Care of the Poisoned Patient

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INTRODUCTION

Many nurses do not feel confident taking care of a poisoning emergency, but using this basic process will ensure you provide safe and comprehensive care.

- Assess/support ABCs.
- Perform a basic neurological assessment.
- Use the coma cocktail.
- Perform a health history, physical exam.
- Consider gastric decontamination.
- Obtain laboratory studies.
- Administer antidotes.

OBJECTIVES

When the student has finished this module, he/she will be able to:

1. Identify the components of the coma cocktail.
2. Identify the proper use of naloxone.
3. Identify two important rules for the use of flumazenil.
4. Identify the signs and symptoms of the anitcholinergic toxidrome.
5. Identify the signs and symptoms of the opioid toxidrome.
6. Identify rules for the use of activated charcoal.
7. Identify rules for the use of lavage.
8. Identify the drug level that should be obtained in every overdose situation.
9. Identify two drugs dangerous in small amounts and two drugs with delayed effects.
10. Identify three uses for whole bowel irrigation.

ASSESSING AND SUPPORTING THE ABCS

Taking care of a patient with a poisoning emergency always starts with the ABCs, and there are *very* few exceptions in which standard airway and circulatory support would not be appropriate. Examples: If the patient is hypotensive, give IV fluids and/or vasopressors. If the patient is bradycardic, follow the Advanced Cardiac Life Support (ACLS) protocol for bradycardia. **Good, basic, supportive care has saved more poisoned patients than anything else.**

NEUROLOGIC ASSESSMENT

Assess the patient's neurological status while the ABCs are addressed. Many patients who have taken an overdose will have a depressed sensorium. (Drugs that cause drowsiness are the most commonly used for suicide attempts) These patients may benefit from the **coma cocktail.**

The coma cocktail is **dextrose, oxygen, naloxone,** and **thiamine.** It is given empirically to patients with a depressed sensorium who have taken an overdose.

- Dextrose: If low blood glucose caused the alteration of consciousness, or the patient has an altered sensorium and a stat serum glucose level isn't available, give 50-100 mL of 50% dextrose, IV push. Hypertonic glucose *may* worsen brain ischemia, but the benefits outweigh this risk.

- Oxygen: Oxygen will help a patient with a depressed sensorium caused by hypoxia. *High flow oxygen should not be given to a patient who has ingested the herbicide paraquat.* Paraquat and oxygen initiate an oxidation-reduction reaction in the alveoli that causes permanent lung damage.

- Naloxone: Naloxone competes with opioids at the brain μ receptors, and it reverses central nervous system (CNS) depression and respiratory depression. Give 0.1-0.4 mg IV push. Increase the dose at two to three minute intervals, PRN. If there is no response after 10 mg, opioid toxicity can be ruled out. **Naloxone should not be used to wake the patient up.** It is

intended to reverse respiratory depression: **use the smallest dose that accomplishes this goal.** No contraindications and essentially no side effects.

- Thiamine: Chronic alcohol abusers may develop WernickeKorsakoff syndrome. This is caused by thiamine deficiency and causes coma, confusion, etc. Thiamine can be given empirically to patients with a depressed sensorium. Dose: 100 mg, IV, over five minutes. No contraindications. Adverse reactions are rare.

Learning Break: Flumazenil reverses the effects of benzodiazepine overdose. Flumazenil should *not* be routinely given to patients with a depressed sensorium and only *rarely* given to patients who have taken an overdose of a benzodiazepine.

THE HEALTH HISTORY AND PHYSICAL EXAM

Find out what was taken, how much, when, and if it is an acute-onchronic exposure: these are serious. If the ingestion was unwitnessed, try and determine what happened. What health problems does the patient have and what medications are prescribed? Perform a quick physical exam: focus on pupil size, skin temperature and color, bowel sounds, basic neurological status, and vital signs.

Learning Break: Do not depend on the patient for information about the overdose. Patients often cannot or will not provide accurate information.

What if no one knows what was ingested? Look for a **toxidrome** and **examine the vital signs**. Most overdoses involve commonly used medications. When taken in excess they produce a group of signs and symptoms called a **toxidrome.** Also, changes in vital signs can be attributed to commonly used/abused drugs.

Toxidromes

- Adrenergic: This toxidrome is caused by sympathomimetics, e.g., cocaine, amphetamines. Pulse, respiratory rate, temperature, and blood pressure are elevated. The patient is

anxious, agitated, has flushed and diaphoretic skin, and dilated pupils.

- Anticholinergic: This toxidrome is caused by drugs that block acetylcholine binding to parasympathetic receptors, e.g., antihistamines. Pulse, blood pressure and temperature are elevated. The patient is agitated and confused. The pupils are dilated, the skin is hot and dry, bowel sounds are decreased or absent, and there may be urinary retention.

- Opioid: This toxidrome is caused by heroin, etc. Key findings are CNS depression, respiratory depression, and miosis. Hypotension and hypothermia are possible.

- Sedative/hypnotic: This toxidrome is caused by benzodiazepines, barbiturates, etc. The pulse, blood pressure, temperature, and respiratory rate are low. The patient is drowsy and may be hypothermic.

Vital Sign Changes Associated with Overdoses

- Tachycardia: Cocaine, amphetamine, anticholinergic drugs
- Bradycardia: Calcium channel blockers, beta blockers, digoxin, clonidine
- Hypertension: Cocaine, amphetamine
- Hypotension: Tricyclic antidepressants (TCAs), calcium channel blockers, beta blockers, clonidine.
- Tachypnea: Salicylates, toxic alcohols (ethylene glycol and methanol)
- Bradypnea: Opioids, ethanol
- Hyperthermia: MDMA (ecstasy), MAO inhibitors, cocaine, amphetamine
- Hypothermia: Opioids, barbiturates

These medications are dangerous and patients require close monitoring: beta blockers, bupropion, calcium channel blockers, INH, MAOIs, and TCAs. **These medications are deceptive because the onset of toxic effects can be significantly delayed:** acetaminophen, aspirin, beta blockers, bupropion, calcium channel blockers, lithium, sulfonylureas, and sustained release products

GASTRIC DECONTAMINATION

Gastric decontamination prevents absorption of an ingested drug/toxin. Each technique has indications, contraindications, and risks.

- **Activated charcoal:** Activated charcoal binds ingested drugs. The drug-charcoal complex is excreted in the stool or dissociates at a tolerable rate. Dose: 50 grams. **It must be given within an hour of the overdose.** Charcoal does not bind iron or lithium. Vomiting and aspiration are common: the patient must be awake, have a good gag reflex, and be in no danger of loss of conscious.

- **Lavage:** Lavage can cause aspiration, and only removes small amounts of drugs in the stomach. **Lavage should only be used for overdose of large amounts of calcium channel blockers, beta-blockers, TCAs, or MAO inhibitors if the patient presents within an hour of the ingestion.**

- **Whole bowel irrigation (WBI):** WBI uses Go-Lytely® bowel prep, to mechanically flush iron, lithium, sustained release drugs, and heroin or cocaine packages from the gut. Start at 250-500 mL/h, PO, advance to 1 to 2 L/h. The end-point is a clear rectal effluent. Nausea and vomiting are common.

Syrup of ipecac induces vomiting, but it should *never* be used for adult *or* pediatric cases. **Cathartics** – magnesium citrate and sorbitol – were though to decrease absorption of drugs but they are ineffective. **Multiple doses of charcoal** are no longer recommended.

Learning Break: Activated charcoal is often mixed with sorbitol. There is no harm to using this preparation.

LABORATORY STUDIES

Blood levels of *many* drugs cannot be obtained stat and are not be clinically useful. *Urine drugs screens are not useful; they only tell you the patient has ingested something, not when or how much.* In many cases, an ECG is diagnostic and can guide therapy, e.g., calcium channel blockers, TCAs, etc. Blood levels of these drugs should be obtained as they can predict the severity of an overdose:

- Aspirin
- Acetaminophen
- Carbamazepine
- Digoxin
- Ethanol
- Ethylene glycol
- Iron
- Lithium
- Methanol
- Phenobarbital
- Valproic acid

Learning Break: *Always* get an acetaminophen level. It is commonly abused and symptoms are significantly delayed.

ANTIDOTES

Occasionally an antidote is needed to effectively treat an overdose.

- Cyanide antidote: The cyanide antidote is sodium thiosulfate and a nitrite. The nitrite is used to induce methemoglobinemia, and the cyanide binds to methemoglobin instead of hemoglobin. Sodium thiosulfate converts cyanide to a less toxic form. The dose of sodium thiosulfate is 12.5 g (50 mL of 25% solution) given at 2.5-5 mL/min. There are no contraindications and few side effects. The nitrites are seldom used.

- Calcium: IV calcium is more effective than ACLS protocols for severe calcium channel blocker overdoses. Dose: 10-20 mL 10% CaCl or 30-60 mL 10% calcium gluconate. Repeat every 20 minutes up to 4 doses. A continuous drip of 0.2-0.4 mL/kg/h of CaCl or 0.6-1.2 mL/kg/h of calcium gluconate can be used. Contraindications: Digoxin toxicity. No significant side effects.

- Deferoxaomine: Deferoxamine binds free iron and is used to treat symptomatic iron overdoses with an iron level > 400-500 mcg/dL. Dose: IV, maximum of 15 mg/kg/h. Do not give for > 24 hours. Side effects: Hypotension and pulmonary toxicity. No contraindications.

- Digoxin-specific antibody fragments: Digoxin-specific antibody fragments bind free digoxin and are used to treat patients with digoxin toxicity who have serious arrhythmias, a serum potassium > 5.0 mEq/L, or a steady-state digoxin level ≥ 10 ng/mL. Dose: The # of vials = serum level x kg body weight/100 *or* # vials = mg ingested/0.5. Give IV through a 22 micron filter over 30 minutes. No real contraindications. Side effects: hypokalemia, CHF exacerbation.

- Ethanol: Ethanol is used to treat ethylene glycol and methanol poisoning. These alcohols are metabolized into highly toxic acids, and ethanol blocks this conversion. Ethanol is given IV at a rate that maintains a serum ethanol level of 100 mg/dL. No contraindications. Side effects: hyponatremia, intoxication, phlebitis.

- Fomepizole: Fomepizole is used to treat ethylene glycol and methanol poisoning by blocking the conversion of these alcohols into toxic acids. Dose: 15 mg/kg IV in 100 mL 0.9% saline; then 4 doses, every 12 hours, of 10 mg/kg; then 15 mg/kg every 12 hours until the ethylene glycol/methanol level is < 20 mg/dL. No contraindications. Side effects: Headache, nausea, dizziness, hypotension, tachycardia.

- Glucagon: Glucagon is used to treat beta-blocker overdose. It bypasses beta receptors and activates intracellular reactions that produce positive chronotropic, dromotropic, and inotropic effects. Dose: IV bolus of 3-10 mg followed by 2-10 mg/h IV. Contraindications: Pheocromocytoma, insulinoma. Side effects: Nausea, vomiting, hyperglycemia, hypokalemia.

- Hyperbaric oxygen: Hyperbaric oxygen is used to treat carbon monoxide poisoning if the patient lost conscious, had a seizure, had a serious arrhythmia, is pregnant, or has a very high carboxyhemoglobin level.

- Insulin and glucose: Insulin and glucose infusions can be used to treat beta-blocker and calcium channel blocker overdoses. Insulin is a positive inotrope, and glucose provides an energy source for the myocardium. The dose is empirical. No contraindications. Side effects: Hyperglycemia, hypokalemia.

- Methylene blue: Methylene blue is used to treat methemoglobinemia. Methemoglobin is hemoglobin that can't carry oxygen, and it is formed when the hemoglobin is oxidized, i.e., loses an electron. This can be an idiosyncratic reaction to, or result from an overdose of benzocaine, dapsone, lidocaine, naphthalene mothballs, and nitrites. Dose: 1-2 mg/kg, IV, over 5 minutes. Repeat in 30-60 minutes as needed. Contraindications: G6PD deficiency, renal failure. Side effects: Headache, dizziness, hemolysis or methemoglobinemia in high doses.

- *N*-acetylcysteine: N-acetylcyteine is used to treat acetaminophen overdose. It binds toxic metabolites and has hepatoprotective effects. Dose, oral: 140 mg/kg loading dose; 17 doses of 70 mg/kg, every four hours. Dose, IV: 150 mg in 200 mL D_5W over 60 minutes; 50 mg/kg in 500 mL D_5W over 4 hours; 100 mg/kg in 1000 mL D_5W over 16 hours. No contraindications. Side effects: Nausea and vomiting are common with oral doses. Mild allergic reactions, anaphylactoid reactions are possible with IV doses.

- Physostigmine: Physostigmine inhibits acetylcholinesterase, the enzyme that degrades acetylcholine. It increases the concentration of acetylcholine at cholinergic receptors, and it can be used to treat severe anticholinergic poisoning. Dose: 0.5-2.0 mg slow IV. Contraindications: TCA overdose, concurrent use of succinylcholine. Side effects: Asytole, bradycardia, hypotension, seizures.

- Pyridoxine: Pyridoxine (vitamin B_6) is used to treat INH poisoning. INH reduces brain B_6 levels. This decreases brain GABA levels (major neuroinhibitor) and causes seizures. Dose: 1 g of drug for every g of INH ingested *or* 5 g empirically. Dilute in 50 mL D_5W, give over 5 minutes. No contraindications. Side effects: None.