Learning Objective:

- Describe the clinical indications and dosing recommendations of administration of bolus dosing of intravenous nicardipine in the emergency department.
Acute pharmacokinetic and hemodynamic effects of intravenous bolus dosing of nicardipine

Decrease in SBP: 20 to 25 mmHg
Decrease in DBP: 15 to 44 mmHg
Onset within 3 minutes
Mean duration of action: 24 ± 5 minutes
Dose-response relationship


Effects of Nicardipine Bolus Dosing on Measured Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0.25 mg</th>
<th>0.5 mg</th>
<th>1.0 mg</th>
<th>2.0 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease in SBP (mmHg)</td>
<td>18 ± 2</td>
<td>32 ± 5</td>
<td>36 ± 4</td>
<td>51 ± 4</td>
</tr>
<tr>
<td>Decrease in MAP (mmHg)</td>
<td>15 ± 5</td>
<td>21 ± 3</td>
<td>24 ± 4</td>
<td>30 ± 2</td>
</tr>
</tbody>
</table>

Dose-dependent effects
Two-compartment pharmacokinetic model
Rapid redistribution

Learning Objective:

- To discuss the use of high dose nitroglycerin boluses in heart failure exacerbation.
Prehospital: BP 250/160 HR 130 RR 38 SpO₂ 82% RA
Received nitroglycerin SL 0.4 mg x 3

Initial VS: BP 190/110 HR 87 RR 36 SpO₂ 89% RA

+JVD, using accessory muscles for respirations

CXR: cardiomegaly and bilateral pleural effusions along with vessel cephalization

68 y.o. male “I can’t breathe”

HPI: SOB last few days, worsen tonight

Initial VS: BP 190/110 HR 87 RR 36 SpO₂ 89% RA

Acute Decompensated Heart Failure

Congestion at rest?

- No
- Warm and Dry
- Warm and Wet
- Yes
- Cold and Dry
- Cold and Wet

Adapted from Nohria, et al. JAMA 2002;287:628–640

The Ailing Heart

Nitroglycerin IV 2 mg bolus

Nitro 2 mg Nitro 2 mg Nitro 2 mg Nitro 2 mg Nitro 2 mg

Time (min) 0 5 10 15 18

BP 190/110 192/140 172/120 163/107 168/115

Improvement in respiratory rate of 30, breathing more comfortably

High Dose Nitroglycerin


Open-label trial, nonrandomized study
High dose nitro* (n=29) vs. cont infusion (n=45)

rate of intubations within first 6 hours
rate of BiPAP
length of hospital stay

*High dose nitro IV 2 mg Q3-5min


High Dose Nitroglycerin

- Acute hypertensive decompensated heart failure ± pulmonary edema
- Up to 2 mg nitroglycerin IV every 3-5 minutes (max 20 mg)
Learning Objective

• Discuss therapies for treatment of epistaxis
  • Focus on vasoconstrictors

Etiology

• Epistaxis digitorum
• Very cold or dry air
• Trauma
• Deviated septum
• Irritation (e.g., allergies, colds, chemicals)
• Overuse of nasal decongestants

Epistaxis

Anterior
• 90% of epistaxis episodes
• Kiesselebach’s plexus

Posterior
• More difficult to treat
• May necessitate ENT consult or admission

Therapies for Epistaxis

• Address underlying cause
• Vasoconstrictors
• Topical hemostatic agents
• Chemical cautery
• Nasal packing
• Plasminogen activation inhibitors
**Topical Vasoconstrictors**

Mechanism of Action
- Oxymetazoline
- Phenylephrine
- Lidocaine + Epinephrine
- Cocaine Topical Solution
  - Note different concentrations (4%, 10%)

Comparative effectiveness studies between these agents are lacking

**Cocaine**

**Pros**
- Potent anesthetic and vasoconstrictor
- Quick on, quick off

**Cons**
- Schedule II
- Cost has risen
- CV effects

**Clinical Effects**

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Heart Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes</td>
<td>Moments</td>
</tr>
<tr>
<td>0   3   6   9 12 15</td>
<td>0   3   6   9 12 15</td>
</tr>
<tr>
<td>60  80 100 120 140 160</td>
<td>40  60 80 100 120 140</td>
</tr>
</tbody>
</table>

- Systolic Blood Pressure
- Diastolic Blood Pressure

**Subjective Effects**

<table>
<thead>
<tr>
<th>Mood/Euphoria</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0   3   6   9 12 15</td>
<td>0   5 10</td>
</tr>
</tbody>
</table>

Memorable Quotes
- “Oooo-weee, this takes me back to the 70’s”
- “I’m feeling good... like James Brown”

**Case Conclusion**

Epistaxis episode resolved →
Untoward effects of cocaine also resolved
Can’t have a presentation without mentioning HCAHPS scores...

**Takeaway Points**

- Key Takeaway #1
  - Topical vasoconstrictors are an excellent, non-invasive pharmacotherapy option
- Key Takeaway #2
  - Recommend the lower end of the 1-3 mg/kg range if using intranasal cocaine
- Key Takeaway #3
  - Lots of different approaches to treat this common scenario; plenty of protocols and expert opinion available

“The next time I come back here, I’m asking for the pharmacists!”
References


Who Nose How to Treat Epistaxis

Cole Sloan, Pharm.D.
PGY2 Resident, Emergency Medicine
University of Arizona Medical Center

Sticking Its Nose in Another Indication: TXA for Epistaxis

Kristan E. Vollman, Pharm.D.
Emergency Medicine Clinical Pharmacy Specialist
Owensboro Health Regional Hospital
Owensboro, KY

Learning Objective:

- Discuss the use of tranexamic acid for treatment of epistaxis.

Patient Case

- 58yo male presents to the ED with recurrent epistaxis

Oxymetazoline  Ice + pressure  Epinephrine + lidocaine  + Antibiotics

Adapted from: arthorcareent.com

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Tranexamic Acid (TXA)

- Lysine analog, reversible, competitive inhibition of plasminogen-fibrin binding sites
- Indications
  - Labeled
    - Tooth extractions
    - Menorrhagia
  - Unlabeled
    - Cesarean sections
    - Hereditary angioedema
    - Traumatic hemorrhage
    - Perioperative bleeding

Indications
- Labeled
  - Tooth extractions
  - Menorrhagia
- Unlabeled
  - Cesarean sections
  - Hereditary angioedema
  - Traumatic hemorrhage
  - Perioperative bleeding

TXA for Epistaxis

- Oral
- Local gel
- Duration of treatment
- Concern for thromboembolic complications with systemic use

Adapted from: obgmanagement.com

TXA for Epistaxis

- Oral
- Local gel
- Duration of treatment
- Concern for thromboembolic complications with systemic use

Efficacy Endpoint | Epi + Lido | TXA | OR (95% CI) | p-value
--- | --- | --- | --- | ---
Bleeding stop time ≤ 10 min (%) | 31.2 | 71 | 2.28 (1.68-3.09) | < 0.001
Discharge time ≤ 2 hours (%) | 6.4 | 95.3 | 14.8 (7.2-30.4) | < 0.001

Complications: no difference
- Re-bleeding: significantly lower with TXA

Key Takeaways
- TXA is a feasible alternative for treating epistaxis
- Limited data comparing topical TXA to current treatment modalities
- Dose: 500 mg (5 mL) soaked in cotton pledget

Sticking Its Nose in Another Indication: TXA for Epistaxis

Thank you!

Got a question?
Ask the experts!

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Holy QT Batman!
Isoproterenol for the treatment of refractory
Torsades de Pointes

Mason Bucklin, Pharm.D.
Emergency Medicine Pharmacist
University of Tennessee Medical Center

Learning Objective:
• Describe the mechanism of beta-agonists in the treatment of refractory torsade de pointes.

Code Blue!
• 62 yo obese female, pale, diaphoretic, vomiting
• Airway is protected, breathing is labored
• Sinus bradycardia in the 50’s and blood pressure is normal

Magnificent Arrhythmia

Initial Treatment
• Pulseless ventricular tachycardia, cardioverted at 120 joules, resulted in conversion to normal sinus
• Magnesium 2 g IV push x 1
• Heart rate starts to slow down again, develops PVC, Torsades returns, cardioverted again and given more magnesium
• She is then stabilized, transferred to the ICU
• QTc 636, K+ 2.6

The Story
• Admitted for NSTEMI and severe gastroenteritis with dehydration two days prior to arrest
• PMH: CAD, CAG, and uncontrolled DM, HTN, and HLD
• Relevant medications: Fluoxetine, Ranolazine, Ondansetron, Promethazine
• DC’d all potential QT-prolonging medications
• Started on K+ at 20 meq/hr and isoproterenol to maintain heart rate above 90 bpm
Torsades de Pointes Etiologies

**Congenital**
- Mutations in Na and K channels

**Acquired**
- Drugs
- Low Mg²⁺/K⁺/Ca²⁺
- Bradycardia
- MI
- Autonomic neuropathy
- HIV

Torsades de Pointes Treatment

- Cardioversion
- Magnesium 2 g IV push
- Correct Electrolytes (K⁺, Mg²⁺, Ca²⁺)
- Isoproterenol
- Transvenous Pacing
- Discontinue offending agent(s)

Isoproterenol

- Indications: acquired long QT with bradycardia as a bridge to transvenous pacing
- MOA: Beta agonist, increasing heart rate will decrease QTc and prevent Torsades
- Dose 2-10 mcg/min as a continuous infusion
  - Titrate to HR goal > 90 bpm
- Hypotension can be a dose-limiting side effect
  - Flushing is also possible
- Relative contraindications:
  - Structural heart disease
  - Severe angina

The End

- She was started on isoproterenol 1-2 mcg/min
- All QT prolonging agents were discontinued
- Potassium was replaced
- She was observed in the ICU for 3 days until electrolytes were fully replaced and QTc was less than 500 ms
- Discharged after 11 days in the hospital

Key Takeaways

- Torsades de Pointes should initially be treated with cardioversion and magnesium 2-4 g given IV push
- Isoproterenol can be given for refractory torsades to maintain heart rate greater than 90 beats per minute

Holy QT Batman!
Isoproterenol for the treatment of refractory Torsades de Pointes

Mason Bucklin, Pharm.D.
Emergency Medicine Pharmacist
University of Tennessee Medical Center
Three ways to use a three-way stopcock

Christopher B. Adams, Pharm.D.
Emergency Medicine Clinical Pharmacist
University of California, Davis Medical Center

Learning Objective:
- Identify opportunities for improved efficiency by utilizing a three-way stopcock.

Meet the Three-Way Stopcock
- Commonly stocked in the ED
- Fluid directional control
- Male, female (x2) Luer Lock system

Procedural Sedation
- Scenario:
  - Preparation of multiple doses of sedation medication(s)
- Opportunity:
  - Decrease waste
  - Improve efficiency

Pediatric Cardiac Arrest
- Scenario:
  - Expedited preparation of weight-based unit dose medication(s)
- Opportunity:
  - Simplify workflow
  - Improved efficiency
Pediatric Cardiac Arrest

Complex IV Administration

- **Scenario**
  - patient requiring many simultaneous continuous infusion medications

- **Opportunity**
  - Improved efficiency

Meet the Manifold

**Summary**

**THREE-WAY STOPCOCK**

Increases efficiency in:

Medication Preparation and Administration

A Case for Confusion: Valproic acid (VPA) induced hyperammonemic encephalopathy (VHE)

Christopher B. Adams, Pharm.D.
Emergency Medicine Clinical Pharmacist
University of California, Davis Medical Center

Tony J. Casanova PharmD
Emergency Department Pharmacist Specialist
Franciscan Health System

Thank You!
Learning Objective:
• To understand the symptoms of patients presenting with valproic acid induced hyperammonemic encephalopathy.

Consider:
A patient presents to your Emergency Department with the assistance of a local medic unit. The report given by the medics was that this individual is a “30 yr. old male, acting very strange, intoxicated, vomiting, tachycardic and probably high on something.”

...Everything is medication related until proven otherwise

VHE Signs and Symptoms
• Lethargy
• Impaired consciousness
• Focal neurological signs
• Disorientation
• Aggression
• Ataxia
• Vomiting
• Mental status changes
• Increased seizure frequency
• Sedation
• Confusion
• Somnolence
• Stupor
• Coma
• Death

Laboratory Values

<table>
<thead>
<tr>
<th></th>
<th>Valproic Acid, Total</th>
<th>Ammonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0 mcg/ml</td>
<td>Normal: 11-35 µmol/L</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>50-100 mcg/ml</td>
<td></td>
</tr>
<tr>
<td>Toxic</td>
<td>&gt;150 mcg/ml</td>
<td></td>
</tr>
<tr>
<td>Valproic Acid, Free</td>
<td>Normal: 0 mcg/ml</td>
<td></td>
</tr>
<tr>
<td>Therapeutic</td>
<td>7-23 mcg/ml</td>
<td></td>
</tr>
<tr>
<td>Toxic</td>
<td>&gt;30 mcg/ml</td>
<td></td>
</tr>
</tbody>
</table>

The Confusion with VHE
• Patients can present
  • with acute (overdose or therapeutic load) or chronic VPA ingestion
  • with therapeutic or supra-therapeutic VPA concentrations
  • who previously were taking VPA without complications
  • with or without abnormal liver function tests

• VHE can mimic underlying disease (psychosis, bipolar, seizures)
• Patients may also present with asymptomatic hyperammonemia
• Hyperammonemia is present in 50% of cases with chronic VPA use
### VHE Risk Factors

<table>
<thead>
<tr>
<th>Non-Medication Related</th>
<th>Medication Related</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Urea cycle disorders</td>
<td>• Increased doses of VPA</td>
</tr>
<tr>
<td>• Malnourishment or catabolic state</td>
<td>• Concomitant</td>
</tr>
<tr>
<td>• Renal failure</td>
<td>• Phenytoin</td>
</tr>
<tr>
<td>• Hypoaalbuminemia</td>
<td>• Phenobarbital</td>
</tr>
<tr>
<td>• L-Carnitine deficiency</td>
<td>• Topiramate</td>
</tr>
<tr>
<td>• Abnormal liver function</td>
<td>• Risperidone</td>
</tr>
<tr>
<td></td>
<td>• Clozapine</td>
</tr>
<tr>
<td></td>
<td>• Acetazolamide</td>
</tr>
</tbody>
</table>

### VHE MOA

- Several proposed mechanisms...
- Multifactorial
- Renal
  - VPA increases uptake of glutamine (leading to ammonia production)
- Hepatic
  - VPA and its metabolites decrease free carnitine, acetyl CoA, and coenzyme A, as well as decrease and inhibit N-acetyl glutamate and carbamoyl phosphate synthetase, which both play a role in the urea cycle
  - Metabolic disorders (urea cycle disorders)
  - Underlying hepatic disease

### VHE Key Takeaways

1. Altered mental status from VHE can be multifactorial and can often masquerade as underlying disease or substance abuse.
2. When in doubt, check a serum ammonia level.
3. Know your patient's medications, everything is medication related until proven otherwise.

### A Case for Confusion: Valproic acid (VPA) induced hyperammonemic encephalopathy (VHE)

Tony J. Casanova PharmD
Emergency Department Pharmacist Specialist
Franciscan Health System

### Learning Objective:
- Discuss therapeutic treatment for valproic acid overdose.

---

**Valproic Acid: The Not-So-Good, The Bad, and The Ugly**

Aimee Mishler, PharmD
Maricopa Medical Center
Emergency Medicine Pharmacist
**Case**

- “30 yr. old male, acting very strange, intoxicated, vomiting, tachycardic and probably high on something.”
- Confused, lethargic, able to protect airway, responsive with verbal and painful stimuli, GCS 14
- Vitals: BP: 138/72, HR: 83, O2 sat: 100%
- Labs:
  - AST/ALT: 35/42 units/L
  - Albumin: 3.4 g/dL
  - INR: 1
  - Ammonia: 150µg/dL
  - Valproic acid: 103mcg/mL

**Lab Findings in VHE**

- Hyperammonemia: serum ammonia >80µg/dL
- AST/ALT and markers of hepatic synthetic function can be normal
- Valproic acid levels can be within normal range

**VHE Treatment**

- Stop and wait
- Immediate discontinuation of VPA
- Time
- Supplementation with L-Carnitine for serum ammonia metabolism
- Decrease GI ammonia production, absorption & increase elimination
  - Consider lactulose, rifaximin, metronidazole
- Other Therapy
  - Consider naloxone

**VHE Treatment**

- Lactulose
  - Inhibits diffusion of NH₃ into blood by causing NH₃ → NH₄⁺ which draws NH₃ from tissue
  - Osmotic effect on colon promoting peristalsis
- Rifaximin or metronidazole
  - Target ammonia producing bacteria in GI tract
- Naloxone
  - May act as a GABA antagonist or inhibit postsynaptic GABA transport

**Valproic Acid and Carnitine**

- VPA depletes carnitine stores
  - Valproylcarnitine and valproyl-CoA formed
  - Valproylcarnitine decreases reabsorption of free carnitine
  - Decreases synthesis of carnitine
  - Blocks carnitine transport into the cell
- Low carnitine → ω-oxidation
- Carnitine deficiency impairs urea cycle → accumulation of ammonia

**L-Carnitine Supplementation**

- Recommend supplementation in exposure to VPA:
  - Ammonia >100µg/dL with no symptoms
  - Ammonia >80µg/dL with symptoms
  - Pediatrics presenting with VPA overdose
- Symptomatic patients
  - 100mg/kg IV (6g max) over 30min
  - Maintenance dose: 15mg/kg IV q4h over 10-30min
- Asymptomatic patients
  - 100mg/kg/day (3g/d max) PO divided q6h
Valproic Acid: The Not-So-Good, The Bad, and The Ugly
Aimee Mishler, PharmD
Maricopa Medical Center
Emergency Medicine Pharmacist

Time for another brief Q&A session!

A Chilling Debate - Medication Use in Hypothermic Arrest
Gabrielle L. Procopio, PharmD
Emergency Medicine Clinical Pharmacist
Hackensack University Medical Center

Physiologic Effects of Mild to Moderate Hypothermia by System

<table>
<thead>
<tr>
<th>System</th>
<th>Temp</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endocrine</td>
<td>&lt; 35°C</td>
<td>↓ insulin sensitivity, ↓ insulin secretion, ↑ fat metabolism</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>34 – 36°C</td>
<td>Shivering</td>
</tr>
<tr>
<td>Metabolic</td>
<td>&lt; 35°C</td>
<td>↓ metabolism, ↓ oxygen consumption</td>
</tr>
<tr>
<td>Hematologic</td>
<td>≤ 35°C</td>
<td>Impaired platelet aggregation, ↑ clotting times</td>
</tr>
<tr>
<td>Renal/Electrolytes</td>
<td>&lt; 35°C</td>
<td>↑ urine output, ↑ loss of electrolytes, ↓ CFI, tubular dysfunction</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>≤ 30°C</td>
<td>Ventricular tachycardia (VT), VF, atrial fibrillation</td>
</tr>
<tr>
<td></td>
<td>≤ 34°C</td>
<td>Prolonged PR, QRS, and QT intervals</td>
</tr>
<tr>
<td></td>
<td>≤ 34°C</td>
<td>Sinus bradycardia</td>
</tr>
<tr>
<td></td>
<td>≤ 35°C</td>
<td>↓ Cardiac output</td>
</tr>
</tbody>
</table>

Learning Objective:
• Discuss medication use during hypothermic cardiac arrest

Cardiac Arrest Medications in Hypothermia

<table>
<thead>
<tr>
<th>Medication</th>
<th>PK Properties</th>
<th>Potential Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine</td>
<td>Metabolism</td>
<td>Hepatically metabolized by MAO and catechol-O-methyl transferase (COMT)</td>
</tr>
<tr>
<td></td>
<td>Excretion</td>
<td>Excreted through urine as mainly inactive metabolites</td>
</tr>
<tr>
<td>Vasopressin</td>
<td>Metabolism</td>
<td>Hepatically and really metabolized</td>
</tr>
<tr>
<td></td>
<td>Excretion</td>
<td>Excreted ~5-15% through urine unchanged</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>Distribution</td>
<td>Vd ~60 L/kg</td>
</tr>
<tr>
<td></td>
<td>Metabolism</td>
<td>Hepatically – extensive with CYP3A4 / CYP2C9</td>
</tr>
<tr>
<td></td>
<td>Excretion</td>
<td>Primarily biliary</td>
</tr>
</tbody>
</table>

May accumulate due to decreased metabolism
May accumulate due to decreased metabolism
May accumulate due to decreased metabolism
May heighten action if cannot distribute

### Guideline Comparison

<table>
<thead>
<tr>
<th>Intervention</th>
<th>American Heart Association</th>
<th>European Resuscitation Council</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic life support</td>
<td>Same as normothermic algorithm</td>
<td>Same as normothermic algorithm</td>
</tr>
<tr>
<td><strong>Drug administration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Initiation</td>
<td>Same as normothermic algorithm</td>
<td>Withhold cardioactive drugs until temp &gt; 30°C</td>
</tr>
<tr>
<td>• Interval between doses</td>
<td>Same as normothermic algorithm</td>
<td>Doubled for temp 30 - 35°C</td>
</tr>
<tr>
<td>• Standard protocol use</td>
<td>Same as normothermic algorithm</td>
<td>Once temp &gt; 35°C</td>
</tr>
</tbody>
</table>

### Key Takeaway Points

- Remember hypothermia is your H ➔ aggressive rewarming
- There may be a potential for drug accumulation due to decreased enzymatic activity during the hypothermic state
- Normothermic ACLS treatment algorithm should be followed per AHA guidelines, as clinical evidence to support holding arrest drugs until a certain temperature is reached is lacking

### What’s the Data?!

- Data is mostly limited to case reports and animal studies, which don’t talk about the drugs
- Most case reports and studies have not evaluated effect of continuous doses of ACLS drugs
- 2014 case report 8mg epinephrine over ~2 hours
- Clinical evidence to support holding arrest drugs until a certain temperature is reached is lacking

**WARM THEM UP!**

### Learning Objective:

- Discuss the most common cognitive errors clinical pharmacist are prone to when working in the emergency department.
Good diagnostics + Best available evidence + Search for cognitive errors

The reasonable decision

Cognitive Errors
- Commission bias
- Omission bias
- Instant gratification bias

Heuristics

Skill Errors
- Slips
- Memory Lapses

“Clinical decision making is built on experience - foundation of experience is the mistakes we made”
- S. Weingart, P. Wyer

The Errors We Make...

Zlatan Coralic, PharmD, BCPS
University of California San Francisco
"Adventures in drug diversion: What you can get in five minutes or less"

Philippe Mentler PharmD BCPS
Pharmacy Implementation Manager
VHA Inc.

Learning Objective:
• The audience will be able to discuss different methods of drug diversion in the ED including ways to spot, monitor and prevent it.

Drug Diversion in Health Care
• Up to 15% Healthcare workers misuse during career
• Opioid and benzodiazepine abuse is more common than in general population
  • Easy access and constant exposure
  • Presumed “knowledge” of medications
  • Job stress and dissatisfaction

Drug Diversion in Health Care
• Drug diversion carries significant risks
  • Impaired healthcare worker
  • Inadequate pain control for patients
  • Infection Risk
    • 2012: 45 patients contract Hepatitis C from worker siphoning fentanyl

Diversion tactics
• Pocketing waste
• Stealing from Sharps Bin
• Siphoning IV drug and replacing with other solution
• Other tactics...

Preventing diversion
• Limit Automated Dispensing Machine (ADM) access
• Actually following waste/witness policies
• Education
• Camera surveillance
• Specialty disposal bins
• Create a Diversion Response team

http://www.health.state.mn.us/patientsafety/drugdiversion/divroadmap041812.pdf
Recognizing Diversion

- Anyone could be diverting
- Think outside the box
  - Consider this case...

CASE: “Those aren’t the 512’s”

- Frequent flyer presents with abd pain
  - Oxycodone/APAP prescribed
  - RN gives the patient this tablet
    - Highly skilled RN with 8+ years at the index hospital. A favorite of the staff.
  - Pt complains, “I want the 512’s, that pill doesn’t work”
  - Meanwhile...


CASE: “Those aren’t the 512’s”

- A technician notes a large discrepancy for the third time in 2 weeks
  - 10 pack of Prednisone 50mg

Detecting Diversion

- Automated dispensing machines
  - Audits
  - Benchmark ADM withdrawals to peers
    - ADM vendor Software available for this
  - Random drug/waste sampling

Dealing with Diversion

- DO NOT TURF RESPONSIBILITY
  - Follow federal and state laws
    - Reporting procedures, etc.
  - Help person seek treatment
    - Healthcare professionals have high success rate

- A Great Resource
References


"Adventures in drug diversion: What you can get in five minutes or less"

Philippe Mentler PharmD BCPS
Pharmacy Implementation Manager
VHA Inc.

Learning Objective

- Describe the role of intravenous lipid emulsion in the management of local anesthetic toxicity.

When fat is your friend: Intravenous lipid emulsion in local anesthetic toxicity

Jackie O'Connor, PharmD
PGY2 Emergency Medicine Resident
Detroit Receiving Hospital

The Surprise Arrest

- 50 y/o M presents to the ED after cardiac arrest during an outpatient surgery
- PMH: diabetes
- Labs: pH 6.85, K 4.4, Ca 7.2, AST 422, ALT 413, trop <0.05
  - No response from the patient
- Epi x3, vasopressin x3, atropine, dopamine given, followed by sodium bicarb, calcium gluconate
  - Still no signs of ROSC...
- 2 boluses of 250mL 20% Intralipid given, followed by an IV infusion of 15 mL/kg/hr
  - ROSC after the first bolus!

What Did Intralipid Do?

- Two theories for mechanism
  - “Lipid sink” – Intralipid sequesters lipophilic toxins to reduce concentration in the blood
  - Reversal of carnitine acylcarnitine translocase (CACT) enzyme inhibition
Intralipid with Local Anesthetics

• Reversal of cardiovascular or CNS toxicity
  • Circulatory collapse in approximately 1/1000 peripheral nerve blocks
• First studies by Weinberg et al. in rats and dogs
  • Pretreatment with Intralipid increased the lethal dose of bupivicaine
  • Speeds loss of bupivicaine from cardiac tissue and accelerated recovery from asystole

What Dose Should I Give?

• Various doses reported in case studies
• Association of Anaesthetists of Great Britain and Ireland guidelines from 2007
  • 1.5 mL/kg bolus 20% ILE over 1 min
  • May repeat two boluses q5min
  • 15 mL/kg/hr infusion 20% ILE
  • Max rate 30 mL/kg/hr

Can I Fix More Things with Intralipid?

• Recent review by Cave et al. found 42 published case reports of Intralipid success
  • 19 local anesthetic toxicity
  • 9 sedative/hypnotic toxicity
  • 5 calcium channel blocker overdose
  • 6 beta blocker overdose
  • 3 tricyclic antidepressant overdose
• Primary indication of cardiovascular collapse or arrest refractory to other therapies

Administration Considerations

• May cause false elevation of hemoglobin and methemoglobin
• Infection risk
• Thrombophlebitis
• Hypersensitivity reactions
  • Consider source of lipid emulsion (egg products, etc)

Key Takeaways

• Intralipid can save lives in acute toxicity
• Give 1.5 mL/kg bolus over 1 min, then 15 mL/kg/hr infusion of 20% Intralipid
• Documented safety and efficacy for local anesthetic toxicity
• Likely safe and effective for other lipophilic drug overdoses

Now a word from our sponsors…
And questions from you!
Reality Bites: Pharmacist Driven Rabies Protocol in the ED

Christi Jen, PharmD, BCPS
Clinical Pharmacist – Emergency Medicine
Banner Boswell Medical Center

Objective
- Outline a pharmacist-driven rabies protocol in the emergency department.

Patient Case
- CC: 68 yo female presents to the ED s/p bobcat bite
- HPI: sunbathing and fell asleep
  - Woke up
  - Bobcat bite to chest area

Rabies
- Virus from Mononegavirales
  - Exposure to saliva or brain tissue
  - Bite from a rabid animal
- Epidemiology
  - Wild carnivores and bats
  - > 90% wildlife
  - Human cases involved organ transplant pts
  - Rare

Management
- Rabies immune globulin on day 0
- Rabies vaccine on day 0, 3, 7, 14, 28* if immunocompromised
- Tetanus vaccine
- Wound management

Risks of Current Rabies Process
- Liability
- Re-Evaluation
- Loss of Follow-Up
- Other

http://www.nh.gov/.../index.html
Mitigating Risks

- Liability
  - Various EDs do not perform callbacks to ensure subsequent visits
- Re-evaluation
  - Day 3 return to ED for wound check if provider deemed appropriate

Mitigating Risks

- Loss of follow-up
  - Community pharmacies will ensure follow-up
- ED Clinical Pharmacist perform call backs
- Other
  - Pharmacist qualifications certified by AZ State Board of Pharmacy
  - Pediatric patients not included in AZ State Board of Pharmacy Statutes

Benefits of Pharmacist-Driven Protocol

- Less burden on patient
- Less burden on ED
  - Community Pharmacies

Workflow

- Rabies risk assessment call to county public health department (required)
- Order day 0 vaccinations and other treatment
- Discharge orders
  - Return to ED on day 3 for wound re-evaluation
  - Rx for vaccines on days 7 and 14; day 28 if immunocompromised
  - Verify insurance coverage prior to discharge
- Consult for clinical pharmacist follow-up

Paperwork Given to Pt at Discharge

- Complete discharge instructions to return on day 3 for re-evaluation
- Prescription for days 7 and 14 and day 28 if appropriate
- Maricopa County Vaccine Form (Day 0 and 3 filled out by RN)
- CDC Vaccine Form

Maricopa County Vaccine Form

- Rabies Post Exposiological Vaccination Document
- Maricopa County Health
- Signature line
- Immunization Date
- Physician signature

If you have questions, please contact the Arizona Department of Health Services at 602-544-4562.
**Workflow**

**BBWMC ED Provider**
- Receives faxed copy of the Rx for day 7 and 14
- Sets up future appointments with patient & performs reminder calls
- Performs required patient assessment via patient questionnaire

**Community Pharmacist**

**BBWMC ED Clinical Pharmacist**

**Workflow**

**BBWMC ED Provider**
- Pharmacist administers the vaccine
- Patient education on:
  - Follow-up
  - When to go to the ER
  - How to report adverse drug reaction
- After each dose given & completion of series, staff to fax vaccine form to Maricopa County & BBWMC ED

**Community Pharmacist**

**BBWMC ED Clinical Pharmacist**

**Workflow**

**BBWMC ED Provider**
- Receives pharmacy consult and documents in chart
- Calls the patient to remind for future vaccine appointments as part of Daily Microbiology Follow-Up
- Receives faxed vaccine completion report and scan into patient's medical record

**Community Pharmacist**

**BBWMC ED Clinical Pharmacist**

**Reality Bites: Pharmacist Driven Rabies Protocol in the ED**

Christi Jen, PharmD, BCPS  
Clinical Pharmacist – Emergency Medicine  
Banner Boswell Medical Center

**PharmDs Read EKGs?: Pointers to Identify the Toxicologic Patient**

Libby Giesler Johnson, PharmD, BCPS  
Clinical Specialist – Emergency Medicine/Critical Care  
John Peter Smith Hospital, Fort Worth, TX
Learning Objective:
• Describe key EKG changes associated with toxic ingestions.

Patient Case #1
56 year old female
• Chief complaint: altered mental status
PMH
• Depression, HTN
Vitals
• BP 112/74 HR 85 RR 13

EKG #1

Tricyclic Antidepressants (TCA): Receptors

Na Channels Blockade
Histamine
Anti-muscarinic
Alpha Inhibitors
K Channel Inhibitors
NE/5HT Reuptake Inhibitors

GABA-A

TCA Toxicity: Conduction Abnormalities

<table>
<thead>
<tr>
<th>Receptor</th>
<th>EKG Changes</th>
<th>Arrhythmia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na Channel Inhibition</td>
<td>QRS &gt; 100ms, R in AVR &gt; 3mm</td>
<td>Ventricular tachycardia</td>
</tr>
<tr>
<td>K Channel Inhibition</td>
<td>QT prolongation &gt; 450 ms</td>
<td>Torsades de pointes</td>
</tr>
</tbody>
</table>
Potassium Channel Blockers
- Antiarrhythmics (1A, 1C, 3)
- Diphenhydramine
- Antipsychotics
- Fluoroquinolones
- Macrolides
- TCAs

Sodium Channel Blockers
- Antiarrhythmics (1A, 1C)
- Cocaine
- Diltiazem/Verapamil
- Diphenhydramine
- Propoxyphene
- TCAs

Patient Case #2
- 77 year old female
  - CC: dizziness and loss of balance
- PMH: HTN, CAD, CHF, AFib

Initial Vitals
- BP 94/40 RR 16 HR 42
- O2 sat 96% on room air
- GCS 15 but confused

Patient #1 EKG
- QRS 90
- QT/QTc: 444/375

Digoxin Toxicity: Electrophysiology

Key Takeaways
- TCA Toxicity
  - Sodium and potassium channels blockers cause many EKG abnormalities
  - Positive R wave in AVR
  - QT prolongation
  - QRS widening (> 100ms → seizures)
- Digoxin Toxicity
  - Leads to a variety of arrhythmias
  - Most common: SVT with slow ventricular response (atrial tachycardia with block)

PharmDs Read EKGs?: Pointers to Identify the Toxicologic Patient
Libby Giesler Johnson, PharmD, BCPS
Clinical Specialist – Emergency Medicine/ Critical Care
John Peter Smith Hospital, Fort Worth, TX
When LVADs Go Bad

Michelle C. Hines, Pharm.D.
PGY-2 Emergency Medicine Pharmacy Resident
University of Maryland Medical Center
Baltimore, Maryland

Learning Objective:
• After completing this session the learner should be able to list four potential left ventricular assist device problems that could be encountered in the emergency department.

What's an LVAD?

Thrombosis Risk

Signs of Thrombosis:
• ↑ Power
• Low flow alarm
• Altered mental status
• Hypotension (MAP <65 mmHg)
• Peripheral emboli

Laboratory Findings:
• Hemolysis
• LDH >1500 mg/dl or 2.5-3x upper limit of normal
• ↑ Serum free hemoglobin

Thrombotic Events

Gastrointestinal Bleeding

Incidence
• 23% in patients with continuous-flow LVAD
• 9.3% recurrence rate

Risk Factors
• Increased age
• Elevated serum creatinine

Management
• Blood products
• Hold anticoagulant and antiplatelet agents
• Proton pump inhibitor
Infection

Sites
- Driveline
- Pump pocket

Usual Suspects
- Staphylococcus aureus
- Enterococcus spp.

Pump Pocket/Deep
- Pseudomonas spp.

What if the patient arrests?

Key Takeaways

- Hold antiplatelet agents and anticoagulation in LVAD patients with a suspected gastrointestinal bleed.

- Empiric antimicrobial therapy for a suspected pump pocket or deep infection should cover Pseudomonas aeruginosa.

When LVADs Go Bad

Michelle C. Hines, Pharm.D.
PGY-2 Emergency Medicine Pharmacy Resident
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Dexmedetomidine: A New Ingredient in the EtOH Withdrawal Cocktail?

Liz Hohner, PharmD
PGY2 Emergency Medicine Resident
The Johns Hopkins Hospital
Baltimore, Maryland
Learning Objective:
• Describe the rationale and utility of dexmedetomidine for alcohol withdrawal syndrome in the emergency department.

Pathophysiology of AWS

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Alcohol status</th>
<th>Normal effect</th>
<th>Clinical effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Blood alcohol</td>
<td>Normal</td>
<td>Baseline normal</td>
</tr>
<tr>
<td>Raised</td>
<td>Blood alcohol</td>
<td>Intoxication</td>
<td>Sedation</td>
</tr>
<tr>
<td>Overdosed</td>
<td>Blood alcohol</td>
<td>Withdrawal</td>
<td>Autonomic instability</td>
</tr>
</tbody>
</table>

Alcohol Withdrawal Syndrome

Anxiety, insomnia, tremor, palpitations, nausea, anorexia

Delirium tremens

Tachycardia, hypertension, high-grade fever, delirium, agitation

Days since alcohol discontinuation


The Kindling Phenomena
• Repeated episodes may lead to permanent down regulation of GABA receptors
• Increasingly severe and increasingly resistant to treatment with benzodiazepines (BZDs)
• May require addition of or switch to different class of medications

Treatment of AWS
• Benzodiazepines
• Treatment of choice
• Symptom triggered administration
• Some patients require exceptionally high doses of benzodiazepines
• Barbiturates
• Propofol
• Alpha-2 adrenergic antagonists?

Dexmedetomidine
• Selective alpha-2 adrenergic antagonist
• Inhibit symptoms related to increased tone
• Anxiety, agitation, elevated BP, tachycardia
• Animal data demonstrating neuroprotective effect from excessive catecholamine release?
• No activity at opioid or GABA receptors = no respiratory compromise
**Dexmedetomidine**
- Mostly case reports and retrospective cohorts; few prospective randomized trials
- Conducted in non-emergency department settings
- May impair ability to administer appropriate BZD treatment as DEX blunts symptomatic assessment
- Large range of infusion rates reported:
  - 0.2 – 4.6 mcg/kg/min
- No clear benefit in decreasing rates of intubation or improving outcomes

---

**Clinical Outcomes with DEX**

<table>
<thead>
<tr>
<th>Study Design</th>
<th>Continuous infusion BZD (lorazepam or midazolam) or DEX in addition to standard medical therapy n = 61</th>
</tr>
</thead>
</table>
| Results      | - No significant differences in:  
  - Respiratory distress requiring intubation  
  - Alcohol withdrawal seizures  
  - Intermittent BZD requirements  
  - Significantly more patients with DEX experienced bradycardia and hypotension |

| Conclusion    | DEX did not result in decreased rates of intubation or alcohol withdrawal seizures.  
  DEX may decrease BZD requirements which could put patients at risk for alcohol withdrawal seizures. |

---

**Key Takeaways**
- Key Takeaway #1  
  - Benzodiazepines are the backbone of therapy for AWS
- Key Takeaway #2  
  - Dexmedetomidine has limited data in AWS that does not suggest any improvement in outcomes
- Key Takeaway #3  
  - Use of dexmedetomidine is discouraged until further data is available

---

**Dexmedetomidine vs. Placebo**

| Study Design | In addition to CIWA-triggered lorazepam:  
  - DEX 1.2 mcg/kg/hr (high dose)  
  - DEX 0.4 mcg/kg/hr (low dose)  
  - Placebo n = 24 |
|--------------|-----------------------------------------------------------------|
| Results      | - No significant difference in:  
  - 7 day lorazepam requirements  
  - Patients with severe CIWA score at 24 hrs  
  - Four patients with DEX experience bradycardia |

| Conclusion    | Adjunctive DEX may help to controls symptoms of AWS but has no significant effect on long-term lorazepam requirements with a CIWA-triggered protocol. |

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Last minute questions?

Thank you!
Tarred and Feathered

Christopher J. Edwards, PharmD, BCPS
Clinical Pharmacy Specialist – Emergency Medicine
The University of Arizona Medical Center – Tucson AZ

What is Hot Tar
- Mixture of organic compounds
- Primarily 3 to 40 ringed polynuclear aromatic hydrocarbons
- Used often for roofing and paving
- Viscosity decreases at higher temperatures
- Industrial applications often maintain temperatures up to 560°F

Options for Removal?
- Manual removal using a scrub brush and forceps
  - PAINFUL!
- Non-polar organic solvents
  - What do we have in the hospital?
    - Various ointments and creams
    - Light mineral oil
    - Soap and water
  - Emulsifying agents
    - Polysorbates (e.g. Tween-80)

Case
- 38 year old male was carrying a bucket of hot tar to a roof when he tripped.
- Both arms coated with a thick layer of black tar except for the areas where burned skin had begun to peel

Time for Science!
- N of 1, unblinded, parallel, cross over study
  - Used light mineral oil, then soap and water on the right arm
  - Thick layer of bacitracin, then soap and water on the left arm
  - No statistical analyses were performed
  - Both agents were effective at removing tar from the patient
  - Subjectively, mineral oil worked faster and with less effort in application

Aftercare
- After the tar has been removed, the extent of injury secondary to burns should be assessed
- Patient will likely need to follow up in burn clinic