Objectives

By the end of this lecture, the provider should be able to...

1. Describe the scope of toxicologic emergencies
2. Explain the effects of certain toxins on the Central Nervous System
3. Explain the importance of diagnosing acetaminophen overdose
4. Explain the role of gastrointestinal decontamination.

The Case:

- The patient is a 20-year-old female who just got into a fight with her boyfriend.
- The boyfriend called EMS because she had taken pills and washed it down with cleaning fluid.
- You get to the scene and you find a crying uncooperative patient who refuses to answer any questions.
- The Patient is hot to the touch her vitals signs are:
  - HR >160 b/min
  - BP 130/90
  - RR 20
- Patient states, “just leave me alone”.
- You find an empty aspirin bottle (200 count 325mg tablets) and an empty 20-ounce bottle of liquid cleaning fluid.
- The boyfriend tells you that the bottle of aspirin was half full and the cleaning fluid bottle was full.
- Ingredients of the cleaning fluid bottle are:
  - Alkali booster
  - Butoxyethanol
  - Inert ingredients and (???)

Issues in this case

- The patient wants to be left alone. What do you do?
- Do you give her charcoal?
- Are there other toxins involved?
- (Answers at the end)
Toxicologic Emergencies in the USA

- In health care today, pre-hospital personnel are being relied upon more than ever to diagnose and treat toxicologic emergencies.
- The American Association of Poison Control Centers estimate over four million poisonings occur a year.
- As much a 10% of all EMS responses involve toxic exposures.
- 70% of accidental poisonings occur in children under the age of six.

References:

2. Bledsoe, Porter, Cherry (2001) Principal and Practice vol 3 Paramedic Care  429

Your approach to the toxicologic emergency

- Goals in managing the poisoned patient
  - Reduce toxin absorption
  - Enhance toxin elimination or breakdown
  - Administer specific antidotes, and, most importantly
  - Basic supportive care

References:


Where to begin with a potential overdose?

- You are called to the scene of a patient who has potentially overdosed on an unknown substance. After ensuring scene safety your first priority begins as always by assessing the patient's airway, breathing and circulation
- Many patients with toxicologic emergencies have an altered mental status and can become comatose.
- These patients can also have cardiac and pulmonary complications.
- At this time, the patient's vital signs should be monitored frequently. Any decline in hemodynamic stability should be treated aggressively. It is imperative that these steps occur within minutes at arrival.
The important and difficult History that must be obtained

- When there is any suspicion of a toxicologic emergency, the patient history is important in the initial evaluation. It is not always easy to communicate with a patient who has an altered mental status.
- History can be difficult to obtain and at times unreliable. Initial clinical presentation is often obscured by possible multiple ingestions.
- An investigation into family history, friends and employer may be necessary and can give important clues to the possible toxin the patient has ingested.
- Look for clues at the scene. You are the only provider who will have access to this information! Pill bottles, alcohol, and signs of drug use are all important clues that aid in the management of the toxic ingestion.

The Diagnosis

- Due to the possibility of an unreliable history, the clinical presentation becomes an important part of the diagnosis.
- The time, amount of pills, and the method of the overdose should be obtained along with the possible motive for taking them.
- When a patient presents with an assumed overdose, it is important to develop a large differential diagnosis.
- Many medical and psychological disturbances can be confused with an overdose.

References:


References:


References:

Diagnosis Continued

- Meningitis, encephalitis, sepsis, metabolic disorders, head trauma and cerebrovascular accidents are all situations that present similar to an overdose.
- It is risky to assume a patient is “just drunk” when they may be suffering from a life threatening disorder.

References:

The Physical Exam

- While the history is being acquired and the airway secured, it is important to perform a thorough, yet rapid physical exam. Begin by observing the patient’s general appearance and level of consciousness. Look for evidence of trauma. A mental status exam consisting of orientation, attention, memory and language should be performed. Many overdoses cause some alteration of mentation.
- Narcotics, sedatives and alcohol cause decreased level of consciousness.
- Stimulants cause hyperactivity, and irritability.
- Others can cause psychotic behavior.
- Check the blood pressure and pulse. Tachycardia, bradycardia, and irregularity can be signs of cardiotoxicity.
- Calcium channel blockers and beta-blockers cause bradycardia.
- Stimulants cause tachycardia and hypertension.
- Antiarrhythmics can cause arrhythmias.
- Check the pupils for size, reactivity, and nystagmus. Many substances affect the pupils in a unique way.
- Narcotics cause pinpoint pupils.
- PCP and Ketamine cause nystagmus. (Rapid back and forth motion of the eyes)
- The patient’s extremities should also be surveyed for any evidence of drug use such as needle track marks.
- It is crucial to frequently monitor vital signs including blood pressure, temperature, heart rate, respiration and pulse oximetry.

References:
Specific Overdoses

- The vast majority of toxic ingestions result in full recovery. There are a number of agents that are potentially lethal in typical overdose quantity. These include Tricyclic antidepressants, Acetaminophen, Sedative-hypnotics, and Opiates to name a few. This lecture will cover some of the most common.

TCA

- Tricyclic antidepressants are prescribed for depression, neuropathic pain, and sleep disorders. As a result, they are a frequently overdosed medication. In the United States alone there are presently ten different types of tricyclic antidepressants. All can be fatal at high dosage.
- A major problem with this type of medication is the low therapeutic to toxic ratio. For example, the therapeutic range for one tricyclic is 2-4 mg/kg, with life threatening emergencies at 10 mg/kg. Peak blood levels are achieved 2-6 hours post ingestion for all TCA’s.

References:


Clinical manifestation of tricyclic overdose

- The clinical manifestations of tricyclic overdose vary from mild to severe.
- Mild ingestions cause sinus tachycardia and anticholinergic symptoms such as dry mouth, flushed skin, and dilated pupils. These symptoms are not always present, but can be a clue that the patient has taken more than the usually prescribed dose.
- Moderate overdose can cause the same symptoms, plus mental status change such as confusion, drowsiness and slurred speech.
- Larger ingestions can lead to coma and seizures. Cardiovascular effects include hypotension and dysrhythmias.
- Electrocardiographic changes include widened QRS, PR and QT intervals. The abnormalities progress from sinus tachycardia, to a wide QRS, to a negative inotropic effect, to conduction delays and decreased heart rate. Ventricular dysrhythmias may occur at any time and without warning.
### TCA Chart

<table>
<thead>
<tr>
<th></th>
<th>CNS effects</th>
<th>Cardiovascular Effects</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Normal Sinus Tach</td>
<td>Dysrhythmias</td>
<td>Dry Mouth Flushed Skin Dilated Pupils</td>
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<tr>
<td>Moderate</td>
<td>Confusion Drowsiness Slurred speech</td>
<td>Dysrhythmias</td>
<td>Dry Mouth Flushed Skin Dilated Pupils</td>
</tr>
<tr>
<td>Severe</td>
<td>Coma V-Tach V-Fib Hypotension Bradycardia</td>
<td></td>
<td>Dry Mouth Flushed Skin Dilated Pupils</td>
</tr>
</tbody>
</table>

References:


### Treatment of TCA

- The treatment of choice for TCA overdose is Sodium Bicarbonate.
- Indication for treatment includes widened QRS interval greater than 100ms, hypotension, and ventricular dysrhythmia.
- A bolus of 1-2mEq/kg (1-2 amps for the average adult) may be given intravenously with goals of obtaining a serum arterial pH of 7.50-7.55. If transport time is prolonged, a bicarb drip may be started. This is usually done by adding 2-3 amps to 1 liter of D5W, and run at a rate of 200 cc’s per hour. Rate can be varied and titrated to effect.
- Patients who do not develop symptoms for 6 hours post ingestion are considered medically stable and are unlikely to develop complications. If ingestion was intentional, psychiatric or social service evaluation is required.

References:

Acetaminophen

- Acetaminophen is a widely used analgesic, and is a common ingredient in many over the counter medications. The acute overdose of acetaminophen is seen in adults when greater than 140mg/kg or 7 grams of this drug has been ingested.
- Acetaminophen is metabolized in the liver and excreted in the urine. At doses greater than 140 mg/kg, (around 7 grams for the average adult. About 21 regular strength tabs or 14 extra strength tabs.) It can cause liver failure and death.
- A blood test in the hospital can measure the level of acetaminophen. This value is only of use if the time of ingestion is known. Here, the pre-hospital history is critical. As time elapses, the measured blood level decreases. The time of ingestion is therefore paramount in interpreting the blood level and risk of liver toxicity.
- In the early stages of acetaminophen overdose, a patient will usually present nonspecific gastrointestinal symptoms such as nausea, vomiting and anorexia.
- After 24 hours, the symptoms will begin to decrease and the patient will appear to improve.
- Unfortunately, this is when liver function begins to become compromised. Peak hepatotoxicity will occur at 3-4 days post ingestion followed by a recovery period of 7-8 days. If complete liver failure occurs, the patient will die. Liver transplant can be life saving, but is rarely available on short notice.

References:


Management of Acetaminophen Overdose

- First line treatment of acetaminophen overdose is gastric decontamination with activated charcoal. It is most effective in the first hour, but is recommended within 4 hours of overdose.
- N-acetylcysteine can be used to prevent liver toxicity and necrosis. It is most effective within 8 hours of ingestion, but can be started within 24 hours.
- The first dose of N-acetylcysteine is 140mg/kg followed by 17 doses of 70mg/kg N-acetylcysteine every four hours. It is diluted in a solution 1:3 in water and can be given orally or through a nasogastric tube.

Opiates

Opiates/narcotics:

- Originally from the poppy seed, opium was used for analgesia in China, where it first became a drug of abuse. It was brought to this country and western medicine during and
after the Civil War, when it quickly became a drug of abuse here as well. It acts by stimulating the endogenous opiate receptors causing a decreased sensation of pain and a feeling of euphoria. Opiates can be taken orally, mucosally, smoked, or injected. The opiates all cause respiratory depression. This is the usual cause of death in opiate intoxication. Most adverse effects are from hypoxia and hypoventilation. The treatment is airway support. The other potential choice for acute opiate overdose is Naloxone. It is an antagonist of the opiate receptors and directly counteracts the effects of opiates. It causes acute withdrawal as well. This is unpleasant.

- Withdrawal from opiates can be severe but is usually not life threatening. When the patient withdraws from opiates, he gets a "rush" or "dump" of norepinephrine, causing a sympathetic overload. The symptoms are sweating, chills, nausea, vomiting, stomach cramps, piloerection (goose bumps), and muscle spasms. It is a difficult withdrawal but usually not fatal. Duration of withdrawal varies depending on the patient, amount, and type of narcotic abused.

- Treatment of withdrawal varies. It can be mostly supportive, or an agent to lessen the symptoms of withdrawal can be given (clonidine), or another opiate can be substituted for the abused drug (methadone). In the pre-hospital environment, treat the symptoms as needed. If the patient is agitated and is a risk, consider benzodiazepines, or a phenothiazine such as Haldol or droperidol.

<table>
<thead>
<tr>
<th>Names</th>
<th>Street Names</th>
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<tbody>
<tr>
<td>Opium</td>
<td>Dust, Yen Shee</td>
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<tr>
<td>Heroin</td>
<td>China Cat, Skag</td>
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<tr>
<td>Fentanyl</td>
<td>STP, Six Pack</td>
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<tr>
<td>Methadone</td>
<td>Orange Barrel, Dolphin</td>
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<tr>
<td>Morphine</td>
<td>Morph</td>
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<tr>
<td>Percocet/ Percodan</td>
<td>Perks</td>
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References:
Sedatives-hypnotics

- The sedatives include a diverse range of drugs including benzodiazepines, barbiturates, tranquilizers and alcohol. Most sedatives act by stimulating the GABA receptors in the brain. Intoxication with any sedative causes depression of mental status, release of inhibitions, decreased anxiety, and a feeling of tranquility. Adverse effects are coma, respiratory depression, amnesia and addiction.

- Symptoms of acute intoxication are slurred speech, ataxic gait, and incoordination. Severe intoxication causes respiratory depression, loss of airway protective mechanism, coma and death. Acute sedative intoxication may mimic other metabolic disorders such as hypoglycemia, DKA, stroke, electrolyte abnormalities and brain injury to name a few. These other disorders must be looked for and ruled out before a patient is deemed to be a pure sedative overdose. Treatment is largely supportive with airway and respiratory protection being paramount.

- Sedative intoxication can cause peripheral vasodilatation as well. Blood pressure and heart rate need to be closely monitored. IV fluids may be necessary. This is especially true in the case of alcohol, which causes a diuresis and subsequent dehydration and hypovolemia.

- Tolerance develops quickly to the sedatives, and severe withdrawal can occur. Signs of withdrawal are those of sympathetic overstimulation. The patient will be tremulous, tachycardic, hypertensive, and possibly hallucinating. The hallucinations of withdrawal are usually visual which differentiates this syndrome from pure psychosis, which are usually auditory hallucinations. The withdrawing patient may suffer from delirium, and be disoriented to person, place and time. Often they will be incoherent. Left untreated, sedative withdrawal has a mortality of up to 25%.

- Treatment of withdrawal consists of supportive care, IV fluids, and benzodiazepines. Typically, the earlier into withdrawal, benzo’s are started, the less severe the withdrawal. Usually the patient is medicated to reduce symptoms and then slowly tapered. This is the usual approach for all sedatives, including alcohol.

<table>
<thead>
<tr>
<th>Names</th>
<th>Street Names</th>
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<tbody>
<tr>
<td>Benzodiazepines</td>
<td>Pumpkin Seeds, Roches</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>Barbs, Ace, Yellow Jackets</td>
</tr>
<tr>
<td>Rohypnol</td>
<td>Rib, Date Pill</td>
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Alcohol

- Alcohol is the most widely abused drug in the world. It behaves like other sedatives but has some distinct characteristics. Chronic alcohol abuse damages all organ systems, especially the liver, brain, heart, and GI tract. It causes a vast array of health and social problems. It is involved in more traumas and environmental emergencies than any other drug. It is widely available, and comes in many different forms. It is universally taken orally.
Often, chronic drinkers will not take in other forms of nourishment, getting most of their calories from alcohol. This sets up the patient for other health problems and nutritional deficiencies. Wernicke-Korsakoff’s syndrome is caused by a thiamine deficiency. It is an encephalopathy that presents as a mental status change such as confusion, stupor or coma. It is therefore recommended that most alcoholics and patients with unknown reason for coma receive thiamine as part of the “coma cocktail” protocol. The other ingredients in the “cocktail are usually Narcan for suspected narcotics, and dextrose if hypoglycemic.

Names:
Colt, brew, mad dog, night train, moon shine, scrap iron.

General treatments for all ingestions

Gastrointestinal decontamination.

- The purpose of gastrointestinal decontamination is to eliminate the toxin before it is absorbed systemically. There are many methods of decontamination, all with their own risks and benefits. The earlier it is started, the more effective it is.

References:

Ipecac

- Ipecac is an over the counter liquid that induces vomiting.
- Risk of ipecac is aspiration, esophageal perforation, and abdominal wall injury. Since it is only minimally effective, and has many serious and common side effects, its use is no longer recommended by poison control centers under any circumstance. It is still available to the general public, and you may encounter its use by lay people.

Gastric Lavage

- Gastric lavage is an emergency department procedure that consists of inserting a very large nasogastric tube into the stomach. This is followed by saline irrigation in an attempt to remove all stomach contents.
- In order to be effective, it needs to be initiated within minutes of the ingestion. If performed after 30 minutes, only 30% of the ingestion can be recovered. After 1 hour, it is probably ineffective in most patients.
The risks of lavage are the same as inducing vomiting. Aspiration and esophageal perforation are the most likely complications.

Since most patients arrive to the hospital more than 30 minutes post-ingestion, it is rarely used.

References:

Activated Charcoal

- Activated charcoal is suspended in water and can be given by mouth or through a nasogastric tube. The dose of activated charcoal is 1-2g/Kg diluted in 8ml of water per gram of charcoal.
- Activated charcoal binds to most toxins and prevents absorption.
- The ratio of charcoal to toxin should be 10:1 or ten times the weight of the toxin.
- Many studies have also shown enhanced elimination with multiple doses of activated charcoal. This is especially important in overdoses of sustained release medications.
- Contraindication includes patients with impaired gag reflex and those with caustic ingestions.
- With multiple-dose activated charcoal, there is an increase in the concentration gradient, which pulls toxins from the blood into the gastrointestinal tract and binds itself to the activated charcoal.
- This is known as gut dialysis. A dose of 0.5-1.0 gm/Kg of activated charcoal is used every 2-6 hours. This is done until clinical signs or lab data shows a decreasing level of toxicity.
- It is recommended that cathartics, better known as laxatives, are used with the first dose of activated charcoal. Sorbitol can greatly enhance elimination of the toxin charcoal complex, which in turn decreases absorption.
- The dose of sorbitol is 1-2mg/Kg of a 35 percent solution. Magnesium citrate can be used as well. The dose is 4ml/Kg.
- Due to the possibility of dehydration and electrolyte abnormalities, cathartics should not be used in multiple doses.

References:
Whole-bowel irrigation

- Whole-bowel irrigation is also used to help decrease absorption and increase clearance of a toxin. Large amounts of polyethylene glycol are used to flush the gastrointestinal system. Dose is 1-2 liters per hour, until all toxin is cleared.
- It is especially helpful in slowly absorbing toxins such as theophylline, sustained release cardiac medications, and iron. It is also helpful in clearing cocaine packets in body stuffers and packers. In this instance, the goal is to clear the packets before they rupture and cause massive sudden release of the drug.

Real Case from the ER

- Back to the case of the patient who overdosed on the aspirin and cleaning fluid.
- Remember she is crying, uncooperative, and wants to be left alone.
- She is hot to the touch her vitals signs are:
  - HR >160 b/min
  - BP 130/90
  - RR 20
- You find an empty aspirin bottle (200 count 325mg tablets) and an empty 20-ounce bottle of liquid cleaning fluid.
- The boyfriend tells you that the bottle of aspirin was half full and the cleaning fluid bottle was full.
- Ingredients of the cleaning fluid bottle are:
  - Alkali booster
  - Butoxyethanol
  - Inert ingredients and (???)

Discussion of the Case

The patient wants to be left alone. What do you do?

a) Honor her right to refuse treatment and ask her to call her doctor.

b) Transport the patient to the ER against her will.

c) Ask boyfriend to take her to the ER.

d) Take as much time as needed to convince her to go to the ER.
B B B B B

- This patient by her actions is incapable of an informed decision. You are obligated to transport her to the nearest ER.
- With what this patient ingested the outcome would likely be death without treatment.
- DO NOT WASTE TIME.
- TRANSPORT!!!

Do you give her charcoal?

NO NO NO

- Alkali is a caustic substance that can erode the lips, mouth, esophagus and stomach if ingested.
- Strong alkali agents usually have a pH greater than 12.5. Examples of alkali agents most people have in their home are Drano or Liquid Plumber. Alkali agents do not cause immediate pain like an acid, so longer tissue contact and deeper injury can occur.
- Charcol will not absorb alkali and you cannot give it for the aspirin in this case because the GI tract maybe severely damaged or perforated from the alkali. You do not want to cause a mediastinitis from the charcoal leaking from a perforated esophagus.

Treatment of this Patient

- O2, watching for signs of respiratory depression with the aspirin. Also watch for hoarseness, stridor or other breathing difficulties that can result from caustic injury to the oropharynx.
- Establish IV access
- Transport to the ER

Conclusion

- As health care professionals, we must understand the importance of acting quickly in any of these situations.
- With today’s wide variety of drugs, a patient with an overdose can present numerous symptoms.
- At times, the drugs can be difficult to identify because of their similarities in symptoms.
- The history and the clinical presentation of the patient become extremely important.
As health care professionals, we need to assess and treat the patient without hesitation. A patient’s outcome is greatly influenced by time; therefore we must become aware of the necessary steps to ensure quick decontamination. This allows the recovery process to take place, leaving the patient with the least amount of residual effects possible.