Are You Up on the New Tox LINGO?
Michael D. Gooch, DNP, ENP, EMT-P

Faculty Disclosure

- Conflicts of interest: NONE
- Employer:
  - Faculty – Vanderbilt University School of Nursing & Middle Tennessee School of Anesthesia
  - Flight Nurse – Vanderbilt LifeFlight
  - Emergency Nurse Practitioner – TeamHealth
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Objectives

At the completion of this lecture, the participant will be able to:

- Recognize the signs and symptoms of at least 10 common toxicological emergencies.
- Restate treatment options for at least 10 common toxicological emergencies.
- Identify the benefits of glucagon, high dose naloxone, insulin, and lipid therapy in specific toxicological emergencies.

Which of the following urinary findings would be associated with an ethylene glycol ingestion?

A. Red discoloration
B. Blue urine
C. Calcium oxalate crystals
D. Hematuria

You arrive to find the patient unresponsive at work. There is no history or signs of trauma. The patient did not respond to naloxone (Narcan) and his finger stick glucose was 106 mg/dL. There is a smell of garlic in the room where the patient was found. The smell of garlic is NOT associated with which toxin?

A. Phosgene
B. Arsenic
C. Organophosphates
D. Phosphorus

You respond to a call for an erratic patient. Which of the following would not cause hostility and hyperactivity in this patient?

A. Jimsonweed
B. Tricyclic antidepressants
C. Gamma-budoxybutyric acid (GHB)
D. Diphenhydramine (Benadryl)

You are called to transport a pediatric patient for a suspected acetaminophen ingestion. At what time frame should the first acetaminophen level be drawn?

A. Upon arrival
B. 2 hours after arrival
C. 6 hours after ingestion
D. 4 hours after ingestion

General Management

- Decontamination
- GI Decontamination
  - Induce emesis
  - GI lavage
  - Whole Bowel Irrigation
- Hemodialysis

Activated Charcoal (AC)
1 gm/kg PO

Prevents Absorption of Most Ingestants

When Not to Use

P	Pesticides
H	Hydrocarbons
A	Alcohol, acids, alkali
I	Iron preparations
L	Lithium
S	Solvents

General Toxidromes

- Anticholinergics
- Cholinergics
- Sympathomimetics
- Opioids
- Cardiotoxics
- Sedative/Hypnotics

- Key points:
  - Manage ABC's
  - AMS=glucose
  - Hyperactivity, Hypertension, & Seizures = Benzodiazepines

Anticholinergics

- ***Blind*** as a bat
- ***Red*** as a beet
- ***Dry*** as a bone
- ***Mad*** as a hatter
- ***Hotter*** then hades
- ***Sick*** like a seizure

Management

- ABC's – intubation is common
- Activated charcoal – EARLY < 2 hrs
- Systemic alkalization – pH 7.5-7.55
  - $NaHCO_3$ 1mEq/kg bolus
  - $NaHCO_3$ Infusion
- Correct hypotension
  - Fluid Boluses
  - Norepinephrine

A patient presents with a history of pesticide ingestion. Which of the following signs and symptoms should the provider anticipate?

A. Diarrhea, excessive salivation, vomiting, urinary incontinence
B. Hot flushed skin, agitation, dilated pupils, dry mucus membranes
C. Dizziness, headache, nausea & vomiting, red mucus membranes
D. Hallucination, tachycardia, loss of control over sensory input

Organophosphates

- Insecticides, Pesticides, Nerve Agents
- Muscarinic Effects: SLUDGE
  - Salivation, lacrimation, urination, defecation, GI, expectoration/emesis
- Nicotinic Effects
  - Tremors, respiratory paralysis, hypertension, tachycardia, mydriasis, AMS
- Management
  - Decontamination, use PPE
  - ABC's - Elevate HOB
  - Atropine - 2-5 mg every 5-10 minutes
  - Pralidoxime (2-PAM) – 2 gm IV followed by 24 hr infusion

You are transporting a 32 year old man with chest pain. His friends inform you that they think he has overdosed on cocaine. Which symptoms of abuse would the provider expect to detect during the assessment?

A. Lethargy and obtunded state
B. Constricted pupils
C. Hypothermia and tiredness
D. Euphoria and restlessness

CNS Stimulants – Assessment

- Mood changes: euphoria, decreased fatigue, increased energy, agitation, paranoia, mania, anxiety
- Cardiac: Tachycardia, hypertension, cardiac dysrhythmias, coronary artery spasm, QT prolongation
- Tremors/Seizures
- Hyperthermia
- Teeth clenching
- Mydriasis
- N/V/D
- Rhabdomyolysis
- Piloerection

Which of the following medications would be contraindicated in the management of a patient with a methamphetamine associated hypertensive crisis?

A. Diazepam (Valium)
B. Lorazepam (Ativan)
C. Nitroglycerin
D. Metoprolol (Lopressor)

Management

- Activated charcoal or Whole bowel irrigation for body packers
- **BENZODIAZEPINES**
- Rehydration
- Monitor for cardiac dysrhythmias
- $NaHCO_3$ for QRS prolongation
- Nitroglycerin or Nipride for HTN
- Cooling measures
- Avoid Pure Beta Blockers

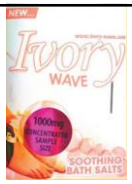
Spice, K_2 - "Legal THC"

- Incense – chemically treated herbal blend
- Produces euphoria by stimulating cannabinoid receptors
- Similar products: Genie, Blaze, Red X Dawn and Zoha
- Effects: tachycardia, loss of consciousness, paranoia, hallucinations, and psychotic episodes
- Management: supportive
  - Benzodiazepines, if needed

Wax, Butter/Budder, Honeycomb

- Concentrated THC - made from the oils
- 1 application may equal 15-20 joints
- Can be eaten, smoked, applied, or vaped
- May lead to psychosis
- Risk of butane contamination

"Bath Salts"



- Khat Plant - Cathinone
- Synthetic amphetamine
  - –mephedrone and methylenedioxypyrovaleron (MDPV)
  - –Zoom 2, Aura, Ivory Wave or Vanilla Sky, White Lightning, Hurricane Charlie
- Increases serotonin, norepinephrine, and dopamine levels by agonist and antagonist effects: empathogenic effects

"Bath Salts"

- Snort, Drink, Smoke, Inject, or Rectally
- Acute Manifestations
  - –Hallucinations, paranoia, tachycardia, hypertensive crisis, hyperthermia, suicidal and homicidal thoughts, hyponatremia
- "Excited Delirium"
- Treatment same as other amphetamines
  - –Benzodiazepines
  - –Antipsychotics

"Bath Salts"

- Complications
  - PEA arrest, rhabdomyolysis, renal failure, seizures
- Long Term Effects
  - Long lasting paranoia, delusions, hallucinations, parkinsonism

2nd Generation Bath Salts

- Gravel or Flakka
  - –α-Pyrrolidinopentiophenone (PVP)
- Ingested, Vaped, Insufflated, Sublingually
- Maybe a mixture of methamphetamine, bath salts, & rat poison
- Maybe mistaken for crack cocaine
- Excited Delirium, paranoia and extreme sympathomimetic response

Involuntary teeth clenching is an adverse effect of which of the following substances?

A. Ecstasy
B. Marijuana
C. Heroin
D. Gamma-budoxybutyric acid (GHB)

Molly's Plant Food

- "Legal Ecstasy"
- Active ingredient is mephedrone
- Increases serotonin, dopamine, and norepinephrine
- Effects
  - Euphoria, anxiety, empathy towards others
  - Paranoia, agitation, tachycardia, hypertension, hyperthermia, delusions, and diaphoresis

- Complications
  - Dehydration
  - Hyperthermia
  - Hyponatremia
- Treatment is supportive
  - Benzodiazepines
- Long Term Complications
  - Long lasting confusion, anxiety
  - Attention Deficit
  - Depression
  - Sleep Problems
  - Drug Cravings

Case Scenario

- Called to transport an 8 y/o
- Found unresponsive with agonal respirations
- Differentials
- Hx: ADHD, Asthma
- Home Meds: Clonidine, Singulair, Albuterol MDI
- Treatment

Naloxone (Narcan)

- Derivative of oxymorphone
- Competitively binds to opioid receptors
  - Mu (μ) > kappa (κ) and delta (δ)
- Highly lipophilic, distribution t½ of ~4.5 mins, effects are seen within 2 mins
- Average duration of effect is 30-90 mins

Naloxone

- Administration
  - Bolus vs. Continuous Infusion
  - Standard dose: 0.1mg/kg
  - 0.13 mcg/kg affects 50% of the body's receptors
    - Very dependent on dose of medication patient received/ingested
  - Routes
    - IV, IM, SQ, IN
    - Auto injector

Naloxone - ROC LAVA X

- **R** – Reserpine
- **O** – Opioids
- **C** – Clonidine
- Except Opioids, dose is 10 mg
  - Infusion at 5-10 mg/hr
- **L** – Lomotil
- **A** – ACE-Is & ARBs
- **V** – Valproic Acid
- **A** – Aldomet
- **X** – Zanaflex

Dextromethorphan (DM)

- Analog of codeine
- Common in numerous cough preparations
- May lead to CNS depression in toxic amounts
- Can be reversed with naloxone in same manner as other opioids
- Some patients may be slow DM metabolizers

Case Scenario

- Called for a 60 y/o patient w/ AMS, hypotension, bradycardia
- Differentials
- Home Medications
  - Metoprolol, Diltiazem, Atorvastatin, Aspirin
- Management

Traditional Management

- IV fluids
- IV Calcium
- Inotropes
- Vasopressors
- Pacing
- What if there is NO improvement with vasopressors & inotropes?

Glucagon

- β-Blocker & Calcium Channel Blocker ingestions
- Glucagon & β-receptors linked to adenyl cyclase enzyme
- + inotrope and chronotrope
  - ↑ intracellular cAMP levels and ↑ calcium influx
  - Stimulates endogenous catecholamine release
- Dose
  - –5 mg IV bolus; Peds: 50 mcg/kg
  - –Infusion 2-5 mg/hr; Peds: 70 mcg/kg/hr
  - –Prepare for N/V, especially if given too fast

High Dose Insulin (HDI) Therapy

- β-Blocker & Calcium Channel Blocker ingestions
- aka Hyperinsulinemia-euglycemia (HIE)
  - –1 unit/kg bolus
  - –0.5-1 unit/kg/hr & titrate
  - –D10 infusion
- ↑ calcium and glucose entry into cells
- ↑ endothelial nitric oxide (NO) synthase activity
- Monitor potassium and glucose closely

IV Lipid Emulsion (ILE) Therapy

- 20% intralipid bolus and infusion
  - –1-1.5 ml/kg bolus, repeat in 5 mins if needed
  - –0.25-0.5 ml/kg/min infusion till stable
  - –Max dose ~10ml/kg
- "Lipid Sink Theory"
  - –Creates lipid compartment & pulls lipophilic meds out of cells
- –+ inotropic effect
  - –Fatty acid uptake = energy
  - –↑ calcium uptake = stronger contractions

Lipid Emulsion Therapy

- Not FDA Approved
- Risks and Complications
  - Fat embolism
  - Phlebitis
  - Hypersensitivity syndromes
  - Acute Lung Injury
  - Pancreatitis

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HDI and ILE Therapy in CCB & BB Overdose

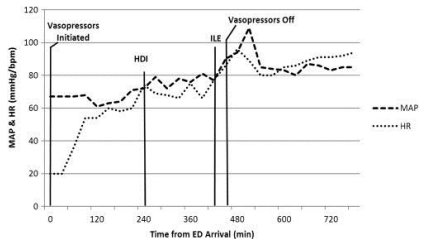

Figure 1.
Mean arterial pressure (MAP) and heart rate (HR) response to high-dose insulin (HDI) and intravenous lipid emulsion (ILE) therapies over time in the first patient.

When assessing the vital signs of a patient who ingested gamma-budoxybutyric acid (GHB) a few hours ago, you would expect the patient would have the following vital signs:

A. Temperature 97.4°F; HR 46; RR 6; BP 120/68
B. Temperature 98.8°F; HR 92; RR 18; BP 114/68
C. Temperature 100.6°F; HR 118; RR 24; BP 148/96
D. Temperature 104.6°F; HR 124; RR 34; BP 176/80

GHB Intoxication

- GHB is a Central Nervous System depressant
- Typical pattern of effect is a short period of euphoria followed by drowsiness; a rapid decline in consciousness occurs with ODs
- Onset of symptoms is within 2-15 minutes when used IV or 15-30 minutes with oral ingestion

Symptoms

- Nausea/Vomiting
- Bradycardia
- Normo-Hypotension
- Confusion
- Dizziness
- Nystagmus
- Urinary and fecal incontinence
- Respiratory Depression
- Myoclonic jerks → Seizures
- Hypothermia
- Management
  - ABC's
  - Supportive

Case Study

- Adult patient who is agitated
- V/S: 120, 160/90, 28, 99%, T 102
- Hx: Depression
- Meds: Sertraline (Zoloft)
  - St. John's Wort
- Differentials
- Plan of Care

Cyproheptadine (Periactin)

- Mild-Moderate Serotonin Syndrome
  - Hypertension
  - Tachycardia
  - Hyperthermia
  - AMS
- Histamine and Serotonin receptor antagonist
- Dose: 8 mg PO q 8hrs x 24 hrs
- See benefit within 1-2 hours
- Severe Serotonin Syndrome
  - Intubation and paralysis
  - Cooling Techniques

The priority treatment of choice for methanol ingestion is:

A. Ethanol IV
B. Activated charcoal PO
C. Naloxone (Narcan) IV
D. Flumazenil (Romazicon) IV

The Toxic Alcohols

- Ethylene glycol (antifreeze) → oxalic acid
  - Renal failure, calcium oxalate crystals in urine, lactic (metabolic) acidosis, mental status changes
- Methanol (wood alcohol) → formic acid
  - Mental status changes, vision changes including blindness, GI upset, lactic (metabolic) acidosis
- Isopropanol (rubbing alcohol)
  - CNS depression, dizziness, poor coordination, GI upset, gastritis, acetone breath

Management

- Isopropanol – supportive care
- Ethylene glycol & methanol
  - Sodium Bicarb Infusion to treat acidosis
  - Fomepizol (Antizol) – best if within 4 hrs
    - 15mg/kg IV loading
    - 10mg/kg IV q12 hours x 4 doses
  - Ethanol 10% infusion or PO
  - Thiamine and pyridoxine for ethylene glycol
  - Folinic or Folic Acid for methanol
  - Hemodialysis

Cyanide Poisoning

- Comes from wool, silk, burning plastics, polyurethane, and precious metal mining
- Cellular Effects
  - No oxidative phosphorylation
  - No Krebs cycle
  - Causes Anaerobic metabolism → Lactic acidosis
  - Cellular asphyxia despite adequate arterial oxygen

Cyanide

- Clinical Presentation
  - AMS
  - Dizziness
  - Headache
  - Tachycardia
  - Tachypnea
- Laboratory Findings
  - Elevated cyanide level
  - Metabolic Lactic Acidosis
- Levels
  - 0.5 – 1 mg/L – flushing
  - 1 – 2.5 mg/L – AMS
  - 2.5 – 3 mg/L – coma
  - > 3 mg/L – death

Management

- Intubate Early
- Cyanide Kit (CAK)
  - No longer available
- Cyanokit
  - Hydroxocobalamin
    - 5 gms chelates 100 mg of cyanide
    - Forms cyanocobalamin and is excreted in the urine
    - If no improvement noted within 15 mins, need to repeat
    - May cause red-orange discoloration

Case Study

- 24 y/o patient unresponsive
- V/S: 120, 90/50, 40, 98%
- Differentials
- Labs
  - Na 138, Cl 98, K 4.0, CO_2 14, BUN 12, Cr .9, Glucose 170
    - Gap 25
  - VBG: pH 7.1 PCO_2 28 PO_2 60 HCO_3 15 BE -8 Lactate 2.4
  - ASA level: 30 mg/dL
- Plan of Care

Salicylates

- "Uncouples" oxidative phosphorylation
- Decreases platelet function
- Inhibits vitamin K dependent clotting factors
- Peak serum levels occur 2-6 hours after acute ingestion (6-9 hours for enteric coated)
- Toxic dose to produce symptoms is 150-300mg/kg. > 500mg/kg is considered lethal

Poisoning Symptoms

- Tinnitus
- Nausea & Vomiting
- **Hyperventilation**
- Deafness
- Diaphoresis
- **Respiratory alkalosis**
- **Metabolic acidosis**
- Mental status changes
- Noncardiogenic pulmonary edema (ARDS)
- Hyperthermia

Management

- Obtain serum salicylate level on arrival and 6 hours after ingestion
- Charcoal if within 3 hrs of ingestion
- Fluid administration
- Monitor urine for hematuria
- Monitor for hypoglycemia and hypokalemia
- Urine alkalinization (3 amps in 1L D5W)
- Hemodialysis for severe ingestions

Questions

michael.gooch@vanderbilt.edu

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