Riot Control Agents
Exposure and Treatment
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INTRODUCTION AND TOXICOLOGICAL CHARACTERISTICS
Introduction

- Riot control agents (RCAs) - popularly referred to as “tear gas” or “pepper spray”

- RCA are NOT to be confused with incapacitating agents
Riot Control Agents and the CWC

- Any chemical not listed in a Schedule, which can produce rapidly in humans sensory irritation or disabling physical effects which disappear **within a short time** following termination of exposure.

- Each State Party undertakes not to use riot control agents as a method of warfare.

- Law enforcement including domestic riot control purposes is not prohibited.
Riot Control Agents - Characteristics

- Riot control agents are compounds that cause temporary incapacitation by
  - irritation of the eyes (tearing and blepharospasm), causing them to close,
  - irritation of the upper respiratory tract.
- Synonyms: irritants, irritating agents, and harassing agents;
- For the public: « tear gas »
Riot Control Agents - Characteristics

- Rapid time of onset of effects (usually less than 1 min)
- Relatively brief duration of effects (15–30 min)
  - After escape from atmosphere
  - And decontamination
- High safety ratio (the ratio of the lethal dose [estimated] to the effective dose).
CN: alpha-Chloroacetophenone

« MACE »

The most toxic – acutely and chronically

- Minimum lethal concentration 850-2,250 mg/m³
- Intolerable concentration: 35 mg/m³
CN: alpha-Chloroacetophenone

- Solid
- Fragrant (like apple blossoms)
- Insoluble in water, soluble in organic solvent
- Short persistency
CS: O-chlorobenzylidene malononitrile

- Carson and Stoughton (1928)
- Use started late 50s

Compared to CN:
- More stable
- Ca. 7-10 times more potent lacrimator
- Less toxic

- Minimum lethal concentration: 2,500 mg/m³
- Intolerable concentration: 5 mg/m³
- Irritation threshold: 0.004 mg/m³
CS: O-chlorobenzylidene malononitrile

- White crystalline powder with pungent odor (pepper)
- Insoluble in water, soluble in organic solvent
- Variable persistency
Oleoresin capsicum (OC) and Natural / Synthetic Capsaicinoids

- First developed 70s
- 90s for derivatives

OC: mixture of several compounds
- Irritation threshold (50% CS): 0.002 mg/m³

Components of OC
- Capsaicin
- n-nonanoyl vanillylamide (VAN), = pelargonic acid
- vanillylamide (PAVA) = Nonivamide

OC/CS
Ca. 0.1% pepper extract

Ca. 10-15 % pepper extract
CR: dibenz[b,f][1,4]oxazepine

- The most potent lacrimator
- The least systemically toxic
  - Minimum lethal concentration 10,000 mg/m3
  - Intolerable concentration: 1 mg/m3
- Highly stable
Other RCA

Old:
- Adamsite (Diphenylaminochlorarsine - Sternutator / vomiting agent)
- Benzyle bromide
- Acrolein (papite)
- Chloropicrin (PS)
- Bromoacetone (BA)

New

Defense spray using isothiocyanate as an ingredient
WO 2012074922 A1
PRESENTATION AND USE
Circumstances of Exposure

- Riot control
- Military and police force training
- Self-defence
- (War operations)
Presentation and use

« Tear gas »: they are NOT gas

Consequences:

- Contamination
- Use of solvents/excipients for delivery
Presentation and use

- Combined with solvents/excipients to make Liquid or gel sprays

- Mixed with water in water cannon
Presentation and use

Pyrotechnic smoke generators/canisters
Presentation and use

- Gun cartridge
- PepperBalls®

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Circumstances of Exposure

- Trainees
- Trainers
- Protesters
- Law Enforcement Officers
- Medical care providers

Acute toxicity
Acute + chronic toxicity
Protection
SIGNS & SYMPTOMS
Low toxicity but

Dangerous

To specific populations
- Elderly/young
- Respiratory defects

In case of
- Misuse or over-zealous use
- Long duration exposure
- Confined space
Signs of Acute Exposure

- Rapid conjunctival irritation, burning sensation in less than 5 min
- Diffuse conjunctival and scleral injection
- Pain
- Periorbital oedema
- Eyelid erythema (more rarely vesications)
- Blepharospasm
- Lacrimation and photophobia for 15-30 min
- Beware: solid particles - keratitis/necrosis…
Signs of Acute Exposure

- Stinging or burning sensation in the nose
- Tightness and pain in the chest
- Sore throat
- Sporadic breath holding, dyspnea
- Coughing, sneezing
- and sometimes retching or vomiting.
  - Lung damage/pulmonary edema in certain extreme cases
Signs of Acute Exposure

- Skin irritation: tingling or burning sensation
  - If prolonged exposure: erythema, oedema, blistering and superficial burns (CN+++)

- If ingested (or by ingestion of contaminated saliva): vomiting, diarrhea
Harmful Effects

- Linked to the RCA (dose and duration)
- Linked to excipients, solvents and method of dispersal
  - Presence of trichlorethylene, trichlorobenzene...
  - e.g. production of chlorine in pyrotechnic device
- Linked to the inappropriate use or to the «dispenser»
  - e.g. cartridge
Other Toxic Effects

- Long term
  - Skin sensitizer (CN+++): allergic dermatitis
“Within Europe, the study found that the biomedical research necessary to justify the deployment of certain crowd control technologies was either absent, lacking or incomplete and that there was inadequate quality control at production level to ensure that adverse or even lethal effects were avoided.”

“Crowd Control Technologies - An Assessment Of Crowd Control Technology Options For The European Union” (EP/IV/B/STOA/99/14/01)
Do we Know Enough?

- Considered relatively safe
  - Reduced precautions by users

- Attract very low attention
  - On the internet more information from unqualified sources than from toxicologists
LETHAL IN DISGUISE

THE HEALTH CONSEQUENCES OF CROWD-CONTROL WEAPONS

CHEMICAL IRRITANTS

Kenya: #OccupyPlayground – Excessive Force in the Quelling of a Public Demonstration at Langata Road Primary School

Egypt: The Case of the Abu Zaabal Police Van

Hungary: Police Attack on Protesting Refugees
MANAGEMENT OF CASUALTIES
High-level evidence for the best treatment is not available

Only case reports or case series
General

- Take away from source of exposure

- Solid particles/not soluble in water!
  - Disrob / use wind or ventilator
  - Decontaminate
    - Wipe skin before washing
    - Soap and water – sodium bicarbonate ca. 7% (CS, CN)
    - Copious amount of water, baby shampoo, vegetal oil or alcohol or milk (OC)
DEFENDING AGAINST TEAR GAS

THE FOLLOWING TIPS ARE TO BE EXERCISED ONLY FOR DEFENSE PURPOSES AND IN THE EVENT OF POLICE/GOVERNMENT OFFICIALS USING TEAR GAS IN PEACEFUL PROTESTS. NEVER INCITE VIOLENCE.

ITEMS YOU WILL NEED

PAINTERS/DUST MASK FOUND IN HARDWARE STORES

EYE PROTECTION FOUND IN HARDWARE STORES

WATER SPRAY BOTTLE

MAKE SURE WASHED OF ANY CLEANING SOLUTION

LIQUID ANTACID

ANY IN LIQUID FORM SUCH AS MAALOX OR MYLANTA

KNOW YOUR ENEMY

TEAR GAS IS A NON-LETHAL CHEMICAL WEAPON THAT STIMULATES THE CORNEAL NERVES IN THE EYES TO CAUSE TEARING, PAIN, AND EVEN BLINDNESS. TEAR GAS WORKS BY IRRITATING MUCOUS MEMBRANES IN THE EYES, NOSE, MOUTH AND LUNGS, AND CAUSES CRYING, SNEEZING, COUGHING, DIFFICULTY BREATHING, PAIN IN THE EYES, TEMPORARY BLINDNESS, ETC.

TEAR GAS RELIEF

Liquid Antacid and Water (Law)

BE PREPARED FOR EXPOSURE. TEAR GAS IS A PARTICULATE, NOT REAL GAS, SO PAINTERS/DUST MASKS HELP.

“Greeks have become skilled at choosing the right protective gear. Maalox is a must.”

ARIS MESSINIS/AFP

1) FIND A GOOD SIZE SPRAY BOTTLE AND WASH WELL.

2) FILL HALF OF SPRAY BOTTLE WITH LIQUID ANTACID (MAALOX).

3) FILL THE REMAINING HALF OF BOTTLE WITH WATER.

4) WHEN EXPOSED SPRAY YOUR EYES AND MOUTH, THEN SWALLOW.

ALSO EFFECTIVE AS PEPPER SPRAY REMEDY.

A UNIVERSITY OF CALIFORNIA SAN FRANCISCO-BASED STUDY HAS FOUND THAT TOPICAL APPLICATION OF ANTACIDS’ FOR CAPSAICIN-INDUCED PAIN IS EFFECTIVE, PARTICULARLY IN EARLY TREATMENT OF EXPOSURE TO REFINED CAPSAICIN.

HELPING YOURSELF AND OTHERS

• AFTER USING THE LIQUID ANTACID AND WATER METHOD ON YOURSELF, HOLD UP YOUR SPRAY BOTTLE AND START SHOUTING FOR PEOPLE TO COME TOWARDS YOUR VOICE FOR HELP. SPRAY THEIR FACE AND MOUTH.

• IF YOU ARE WEARING EYE PROTECTION OR A MASK, BE PROACTIVE AND KICK THE CANISTER AWAY FROM THE CROWD. IF YOU CAN KICK IT DOWN A GUTTER, OR DOUSE IT WITH WATER, YOU CAN MINIMIZE ITS IMPACT.

• STAY PEACEFUL. PEACEFUL PROTEST IS THE ONLY WAY TO BE TAKEN SERIOUSLY AND TO BE TRULY HEARD.

STAY VIGILANT. STAY UNITED. STAY INFORMED. PROTECT YOUR FELLOW COUNTRYMEN. DO NOT TRUST THE MEDIA.

SOURCES:
@Jason/Pcard
WIKIA (Medic Wiki): http://medic.wikia.com/wiki/Pepper_spray_and_tear_gas
WIKIPEDIA: http://en.wikipedia.org/wiki/Tear_gas

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Management of Eye Exposure

- Remove contact lenses
- Flush copiously with water/saline
- Limited data on other means
Management of Lung & Skin Exposures

- Pulmonary complications
  - Oxygen
  - Beta 2 agonists...

- If severe dermatitis (rare)
  - Topical corticosteroids and/or antihistamines
RECOMMANDATIONS & TAKE AWAY MESSAGES
Recommandations

- Improve degree and quality of research that supports the development of RCAs
- Better evaluate RCAs (independent studies)
  - Formulations
  - Efficacy
  - Long-term health effects (genotox…)
  - Effects on susceptible subpopulations..
- Develop adequate doctrine of use
- Train the users
Key Take Away Points

- RCAs are different from other incapacitating agents.
- Acute exposure is generally safe unless:
  - High exposure in confined space or direct contact.
  - Eyes, upper airways and skin are targeted.
- Acute exposure does not generally involve long term effects.
Key Take Away Points

Casualty management involves
- Withdrawal from source
- Decontamination
  - Disrobing / wind
  - Water/soap
- Emergency care
Key Take Away Points

- Do not expose yourself « for fun »

- Repeated exposures should be avoided
To know more – selected readings

Riot control agents: the tear gases CN, CS and OC—a medical review

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Questions?
Mechanisms of Acute Toxicity

- CS/CN
  - Would act as SN2-alkylating agents, reacting readily with nucleophilic sites.
  - Important targets include thiol and sulfhydryl groups of enzymes, (e.g. lactic dehydrogenase, glutamic dehydrogenase and pyruvic decarboxylase).
  - TRPA1, sensory neuronal receptor for mustard oil (allyl isothiocyanate) and widely sensitive to other reactive irritants, including CS.
Mechanisms of Acute Toxicity

OC

- Roles of Transient receptor potential (TRP) channels present in airway sensory fibres; TRPV1 (vanilloid) receptors