The General Management of Acute Overdose

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Introduction

This handout is meant to serve as a guide for the management of patients who present to the emergency department with acute medication/toxin overdose. The information found here highlights what was said during my presentation, but also provides additional information.

1) ABC approach

A patient presenting to the emergency department having experienced an acute overdose will usually require immediate life-saving treatment. The first step in this treatment algorithm is to manage the patient’s vital signs in order to ensure that patient is stable. This can effectively buy time for the physician to determine the diagnosis and treatment plan for the patient, which is extremely vital in a situation when the toxin ingested is unknown.

An approach used by physicians and emergency health professionals is known as the ABC approach. This mnemonic stands for Airway, Breathing and Circulation.

Airway

The first part of this technique is to determine whether or not the patient’s airway has been obstructed at all. A simple way to determine this is to have the patient speak to you (if they are conscious). A normal voice indicates that the airway is not obstructed. However, if the patient’s voice appears to be laboured, or there is signs of stridor (noisy breathing) it is likely that the airway is at least partially obstructed. In an unconscious patient, an obstruction may be possible if he/she is snoring.

What to do?
• Head-tilt and chin-lift maneuver
• Suction/remove any obstructions (i.e. blood and vomit)
• Provide patient with oxygen

**Breathing**

It is important to determine both the rate and quality of breathing. Physicians must be thorough in their examination in order to determine the cause of insufficient/laboured breathing. Signs of cyanosis (blue coloured skin) and distended neck veins is indicative of a lack of oxygenation and therefore the patient requires assisted ventilation. In the presence of bronchoconstriction, inhaler medication (salbutamol) must be administered.

**Circulation**

Patients presenting to the emergency room may have a lack of blood perfusion to areas of their body. This is evidenced by sweating, change of skin colour and a loss of consciousness. An easy way to measure the circulation of patient is to get their pulse rate. In addition, blood pressure and EKG monitoring should be done as soon as possible to monitor the situation. For a patients presenting with low circulation, must receive IV fluids as soon as possible to maintain a hemodynamic state (i.e. systolic blood pressure between 100-140 mmHg and pulse rate between 60-100 bpm).

**Reference**


**2) Call Poison Control**

The poison control centres can serve as a valuable information resource in the setting of acute overdose. The employees at these centres are experts in the area of poisonings, and are available 24/7. They are especially useful in a situation where the toxin is unknown, or if the physician has encountered a toxin that they are unfamiliar with. They also provide information for special populations including infants and pediatrics.

In addition, these centres provide valuable information for non-emergency situations as well. I found that were especially helpful when I was responsible for developing an overdose
order set during my last co-op placement. The combination of evidenced based and expert opinion that they provide is very helpful.

Website: www.ontariopoisoncentre.com
Phone number: 1-800-268-9017

3) Obtain Best Possible Medical History

In an acute overdose setting, obtaining correct information is vital for the patient’s survival. This includes determining the causative agent, the route, time since exposure and symptoms. Knowing this information will determine the patient’s treatment course. It can determine if the patient requires an antidote or if only supportive therapy is required.

The pharmacist may have the opportunity to help identify the causative agent through medication reconciliation. By either speaking directly with the patient (if possible), the patient’s family/friends the pharmacist and the patient’s pharmacy, the pharmacist will be able to obtain an accurate medication list. This information can be brought to the physician’s attention and may allow them to correlate the patient’s prescribed medications to the symptoms that they are experiencing. This is possible since certain medications illicit specific signs and symptoms in a patient. This is known as a toxidrome. Please see the “summary of toxidromes” section on my website for further information on this topic.

4) Lab Tests

This section was just briefly touched on in my presentation, however I provided you with more in-depth information about some of the important lab tests that are useful in the management of acute overdose.

Toxicology Screen

Urine Test vs. Serum Test

In the acute overdose setting it is always recommended that a blood sample is obtained in order to test for toxins. The levels determined from the patient’s serum are a better
indicator of the patient's current condition. The opposite can be said about a urine test, since these assays can reveal a positive result long after the toxin’s effects have worn off.

*Serum Overdose Panel*

The serum lab tests are organized into a panel, which is a group of tests that identify a variety of potential toxins. This is important especially in a case where multiple drugs have been ingested by the patient. The type of drugs that each panel test for will vary by institution, but will usually test for the following: acetaminophen, salicylates, barbiturates, tricyclic antidepressants and alcohol (ethanol, methanol, isopropyl alcohol).

The results from these tests are important in confirming or changing an initial diagnosis, and will allow for treatment to go forward.

*Anion Gap*

This another test that requires a serum sample. The result of this test measures the difference between the cations and anions that are present in the blood. The formula is shown below:

\[
\text{Anion gap} = [\text{Na}^+] - [\text{Cl}^-] - [\text{HCO}_3^-]
\]

In acute overdose, it is possible that there will be an increase in the anion gap (more anions in the blood than usual), which can lead to metabolic acidosis (too much acid in the blood). This is commonly caused by the following toxins: NSAIDs, salicylates, metformin, ethanol, methanol, propylene glycol, isopropyl alcohol and isoniazid.

Treatment of metabolic acidosis requires the administration of Sodium Bicarbonate which will help raise the pH of the blood back to normal. In addition, in the presence of potential serious heart arrhythmias (i.e. ventricular tachycardia) the administration of calcium gluconate and constant EKG monitoring is required.

I have included additional lab tests that are usually ordered in this clinical scenario:

<table>
<thead>
<tr>
<th>Lab test</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrolytes and Blood gases</td>
<td>Determine acid/base balance</td>
</tr>
<tr>
<td>BUN and SCr</td>
<td>Measure of patients kidney function</td>
</tr>
<tr>
<td>Liver Panel</td>
<td>Measure of patients liver function</td>
</tr>
<tr>
<td>Blood Glucose</td>
<td>To determine if patient is hypo/hyperglycemic</td>
</tr>
</tbody>
</table>
These above mentioned lab parameters can help guide treatment, as well will help determine the effectiveness of the various treatment methods employed during the patient’s course in hospital.

Reference:


5) Prevent Absorption

This section highlights various methods that are employed to prevent further absorption of the ingested toxin. These practices will only be used in patients who have orally ingested a substance. The efficacy of each method is highly dependent on the amount of time that has passed since the toxin has been ingested.

*Activated Charcoal*

Activated charcoal is administered orally and works by adsorbing toxins that are still in the stomach or small intestine. This substance is very effective at adsorption due to its very high surface area (1 gram has a surface area of 500 m²) and because of its ability to bind a wide variety of substances via van der Waal forces. The use of activated charcoal is most prudent within an hour of ingesting the toxin; however in cases where an SR (sustained release) formulation has been ingested, the efficacy of activated charcoal extends beyond an hour.

Effective for the following substances:
- Acetaminophen
- Tricyclic antidepressants
- Arsenic
- Aspirin
- Atropine
- Antihistamines
- Phenothiazines
- Dextro-amphetamine
- Digoxin
- Isoniazid
- Salicylates
- Morphine
- Barbiturates
• Penicillin
• Phenytoin
• Propoxyphene
• Quinine

Not useful for the following substances:
• Acids and Caustic alkalis
• Aromatic alcohols
• Boric acid
• Ethylene glycol
• Heavy metals
• Iron
• Lithium
• Methanol

*It is important to note that activated charcoals can bind certain antidotes (i.e. methionine) and therefore should not be given together.

**Adverse Effects:** constipation, development of ileus, vomiting, aspiration pneumonia

**Dose:**
Initial- 50-100g
Subsequently- 15-20g q 4-8 hours (up to 24 hours)

**Orogastric Lavage**

This method is no longer recommended and rarely used today. It has been found that the use of activated charcoal is just as effective with less serious side effects.

**Syrup of Ipecac**

This method is also no longer recommended. It has not been found to be consistently effective at removing toxins and can significantly reduce the efficacy of activated charcoal, gastric lavage and antidote. I invite you to read the following position paper that summarizes the use of syrup of ipecac.

In addition, I have included another journal article that compares the efficacy of the 3 methods mentioned above. This paper supports the use of activated charcoal as the first line agent for GI decontamination.


6) Enhance elimination

The last step in the management of acute overdose is to eliminate the toxin(s) from the body. This can be done in one of two ways which includes: administration of antidote and hemodialysis/hemoperfusion.

Administration of Antidote

An antidote is a substance that counteracts the effects of the ingested toxin. This can be achieved in a variety of ways. For example, in opioid toxicity, Naloxone (antidote), will competitively compete with the opioid for the mu receptors in the body. However, because Naloxone is an atagonist, it’s binding to the mu receptor will not illicit the same response as the opioid does when it is bound to the mu receptor. This effectively reverses the side effects caused from the opioid, and will allow the body to more effectively excrete the toxin.

I have included a general table that lists a wide variety of antidotes and their indication. Please visit my website for a more thorough document on the various antidotes available.
<table>
<thead>
<tr>
<th>Offending Agent</th>
<th>Antidote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tylenol</td>
<td>N-acetylcysteine</td>
</tr>
<tr>
<td>Anticholinergics</td>
<td>Physostigmine</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>Flumazenil</td>
</tr>
<tr>
<td>CCB</td>
<td>Glucagon, Calcium</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>Glucagon</td>
</tr>
<tr>
<td>Opioids</td>
<td>Naloxone</td>
</tr>
</tbody>
</table>

**Reference:**

**Haemodialysis/Haemoperfusion**

These methods serve to filter the patient’s blood, which in effect will remove the ingested toxin from the body. For haemodialysis, the use of this method is generally reserved for serious life threatening toxicities with the following substances: Lithium, salicylates, theophylline, methanol and ethynlene glycol. The use of haemoperfusion is reserved for life threatening toxicities with: theophylline, carbamazepine and phenobarbitol.

The uses of these techniques are limited by the severe adverse effects associated with them, which includes hypotension, sepsis and air embolism. As a result, their use should be reserved for only severe cases and for a specific set of medications/toxins.

**Reference:**