Toxicology Screening in the Immediate Management of the Poisoned Patient
What Do You Really Need?
What’s Out There?
A UK Perspective

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At the end of this session the audience should be able to:

• List those tests that should be available promptly to support the management of patients with acute poisoning.

• List those tests that should be available to support the management of patients with acute poisoning, but which may be supplied on a regional basis.

• Outline guidelines recommending availability of laboratory assays.
At the end of this session the audience should be able to:

- Describe the current availability of assays within the United Kingdom.
- State indications for requesting analytical support for the management of poisoned patients.
Background

- Laboratory assays for toxins and/or their metabolites are a very important part of the management of patients with potentially serious poisoning.
However:

- Evidence that the availability of these investigations varies between hospitals, particularly when required outside normal working hours.
  - This may present management problems.

- Anecdotal evidence that laboratory toxicological investigations are overused by medical staff.
So:

- What do we need the lab for?
What do we need the lab for?

Biological markers of metabolic processes:

- Glucose
- Urea
- Creatinine
- Prothrombin time
- Lactate
Supportive investigations

- Full blood count
- Sodium, potassium, urea, creatinine
- Glucose
- Calcium, albumin, magnesium
- International normalized ratio (INR)
- Liver function tests (transaminases)
- Anion gap (chloride and bicarbonate)
- Plasma osmolality (freezing point depression method) and osmolar gap
- Arterial blood gases
- Creatine kinase
General principles

Indications for specialist laboratory assays (1):

- To confirm the diagnosis of poisoning when this is in doubt.

- To influence patient management, e.g. the need for:
  - further investigations.
  - antidotes.
  - haemodialysis or other extracorporeal methods.
  - to stop treatment.
General principles

Indications for specialist laboratory assays (2):

- To plan the re-institution of chronic therapy.
- In the diagnosis of brain death and in assessing the suitability of potential organ donors.
- For medico-legal or forensic reasons.
Unlike forensic toxicology, analytical toxicology may:

- Sacrifice specificity
- Sacrifice accuracy

...to gain

- Speed
- Convenience
Analytical methods

• Be aware of the limitations of your local assays

• Substances may be present but fall below the detection limit of the assay.

• NB Possible implications for late paracetamol poisoning.
TREATMENT LINES

Plasma paracetamol (mg/l)

Plasma Paracetamol (mmol/l)

Normal treatment line
High risk treatment line

prognostic accuracy after 15 hours uncertain
How should we use the lab?

- Use of the lab out of hours should be restricted to those instances when an urgent result is needed for immediate patient management.
How should we use the lab?

However:

- Where acutely poisoned patients are managed supporting investigations do need to be available 24 hours per day.
How should we use the lab?

• In the United Kingdom there is agreement between National Poisons Information Service and Association for Clinical Biochemistry about:

  • Assays which should be available
  • Timeliness of results being available
  • National guidelines available!
Guidelines

Laboratory analyses for poisoned patients: joint position paper

National Poisons Information Service and Association of Clinical Biochemists

Abstract

To enable consistency of investigation and the establishment of best practice standards, consensus guidelines have been formulated jointly by the UK National Poisons Information Service (NPIS) and the Association of Clinical Biochemists (ACB).

The types of laboratory investigation required for poisoned patients were categorized as either (a) essential common laboratory investigations or (b) specific toxicological assays, and also as either (i) common or (ii) specialist or infrequent.

Tests in categories (a) and (b) are expected to be available 24 h per day, with a maximum turnaround time of 2 h. For the specialist assays, i.e. category (bii), availability and turnaround times have been specified individually. The basis for selection of these times has been clinical utility.

The adoption of these guidelines, along with the use of the NPIS online poisons information resource TOXBASE (www.spib.axi.co.uk), will enable the poisoned patient to receive appropriate, ‘best practice’ investigations according to their clinical needs and
Guidelines

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These joint guidelines have been updated to reflect modern therapeutic approaches and best practice.

The types of laboratory investigation required for poisoned patients are categorized as either:

- (a) essential common laboratory investigations
- (b) specific toxicological assays.

Degree of urgency required.
Specific assays divided into two groups:

- The first group should be available on a 24 h basis in all hospitals that admit patients with acute poisoning.

- The second group are assays that are important in patient management but which are infrequently needed.
  - For these, arrangements need to be in place so that the assays can be obtained from specialist laboratories if they are not available on site.
Specific assays

Group 1

• Should be available 24 hours in all acute hospitals

Group 2

• Specialist or infrequent assays
Group 1
(Results within 2 hours)

- Carboxyhaemoglobin
- Digoxin
- Ethanol
- Lithium
- Methaemoglobin
- Paracetamol
- Paraquat (qualitative urine test)
- Salicylate
- Theophylline
**Group 2**  
**Specialist or infrequent assays**

- It is not necessary for these assays to be available directly from all acute hospital laboratories.

- Arrangements should be in place so that they can be accessed urgently when necessary.

- This may involve an arrangement with a supra-regional specialist toxicology laboratory or a subregional centre.
Group 2
Specialist or infrequent assays

- It is the responsibility of each individual hospital to ensure that appropriate arrangements are in place and that staff can follow these arrangements when the need arises, including outside normal working hours.

- Laboratory staff should have contact details readily available for specialist laboratories providing these assays, together with information on how samples should be collected and transported.
Group 2
Specialist or infrequent assays

- Suggested that clinical staff should discuss the use of these assays with a local clinical biochemist.

- Advice is also available from the NPIS when required.
Group 2
Specialist or infrequent assays

Arsenic
Carbamazepine
Cholinesterase
Ethylene Glycol
Lead
Mercury
Methanol

Methotrexate
Paraquat (quantitative)
Phenobarbital
Phenytoin
Thallium
Thyroxine
‘Toxicology screen’

Cyanide**
Toxicology Screen
- Drug abuse screening

Indications

e.g.

• To confirm abusers are taking illicit drugs
e.g. before prescribing saleable narcotics.

• To detect illicit use
e.g. continued use by patients on methadone.
How to report the results?

- Agreed by ACB and NPIS that concentrations for drugs should be reported in mass per litre with the exception of iron, lithium, methotrexate and thyroxine.

- It is recommended that, with the exception of these four agents, laboratories that report in molar units should also provide the result in mass units and should be encouraged for patient safety reasons to adopt the recommended use of mass units.
What’s out there?
Joint study conducted by NPIS and Association for Clinical Biochemistry

- Laboratories in major hospitals throughout England, Scotland and Wales were identified.
- Surveyed to ascertain the availability and timeliness of assays specified in the new joint guidelines.
For each assay, laboratories were asked when the assay was available.

- Always available?
- Available Monday to Friday during daytime working?
- Available Monday to Friday during daytime and overnight?
- Available at weekends – daytime only?
- Available at weekends – daytime and overnight?
• Could the assay be done locally?

• Where were samples sent?

• Free text fields were provided to allow for comments about each assay

• How long would it take for the result to become available?
Interim results
Results

Number of Sites at which Group 2 Assays are Always Available

Interim results
Results

**Number of Sites at which Group 2 Assays are Always Available**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Bar Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>120</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>100</td>
</tr>
<tr>
<td>Cholinesterase - Plasma</td>
<td>60</td>
</tr>
<tr>
<td>Cholinesterase - Erythrocyte</td>
<td>10</td>
</tr>
<tr>
<td>Cyanide</td>
<td>0</td>
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<tr>
<td>Ethylene glycol</td>
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<tr>
<td>Lead</td>
<td>0</td>
</tr>
<tr>
<td>Mercury</td>
<td>0</td>
</tr>
<tr>
<td>Methanol</td>
<td>0</td>
</tr>
<tr>
<td>Methotrexate</td>
<td>0</td>
</tr>
<tr>
<td>Paraquat - quantitative</td>
<td>0</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>0</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>0</td>
</tr>
<tr>
<td>Thallium</td>
<td>0</td>
</tr>
<tr>
<td>Toxicology Screen - Urine</td>
<td>0</td>
</tr>
<tr>
<td>Toxicology Screen - Plasma</td>
<td>0</td>
</tr>
</tbody>
</table>

*Interim results*
Number of Sites at which Group 2 Assays are Always Available

- Arsenic
- Carbamazepine
- Cholinesterase - plasma
- Cholinesterase - Erythrocyte
- Cyanide
- Ethylene glycol
- Lead
- Mercury
- Methanol
- Methotrexate
- Phenobarbital
- Phenytoin
- Paraquat - quantitative
- Thallium
- Toxicology Screen - Urine
- Toxicology Screen - Plasma

Interim results
Group 1 Example

Digoxin

- Always available
- Mon-Fri Daytime only
- Mon-Fri Daytime and overnight
- Weekends Daytime only
- Weekends Daytime and overnight
- Sample sent elsewhere
Group 1 Example

Digoxin
If Always Available- Time to Result

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Group 1 Example

Digoxin
If Sent Elsewhere - Time to Result

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Group 2 Example

Ethylene Glycol

- Always available
- Mon-Fri Daytime only
- Mon-Fri Daytime and overnight
- Weekends Daytime only
- Weekends Daytime and overnight
- Sample sent elsewhere

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Group 2 Example

Ethylene Glycol
If Always Available - Time to Result
Group 2 Example

Ethylene Glycol
If Sent Elsewhere - Time to Result

© National Poisons Information Service
Group 2 Example

Ethylene Glycol
If Sent Elsewhere - Time to Result
Conclusions

Group 1:
• Assays are widely available in a timely manner.

Group 2:
• Some assays are barely available.
• Results may be delayed.
• Assays which may influence the use of antidotes often not available sufficiently quickly.
Conclusions

• Therapeutic decisions may need to be taken in the absence of prompt analytical support.

• There is room for considerable improvement in the availability of analytical support for the management of poisoned patients within the UK.
Aspiration for the future:

• Clear guidelines may produce more effective use of the laboratory in the management of poisoned patients.

• That updated national guidelines and standards may support hospitals in developing and maintaining analytical support for poisoned patients.
Thank You!

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