0, respectively. In pregnant women, serum levels were as follows (GM, 95 CI): OCDD 188 pg/g (145–243), 1234678HpCDD 26 pg/g (21–31), ppDDE 119 ng/g (89–161), and trans-nonachlor 11 ng/g (9–13). These levels were not different by pregnancy status and correlated directly with age. ppDDE level was higher in women of non-US births, and in Mexican-Americans. The estimates at the 95th percentile (95 CI) for the levels of the following chemicals in pregnant women were: 123678H×CDD 26 pg/g (16–30), 1234678HpCDD 75 pg/g (35–105), 23478PeCDF 10 pg/g (4–18), 1234678HpCDF 12 pg/g (10–44), for the indicator PCBs 118 and 180 they were 12 ng/g (5–21) and 19 ng/g (11–67), respectively, and for ppDDT 19 ng/g (8–45). The estimate at the 95th percentile for the TEQ (PCBs, PCDDs, PCDFs) (WHO'98) in pregnant women was 8.6 pg/g (95 CI 4.2–12.8). **Conclusion:** The levels of these persistent organochlorine chemicals in pregnant women are low and reflect a decreasing trend in environmental exposure to the general population since the ban/reduction of these chemicals in the United States. In pregnant women, increased age and foreign birth (for DDT and DDE) are associated with higher levels of these chemicals, which is similar to that observed in other populations.

#### 255. Sputum Cytokines and Longitudinal Decline in Lung Function in Firefighters

Josyula AB,<sup>1</sup> Kurzius-Spencer M,<sup>1</sup> Littau SR,<sup>1</sup> Fleming J,<sup>2</sup> Burgess JL.<sup>1</sup> <sup>1</sup>The University of Arizona, Tucson, AZ, USA; <sup>2</sup>Phoenix Fire Department, Phoenix, AZ, USA.

**Background:** Firefighters demonstrate extensive variability in annual change in lung function with some exhibiting increased rates of decline. Interleukin-8 and -1β (IL-8 and IL-1β) are proinflammatory cytokines and IL-8 also is involved in recruitment of neutrophils into the lung. In this study we evaluated the association between longitudinal decline in lung function and proinflammatory cytokine concentration in sputum. **Methods:** A convenience sample of 69 firefighters was recruited from the Phoenix Fire Department. Occupational exposure history, medical history with prior 5-years pulmonary function data, and

induced sputum were collected. Sputum samples were processed for cell differential counts and supernate was analyzed for IL-8 and IL-1 $\beta$  using ELISA. A multiple linear regression model was used to evaluate the relation between decline in FEV<sub>1</sub> and sputum cytokines. *Result:* The rate of annual change in FEV<sub>1</sub> ( $\Delta$ FEV<sub>1</sub>) averaged (0.005 $\pm$ 0.105) L/yr. After adjusting for potential confounders including age, height, and baseline FEV<sub>1</sub>, increased log IL-8 concentration was positively associated with more rapid annual decline in FEV<sub>1</sub> (p=0.003). Log IL-1 $\beta$  was not significantly associated with  $\Delta$ FEV<sub>1</sub> (p=0.078). Percentage neutrophils was significantly correlated with IL-1 $\beta$  (p=0.002) but not IL-8. *Conclusion:* Higher sputum IL-8 levels are associated with increased rate of decline in lung function in firefighters, indicating that increased baseline inflammation measured as sputum IL-8 could contribute to accelerated rate of decline in lung function.

## 256. Environmental Arsenic Exposure and Sputum Metalloproteinase Concentrations

Josyula AB, Rowland H, Kurzius-Spencer M, Kopplin M, Lantz RC, Burgess JL. *The University of Arizona, Tucson, AZ, USA.*

*Background:* Exposure to inorganic arsenic through drinking water is associated with an increased rate of lung cancer. The objective of the study was to determine if low-level arsenic exposure causes changes in lung inflammation measured by sputum metalloproteinase and anti-protease activity. *Methods:* Subjects residing in Ajo and Tucson, AZ were recruited for the study. Tap water and first morning void urine were analyzed for arsenic. Matrix metalloproteinase 2 and 9 (MMP-2, MMP-9) and tissue inhibitor of metalloproteinase 1 (TIMP-1) in induced sputum were measured using ELISA. *Result:* Tap water arsenic levels for 40 subjects in Ajo, AZ (20.3 $\pm$ 3.7  $\mu$ g/L) were higher than for 33 subjects in Tucson, AZ (4.0 $\pm$ 2.3  $\mu$ g/L). Log-normalized MMP-2, MMP-9, and TIMP-1 concentrations were not significantly different between towns. However, after adjusting for potential confounders, both sputum MMP-9/TIMP-1 (p=0.005) and MMP-2/TIMP-1 (p<0.001) were positively associated with total urinary inorganic arsenic. Sputum TIMP-1 was negatively associated (p=0.005) with urine arsenic. *Conclusion:* Urinary arsenic concentrations were positively correlated with increased sputum protease/antiprotease ratios through a reduction of TIMP-1, suggesting inflammation as a possible carcinogenic mechanism of arsenic at low exposure levels.

## 257. Pesticide Contamination of Objects Repatriated Under the Native American Graves Protection and Repatriation Act: A Multi-Disciplinary Approach

Seifert SA,<sup>1</sup> Odegaard N,<sup>2</sup> Smith DR,<sup>2</sup> Smith DL.<sup>3</sup> <sup>1</sup>Nebraska Regional Poison Center, Omaha, NE, USA; <sup>2</sup>University of Arizona, Tucson, AZ, USA; <sup>3</sup>Winnebago Tribe, Winnebago, NE, USA.

*Background:* The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 provided for the return of human remains, funerary objects, sacred objects, and objects of cultural patrimony, from museums, universities, and federal agencies to Native American Tribes. As a routine part of preservation, many objects were treated with pesticides, including compounds of arsenic and mercury. Curatorial records are seldom complete. There is a potential for human exposures, particularly with transfer to non-museum settings or in return to cultural use. *Methods:* Four objects eligible for repatriation were evaluated by a team consisting of a museum conservator, an analytic chemist, a medical toxicologist, and tribal representatives. The following were addressed: 1) Object construction and collection history; 2) Quantitative determination of

TABLE 1  
Selected metal content of NAGPRA objects

Object	As	Hg	Pb	Cr
Headdress	—	—	—	+++
Medicine Bag 1	+	+	—	—
Medicine Bag 2	+	+	+	—
Leather Shirt	+++	+	+++	++

residues detectable by X-ray fluorescence spectroscopy (XRF); 3) Past, current and future object storage, handling, and use; 4) Exposure risk assessment and development of storage, handling, and use guidelines; 5) Communication of findings; and 6) Tribal concerns. *Result:* A headdress (rows of upright hair on a leather base), two medicine bags (otter skins with textile and metal attachments), and a leather shirt (semi-tanned buckskin and glass beads) were evaluated. XRF detected As, Cr, Fe, Hg, Pb, Rb, Sr, and Zr in the objects or attachments. General results are summarized in Table 1. *Conclusion:* One of four objects tested had high levels of arsenic and lead, without indications of prior pesticide treatment. This object poses significant potential health risks. Other metals detected were likely related to leather tanning, or in glass or metal attachments, and pose minimal health risks. A multi-disciplinary approach allowed a more comprehensive assessment of object history, pesticide contamination, tribal capabilities, the potential for human exposures, and in education efforts.

## 258. Polycyclic Aromatic Hydrocarbon Exposure and C-Reactive Protein Response

Wang RY,<sup>1</sup> Caudill SP,<sup>1</sup> Grainger J,<sup>1</sup> Ford ES,<sup>2</sup> Patterson DG,<sup>1</sup> Needham LL,<sup>1</sup> Myers GL.<sup>1</sup> <sup>1</sup>National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, GA, USA; <sup>2</sup>National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA, USA.

*Background:* People are exposed to polycyclic aromatic hydrocarbons (PAHs) from smoking and air pollution, which are associated with an inflammatory response. This study evaluates the association between PAH exposure and C-reactive protein in the general population. *Methods:* Cross sectional design consisting of participants in the National Health and Nutrition Examination Survey (1999 to 2000), who ranged in age from 6 to +20 years. Levels for the metabolites of 7 PAHs were measured in urine by GC/HRMS, and they were used as an index for PAH exposure. Serum C-reactive protein (CRP) was measured by latex-enhanced nephelometry. Data was analyzed with a multiple linear regression model with age, smoking status, gender, race/ethnicity, BMI, and urine creatinine as covariates. Alpha was set at 0.05. *Result:* In participants ranging in age from 6 to 19 years (n=729), the urinary level for 2-hydroxyphenanthrene correlated directly (p=0.01) with serum CRP level. A 50% increase in the 2-hydroxyphenanthrene level was associated with a 5.2% increase in the serum CRP level. Urinary levels of 1-, 2-, and 3-hydroxyphenanthrenes were all found to be higher in adult smokers than non-smokers. *Conclusion:* The above finding of the association between PAH (phenanthrene) exposure and an increase in the serum C-reactive protein level may be consistent with types of exposures known to contain PAHs and to cause an inflammatory response, such as smoking and air pollution. Additional work is necessary to corroborate this finding and to evaluate whether this effect is directly attributable to either PAH or another agent and PAH is serving as a surrogate marker for its exposure.

## 259. Monitoring of Human Operators During 1080 Baiting Operations in New Zealand—Exposure Assessment and Establishment of a Biological Exposure Index

Beasley M,<sup>1</sup> Fisher P,<sup>2</sup> O'Connor C,<sup>2</sup> Eason C.<sup>2</sup> <sup>1</sup>National Poisons Centre, Dunedin, Otago, New Zealand; <sup>2</sup>Landcare Research, Christchurch, Canterbury, New Zealand.

*Background:* Sodium fluoroacetate (1080) is a pesticide commonly used for field control of vertebrate pests in New Zealand. While its acute toxicity is well described, little is known about its chronic effects in humans, but recently completed animal studies suggest potential for significant fetal, male fertility, and cardiac effects following repeated exposure. Strict minimization of exposure in personnel involved in preparation and application of baits is therefore imperative. *Methods:* We developed a protocol for collection and analysis of 1080 in blood, urine, and breathing-zone air samples in volunteer operators, as a means of assessing exposure during 1080 bait distribution in the field. We subsequently derived a provisional biological exposure index (BEI) for 1080 concentrations in urine, as a basis for determining the acceptability of exposure control measures. *Result:* Initially results were classified into one of three levels. The highest exposures were found with aerial carrot bait operations (and bait formulation), and despite use of gloves and face shields (and masks by the majority of workers), only modest reduction of exposure was found in a second monitoring program. This highest exposure category meant the exposure level was also above the selected urinary BEI value of 0.015 mg/L. *Conclusion:* Certain work practices are the probable cause of exposure levels just exceeding the BEI. Changes in work practices have reduced exposure but monitoring is necessary to ensure their ongoing benefits and for compliance. As the BEI is not based on substantial human data, exposure below this value does not guarantee no potential long-term effects, and a broader program of health monitoring is desirable.

TABLE 1  
Hydrocarbon hazard factors and major effect/death outcome rates by age

Hydrocarbon category	Age	Number of cases	Hazard factor	Est. no./1000
Benzene	>59	12	10.94	83.33
Toluene/xylene	20–59	110	5.21	27.27
Halogenated, other	<6	57	4.82	17.54
Kerosene	20–59	4,736	3.95	20.69
Lamp Oil	>59	120	3.28	25.00
Halogenated, other	>59	283	3.25	24.73
Toluene/xylene	<6	17,905	2.95	10.72
Other	20–59	2,272	2.94	15.40
Halogenated, other	>59	180	2.92	22.22
Fluorocarbon	13–19	2,127	2.81	21.63
Halogenated, other	13–19	3,701	2.35	18.10
Halogenated, other	<6	9,870	2.17	7.90
Other	6–12	187	2.15	5.35
Mineral spirits	13–19	435	2.09	16.09
Toluene/xylene	6–12	402	2.00	4.98

## 260. Hydrocarbon Toxicity: An Analysis of AAPCC TESS Data

Cobaugh DJ,<sup>1</sup> Krenzelok EP,<sup>2</sup> Seger DL.<sup>3</sup> <sup>1</sup>ASHP Research and Education Foundation, Bethesda, MD, USA; <sup>2</sup>Pittsburgh Poison Center and University of Pittsburgh Schools of Pharmacy and Medicine, Pittsburgh, PA, USA; <sup>3</sup>Tennessee Poison Center and Vanderbilt University School of Medicine, Nashville, TN, USA.

**Background:** The objective of this study was to calculate, by age group, hazard factors (HFs) and estimated major effect and death rates for hydrocarbon categories included in the Toxic Exposure Surveillance System (TESS). **Methods:** Outcome data for single-substance, hydrocarbon exposures reported to TESS from 1994 through 2003 were analyzed. Only cases with definitive medical outcomes were included. Analysis was stratified by 5 age groups – <6 years, 6–12 years, 13–19 years, 20–59 years, >59 years. HFs were determined by calculating the sum of the major effects and deaths for each hydrocarbon category and dividing this by the total number of exposures for that category. To normalize the data, the overall rate of major effects and deaths for each age group was assigned an HF of 1. Hydrocarbon categories with a HF of >2.0 were included in the final analysis. Estimated rates of major effect and death outcomes (outcomes/1,000 people) were also calculated. **Result:** 318,939 cases were analyzed. Table 1 summarizes the findings of this analysis. **Conclusion:** These data demonstrate that systemically absorbed hydrocarbons and those with low viscosities are associated with higher hazard factors. The risks associated with hydrocarbons often implicated in abuse by older children and adolescents are also confirmed.

## 261. Study of Some Controversies in Carbon Monoxide Poisoning

Dueñas-Laita A,<sup>1</sup> Pérez-Castrillón JL,<sup>2</sup> Martín-Escudero JC,<sup>2</sup> Ruiz-Mambrilla M,<sup>2</sup> Enriquez Giraud P.<sup>2</sup> <sup>1</sup>Regional Unit of Clinical Toxicology, Río Hortega Hospital, Department of Medicine, University of Valladolid, Valladolid, Spain; <sup>2</sup>University of Valladolid, Valladolid, Spain.

**Background:** Carbon monoxide (CO) poisoning is a frequent problem, about which there is little epidemiological data available in Spain. In addition, certain aspects of its physiopathology, toxicokinetics, and short and long-term neurological sequelae are controversial. The object of the present study was to better typify the epidemiological profile of acute carbon monoxide poisoning (COP) and to analyze some of the existing controversies in toxicokinetics and in delayed neuropsychiatric syndrome. **Methods:** During a seven-year period (1998–2004), data from the COP patients admitted to the Emergency

Department of the hospitals in Valladolid, Spain, were analyzed prospectively. During the final two years of the study (2003–2004) the half-life ( $t_{1/2}$ ) of the carboxyhemoglobin (COHb) in patients with COP treated with 100% oxygen was calculated. In identical periods, 1–2 weeks and 2 months after COP, short-term memory was evaluated by standardized tests in both the patients and in a control population paired by sex and age. *Result:* During the study period, 621 COP cases ( $88.7 \pm 9.2$  cases/year) were registered, 29 of which ( $3.2 \pm 0.9$ ) died before reaching the hospital. Heaters and water heaters were the cause in 67.6% of the cases. The  $t_{1/2}$  of the COHb in the patients ( $n=105$ ) was  $83 \pm 34$  minutes and in the newborn and infants ( $n=5$ ,  $<90$  days) it stood at  $140 \pm 7$  ( $p < 0.001$  vs. the remainder of the sample). Memory worsened 1–2 weeks after COP ( $n=54$ ) with respect to the paired controls ( $p < 0.01$ ) and reestablished itself at two months ( $p < 0.01$ ) in the patients with COP. *Conclusion:* COP is probably a more prevalent medical emergency than is suspected in Spain with a high mortality among the pathology produced by toxins. The newborn and infants ( $<90$  days) represent a subpopulation that eliminates CO more poorly than adults. Memory disorder affects a high percentage of those patients with COP but who do recover in the short term.

## 262. Health Hazards and Community Responses to Arsenic Effects in Developing Country

Joshi SD, Pandit N, Kumar S. *Nepal Medical College and Teaching Hospital, Kathmandu, Nepal.*

*Background:* The arsenic hazard in Nepali villages now appeared as a ‘real disaster’, affecting thousands physically, physiologically, mentally and economically; it is intensifying malnutrition, poverty and destitution among the already poor villagers. The majority of people in these areas have no awareness about these hazards. *Methods:* Water samples from different areas were collected on the other hand hospital patients and community people were interviewed about these hazards. The data was edited and analyzed with the help of EPI info software. *Result:* The relation between the water samples contained arsenic and its hazards shown that in the rural areas where the people are mostly dependent on ground water (tube wells) without purification and long term drinking of this water are mostly affected. The awareness and purification about the arsenic contamination is negligible among community people. In hospital patients 33% have diffused hyper-pigmentation, 46% have Hepatomegaly 14% have malnutrition with weight loss, 5% have Mee’s lines in nails, 2% have other symptoms. *Conclusion:* The result shows the health hazards is increasing day by day and there is necessary of prompt action in those areas and awareness program among community people. Lesson learned: Most of the rural areas people don’t know about this hazards. There is need of;

- Community education and awareness.
- Purification of water.
- Should include this subject in school curriculum
- Joint work among government and other organizations in affected areas.

## 263. Intraoperative Lead Levels During Surgical Removal of Retained Bullet Fragments

Haroz R, Qahwash O, Kralick FA, Greenberg MI. *Drexel University College of Medicine, Philadelphia, PA, USA.*

*Introduction:* Lead toxicity from retained bullets is not common. Bullets in contact with joint fluid may present a greater risk of systemic absorption and often need to be surgically removed. Case reports reveal that surgical removal without prior chelation may result in remobilization and systemic redistribution of lead. We are reporting what we believe is the first case where intraoperative blood lead levels (BLL) were obtained during bullet fragment removal. *Case Report:* A 34-year-old male presented with a change in mental status, weight loss, abdominal pain and progressive weakness. The patient had sustained multiple gunshot wounds nine years previously. On admission, the hemoglobin was 6.5 g/dL with basophilic stippling. The BLL was 160 mcg/dL, and the CSF level was 130 mcg/dL. Radiographic studies showed bullet fragments in the left supraclavicular and C7-T2 regions with disintegration of bullet fragments compared to previous studies. Parenteral chelation was initiated with BAL and EDTA. BLLs stabilized, and the patient was taken to surgery for bullet removal. BAL was administered 4 hours prior to surgery and succimer was continued for one week post-operatively. Surgery to remove bullet fragments from within the vertebral canal lasted seven hours. Nine intraoperative lead levels were drawn at 40 minute intervals to determine whether tissue

manipulation caused BLLs to rise. Intraoperative BLLs ranged from 36–48 mcg/dL and were consistent with pre-operative levels. *Case Discussion:* Surgical manipulation of joints, tissue and bone in order to remove bullet fragments has been reported to cause elevations in BLLs. The consequent potential for redistribution of lead into the CNS and soft tissue is a concern. Instituting chelation prior to surgery has led to improvement in outcomes in previous cases. The case we report demonstrates that with preoperative chelation BLLs remained relatively low despite extensive surgical manipulation of bullet fragments. *Conclusion:* Intraoperative BLLs drawn during removal of cervical retained bullet fragments remained low. This may be attributable to the chelation therapy the patient received prior to surgery.

## 264. Phototoxic Keratoconjunctivitis from Coal Tar Pitch

Curtis JA, Greenberg MI. *Drexel University College of Medicine, Philadelphia, PA, USA.*

*Background:* Phototoxic keratoconjunctivitis is an uncommon occupational problem. We describe such a case in a roofer following exposure to coal tar pitch and sunlight. *Methods:* A 43 year-old roofer presented with ocular burning and itching. He indicates that his symptoms began shortly after tearing off a roof composed of coal tar pitch. He did not wear eye protection, but denied ocular exposure to the dust produced by his activities and had no symptoms while at work. While driving away from the site he developed lacrimation, a foreign body sensation, increasing pain and photophobia after exposure to sunlight through his windshield. The conjunctivae were noted to be hyperemic and there was a clear discharge from both eyes. Fluorescein staining revealed a large central corneal abrasion of the right eye. The patient was treated with ophthalmic antibiotics, cycloplegics and discharged to home. *Result:* Coal tar pitch is a semi-solid mixture of aromatic and aliphatic high molecular-weight hydrocarbons. The vapors released from pitch are referred to as coal tar pitch volatiles (CTPV). Both CTPV and coal tar dust are known to cause a phototoxic dermatitis characterized by an intense burning sensation or “tar smarts”, but the ability of CTPVs to cause a phototoxic keratoconjunctivitis is less well documented. Most phototoxic reactions are caused by excitation of electrons in aromatic compounds, primarily by UVA radiation (320–400 nm) which penetrates to deeper layers of the skin and which is not significantly blocked by window-glass. The initial exposure to the sensitizing agent may not have caused symptoms and thus may not be recalled by the patient. Symptoms develop within minutes to hours after ocular exposure to UV radiation. The clinical picture is that of a corneal abrasion with lacrimation, conjunctival injection and photophobia. Since the visual axis receives the most exposure to light, corneal defects tend to be central. *Conclusion:* Phototoxicity is a phenomenon by which adverse reactions to a xenobiotic are caused or accentuated by exposure to light. Topical and systemic photosensitization is a property of many medications and foods. Ocular phototoxicity is an uncommon but important occupational hazard.

## 265. Prolonged Increases in Troponin T After Carbon Monoxide Poisoning

Johnson-Arbor KK, McKay CA. *University of Connecticut/Hartford Hospital, Hartford, CT, USA.*

*Introduction:* Although carbon monoxide (CO) poisoning has been reported to cause transient reversible myocardial dysfunction, there are few reports that describe prolonged cardiotoxicity after CO exposure. We present a case of a patient with CO poisoning and cardiac symptoms who had prolonged elevation of troponin T without EKG or echocardiographic evidence of myocardial damage. *Case Report:* A previously healthy 36 year-old male was found in his car. He admitted to being suicidal, and stated that he had ingested a bottle of Unisom (doxylamine). In the Emergency Department, he was somnolent but complained of chest pain. Physical exam showed no signs of trauma. An EKG demonstrated sinus tachycardia. The patient's carboxyhemoglobin was 19%, and troponin T was 0.21 ng/mL (normal < 0.03 ng/mL). Due to a suspicion of CO-induced myocardial ischemia, the patient was transferred for hyperbaric oxygen therapy (HBO<sub>2</sub>T). At the referral hospital, the patient continued to complain of chest pain. Repeat EKG revealed sinus tachycardia without ischemic changes. Renal function was normal, and a urine screen for cocaine and amphetamines was negative. One hour after the first HBO<sub>2</sub>T was completed, the patient had an 8-beat run of asymptomatic ventricular tachycardia. An echocardiogram demonstrated normal systolic function and an ejection fraction of 60–65%. Serial troponin T measurements increased from 0.21 ng/mL before his first HBO<sub>2</sub>T to 0.28 ng/mL thirty-six hours after his removal from the car. The patient's chest pain slowly resolved, and he was transferred to psychiatry three days after admission. He was instructed to schedule outpatient stress testing after discharge from psychiatry, but was lost to follow-up. *Case Discussion:* Troponin T usually peaks 12 hours after myocardial injury. Despite the lack of

echocardiographic evidence of cardiac dysfunction, this patient had troponin T levels that continued to rise almost two days after his CO exposure. This may indicate ongoing myocardial cellular injury following removal from CO exposure, perhaps due to the presence of inflammatory mediators. *Conclusion:* Further investigation is needed to determine the relationship between CO poisoning, elevations in cardiac enzymes, and myocardial dysfunction.

## 266. Does a Toxidrome of Acute Cyanide Poisoning Exist?

Baud FJ, Guerrier G. *Lariboisière Hospital, Paris, France.*

*Background:* Cyanide poisoning is considered life threatening. The definitive diagnosis can only be made from the measurement of blood cyanide concentration, not immediately available in an emergency setting. Clinical findings resulting from cyanide poisonings are consistently described as nonspecific. Accordingly, no cyanide toxidrome has been reported. *Methods:* To test the hypothesis that a cyanide toxidrome does exist, we reviewed all cases of pure cyanide poisoning published in the medical literature and a few cases on which we consulted. Not included were victims of smoke inhalation and patients found dead at the scene. Clinical data were collected before any antidotal treatment. Oxygen may have been administered prior to collection of clinical data. Results are expressed as median [range] or percentages. *Result:* We summarize data from 138 acute pure cyanide poisonings reported since 1950. Cyanide poisonings primarily resulted from suicide attempts by ingestion. A typical case of cyanide poisoning was a 28-year-old male [1–83] presenting 37 min after exposure [3–720] with altered mental status (80%), mydriasis (75%), and abnormal respiratory pattern (100%). Seizures were witnessed in 26% of poisonings, pulmonary edema in 5%, and premature ventricular contractions in 18%. Heart rate was 100 bpm [0–176] and systolic blood pressure was 80 mmHg [0–168]. Arterial pH was 7.30 [6.4–7.6], PaCO<sub>2</sub> was 25.6 mmHg [9–53.6], and plasma lactate was 11.5 mmol/l [2.4–53]. The overall mortality rate was 28%. *Conclusion:* The results of this analysis suggest that the toxidrome of cyanide poisoning includes altered mental status with mydriasis, abnormal respiratory pattern, low systolic blood pressure with increased heart rate, and metabolic acidosis with a large increase in blood lactate. Health care providers should be educated about these signs and symptoms in order to improve the recognition and treatment of cyanide poisoning.

## 267. Marked Elevation in Blood Lead Levels in a Pediatric Patient Without Evidence of Encephalopathy

Temple KJ, Aaron CK. *Detroit Medical Center, Detroit, MI, USA.*

*Introduction:* Lead poisoning is in the differential diagnosis of pediatric encephalopathy. Blood lead levels (BLL) exceeding 70 mcg/dL lead to an increased risk for altered sensorium, ataxia, vomiting, tremors, seizures, and coma. We present a pediatric patient with a BLL greater than 120 mcg/dL without evidence of encephalopathy. *Case Report:* A two year old male with known history of lead (Pb) toxicity and pica, presented to hospital with elevated Pb levels. The child was previously admitted three months earlier for a BLL of 57 mcg/dL after ingesting paint chips. He received whole bowel irrigation (WBI) and chelation treatment. On follow-up, a repeat Pb level was 68 mcg/dL but the patient's mother was not notified until 11 days later. She then brought the patient directly to the Emergency Department where he was readmitted. The admission Pb level, run the following day, was 123 mcg/dL. Pb level drawn the next morning was 93 mcg/dL. On presentation, the patient was at his baseline and other than pre-existing delayed speech development and mild anemia, was neurologically intact. He was awake, alert, interactive and smiling without mental status changes, ataxia, emesis, abdominal pain or seizures. Abdominal X-rays showed new radio-opaque densities in the GI tract. WBI and intramuscular British Anti-Lewisite (BAL) were started. When the GI tract was clear, IV calcium disodium EDTA was added to BAL for an additional five days. The patient was discharged without complications. *Case Discussion:* The mechanism of neurologic Pb poisoning is poorly understood but theories include calcium interference with evoked neurotransmitter release, blockade of NMDA channels and alteration in the blood brain barrier. These effects are seen at levels exceeding 70 mg/dL. Although our patient had signs of chronic neurological injury, he had no stigmata of acute toxicity with a significantly elevated Pb level. The reason for his lack of encephalopathy after an acute re-exposure not known. *Conclusion:* Pb encephalopathy is common in pediatric patients with Pb levels greater than 70 mcg/dL. In this case, an acute level of 123 mcg/dL was not associated with new signs and symptoms of lead toxicity leading to the delay in chelation until the following morning.

## 268. The Outcome of Accidental Mushroom Ingestions in Children with Various Decontamination Treatments

Beuhler MC, Watson WA. *Carolinas Poison Center, Charlotte, NC; AAPCC, Washington, DC.*

**Background:** Poison centers are often contacted after young children ingest a usually unidentifiable mushroom. Gastrointestinal decontamination may have a role in the removal of vegetable matter. Evidence-based decontamination recommendations are lacking. **Methods:** The 1992–2003 AAPCC Toxic Exposure Surveillance System was searched for unintentional acute human mushroom ingestions age <6 years. Cases were excluded if the outcome was unknown or if there was co-ingestion of any substance other than mushroom, fungi or lichen. Cases were grouped based on three possible treatments received; ipecac only, single dose activated charcoal only, or no gastric decontamination. The number of cases in each group, the sum of [death+major outcomes] and the sum of [death+major+moderate outcomes] were calculated. The treatment groups were compared using two-tailed Fisher's exact test with Bonferroni correction for multiple comparisons ( $p < 0.008$  significant). **Result:** 72,923 cases met the inclusion criteria. 18,119 cases were excluded by criteria; resulting in 54,804 cases. There were no deaths. There were 41,704 cases in the three treatment groups analyzed; see Table 1. There was a significantly smaller proportion of cases with moderate or major outcomes in the ipecac group compared to charcoal ( $p < 0.0001$ ), and for ipecac compared to no decontamination ( $p < 0.0001$ ). There were significantly smaller proportion of cases with major outcomes ( $p < 0.0001$ ) in the ipecac group compared to charcoal, and for ipecac compared to no decontamination ( $p < 0.0001$ ). There was no significant difference between the proportion of cases with moderate or major outcomes in the charcoal group compared to no decontamination ( $p = 0.04$ ), and in the proportion of cases with major outcomes in the charcoal group compared to no decontamination ( $p = 0.33$ ). **Conclusion:** Treatment of unintentional mushroom ingestions in pediatric patients with ipecac may decrease the frequency of clinically significant outcomes.

TABLE 1

Treatment group	Number of cases	Cases with major outcome	Cases with moderate or major outcome	Percentage of cases with moderate or major outcome
Ipecac only	25,441	0	47	0.18%
Activated charcoal only	5,478	8	98	1.8%
No gastric decontamination	10,785	10	147	1.4%

## 269. Melatonin Overdose Resulting in Respiratory Depression and Coma Responsive to Naloxone

de Haan M,<sup>1</sup> Macnab J,<sup>2</sup> Kent DA,<sup>1</sup> Kennedy J.<sup>1</sup> <sup>1</sup>BC Drug and Poison Information Centre, Vancouver, BC, Canada; <sup>2</sup>Royal Columbian Hospital, New Westminster, BC, Canada.

**Introduction:** Melatonin is a dietary supplement used for insomnia, stress, and jet lag. It is generally well tolerated, however in one previous case, lethargy and disorientation developed in a 66-year-old who ingested 24 mg of melatonin along with his usual doses of chlorthalidopoxide and amitriptyline. We report a potentially life-threatening reaction to 27 mg of melatonin in a healthy young Asian woman. **Case Report:** A previously healthy 24-year-old Asian female ingested 9 mg of melatonin for insomnia at 2300 hours and another 18 mg 4 hours later. In mid-afternoon she was found unresponsive. Paramedics arrived at 1607 and administered naloxone 0.8 mg IV for RR=6 and GCS=3. On ER arrival at 1708, she was conversing; VS were RR=15, BP 111/61, HR=67, and T=98.2. O2 sat was 100%. By 1728, she had a decreased LOC and RR=5. Pupils were mid-size. Another dose of naloxone 0.8 mg IV was administered resulting in RR=14. Subsequently, she remained stable, was monitored overnight, and discharged in the morning. She denied use of other medications, alcohol or illicit substances. Her ECG and blood sugar were normal. Toxicology screen was negative for opioids, benzodiazepines, cocaine, ASA, acetaminophen, and alcohol. Melatonin content of the tablets was confirmed by gas chromatography and mass spectrometry. Urinary melatonin concentration was higher than physiologic values but serum concentration was undetectable (detection limit 10 ug/L). **Case**

*Discussion:* Melatonin overdose in humans is generally benign. Most reported cases result in no clinical effects. Animal data suggest that melatonin interacts with CNS receptors and effects may be antagonized by naloxone and flumazenil. Melatonin is thought to be metabolized by CYP2C19 and CYP1A2; 23% of Asians are poor metabolizers of compounds metabolized by CYP2C19. Whether this woman had increased melatonin-receptor sensitivity or was a poor metabolizer, is only speculative. *Conclusion:* Melatonin overdoses may be less benign than previously believed and some populations may be at increased risk of toxicity. Naloxone might have a stimulatory effect in the treatment of melatonin-induced respiratory and CNS depression.

## 270. Negligible Oleandrin Content of Hot Dogs Cooked on Nerium oleander Skewers

Suchard JR, Janssen MU. *University of California Irvine Medical Center, Orange, CA, USA.*

*Background:* Multiple sources in the medical and lay literature report that poisoning may occur by consuming food cooked on *Nerium oleander* branches. Although several modern case reports have demonstrated toxicity from ingesting oleander leaves or decoctions, the only reports of alleged oleander toxicity via a skewered food mechanism occurred in the early 1800s and include few clinical details and no analytical laboratory results. The lack of well-documented poisonings by cooking food on oleander branches suggests that the common assumption they do occur could be an urban myth. *Methods:* Hot dogs (Hebrew National Beef Franks, ConAgra Foods) were skewered their full length on either freshly-cut or dried *Nerium oleander* branches (4 each) and cooked over a disposable charcoal barbecue. The cooked hot dogs were then frozen until analysis of oleandrin content by liquid chromatography/mass spectroscopy. *Result:* Hot dogs cooked on dried branches contained  $14.3 \pm 8.8$  ppb oleandrin, while hot dogs cooked on freshly-cut branches contained  $7.0 \pm 2.1$  ppb oleandrin (control:  $<1$  ppb oleandrin). The most contaminated hot dog contained  $<1.5$  mg oleandrin; even allowing for other unmeasured cardiac glycosides, this oleandrin content is orders of magnitude lower than that expected to cause human toxicity if the hot dogs were consumed. In addition, several mechanical difficulties with both the freshly-cut and dried oleander branches make their practical use as skewers to cook food unlikely. *Conclusion:* Hot dogs cooked on *Nerium oleander* branch skewers contain a negligible amount of oleandrin. Poisoning by consuming hot dogs or other food items cooked on oleander branches is probably an urban myth.

## 271. Fulminant Hepatic Failure After Using Reported Herbal Medication Containing High Levels of Acetaminophen

Maloney GE,<sup>1</sup> Rhee JW,<sup>1</sup> Schuermann T,<sup>2</sup> Saeedi B,<sup>3</sup> Leikin JB.<sup>4</sup> <sup>1</sup>Toxikon Consortium, Chicago, IL, USA; <sup>2</sup>Illinois Poison Control Center, Chicago, IL, USA; <sup>3</sup>SET Environmental, Inc., Wheeling, IL, USA; <sup>4</sup>Evanston OMEGA Healthcare, Evanston, IL, USA.

*Introduction:* Use of traditional or herbal medicines has become increasingly common in pediatric populations. However, the pharmaceutical composition of these products are frequently unknown. We report a case of fulminant hepatic failure requiring transplantation in a child who was being treated with a white powder her parents believed was an herbal medication that was identified as containing nearly 100% acetaminophen. *Case Report:* A 6 year old female presented to the hospital with abdominal pain and altered mental status. She experienced rapid clinical deterioration and was intubated and found to be in multi-organ failure. She had been using the powder for 3 days, last use the evening before presentation, for URI symptoms. Her parents had also been giving her therapeutic doses of acetaminophen-containing over the counter medications. She had been seen in the Emergency Department 36 hours prior and had normal labs, including transaminases, at that time. Her initial AST was 8000 IU/L, ALT 23000 IU/L, INR 6.7, bilirubin 5 mg/dL, creatinine 2.9 mg/dL, and pH 7.19. Her initial acetaminophen level was 18 µg/ml. Intravenous N-acetylcysteine treatment was recommended and the powder sent to SET Environmental, Inc., an environmental chemical analysis service. The powder was definitively identified by IR spectroscopy as containing 99% acetaminophen. The patient required orthotopic liver transplantation and ultimately survived to discharge. *Conclusion:* Herbal preparations may contain large amounts of standard pharmaceutical compounds. Clinicians should be aware of this possibility when evaluating patients using herbal medications.

## 272. Lithium Toxicity From an Internet Dietary Supplement

Paule DK, Humberston L, Brooks DE, Katz KD. *Pittsburgh Poison Center, University of Pittsburgh Medical Center, Pittsburgh, PA, USA.*

*Introduction:* The widespread availability of medications and herbal products on the internet has increased the potential for poisonings. We report a case of mild, acute lithium toxicity occurring after the intentional misuse of a lithium-containing “dietary supplement” (Find Serenity Now<sup>®</sup>) obtained over the internet. *Case Report:* An 18 year old woman presented to our ED after ingesting 18 tablets of Find Serenity Now<sup>®</sup>; each tablet listed as containing 120 mg of lithium orotate [3.83 mg of elemental lithium per 100 mg of (organic) lithium orotate compared to 18.8 mg of elemental lithium per 100 mg of (inorganic) lithium carbonate]. She complained of nausea and reported one episode of emesis. Her examination revealed normal vital signs and was only significant for a mild tremor without rigidity. Almost 90 minutes after the ingestion, her serum lithium level was 0.31 mEq/L, urine drug screen was negative and her ECG showed a normal sinus rhythm. The patient received IVFs and an anti-emetic, and one hour later, her repeat serum lithium level was 0.40 mEq/L. After three hours of observation her nausea and tremor had resolved, and she was subsequently transferred to a psychiatric hospital for further care. Prior human and animal data have shown similar pharmacokinetics and shared clinical effects between these lithium salts. *Conclusion:* Over-the-internet dietary supplements may contain ingredients capable of causing toxicity in overdose. Chronic lithium toxicity from ingestion of this product is also of theoretical concern.

## 273. Foxglove Salad Ingestion

Ciancaglini PP,<sup>1</sup> Vence T,<sup>2</sup> Benitez JG,<sup>1</sup> Lawrence RA.<sup>1</sup> <sup>1</sup>*University of Rochester, Rochester, NY, USA;* <sup>2</sup>*Cayuga Medical Center, Ithaca, NY, USA.*

*Introduction:* *Digitalis purpurea*, a biennial herb known as foxglove, contains numerous cardiac glycosides including digitoxin, gigitoxin, and gitaloxin. A related plant, *Digitalis lantana*, generally has higher cardiac glycoside content than *D. purpurea* and is a source of commercial digoxin. All plant parts contain cardiac glycosides. Symptoms of foxglove intoxication include dizziness, nausea, vomiting, arrhythmias, heart block, delirium and hallucinations. We report a case of human intoxication by foxglove. *Case Report:* A 33-year-old female was admitted to the hospital following 3 days of nausea and vomiting which produced dehydration and renal failure. She was subsequently hydrated and treated with antiemetics which improved her general condition. On the second day of hospitalization, she was noted to have third degree heart block and bradycardia (HR 40's) and was transferred to the ICU. The next day she began complaining of yellow vision. A digoxin level of 17.9 ng/ml (normal 0.8 to 2 ng/ml) was obtained. The patient had no access to digitalis medications. She later admitted ingesting a salad containing 3 foxglove leaves from her garden prior to the onset of symptoms. Testing of admission blood samples revealed a digoxin level of 40.5 ng/ml and a digitoxin level of 45.5 ng/ml. The patient's condition improved following treatment with 10 vials of digoxin immune Fab. Her heart rate increased from the 40's to the 60–70's and heart block improved to first degree. Free digoxin levels following Fab fluctuated between 2.3 and 3.0 ng/ml over the next 6 days. *Case Discussion:* Digoxin and digitoxin assays may have measured other cardiac glycosides making it difficult to accurately interpret lab results. Common formulas for calculation of the Fab dose could not be relied upon and empiric treatment with Fab improved both heart rate and cardiac conduction. *Conclusion:* Foxglove ingestion may lead to serious and prolonged toxicity. Foxglove contains numerous cardiac glycosides making interpretation of digoxin or digitoxin assays difficult. Treatment guidelines for use of Fab following foxglove ingestion are not available. We suggest supportive care and digoxin immune Fab for manifestations of severe toxicity.

## 274. Amanita phalloides Heads North

Friesen M,<sup>1</sup> Pringle A,<sup>2</sup> Callan B,<sup>3</sup> Leatham A.<sup>1</sup> <sup>1</sup>*BC Drug and Poison Information Centre, Vancouver, BC;* <sup>2</sup>*Organismic and Evolutionary Biology, Harvard University;* <sup>3</sup>*Natural Resources Canada, Pacific Forestry Centre.*

*Introduction:* *Amanita phalloides* is a highly toxic cyclopeptide mushroom. It is hypothesized to be an exotic introduced from Europe. On the North American west coast it was collected from various counties surrounding San Francisco in 1977. The

fungus is now abundant in California in both urban landscapes and undisturbed forests. In contrast, in the Pacific Northwest (PNW) collections are few and sporadic. Collections have been made in Ashland and Portland, OR and DNA analyses have confirmed collections from Seattle, WA in 1999. In Canada, the first collection of *A. phalloides* occurred in Mission, BC in 1997 and subsequently in Victoria and Chilliwack, BC. Collections from Victoria, BC in 2002 were confirmed with DNA analyses. We report the first case of poisoning in BC, and possibly Canada. *Case Report:* In August 2003, a 46-year-old male presented to ER with nausea, vomiting, abdominal pain, and diarrhea 45 H following a meal of 2 cooked mushrooms collected from beneath an English oak tree (*Quercus robur*) in his yard in Victoria, BC. He thought they were puffballs. Six H after exposure he experienced fatigue and mild nausea. Symptoms progressed over 12–24 H and included vomiting, profuse diarrhea and abdominal pain. Admission bloodwork showed AST 964, ALT 1703, alk phos 91, GGT 20, total bili 18 ( $\mu\text{mol/L}$ ), INR 1.1, PTT 29. Electrolytes, protein, albumin, BUN and SCr were normal. Routine urinalysis was positive for WBCs, hyaline casts, epithelial cells, calcium oxalate crystals, mucus and protein 0.3 g/L. Toxicity from *A. phalloides* ingestion was suspected. Treatment included MDAC, IV N-acetylcysteine and oral milk thistle supplements. The patient was hospitalized for 4 days and AST and ALT decreased to 131 and 1470, respectively. INR peaked on hospital day 3 at 1.3 and upon discharge was 1.1. The mushroom was identified as *A. phalloides*. *Conclusion:* The recent discovery of *A. phalloides* in the PNW is a public health concern. Mushroom collectors may mistake it for an edible and pediatric exposures are possible. *A. phalloides* ingestion should be considered in symptomatic cases of mushroom exposures in the PNW region, including BC.

## 275. Home Observation of Tended-Yard Mushroom Ingestions in Nebraska, Wyoming, and Western Iowa

Lubbert J,<sup>1</sup> Jacobitz K,<sup>1</sup> Suhr D,<sup>1</sup> Weber AT,<sup>2</sup> Seifert SA.<sup>1</sup> <sup>1</sup>Nebraska Regional Poison Center, Omaha, NE, USA; <sup>2</sup>University of Nebraska-Omaha, Omaha, NE, USA.

*Background:* To determine whether ingestion of one or fewer mushrooms from a tended yard in Nebraska (NE), western Iowa (IA), and Wyoming (WY) could be safely observed at home. *Methods:* This was a prospective, outcome-based study. Inclusion criteria for home observation were: 1) unintentional ingestion; 2) age <19 years; 3) One mushroom or less from a tended yard within NE, WY, or western IA (712 area code); 4) asymptomatic or no more than one episode of vomiting and/or diarrhea; 5) previously healthy; 6) no coingestant; and 7) phone follow-up possible. Follow-up calls were performed at 4, 24, and 48 hours post-ingestion. Mushroom specimens were preserved for possible later identification when available. *Result:* Between 1998 and 2002, 152 cases met inclusion criteria. Patient demographics are summarized in Table 1. Of 152 patients, 140 (92%), remained asymptomatic. At the four, 24 and 48 hour follow-ups, 138 (91%), 135 (89%), and 143 (94%) of patients, respectively, were contacted. All patients were able to be contacted in follow-up at least once. Twelve cases (8%) developed mild gastrointestinal (GI) symptoms at some point. Two (1.3%) of these cases met health care facility (HCF) referral criteria. One patient declined referral but was asymptomatic at 48-hours. The other was evaluated at a HCF, and discharged asymptomatic without specific treatment. Mycologist identification of a GI-irritant mushroom was made in this case. *Conclusion:* The vast majority of pediatric unintentional, tended-yard mushroom exposures of one or fewer in NE, WY, and western IA, were observed safely at home with observation and telephone follow-up. A small number developed mild GI symptoms and 1.3% required healthcare facility referral, but without significant sequelae.

TABLE 1  
Demographics of included patients

Parameter	Distribution
Enrollment by location	NE=123; WY=24; IA=5
Gender	Male=77 (51%); female 75 (49%)
Age	Range=7 mos–14 yrs (median 2 yrs)

## 276. Hepatic and Pulmonary Venous-Occlusive Disease in Siblings Administered ELTHCHO Tea

Cumpston KL,<sup>1,2</sup> Goldstein L,<sup>1</sup> Monge T,<sup>3</sup> Cano D.<sup>2</sup> <sup>1</sup>University of New Mexico, Albuquerque, NM, USA; <sup>2</sup>New Mexico Poison Center, Albuquerque, NM, USA; <sup>3</sup>Pediatric Critical Care, Albuquerque, NM, USA.

**Introduction:** Hepatic veno-occlusive disease has been described in liver biopsies of people who have ingested plants containing pyrrolizidine alkaloids (*Senecio*, *Heliotropium*, *Crotalaria*, *Symphytum*). Rarely pulmonary toxicity has also been described. Destruction of the vascular endothelial cells of these organs leads to accumulation of debris causing hepatic and pulmonary hypertension, and organ dysfunction. **Case Report:** A three year old female and her ten month old brother, were administered a Navajo herbal tea called ELTHCHO in doses of an unknown amount or frequency, by their maternal grandmother. The herbal exposure was not discovered until the younger siblings liver biopsy displayed hepatic veno-occlusive disease, and the family was re-questioned about herbal teas. The younger sibling demonstrated signs of structural and functional hepatic failure. The older sibling presented prior to his arrival with hepatic failure and was considered for hepatic transplant. Subsequently, she developed respiratory failure with signs of pulmonary hypertension, and progression of hepatic failure. The grandmother provided a sample of the plant used to prepare the tea. The plant was identified as *Senecio longilobus* by two botanists. The hepatic condition has stabilized in both children with supportive care, but the older sibling remains intubated without any change in pulmonary status. The younger child is being considered for hepatic transplant, but the sisters prognosis is poor. **Conclusion:** Hepatic and Pulmonary veno-occlusive disease is a rare toxicological entity. Herbal causes of hepatic failure must be a priority in cultures which use non-traditional therapy. Despite no well studied specific therapies, early discovery of the etiology of hepatic failure is helpful. The older sibling could have had hepatic transplantation, before clinical deterioration, and the younger sibling may have avoided further exposure. The Indian Health Service was alerted to monitor the remaining siblings.

## 277. A Report of *Lupinus mutabilis* Anticholinergic Toxicity

Smith SW, Halcomb SE, Hoffman RS, Nelson LS. *New York City Poison Control Center, New York, NY, USA.*

**Introduction:** Herbal supplements are used worldwide as home-remedies for multiple ailments. Patients develop unusual toxidromes after consuming these remedies, which presents a diagnostic dilemma for physicians. We present a case of poisoning due to misuse of lupine seeds as an herbal therapy. **Case Report:** A 28-year-old woman presented to the ED complaining of blurry vision and photophobia. Twelve hours earlier she ingested a glass of liquid prepared by rehydrating dried Ecuadorian lupine beans—used as a natural purgative in her native country. Gastric distress followed 3 hours later, and was so severe that she attempted to induce emesis. A review of systems was also remarkable for a dry mouth and headache. Vital signs were: BP, 120/80 mmHg; P, 88/min; RR, 18/min; and T 98.0°F. She had poorly reactive 7 mm pupils, a normal fundoscopic examination, and a dry oropharynx. The remainder of her examination was normal. She received one dose of activated charcoal and 650 mg of acetaminophen for her headache and was observed for 3½ hours. At discharge her symptoms were resolving and her pupils were more reactive. A sample of the patient's beans was subsequently identified as *Lupinus mutabilis*. **Case Discussion:** *L. mutabilis* contains high levels of lupanine, 13-hydroxylupanine, 4-hydroxylupanine, and sparteine—quinolizidine alkaloids which produce anticholinergic toxicity in humans. Quinolizidine alkaloid content and composition vary by species, germination time, and maturation environment. Varieties with a high quinolizidine alkaloid content require extensive boiling and washing. This patient's consumption of lupine quinolizidine alkaloids in the rehydrating solution resulted in toxicity. This case highlights the hazards when natural products are used outside of their traditional region. Simple substitution of a similar species can result in significant toxicity. **Conclusion:** Our case illustrates the use of an herbal remedy causing an atypical toxidrome. Physicians who encounter patients with an atypical syndrome should be aware that different cultural practices may influence the presentation.

## 278. First Use of IV N-Acetylcysteine in a Pennyroyal Oil Poisoning

Mullen WH,<sup>1</sup> Camarata G,<sup>2</sup> Bergman K,<sup>2</sup> Nelson SD,<sup>3</sup> Anderson IB,<sup>1</sup> Blanc PD.<sup>1</sup> <sup>1</sup>California Poison Control System, San Francisco Division, San Francisco, CA, USA; <sup>2</sup>Sutter Medical Center, Santa Rosa, CA, USA; <sup>3</sup>School of Pharmacy, University of Washington, Seattle, CA, USA.

**Introduction:** Background: Pennyroyal has been used since Roman times as an abortifacient despite its potentially lethal hepatotoxic effects. Pulegone is the primary toxic component of pennyroyal oil. There are two previously reported cases of

pennyroyal ingestion treated with oral N-acetylcysteine (NAC), one with laboratory confirmation. This is the first report of IV NAC treatment in a pennyroyal poisoning. *Case Report:* 62 y o M with Alzheimer's disease reportedly ingested 15 ml of 100% pennyroyal oil. A caregiver witnessed the ingestion. He presented to the ED approximately 1 hour post-ingestion, asymptomatic with normal vital signs. Initial labs including liver and renal function tests were normal. Activated charcoal (AC) was given. IV NAC was started within 2 hours post-ingestion using the standard 20-hour infusion protocol used for acetaminophen toxicity. During ED observation, the patient developed profuse diarrhea that smelled strongly of pennyroyal. The hospital course was otherwise benign with no mental status changes or seizures noted. The patient was discharged once his IV NAC course was completed. His liver and renal function tests remained normal. *Case Discussion:* Serum assays for menthofuran and pulegone are pending and will be presented. Although if quantified these levels would serve to confirm the severity of exposure and potentially shed light on metabolic kinetics, the reported exposure and the aromatic stool indicate that this was indeed a substantive exposure and that the patient may have benefited from glutathione repletion. *Conclusion:* The first successful case of IV NAC treatment following a dose of pennyroyal oil, previously reported as fatal, is presented.

### 279. Accuracy and Completeness of Initial Substance Identification: Is What You Hear, What They Got?

Lubbert J, McVoy J, Seifert SA, Jacobitz K. *Nebraska Regional Poison Center, Omaha, NE, USA.*

*Background:* There is little published data on the accuracy or completeness of initial substance identification in human exposures reported to poison centers. *Methods:* All human exposures reported to a poison center from 5/10/04 to 9/10/04 were prospectively evaluated for the accuracy of initial substance identification by confirmation of trade name, ingredients, and formulation, from the original container. Also, 500 random human exposures and 200 hospitalized cases from the same period were evaluated for completeness of initial substance identification by comparison with closed-case substances coding. *Result:* Of 9,190 exposures, 174 (1.9%) had inaccurate or indeterminate initial identification of exposure substances. Reasons included: 1) Accurate ingredients but inaccurate trade names; 2) Accurate trade names but inaccurate ingredients; 3) Neither accurate trade names nor ingredients; 4) Original containers not being available; and 5) Inability to read the label (see Table 1). Management was potentially affected in 56 cases (32.2%). Case management was actually affected in two cases (1.1%; 0.02% of all cases) but without adverse consequences. Incomplete initial substance identification occurred in none of 500 randomly selected cases, but in five of 200 hospitalized cases (2.5%). *Conclusion:* Inaccurate or indeterminate initial substance identification occurred in 1.9% of human exposures. In 33% of these cases, the chemical ingredients of exposure differed from those initially stated, and in 16% confirmation of substances was not possible. In more than half, trade names were inaccurate. Incomplete initial substance identification occurred in <0.1% overall, but at higher rates in particular scenarios. Obtaining an accurate and complete substance exposure history is a critical SPI action, with implications for patient management, toxicosurveillance, quality improvement, and consequences to manufacturers.

TABLE 1  
Inaccurate or indeterminate initial substance identification

Reason	Number (percent)
Ingredients same, different trade names	90 (51.7)
Trade names same, different ingredients	43 (24.7)
Neither same trade names nor ingredients	15 (8.6)
Container not available	24 (14.8)
Could not read label	2 (1.1)

## 280. Drug Identification: Varying Practices Amongst Poison Control Centers

Redding TC,<sup>1</sup> Sheppard MA,<sup>2</sup> Guard A.<sup>3</sup> <sup>1</sup>PIRE, Beltsville, MD, USA; <sup>2</sup>PIRE, Beltsville, MD, USA; <sup>3</sup>EDC, Newton, MA, USA.

*Background:* Toxic Exposure Surveillance System (TESS) data collected in 2003 by the American Association of Poison Control Centers (AAPCC), the policy-making organization for the nation's Poison Control Centers (PCCs) indicates that 617,414-drug identification (ID) calls were made to PCCs. Drug ID calls come from health care professionals, law enforcement agents and consumers. During the 2003 TESS reporting period, forty-six percent (46%) of the drug ID calls received by PCCs involved substances which may be abused. Although 64 centers reported TESS data to AAPCC; it is not known how many handled drug identification calls in 2003. PCCs are responding to drug ID inquiries in a variety of methods. *Methods:* Poison Centers were queried about their drug ID policies in three different ways: all were asked to respond to a list serve, a convenience sample of PCCs was completed at a mandatory meeting of all PCCs, and a subset of PCCs were called and interviewed. *Result:* Five PCC managers provided responses on the list serve. Eight medical directors were contacted at a mandatory PCC meeting. Two of the most common reasons PCCs choose not to offer drug identification services to consumers include HIPAA privacy regulations and excessive use of PCC's drug ID services by substance abusers. Centers that do not offer drug ID services refer callers to Pharmacists, drug ID websites, or suggest the caller discards the substance. Poison centers which respond to drug ID request send the calls to a phone line which is staffed by pharmacy students or Poison Information Provider (PIP) staff. Some PCCs indicated they limit drug ID services to health care and law enforcement professionals. One PCC reported that they identify substances for all callers and provide substance abuse treatment referrals to callers if the staff suspects the substance identified is used for drug abuse. *Conclusion:* Patient privacy, assistance to other professionals, and staff suspicions of calls regarding substances which may be abused appear to be the main factors in determining whether or not a PCC provides drug ID services.

## 281. Effectiveness of a Restrictive Drug Identification Policy

Jaramillo JE, Shum S. *Texas Panhandle Poison Center, Amarillo, TX, USA.*

*Background:* Many poison centers have offered drug identification as one component of their services. According to the American Association of Poison Control Centers' annual reports, drug identification calls increased almost 2% from 2002 to 2003; accounting for over 2 million calls to poison centers nationwide in 2003. Unfortunately, as call volumes steadily increase, many centers continue to face decreasing or flat funding and may have to consider what services must be sacrificed. As a center that has faced flat funding and increasing call volume for years, our center determined that restriction of drug identification might be an option to curtail the current increase in non-exposure call volume that has been experienced. Limiting this service to only cases in which an exposure was involved was determined to be detrimental as the staff of our center strongly felt that there are valid reasons for providing drug identification in some non-exposure circumstances. Therefore, a permissive but restrictive policy was developed. *Methods:* In April of 2003, our center instituted a policy restricting drug identification services. This policy allowed the continued provision of drug identification to health care professionals, law enforcement officers, and in limited circumstances, the general public. Archived records from our network database were utilized to determine drug identification call rates for a six month time period preceding the implementation of this restrictive policy (12/02–3/03) and for the same six month period two years later (12/04–3/05). Results from our center were compared to all other centers within our network combined (other centers did not implement a restrictive policy). *Result:* Drug identification calls as a percent of total calls to our center increased from 13.5% in 2002/03 to 15.8% in 2004/05; a 2.3% increase. Identification for the other centers increased from 18.1% in 2002/03 to 23.7% in 2004/05; a 5.6% increase. *Conclusion:* Drug identification calls to other centers within our network increased at more than twice the rate of identification calls to our center. A restrictive policy was successful at curtailing an increase in drug identification calls to our center.

## 282. Human Poison Exposure Case Documentation: Does the Written Documentation Correlate with the Voice Recording?

Jones Easom LA, Benson BE, Cumpston KL. *New Mexico Poison and Drug Information Center, University of New Mexico, Albuquerque, NM, USA.*

*Background:* Written case records are used by poison centers to document telephone inquiries regarding poisoned patients. This documentation is used for patient care management, quality assurance, employee evaluation, guideline development, research, toxicosurveillance, and litigation. This study determined whether written case documentation correlated with the voice recordings for human poisoning exposure calls received by a regional poison control center. *Methods:* This project was conducted by a single auditor who randomly selected and reviewed Toxicall written records and the corresponding voice recordings (retrieved using Dictaphone ProLog). Inclusion criteria were that the case 1) was managed by a Specialist in Poison Information and 2) involved a human poisoning exposure. The auditor evaluated whether the documentation was an accurate reflection of the conversation; focusing on data elements that optimize patient care and/or the number of errors per case. Scoring graded the written documentation as either correlating or not correlating to the voice recording. Error types were categorized as: 1) information was stated verbally but not documented in the written record or 2) information was documented in the written record but not stated verbally. Errors were further categorized to identify specific types of discrepancies. *Result:* 418 written records and corresponding voice recordings were audited from 11/02/00 to 01/28/05. There was acceptable verbal-to-written correlation for 317/416 (76%) of the cases reviewed. Cases that did not have acceptable verbal-to-written correlation had an average of 3 discrepancies per case. 74% of the errors were information stated but not documented; 26% were information documented but not stated. *Conclusion:* 76% of the cases at this regional poison control center had acceptable verbal-to-written correlation for case documentation. This establishes the baseline performance level for this center and can be used as a comparison point for other centers that choose to evaluate the correlation between voice recording and written case documentation.

### 283. Three-Call Model for Staffing of a Poison Center Network

Jaramillo JE,<sup>1</sup> Cobb D,<sup>2</sup> Gracia R,<sup>3</sup> Garrison J.<sup>3</sup> <sup>1</sup>Texas Panhandle Poison Center, Amarillo, TX, USA; <sup>2</sup>South Texas Poison Center, San Antonio, TX, USA; <sup>3</sup>North Texas Poison Center, Dallas, TX, USA.

*Background:* The purpose of this analysis was to create a model from call volume data to assist with efficient staffing of a network of poison centers. For this network, the abandoned call rate pattern closely resembles that of diverted calls. Therefore, in lieu of an accurate abandoned call reporting system, diverted calls were utilized as an indicator of the likelihood of abandoned calls. By targeting staffing patterns to call volume on a network-wide basis as opposed to an individual center basis, we hope to better utilize network resources. *Methods:* An analysis was conducted for the month of December 2004. Call volume for each center within a poison center network was determined by center codes. Calls from any one respective poison center's coverage area (based on county of call origination), but answered by an alternate center within the network were counted as diverted calls. Number of calls/SPI/hour was determined by dividing total call volume/hour by average number of SPIs/hour. Additionally, number of diverted calls/hour was compared to number of calls/SPI to develop a model. An acceptable rate for diverted calls was set at 5 calls/hour network-wide for an average of <1 diverted call/hour per center. *Result:* Using the data collected above, it appears that at any time in which the SPIs average 3 or more calls per hour the acceptable threshold for diverted calls (and hence, abandoned calls) is exceeded. Therefore, we developed a "3-call per hour" model: expected call volume per hour/3=# SPIs needed per hour. Using this model, we found that for the month analyzed, our network had an average of thirteen overstaffed hours per day and ten understaffed hours per day. *Conclusion:* Using this model, it appears that our current staffing practices are inefficient. By shifting SPIs from times of excess staffing to times of deficient staffing, based on expected call volume, we can better utilize our resources. Further analysis is being conducted to test this 3-call per hour SPI model. With further testing, this model may be applicable to other poison center networks.

### 284. The Role of Poison Centers in a Mass Chlorine Exposure

Eldridge DL,<sup>1</sup> Richardson W,<sup>2</sup> Michels JE,<sup>2</sup> Holstege CP,<sup>1</sup> Kirk MA.<sup>1</sup> <sup>1</sup>Division of Medical Toxicology/University of Virginia, Charlottesville, VA; <sup>2</sup>Palmetto Poison Center, Columbia, SC.

*Background:* During mass chemical exposures, poison centers (PCs) are a valuable information resource. We report an incident that illustrates the challenges encompassing disaster management and the mechanisms by which PCs may assist. *Methods:* A freight train accident occurred at 2:40 am, resulting in the release of a large toxic cloud from wrecked tanker cars. The PC was

initially contacted by an individual near the accident who reported a “chemical odor.” The PC immediately contacted the nearest ED. The sole physician on duty had just received the first patient from the scene who was critically ill with respiratory distress. Communications were immediately established between the on call medical toxicologist and the ED physician. Subsequent PC callers reported a green gas cloud with an odor “like a pool.” Subsequent ED patients presented with eye irritation, cough, dyspnea, and pulmonary edema. On the basis of this clinical information, the PC suggested an irritant gas was likely responsible (i.e. chlorine) and provided appropriate treatment recommendations. The triage and management of more than 100 patients presenting to this ED were based on this identified toxic syndrome. Chlorine was later confirmed as the true causative agent. The PC continued to assist physicians with the management of patients at various hospitals and provided information about chlorine gas exposure management. Overall, this incident resulted in 9 deaths, 529 people seeking medical care (69 hospitalizations—11 critical), and the evacuation of 5400 people. *Result:* This disaster depicts the PC’s role during a mass chemical exposure. As one of the first public service agencies often alerted following such events, PCs can provide a rapid source of information. PCs can assist in collecting and assessing information when there is a delay in identification of a suspected chemical. By reviewing incoming data, a distinct toxic syndrome category can be identified and appropriate management initiated. *Conclusion:* Local PCs are valuable clinical resources in mass chemical exposures and are an integral component of an emergency response plan.

### 285. SPI Research Activities and Interest: Analysis of 2004 NACCT Presentations

Meier KH, Starr PE, Banerji S, Branton TJ, Kimball T. *California Poison Control System-SF, UCSF, SF, CA, USA; Maryland Poison Center, Baltimore, MD, USA; Rocky Mountain Poison Center, Denver, CO, USA; Finger Lakes Poison and Drug Info Center, Rochester, NY, USA; Florida Poison Center, Tampa, FL, USA.*

*Background:* Our goals were to quantify Specialist in Poison Information (SPI) involvement in published abstracts at the 2004 North American Congress of Clinical Toxicology (NACCT) and, independently, to characterize SPI perceptions of obstacles to and facilitators of their research efforts. *Methods:* We interviewed authors either in person at the 2004 NACCT meeting or by telephone. Specific data elements included SPI involvement and demographics. We also distributed a survey to all SPIs who attended the SPI Symposium and Roundtable sessions to determine broader interest and experience in research. SPI was defined as one who devoted >49% employed time to answering the PCC hotline. *Result:* Of 251 NACCT abstracts, PCC membership was noted on 155 (62%). Of these 155, 52 (34%) had SPI authors, including 33 with a SPI first author. SPI authors had an average of 11 years of PCC service and had pharmacy (64%), nursing (31%) or other (5%) backgrounds. For each abstract, at least 1 SPI author was afforded time off the phones for abstract work (59%) and given opportunity to attend NACCT (90%). Seventy completed surveys were tabulated from attendees of the two SPI forums. The average years of SPI service was 10.5 years and educational background was 37% pharmacy, 57% nursing and 6% other. Almost half (43%) of the SPIs had participated in a research project and 24% had originated or directed the research. Of those who did not have experience, interest in originating (37%) or participating in(38%) a project was noted. The main contributors to successful SPI research involvement are interest in the topic (51%) and active mentors (41%). Medical and managing directors were most commonly identified as mentors. *Conclusion:* SPI have a significant presence in NACCT professional presentations, indicating success in research projects. Additional mentor and support mechanisms can foster the interests of additional SPIs in contributing to toxicology related research.

### 286. Reduction of Medical Error by Introduction of a New Clinical Management Protocol in a Poison Center

Seifert SA,<sup>1</sup> Boyer LV,<sup>2</sup> Bronstein AC,<sup>3</sup> Jacobitz K,<sup>1</sup> McNally J,<sup>2</sup> Meza JL.<sup>1</sup> <sup>1</sup>*Nebraska Regional Poison Center, Omaha, NE, USA;* <sup>2</sup>*Arizona Poison and Drug Information Center, Tucson, AZ, USA;* <sup>3</sup>*Rocky Mountain Poison and Drug Center, Denver, CO, USA.*

*Background:* In a previous retrospective study of poison center medical error, a majority of the errors were felt to be “definitely” or “probably” preventable. This prospective study was designed to evaluate the error-reduction effect of the introduction of a new, Intentional Exposure Management Protocol at a poison center. *Methods:* Following a retrospective review of medical error at a poison center, error types and causations were analyzed. A new protocol was introduced requiring

TABLE 1  
Acetaminophen-related recommendations in intentional overdoses

	Pre-protocol	Post-protocol	Significance
APAP level not recommended	38 (18.5%)	3 (1.5%)	p<0.0001
APAP level not documented	35 (17.1%)	7 (3.4%)	p<0.0001
Follow-up not timely	45 (22%)	2 (1%)	p<0.0001

the recommendation of an acetaminophen (APAP) serum concentration, documentation of APAP serum concentration results, and follow-up in a clinically relevant time frame, in all cases of intentional exposures. Randomly-selected cases of intentional exposures were then independently reviewed by two Certified Specialists in Poison Information (CSPI) and subsequently by a single medical reviewer. 205 cases from the period of the retrospective review, and 206 cases following introduction of the new protocol were reviewed. Results were analyzed by 2-tailed Fisher's Exact test. *Result:* The medical reviewer confirmed 71% and 29% of CSPI-identified possible error cases, pre- and post-protocol introduction, respectively. In intentional exposures, failure to recommend an APAP serum concentration, failure to document an APAP serum concentration, and failure to follow-up in a clinically-relevant time frame, all decreased significantly following introduction of the new protocol (see Table 1). *Conclusion:* Analysis of error types and causations, and relatively simple and practical management protocol changes, can reduce medical error in a poison center setting. This work was supported by DHHS/HRSA/MCHB Grant #4 H4B MC02322-01-01.

### 287. Determining Triage Guidelines for Unintentional Overdoses with Sulfonylureas

Cantrell FL, Clark RF. *California Poison Control System, San Diego Division, San Diego, CA, USA.*

*Background:* Sulfonylureas (SFU) are known to cause hypoglycemia in therapeutic doses and in overdose. Determining triage guidelines for supratherapeutic SFU ingestions is an important but difficult task. This study was performed to determine if an accidental overdose of a patient's SFU would result in clinically significant symptoms of hypoglycemia (tachycardia, diaphoresis, lethargy, confusion, dizziness, seizures) or documented blood glucose (BG) levels of <60 mg/dl. *Methods:* Poison center records over a 3 year period were reviewed for cases of adults accidentally ingesting more than their prescribed doses of SFUs. Cases were reviewed for: patient age and sex, SFU involved, co-ingestants, dose taken, usual single dose (USD), usual daily dose (UDD), symptoms, blood glucose concentration, vital signs, therapeutic interventions and management site. *Result:* 85 cases were identified (an additional 73 cases lacked pertinent information/follow-up or received gastrointestinal decontamination and were excluded). 53 patients (62%) were female and the mean patient age was 60 years. 47 cases (55%) involved ingestions that exceeding the patient's USD and 38 cases (45%) involved ingestions exceeding both the USD and UDD. 52 ingested supratherapeutic doses of their other medications at the same time. 68 cases were managed at home, 17 cases were managed in a hospital. 61 (72%) cases had at least one documented BS drawn at least 2 hours after ingestion, the remaining 24 cases were followed up for clinical symptoms at least 3 hours post-ingestion. 29 patients received oral glucose/carbohydrate supplementation. Although 8 patients had complaints of shakiness or dizziness, no patients had a documented BG of <60 or developed clinical symptoms refractory to oral glucose/carbohydrate supplementation or requiring intravenous dextrose. *Conclusion:* In our study, diabetic patients who accidentally ingested more than a USD or UDD of their SFU, even when co-ingestants were involved, were safely monitored at home as long as they were comfortable observing for subjective or objective signs of hypoglycemia and could self-administer oral glucose/carbohydrate supplementation.

### 288. Legal Liability of Poison Control Center Consultants

Curtis JA,<sup>1</sup> Greenberg MI.<sup>2</sup> <sup>1</sup>Drexel University College of Medicine, Philadelphia, PA, USA.

*Background:* The extent to which PCC consultants (PCCCs) are exposed to legal risk is unknown, as is the degree to which concern over malpractice influences the practice of medical toxicology. *Methods:* An anonymous survey was sent to the

members of the American College of Medical Toxicology (ACMT). Data requested include the number of years served as a PCCC and the dates, basis and outcome of any lawsuits resulting solely from PCC consultation. Respondents were asked to quantify the degree to which concern over malpractice influenced their consults. In addition, Lexis-Nexis searches for lawsuits filed against medical toxicologists and statutes affecting PCC consultants were performed. *Result:* 152 of a possible 395 AACT members responded to the survey, of whom 117 (78%) were active consultants and 149 (98%) had served as a PCCC within the last 10 years. 70 (46%) had served for greater than 10 years, while only 10 had served for less than one year. 121 (79%) of consultants reported some concern over their legal liability. Nine lawsuits were reported by 8 respondents; 7 for nonfeasance—2 of which were dismissed prior to settlement and one case where the consulting toxicologist was protected from liability by state law. 2 cases of malfeasance were settled prior to trial. The 6 respondents who reported being named in the 7 most recent lawsuits were still active consultants, while the 2 respondents with the claims filed more than 15 years ago had served within the last 10 years. A Lexis-Nexis search revealed that 9 states have enacted laws meant to protect PCC personnel from legal liability. *Conclusion:* Legal action against toxicologists serving as PCCCs is not common. Lawsuits are usually based upon nonfeasance, and are typically settled or dropped before trial. While concern over liability was common, it did not seem to be effected by a history of legal action. There were no cases in which a PCCC appeared to retire as a result of malpractice litigation. Knowledge of the national prevalence of such litigation, as well as awareness of the local practice environment is necessary to effectively assess the degree of legal risk assumed by toxicologists serving as PCCCs. Risk may vary from state to state as well, based on specific protective laws.

### **289. American Academy of Pediatrics (AAP) Policy to Abandon Home GI Decontamination with Syrup of Ipecac: Impact on Poisoned Patient Triage Decisions**

Kim AS,<sup>2</sup> Kearney TE,<sup>1</sup> Hiatt PH,<sup>1</sup> Burkhardt C,<sup>1</sup> Rowley F,<sup>1</sup> Tsutaoka B,<sup>1</sup> Olson KR,<sup>1</sup> Lightwood J.<sup>2</sup> <sup>1</sup>California Poison Control System (CPCS)-SF Division, Department of Clinical Pharmacy, University of California, San Francisco, CA, USA; <sup>2</sup>UCSF School of Pharmacy, San Francisco, CA, USA.

*Background:* We recently modified our poison control center (PCC) guidelines for managing pediatric ingestions to eliminate use of syrup of ipecac (SI) in accordance with the AAP policy statement. *Objective:* To determine the impact of recent policy change on triage decisions and associated emergency department (ED) referral rates. *Methods:* Chart review and reassessment of 2002 CPCS cases administered SI. Inclusion criteria: unintentional, ingestion, <6 years, call to PCC from home, SI recommended by PCC. Cases were blinded with respect to management and were reviewed and coded by 3 Specialists in Poison Information (SPI). (Each case was reviewed by 2 SPIs and all cases with disagreement were reviewed by a third SPI.) Triage options included: home management, ED referral, or MD referral, but not SI administration. Reasons for triage decision were tailored to each option (e.g. “non-toxic substance” for home management; “symptoms” for ED referral) and one was chosen by the SPI as their principle reason. *Result:* Of 231,961 pediatric exposures, we identified 526 cases (0.2%) treated with SI at home, with only 240 of these cases recommended SI by the PCC, and, of these, only 26 (10.8%) were subsequently referred to an ED. On blinded review (without the option of SI), SPIs selected 218 of 240 (90.8%) cases for ED referral. The vast majority of these cases (190/218, 87%) involved ingestion of a mushroom. Inter-rater consistency in one pair of reviewers was very good ( $\kappa=0.85$ ) but only moderate for the other 2 pairs ( $\kappa=0.56$  and  $\kappa=0.52$ ). *Conclusion:* Use of SI was rare before the AAP policy and most often used without professional advice. The increase in ED referral represents a significant potential increase in hospital charges for poisoning management. We are reviewing our mushroom management guideline in an effort to develop additional options for safe management without ED referral.

### **290. The Toxicology Service Model—A New Approach to Managing Toxicology Cases**

O'Donnell SJ,<sup>1</sup> Donovan JW,<sup>1</sup> Burkhart KK.<sup>2</sup> <sup>1</sup>PinnacleHealth System, Harrisburg, PA; <sup>2</sup>Agency for Toxic Substances and Disease Registry, Philadelphia, Pennsylvania.

*Background:* Many regional poison centers (RPC) have faced the possibility of closure due to lack of financial support. We report a unique reconfiguration of toxicology services to a region after closure of the RPC. *Methods:* In 2003, a RPC was closed due to diminished financial support. Separation of *public poison control* functions and *professional toxicology service*

functions was accomplished. Telephone exchanges within the region were redistributed between two existing RPC's in the state to provide public poison control and access to The Poison Help Line. A toxicology treatment and consultation center was established at an urban teaching hospital and a toll-free telephone number for toxicology services was provided to area hospitals. The service, the first of its kind in the US, is staffed by board certified medical toxicologists and toxicology residents. An 8 bed treatment unit was established with biomedical and visual monitoring capabilities, and staffed by critical care and toxicology-trained nursing staff and a multidisciplinary medical team including psych/social services and aeromedical transport. The consultation center is staffed 24/7 by the same team of toxicologist and residents staffing the treatment unit. Management protocols and a Case Encounter Form were developed and implemented. Additionally, a Consultation Form was developed following standard toxicology treatment guidelines, individualized to each patient's needs and faxed to the caller. *Result:* Of the 51 hospitals offered membership in the system, 46 (90%) agreed to participate. Another 3 hospitals agreed to participate on a fee-for-service basis. During the first 20 months, the center managed 7900 phone consults, with an average of 13/day. There were 619 admissions to the toxicology service, 317 (51%) of which were transferred from other hospitals, 121 in-patient consults and 121 ED consults. This compares to 10 hospital calls/day by the former RPC during the last 6 months of its operation. *Conclusion:* The provision of toxicology services by a dedicated staff of professionals whose sole function is managing toxicology cases in healthcare facilities (the toxicology service model) is a reproducible model and an alternative to the traditional poison control center model.

### **291. Have You Got What it Takes to be a SPI?: Guidelines for Pre-Employment Assessment**

Webster SS, Lopez GP. *Georgia Poison Center, Atlanta, GA, USA.*

*Background:* From 2002–2004, this regional poison center (RPC) experienced an attrition rate as high as 52% of Specialists in Poison Information (SPI). Informal interviews of these SPI's revealed difficulty with math and critical thinking skills, high call volume, high acuity level of victims, and physical discomfort of the setting as reasons for dissatisfaction. Due to high costs of time and money in recruitment and orientation, the following questions were asked: are the job expectations for SPI's being realistically portrayed to applicants and are the most qualified candidates being hired for the position? *Methods:* A review of the literature revealed a paucity of research on the job requirements of SPI's. Published studies on telephonic nursing provided the transferability needed to identify key skills as indicators of competency when working in a call center. Information from a management-consulting firm assisted in the development and standardization of the employee selection process. *Result:* Communication, documentation, assessment, and critical thinking were identified through research as key skills required for optimal performance as a telephone nurse. Procedural guidelines for a Pre-Employment Assessment (PEA) of applicants, along with the development of a PEA tool used to assess documentation, critical thinking, assessment, and mathematical skills, resulted from the evaluation of literature. During an introductory visit, each applicant completes the PEA tool and observes the SPI's as they perform their duties within the call center. The candidate is instructed to reflect on the job requirements and call the poison center to schedule a formal interview if he/she decides to continue with the application process. *Conclusion:* The new procedure for hiring SPI's has been in effect for 11 months. Seven employees completed the PEA tool and 6 were hired as SPI's. Two have resigned from the RPC, citing scheduling difficulties and family illness. Difficulty with the mathematical questions and the critical thinking component of the PEA tool led the GPC to not offer a position to one candidate.

### **292. Member Hospital Satisfaction Survey: Rating Poison Center Services**

Doyle C,<sup>1</sup> Mrvos R,<sup>1</sup> Krenzelok EP.<sup>1,2</sup> <sup>1</sup>*Pittsburgh Poison Center, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA;* <sup>2</sup>*Schools of Pharmacy and Medicine, University of Pittsburgh, Pittsburgh, PA, USA.*

*Background:* The partnership of poison centers and emergency departments is an important component in the treatment of poisonings. Poison Centers and emergency departments work together to provide the highest quality of patient care possible. Communication is key to maintaining the most positive relationship possible. The assessment process is critical to strategic planning towards service improvement. To determine if the needs of member hospitals are being met by the poison center, a survey was conducted. *Methods:* A survey tool was developed using questions relative to specific attributes of providing poison information. The survey rated the quality of information provided, toxicology consultation and responsiveness to specific needs and was sent to the emergency department medical directors, nursing staff and pharmacy department of 62 member

hospitals. Additional information regarding website use and assimilation of the national toll-free telephone number were also gathered. Additional comments were requested. *Result:* Overall, the poison center received a 95% satisfaction rating for services provided. Satisfaction with specific poison center services included: quality of information (99.0%), communication skills (92.9%) and toxicology consultation (82.5%). The most favorable attributes were the accessibility and quality of information provided by the poison center. The least favorable attribute was the current method of obtaining follow-up information and the provision of subsequent guidance for patient management. Only 1.09% of respondents have utilized the Poison Center website. Use of the national toll-free telephone number is successful with 96.5% usage. *Conclusion:* The poison center is viewed as a valuable asset to emergency departments. The quality of information provided is regarded highly. The survey has prompted the development of strategies to improve communication between the poison center and the emergency department staff to enable greater cooperation in the sharing of information.

### 293. Emergency Physician's Opinions Re: Washington Poison Center

Robertson WO, Caffrey A. *Washington Poison Center, Seattle, WA, USA.*

*Background:* In 1986, we conducted our first survey of Washington Emergency Physicians about their perceptions of the Washington Poison Center's (WPC's) performance; the results were summarized and published. The exercise was repeated in '93, '97 and in 2005. *Methods:* The original conventional 2 page survey was updated; it was distributed along with an explanatory letter and a return envelope to a mailing list obtained from the state chapter of the American College of Emergency Physicians. Responses were tallied, summarized and compared to prior surveys. *Result:* For 2005, some 612 surveys were distributed; 221 were returned. The average respondent had been in practice for 14 years—with more than 50% functioning in "urban" communities. They reported calling the WPC an average of 19 times per year—despite having Micromedex's Poisindex operative in their ED's. They valued: 1. Emergency treatment measures; 2. Ingredient data; 3. Acute toxicity S/Sx; 4. Various treatment guidelines and 5. Potential long term effects. Thirty six percent were uncertain about the professional status of the WPC's staff—but 97% reported their "satisfaction titer" at 80% or better. Occupational and environmental exposures were the newest problem for them and, in sharp contrast to years gone by, more than 70% felt the WPC should be governmentally supported. *Discussion:* Once again, recipients were most positive in their responses—and particularly valued being able to consult with a Board-Certified Medical Toxicologist in a virtually "STAT" manner. In more than 80% of their calls, the information had played a + role in management of the patient. *Conclusion:* Washington's emergency physicians continue to highly value the WPC's services with increasing numbers calling for governmental support.

### 294. Review of Hydrocarbon Follow-Up Protocol Utilizing Result and Outcome Information

DeSimone ED. *Florida Poison Information Center/Jacksonville, Jacksonville, FL, USA.*

*Background:* The Florida Poison Information Center—Jacksonville protocol for ingestions of 1 taste, lick, sip, mouthful or teaspoon of a hydrocarbon has required follow-up at 1 and 4 hours. A 1 year review of our poison centers data on hydrocarbon exposure cases involving ingestion of no more than 1 taste, lick, sip, mouthful or teaspoon and the result/outcome findings with that exposure was done in order to determine if both follow-ups were necessary. To this date, no published studies have been done on the efficacy of our current hydrocarbon protocol. *Methods:* Poison Center data was obtained for year 2004 on all hydrocarbon ingestion exposures of 1 taste, lick, sip, mouthful or teaspoon in humans. This data was also selected to include symptoms, results and medical outcome. All data was reviewed to determine if both the 1 and 4 hour follow-ups in all hydrocarbon ingestion cases was necessary. *Result:* 364 cases were reviewed of all age groups for ingestion of a hydrocarbon product in the amounts of 1 taste, lick, sip, mouthful or teaspoon. Inclusion criteria were met on 133 cases having a 1 and 4 hour follow-up. *Outcome Results:* Out of a total of 133 cases which met inclusion criteria, 130 cases (97.7%) resulted in no change in *Results:* effect after the initial 1 hour follow-up. Fifty-six cases (42%) resulted in no effect at both the 1 and 4 hour follow-up, and 77 cases (57.7%) had resolution of symptoms prior to the initial 1 hour follow-up call. A majority of cases resulted in resolution of symptoms without medical intervention at, or before the 1 hour follow-up was performed. The current protocol of follow-up on all hydrocarbon cases where ingestion amounts were equal to or less than 1 taste, lick, sip, mouthful or teaspoon, where follow-up was 1 and 4 hours after exposure, did not result in a change of outcome. *Conclusion:* The current Poison Center protocol of additional follow-up at 4 hours for hydrocarbon ingestion including 1 taste, lick, sip, mouthful, or teaspoon

appears to be unwarranted and should be reconsidered. Our data has shown that there has been no change in result/outcome past initial 1 hour scheduled follow-up. Additional studies using multiple centers should be performed to validate the data.

### 295. Lack of Poison Center Standard of Care Following Tetrahydrozoline Exposures

Welch S, Klemens J, Waszolek K, Lovecchio F. *Banner Good Samaritan Regional Poison Center, Phoenix, AZ, USA.*

*Background:* Retrospective poison center studies have suggested that asymptomatic pediatric ingestions involving <7.5 ml of tetrahydrozoline may be managed at home. Despite this, treatment guidelines or prospective validation studies are rarely reported. *Methods:* This was a prospective poison center survey. Seventy-five certified poison control centers in the US and Canada were sent a facsimile regarding management questions pertaining to an acute asymptomatic tetrahydrozoline exposure in a child occurring <5 minutes ago. If participants did not respond after two days, a telephone follow-up occurred. Responses were made by certified specialists in poison information (CSPI's) or physician medical toxicologist. *Results:* Fifty-three centers replied (71%) with CSPI's (53) and medical toxicologist (1) responding. Twenty-two (42%) of centers reported protocols that were consistent with immediate health care evaluation for children who ingested >7.5 ml tetrahydrozoline regardless of symptoms. Thirty-one centers (58%) had variable referral criteria ranging from >5 ml (28%) to any (or no known) dose (30%). Only 36 (68%) of centers had a written or verbal protocol. Typical initial treatment recommendations included immediate emergency department evaluation (81%) or home observation (19%). *Conclusion:* A wide variation exists in poison center recommendations in accidental symptomatic tetrahydrozoline exposures.

### 296. Antidepressant Poisonings Reported to the Drug and Poison Information Center in Izmir, Turkey

Akgun A,<sup>1</sup> Hocaoglu N,<sup>1</sup> Kalkan S,<sup>1</sup> Capar S,<sup>2</sup> Tuncok Y.<sup>1</sup> <sup>1</sup>*Dokuz Eylul University School of Medicine, Izmir, Turkey;* <sup>2</sup>*Dokuz Eylul University Faculty of Art and Sciences, Izmir, Turkey.*

*Background:* Poisonings concerning antidepressants that were reported to Drug and Poison Information Center (DPIC), in Izmir between 1993 and 2004 was analyzed in our retrospective study. *Methods:* Age, sex, antidepressant type, route and reason for the exposure, clinical effects and outcome of the poisoned patients were recorded on standard data forms, then entered into a computerized database program. The severity of clinical manifestations were graded and assessed according to the EAPCCT/IPCS Poisoning Severity Score. Statistical analysis was performed by using the chi-square test. *Result:* The DPIC recorded 55,962 calls concerning poisoning, 5,516 (9.9%) of them with 5857 antidepressant agents were antidepressant poisonings. Female/male ratio was 2.7. The most involved antidepressants were tricyclics (62.4%, 45% of them amitriptyline) and selective serotonin re-uptake inhibitors (23.2%). The incidence of concomitant drug or alcohol intake with an antidepressant drug was 6.2%. While accidental poisonings were the most common cause of poisoning between 0–6 years (92.1%), rate of intentional poisonings were higher in 19–29 age group of adults ( $p < 0.05$ ) and 13–18 age group of children ( $p < 0.0001$ ). At the time of the telephone inquiry, there were no symptoms in 80.6% of patients. Clinical effects were graded as mild (11.7%), moderate (2.6%) or severe (5.1%). Observation alone was recommended in 23.9 of cases. Gastric lavage (0.8%), activated charcoal (31.2%), gastric lavage with activated charcoal (30.6%) were other recommended gastrointestinal decontamination attempts. Outcome results of most of the patients were not reached (85.7%). According to our results, only one 2.5 year old child died from amitriptyline ingestion. *Conclusion:* Intentional poisonings with tricyclic antidepressant ingestions are common cause of antidepressant poisonings reported to our DPIC. Although our center helps the appropriate management of antidepressant ingestions, spontaneous reporting system limits the records of all antidepressant poisonings with their outcome results.

### 297. Exotic Snakes-Not Always in Exotic Places

Lubich C, Krenzelok EP.<sup>1,2</sup> <sup>1</sup>*Pittsburgh Poison Center, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA;* <sup>2</sup>*Schools of Pharmacy and Medicine, University of Pittsburgh, Pittsburgh, PA, USA.*

*Introduction:* The exotic pet industry is estimated to be worth \$15 billion annually in the United States alone. Approximately 3% of U.S. households harbor 7.3 million pet reptiles, the majority of which are snakes and include venomous snakes such as

*Crotalidae* and *Micrurus* species. Poison center staffs throughout the US are familiar with the management of envenomation from these indigenous species. However, venomous species may include exotic reptiles whose bites pose substantial treatment challenges due to both a lack of experience and the difficulty in obtaining antivenoms. Two pet cobra envenomation incidents illustrate the challenges that face poison centers that are confronted with these exposures and stress the importance of being aware of how to manage exotic reptile exposures. *Case Report:* A female was bitten on the buttock by a *Naja naja kaouthia* while cleaning its cage. The local zoo administrative office was closed on a weekend and it took approximately 35 minutes to contact a zoo reptile expert to assist the RPIC in locating Saimarr Cobra Antivenom which was flown to the treatment facility. The patient received antivenom therapy 8 hours after the exposure. Three weeks later a male was envenomated by a *Naja naja kaouthia*. Antivenom was obtained from the same source in less than one hour and administered to the patient successfully. Both patients had favorable outcomes. *Case Discussion:* There was a significant time lag between the first envenomation and treatment due to the length of time that it took to locate and transport the antivenom owing to the lack of familiarity with exotic snake envenomation and associated resources. The second case was resolved expediently due to recent experience with a similar envenomation case. *Conclusion:* Most snakebite cases in the U.S. are expected to involve native species. However, it is important for poison centers to be aware of the large underground presence of exotic venomous reptile pets. It is critical for a RPIC to be aware of the resources available and have procedures and protocols in place to manage these exposures.

## 298. Utilization of a Quality Assurance Program by a Regional Poison Center

Barker KA. *Tennessee Poison Center, Nashville, TN, USA.*

*Background:* In 2003, U.S. Poison Centers received 2,395,582 calls regarding human exposures. This data is collected by Specialists in Poison Information (SPI) at the 61 U.S. Poison Centers and uploaded to the national TESS database. The quality of this TESS data depends on the validity of the data provided by the individual poison centers. TESS has required fields that must be documented. However, there are not specific requirements for the documentation field. Lack of requirements in this field may result in invalid clinical effects or treatment being reported. *Methods:* The Tennessee Poison Center (TPC) developed a quality assurance program to assess the validity and consistency of its case documentation. Fifteen substances were selected as potentially highly toxic agents that required defined documentation for cases treated at a hospital. Documentation guidelines were written by the managing director and reviewed by the medical director. Focus was given to specific concerns for the particular poison. SPIs were given copies of all documentation guidelines to follow. A search was written for each substance in Toxicall. All SPIs were trained in running searches and completing the QA form. Each weekday, a SPI performed QA. *Result:* TPC utilized this QA program over a 12-month period. The results revealed an overall adherence of over 95% to documentation guidelines. The utilization of SPIs to perform QA did not take away time from answering the phones. The daily search would only retrieve cases that had been closed since the search the day before. By standardizing the QA form with specific parameters, individual interpretation by the SPI was minimized. The QA program did identify certain consistent items omitted from the written documentation of the chart. These items were not limited to one particular shift or particular SPI. SPIs received education that detailed reasons for the required documentation that had been omitted. *Conclusion:* A poison-specific QA program can be a benefit for regional poison centers and an educational tool for SPIs. Identifying required documentation on cases can improve the quality of the data obtained by Poison Centers and increase the validity of data submitted to TESS.

## 299. A Quality Assurance Tool for Call Recordings

Muller AA. *The Poison Control Center at The Children's Hospital of Philadelphia, Philadelphia, PA, USA.*

*Background:* Our Poison Control Center's (PCC) quality assurance (QA) program includes regular, systematic visual chart reviews by the Clinical Managing Director and Medical Director. We recently obtained a call recording system and needed a tool to objectively evaluate the quality of calls. At the same time, our institution's performance evaluation process was being

overhauled to include more measurable aspects of performance. *Methods:* A list of quality standards, based on our PCC's Specialist in Poison Information and PharmD intern job descriptions, and a scoring system, weighted by level of importance, were merged to create the QA tool. These quality standards include: communication skills, active listening skills, poisoning management and documentation. In order to simply test the objectivity of this tool, 2 members of the PCC reviewed 20 calls along with the written charts, and completed the QA tool for each of them. The scores for each question were compared. *Result:* A pattern was noted in that scores for certain questions were not consistent between the two testers. This led to a revision of the tool. Those questions that were deemed somewhat subjective were made more specific. *Conclusion:* This tool can be used as another aspect of PCC quality assurance. In addition, this measuring tool will be integrated into our PCC's performance management program. Further study is needed to evaluate its impact on our PCCs overall quality of care.

### 300. Washington Poison Center's Weekly Teleconference

Robertson WO. *Washington Poison Center, Seattle, WA, USA.*

*Background:* Twelve years ago, we began a weekly one hour Monday 8:30 AM teleconference among our associate medical directors in Seattle, Tacoma, Spokane and Boise, Idaho. We have subsequently expanded participation to include centers in British Columbia, Oregon, New Jersey and Nebraska—plus an individual in Tucson, AZ and another in Anchorage, AK. The focus is on interesting and 'different' cases, new business involving the centers and/or the specialty of toxicology, 6–10 'hot' newspaper articles plus 5–10 recent journal articles. Minutes are distributed along with copies of the clippings and the journal articles (or abstracts). WPC staff can attend and all are encouraged to peruse the weekly minutes as part of their in-service activity. We decided to survey participants about the program. *Methods:* A one-page objective survey was distributed and returned—"anonymously". *Result:* Ten of 10 medical toxicologists responded; 10 of 20 WPC staff did so; 7/10 toxicologists liked the time of day; three with kids found it a problem. Better and longer-term follow-up was the most-sought addition; 9/10 encouraged continuing the newspaper clippings; all valued the center updates with several asking for more about what was happening in D.C.—with AAPCC and with the 'Feds' (HSRA, CDC and FDA in particular). Journal additions were positively seen—but at least 4 respondents found them "too much to read!" The medical toxicologists seemed to particularly value the back and forth discussion—and not a one felt a visual interaction was worth the time and effort—and costs-involved. WPC staff's responses conveyed largely the same messages. *Discussion:* All in all, we plan for more of the same—and would invite others to join. *Conclusion:* For our colleagues, our current telephone conference appears to meet their wants and needs.

### 301. The Effect of High Flux Hemodialysis on Serum Fomepizole Concentrations

Mowry JB,<sup>1</sup> McMartin KE,<sup>2</sup> Wedin GP,<sup>3</sup> Hornfeldt CS,<sup>3</sup> Hardy AE.<sup>4</sup> <sup>1</sup>Indiana Poison Center, Indianapolis, IN; <sup>2</sup>Louisiana University State Health Sciences Center, Shreveport, LA; <sup>3</sup>Orphan Medical, Inc., Minnetonka, MN; <sup>4</sup>Butler University, Indianapolis, IN.

*Background:* High flux hemodialysis shortens the elimination half-lives of methanol and ethylene glycol compared to standard hemodialysis; however, the effect of high flux hemodialysis on fomepizole elimination remains unknown. We designed a protocol to study the effects of high flux dialysis on the elimination half-life of fomepizole and determine if the recommended dosing regimen during hemodialysis needs adjustment. *Methods:* Eligible patients are those presenting to our hospital with methanol or ethylene glycol poisoning requiring treatment with both fomepizole and high-flux hemodialysis. After initiation of hemodialysis, fomepizole is administered every 4 hours according to the product labeling with blood collected every 30 minutes throughout dialysis. Samples are collected on ice, centrifuged and the serum frozen for analysis. Time versus concentration data are analyzed by non-linear regression for determination of elimination half-life. Serum fomepizole concentrations during dialysis are compared to the reported minimal inhibitory concentration. *Result:* Elimination in the

three subjects enrolled to date appears to be first order with a mean half-life of  $1.7 \pm 0.6$  hours compared to  $3.0 \pm 0.4$  hours reported in the literature.

Subject	Elimination rate constant ( $\text{hr}^{-1}$ )	Elimination half-life (hr)	Correlation coefficient ( $r^2$ )	Time to $<10 \mu\text{M}$ (hr)
1	0.373	1.86	0.978	7.99
2	0.626	1.11	0.972	3.94
3	0.310	2.23	0.877	7.57

Serum fomepizole concentrations remained above the minimum inhibitory concentration of  $10 \mu\text{M}$  throughout dialysis except in one subject whose hemodialyzer malfunction delayed administration of the scheduled 4 hour fomepizole maintenance dose. Using each subject's serum fomepizole concentration at the start of dialysis, the time for concentrations to become subtherapeutic without administration of a 4 hour maintenance dose were calculated. *Conclusion:* These data suggest that the elimination of fomepizole is increased during high-flux hemodialysis compared to standard dialysis.

### 302. Determining Alcohol Elimination Rates in Chronic Alcoholics Presenting to the ED

Readie J, Hung OL, Hochman S, Shih RD. *Morristown Memorial Hospital, Morristown, NJ, USA.*

*Introduction:* Chronic alcoholics eliminate ethanol at higher rates than non-tolerant drinkers. Certain alcoholics may eliminate ethanol at much greater rates than the estimated 20–25 mg/dL/hr for alcohol-tolerant individuals. It has been suggested that first order elimination kinetics may occur in individuals with extremely high ethanol levels. The purpose of the study is to evaluate ethanol elimination rates among chronic alcoholics presenting to the emergency department with extremely high serum ethanol levels. *Case Report:* The study design was a prospective, convenience sample of alcohol-intoxicated patients presenting to the ED with an initial serum ethanol  $>400$  mg/dL. Serial serum ethanol measurements were obtained over 4 hours on a predetermined schedule. Informed written consent was obtained during a prior ED visit when the patient's initial blood alcohol level was measured  $>400$  mg/dl and the patient (when no longer intoxicated) agreed to enroll in the study if he/she returned on a future ED visit for the same presentation. Demographic data (ethnicity, gender, age), serum ethanol level, time of sampling was recorded. Elimination rates were calculated for each patient. *Case Discussion:* 9 male patients enrolled in the study. Mean initial serum ethanol level was 471.53 mg/dL. (range: 405.1–602.7 mg/dL). Mean elimination rate =  $28 \pm 5$  mg/dL/hr (range 21–36). Mean correlation coefficient =  $-0.97 \pm 0.03$ . (range  $-0.92$ – $-0.99$ ). No evidence of first-order kinetic metabolism was noted for any patient. *Conclusion:* Chronic alcoholics with serum ethanol levels greater than 400 mg/dL appear to eliminate alcohol using zero kinetics at a mean rate of 28 mg/dL/hr.

### 303. Topical Heparin with Tetracycline Versus Heparin or Tetracycline Alone, in Preventing Ocular Scarring Due to the Venom of the Black Spitting Cobra (Naja Sumatrana)

Cham G,<sup>1</sup> Pan J,<sup>1</sup> Lim F,<sup>2</sup> Gopalakrishnakone P.<sup>3</sup> <sup>1</sup>Tan Tock Seng Hospital, Singapore; <sup>2</sup>Singapore Zoological Gardens, Singapore; <sup>3</sup>National University of Singapore, Singapore.

*Background:* The black spitting cobra (*Naja sumatrana*) is the commonest venomous snake in Singapore. In defense, it can spit venom at an attacker's eyes. Various ocular injuries have been described some resulting in blindness. There are no recommendations for therapy. The study aims to determine the efficacy of topical ocular heparin, tetracycline ointment or both, in treating ocular injury from the venom of the *Naja sumatrana* in a rabbit model. *Methods:* New Zealand White Rabbits were used. Pooled fresh venom from the cobras was obtained. Heparin 5000 IU/ml and 1% tetracycline ointment were used. In random groups of three rabbits, they were anaesthetized and 0.05 ml of 20 times dilute venom was introduced topically into the conjunctival sacs. After a specified delay, heparin, tetracycline ointment, heparin-tetracycline combination and saline, was

introduced topically on the rabbit conjunctivae. The rabbits were assessed after 24, 48, 72 hours, one and two weeks by an ophthalmologist blinded to the treatment arms. A portable slit lamp was used. Corneal scarring, ectropion or entropion were considered scar features. The Roper-Hall classification was used. Hazy corneal reflex, chemosis, corneal discharge, conjunctival and ciliary injection were considered inflammatory features. Corneal defect was revealed by fluorescein staining. The Kruskal-Wallis test was used to compare endpoints. *Result:* In the heparin and heparin-tetracycline groups, there were no features of scarring at two weeks while the saline and tetracycline groups were significantly scarred; the Roper-Hall grades were normal from day two onward, but highest in the saline group; inflammatory features subsided significantly faster compared to saline or tetracycline. There was no difference in the rate of corneal re-epithelialization. *Conclusion:* Topical heparin therapy was better than tetracycline or saline. It reduced scarring, inflammation and improved overall ocular outcome after exposure to *Naja sumatrana* venom. The efficacy of the heparin-tetracycline treatment combination is driven by heparin.

### 304. Tracheobronchial Biomarkers of Acute Lung Injury

Burgess JL,<sup>1</sup> Foster KN,<sup>2</sup> Kurzius-Spencer M,<sup>1</sup> Littau SR,<sup>1</sup> Richey KJ,<sup>2</sup> Josyula AB.<sup>1</sup> <sup>1</sup>University of Arizona, College of Public Health, Tucson, AZ, USA; <sup>2</sup>Arizona Burn Center, Maricopa Integrated Health System, Phoenix, AZ, USA.

*Background:* Smoke Inhalation victims are at high risk of lung inflammation and acute lung injury. Evaluation of pulmonary inflammatory biomarkers associated with the extent of lung injury may help to identify options for future pharmacologic interventions. *Methods:* Patients with inhalation injury admitted to a regional burn center and requiring intubation were eligible for the study. Tracheobronchial suction fluid was collected every two hours for up to 72 hours and supernatants were analyzed for interleukins (IL) -1 $\beta$  and -8, and tumor necrosis factor alpha (TNF- $\alpha$ ) by ELISA. Data on clinical course included arterial oxygenation (PaO<sub>2</sub>) and fraction of inspired oxygen (FiO<sub>2</sub>) at 2–4 hour intervals. Standard parametric and non-parametric statistics were used. *Result:* Of 56 subjects, 6 (10.7%) died, and over 53% of surviving subjects were diagnosed with acute respiratory distress syndrome (PaO<sub>2</sub>/FiO<sub>2</sub><200). PaO<sub>2</sub>/FiO<sub>2</sub> decreased over time (p<0.0001), generally reaching its nadir about 20–30 hours post-intubation. Log-transformed cytokine values were significantly correlated with each other (all p<0.001) and increased significantly over time (all p<0.001), but most sharply in the first four hours post-intubation. PaO<sub>2</sub>/FiO<sub>2</sub> had a significant inverse relation to IL-1 $\beta$  and TNF- $\alpha$  (p<0.025 and p<0.035, respectively). Log IL-8 values in the first 6 hours were significantly higher in patients with sepsis (p<0.023). Although early cytokines tended to be higher in the presence of trauma, fracture or percent full thickness burn, the differences were not significant. *Conclusion:* In patients admitted to a burn center with smoke inhalation requiring intubation, tracheobronchial suction material concentrations of IL-1 $\beta$  and TNF- $\alpha$  were negatively correlated with PaO<sub>2</sub>/FiO<sub>2</sub>. This research was supported by the U.S. Army Peer Review Medical Research Program, grant DAMD17-02-1-0673.

### 305. Is Total Urinary Lead Excretion by Children During Chelation Predicted by Optimally Timed 24-Hour Urine Aliquots?

Onisko N,<sup>1</sup> Daubert GP,<sup>1</sup> White SR,<sup>1</sup> Grzybowski M,<sup>1</sup> Bhambani K.<sup>2</sup> <sup>1</sup>Children's Hospital of Michigan Regional Poison Control Center, Detroit, MI, USA; <sup>2</sup>Children's Hospital of Michigan, Detroit, MI, USA.

*Background:* Approaches to chelation therapy for children with lead poisoning are evolving. While various regimens are in place at our institution, all guidelines have historically recommended monitoring daily 24-hour urine collections for the first 5 days of chelation. In non-toilet trained children, this necessitates foley catheterization with its inherent risks and difficult maintenance. The ability to predict total urinary lead excretion from fewer than five 24-hour urine collections during pediatric lead chelation has not previously been reported. The objective of this study is to evaluate the optimal timing and minimum number of urine aliquots necessary to predict total lead excretion. *Methods:* Retrospective chart review of 67 children with blood lead levels greater than 40 mcg/dL who underwent chelation for lead toxicity at our center between March 1, 2003 and January 5, 2003. Data included demographics (predictors) and total 24-hr urine Pb concentrations on days 1–5 during chelation (outcome). Differences in urinary lead levels were evaluated using a mixed model for repeated measures which accounts for missing values. *Result:* Most patients were male (66%) and African-American (90%). 25.4% had a history of prior chelation. The mean age was 3.2 years. Only race and treatment were significantly associated with urinary lead excretion during chelation.

After controlling for race and treatment, there were no significant differences in urinary lead levels after Day 3. Delta urinary lead levels were (mcg/L): 131.8 ( $p < 0.05$ ), 138.0 ( $p < 0.05$ ), 75.8 ( $p = 0.21$ ), and 51.3 ( $p = .47$ ) higher from Days 1 to 2, 2 to 3, 3 to 4, and 4 to 5, respectively, at all p-values. *Conclusion:* Based on our preliminary data, the optimal timing for the collection and prediction of total five-day urine Pb excretion is Day 1 through Day 3 of chelation. While more research is warranted and we plan to expand our dataset, this finding may allow a reduction in prolonged urinary catheterization, complications, nursing time and laboratory costs.