Emergency Medicine Pearls 2018

Section Advisory Group on Emergency Care
Section of Clinical Specialists and Scientists
American Society of Health-System Pharmacists
Disclosures

All planners, presenters, reviewers, and ASHP staff of this session report no financial relationships relevant to this activity.
Emergency Medicine Pearls 2018

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Director – PGY2 Emergency Medicine Pharmacy Residency
Maricopa Integrated Health System
@EM_Pharm
Thank You Committee Members and Peer Reviewers
Engage Online!

@ASHP_EMPharm
#EMpearels
#ASHP18
Don’t Just Treat the Symptoms, Treat the Disorder: Buprenorphine Induction in the ED

Terry Makhoul, Pharm.D.
Emergency Medicine Clinical Pharmacy Specialist
Santa Rosa Memorial Hospital
Twitter: @terrymakh
Learning Objectives

• Discuss the value of buprenorphine induction in the emergency department (ED).

• Describe a typical buprenorphine induction strategy.
The Opioid Epidemic

In 2016...

116 people died EVERY DAY from opioid-related overdoses

11.5 million people misused prescription opioids

2.1 million people had an opioid use disorder

170,000 people used heroin for the first time

504 billion dollars in economic costs

Buprenorphine

- Partial opioid agonist
- Medication assisted treatment (MAT)
- Various formulations
  - Buprenorphine/naloxone
  - Buprenorphine

The Evidence

Buprenorphine ➤ Symptomatic management*

Withdrawal Severity

Withdrawal Treatment Duration

Treatment Completion

*clonidine or lofexidine


@terrymakh
Buprenorphine Induction

Moderate opioid withdrawal using COWS*

Administer 2 mg x 1

If no withdrawal, give 8 mg x 1

If withdrawal symptoms fully suppressed

1-2 hrs

1. Qualified provider to provide a short-term prescription
2. Connect with outpatient provider

*COWS: Clinical Opiate Withdrawal Scale

Key Takeaways

#1: Buprenorphine is a partial opioid agonist that can be initiated in the ED setting to treat opioid use disorder

#2: Encourage implementation of buprenorphine induction and referral to outpatient providers in the ED setting
Physostigmine for Anticholinergic Overdose

Anne Zepeski, Pharm.D., BCPS
Clinical Pharmacist – Emergency Medicine
University of Iowa Hospitals and Clinics
Twitter: @annezepeski
Learning Objective

• Identify appropriate clinical scenarios for physostigmine use in anticholinergic toxicity.
Anticholinergic Toxicity

**Anticholinergic Toxidrome**
- Hot as a hare
- Blind as a bat
- Dry as a bone
- Red as a beet
- Mad as a hatter

**Major Offenders**
- Antihistamines
- Antipsychotics
- Cyclic antidepressants
- Anticholinergic botanicals
- Benztropine

**Treatment Overview**
- **Agitation, Seizures:** benzodiazepines
- **Delirium:** physostigmine
- **QRS widening (TCAs):** sodium bicarbonate
- **Airway management**

Physostigmine

Mechanism of Action: acetylcholinesterase inhibitor

Adverse Effects
- Cholinergic toxicity
- Seizures
- Bradycardia

**Physostigmine Dosing and Administration**

<table>
<thead>
<tr>
<th>Adult</th>
<th>Pediatric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physostigmine 1 mg IV</td>
<td>Physostigmine 0.02 mg/kg</td>
</tr>
<tr>
<td>may repeat in 5 min</td>
<td>IV (max 0.5 mg/dose)</td>
</tr>
<tr>
<td>Administration rate: ≤1 mg/min</td>
<td>May repeat q 5-10 min</td>
</tr>
<tr>
<td></td>
<td>Max total dose: 2 mg</td>
</tr>
<tr>
<td></td>
<td>Administration rate:</td>
</tr>
<tr>
<td></td>
<td>≤0.5 mg/min</td>
</tr>
</tbody>
</table>

Paradigm Shift: Asystole following physostigmine in TCA overdose

**Patient 1**
- Seizures
- QRS interval: 240 ms
- Heart rate: 75 bpm

**Patient 2**
- Seizures
- QRS interval: 120 ms
- Heart rate: 75 bpm

Physostigmine $\rightarrow$ bradycardia $\rightarrow$ atropine $\rightarrow$ asystole

Physostigmine and Tricyclic Antidepressants

- **Mild**
  - Anticholinergic activity $>>$ Na$^+$ channel blockade

- **Moderate**
  - Anticholinergic activity $\approx$ Na$^+$ channel blockade

- **Severe**
  - Na$^+$ channel blockade $>$ anticholinergic activity

Physostigmine is **contraindicated** in patients with QRS prolongation

Lasting Effects: Physostigmine Underutilization

From 2012-2014, only 21% of anticholinergic toxicity cases were treated with physostigmine.

Despite studies showing:

- Reduced rates of intubation
- 100% response in patients with non-diphenhydramine antihistamine, antipsychotics and TCA overdose
- Favorable safety profile

@annezepeski

Key Takeaways

• Physostigmine is likely underutilized in anticholinergic overdose

• Physostigmine should not be used in patients with prolonged QRS complex, and should be used in caution in TCA overdose (QRS prolonging agents)

• Administer physostigmine as a slow IV push and keep atropine at bedside

@annezepeski
Poor Man’s Ethylene Glycol Test

Erin M. Lingenfelter, Pharm.D.
Clinical Pharmacist – Emergency Medicine
PGY2 Critical Care Residency Program Director
University of Utah Health
Twitter: @SLC_EMPPharmD
Learning Objective

• Interpret a “lactate gap” and evaluate its potential role in identifying patients needing treatment for ethylene glycol poisoning
He has a lactate of what?!?!?!

- 56 year old male via EMS secondary to a concerned citizen reporting him passed out in 102° heat
- 39.1°C, HR 115, BP 158/75, RR 24, GCS 8
- pH 6.9, pCO2 44, anion gap 27, **lactate 24**
- EtOH level: **undetectable**
- PharmD recommends adding on a **SERUM** lactate measurement
He has a lactate of what?!?!?!

- Blood gas lactate: 24
- Serum lactate: 1.8
Ethylene Glycol Poisoning

- **Presentation/toxicity**
  - Phase 1 (0-12 hours): Neurological
  - Phase 2 (12-36 hours): Cardiopulmonary
  - Phase 3 (24-72 hours): Renal

Ethylene Glycol Poisoning

• Diagnosis
  – Serum gas chromatography
    • Remote or send off
  – Conventional lab results
    • Anion gap, osmolar gap, ionized calcium, negative EtOH level
  – Clinical signs

• What about those lactate results?

Brindley, et al. CMAJ. 2007;176(8):1097-1099
How does this happen?

- Interference of glycolic acid/glycolate in the lactate-oxidase assay resulting in a falsely elevated result
- Two different analysis techniques produce vastly different results identifying a “lactate gap”

Lactate Gap
Bringing it home.....

• Know your lab’s analysis techniques and its limitations.
  – L-lactate oxidase
• Unexplained elevated lactate? Consider looking for a lactate gap.
• If clinically indicated, treat patient for EG poisoning, don’t wait for confirmatory EG levels!

@SLC_EMPharmD
References

Cannabinoid Induced Coagulopathy

Kortney Morrell, Pharm.D.
PGY2 Emergency Medicine Pharmacy Resident
University of Maryland Medical Center
Twitter: @KM_PhamER
Learning Objectives

• Identify patients at risk for synthetic cannabinoid-associated coagulopathy

• Recall laboratory parameters to identify and monitor patients with synthetic cannabinoid-associated coagulopathy

• Develop a treatment regimen for a patient with synthetic cannabinoid-associated coagulopathy
Patient Case

Initial Presentation:
• Hallucinating
• Combative
• Hypertensive
• Tachycardic

Patient takes “spice” regularly


@KM_PhamER
Synthetic Cannabinoids

- Street name: Spice, K2

- Acute intoxication:
  - Psychosis, hallucinations/delusions
  - Violence, agitation, irritability
  - Tachycardia, hypertension, tachypnea
Patient Case

Initial Presentation:
• Ripped out IV line
• Persistent bleeding


@KM_PharmER
Reported Cases

• March-April 2018: 94 patients present to ER with unexplained bleeding
  – INR values 6 to >20 on presentation
  – Nose bleeds, urinary tract bleeding, bleeding gums, bleeding disproportionate to the size of the wound

• **CDC Outbreak Alert:** Potential Life-Threatening Vitamin K-Dependent Antagonist Coagulopathy Associated with Synthetic Cannabinoid Use

• Several states have been affected, with the most cases reported in:
  – Illinois
  – Maryland
  – Wisconsin

Brodifacoum

• 4-hydroxycoumarin derivative: “Superwarfarin”

• 100x more potent than warfarin

• Coagulopathy lasting weeks to months

• Gastrointestinal and genitourinary are the most common sources of bleeding

Patient Case

- Despite applying continuous pressure to the wound, it continues to bleed profusely
- INR results at 15


@KM_PharmER
Management

• Initial Management:
  – Labs: INR, PT, Hgb, Hct if active bleeding
  – Antidotes:
    • Four factor prothrombin complex concentrate (Kcentra®)
      – INR 2 to <4: 25 units/kg, maximum dose 2,500 units
      – INR 4 to 6: 35 units/kg, maximum dose 3,500 units
      – INR >6: 50 units/kg, maximum dose 5,000 units
    • High dose vitamin K:
      – 10mg IV (dosing may vary based on institution)
        » Up to 50mg IVPB Q8H
Management

• Long Term Management:
  – Weeks to months of vitamin K therapy
    – Vitamin K 25-50mg PO, TID-QID
    – Titrate down when INR <2
  – Expensive: $4,000-$14,000 per week
    • Dose/duration exceeds insurance restrictions

• Report ALL cases to local health department and Poison Control Center
Key Takeaways

• At risk patients: psychosis, violence, agitation, tachycardia, tachypnea

• Monitoring parameters: INR, PT, plus Hgb and Hct if active bleeding

• First line treatment:
  – Four Factor PCC + Vitamin K IV
Q&A Session

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#ASHP18
Questions?

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Anne Zepeski, PharmD, BCPS: @annezepeski
Erin Lingenfelter, PharmD: @SLC_EMPHarmD
Kortney Morrell, PharmD: @KM_PharmaER
Haloperidol for Cannabinoid-Induced Hyperemesis

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PGY-2 Emergency Medicine Pharmacy Resident
Maricopa Integrated Health System
Twitter: @EmergencyPharmD
Learning Objectives

At the end of this presentation the audience should be able to:

• Describe the clinical presentation and pathophysiology of cannabinoid hyperemesis syndrome.

• Summarize the role of haloperidol in treating cannabinoid hyperemesis syndrome.
What is Cannabinoid Hyperemesis Syndrome?

Characterized by:

• Long history of cannabis use

• Cyclic vomiting

• Compulsive bathing in hot showers

What is the pathophysiology of CHS?

Receptors involved in cannabinoid use:

- **CB1**
  - Slows gastric motility, reduces gastric acid secretion
- **CB2**
  - Involved in intestinal motility and has immunomodulatory effects
- **TRPV1/TRPA1**
  - Involved in gastric motility
  - Activated by cannabinoids, high temperatures, and capsaicin

What are other current treatments for CHS?

CHS is not typically responsive to traditional antiemetics!

Moon et al. ACG Case Rep J. 2018 Jan 3;5:e3.
How does haloperidol fit in?

- Traditionally used to treat agitation in the ED
- Has been shown to be effective as an antiemetic

What does the literature say?

<table>
<thead>
<tr>
<th>Study Design</th>
<th>Case Report</th>
<th>Case Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2013</td>
<td>2017</td>
</tr>
<tr>
<td>Number of patients</td>
<td>N = 1</td>
<td>N = 4</td>
</tr>
<tr>
<td>Setting</td>
<td>Emergency department</td>
<td>Emergency department</td>
</tr>
<tr>
<td>Haloperidol dosing</td>
<td>5 mg IV x 1 dose</td>
<td>5 mg IV x 1 dose</td>
</tr>
<tr>
<td>Time to symptom</td>
<td>1 hour</td>
<td>1 hour for 3 patients</td>
</tr>
<tr>
<td>improvement</td>
<td></td>
<td>2 hours for 1 patient</td>
</tr>
</tbody>
</table>

## What does the literature say?

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</tr>
<tr>
<td>Setting</td>
<td>Outpatient setting</td>
<td>ED &amp; Inpatient</td>
</tr>
<tr>
<td>Haloperidol dosing</td>
<td>5 mg PO daily</td>
<td>1 mg x 1 dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 mg x 2 doses</td>
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<tr>
<td></td>
<td></td>
<td>Unknown timing of doses</td>
</tr>
<tr>
<td>Time to symptom</td>
<td>1 day</td>
<td>After 3 doses</td>
</tr>
<tr>
<td>improvement</td>
<td></td>
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</tr>
</tbody>
</table>

What can we expect in the future?

Haloperidol Versus Ondansetron for Cannabis Hyperemesis Syndrome (HaVOC)
• Estimated Study Completion Date: July 2019

Expert Consensus Guidelines
• Published in March 2018
• Recommends haloperidol 5 mg IV/IM as supportive therapy

ClinicalTrials.gov. Haloperidol Versus Ondansetron for Cannabis Hyperemesis Syndrome
Key Takeaways

1. Cannabinoid hyperemesis syndrome (CHS) is characterized by long history of cannabinoid use, cyclic vomiting, and compulsive hot-water bathing.

2. Haloperidol is used as an antiemetic due to its effect on dopamine receptors related to the emetic reflex.

3. Limited case reports and case studies have demonstrated a benefit in using haloperidol for CHS relief.

4. Haloperidol has been included in proposed guidelines for the treatment of CHS.
Propofol for Migraines

Kevin Mercer, Pharm.D.
PGY2 Emergency Medicine Pharmacy Resident
The Johns Hopkins Hospital
Twitter: @ohsnapapimginger
Learning Objective

• Discuss the role of propofol in the treatment of migraine headache.
Epidemiology of Migraine

- Seventh leading cause of missed work worldwide
- 2-3 times more common in women
- Migraine headache (MHA) responsible for 2.2% emergency department (ED) visits

### Definition

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Migraine Headache (MHA) without Aura | HA lasting 4–72 hr  
HA with ≥2 of the following four characteristics:  
• Unilateral location  
• Pulsating quality  
• Moderate or severe pain intensity  
• Aggravation by or avoidance of routine physical activity  
During HA, at least one of the following:  
• Nausea and vomiting  
• Photophobia and phonophobia |

Pathophysiology of Migraine

• Form of neurovascular headache secondary to dilation of blood vessels causing pain and further nerve activation

• Migraine involves dysfunction of brain-stem pathways normally modulating sensory input
  – Key pathway: trigeminal

• Trigeminal-autonomic reflex may be active in migraine

Treatment with Migraine Cocktails

- Safe and effective for MHA attacks
- Complications:
  - Treatment refractory MHA may persist
- New treatment modalities:
  - ketamine
  - intranasal lidocaine
  - propofol

MHA Treatments in the ED

- anti-cholinergic
- dopaminergic
- NSAID

@ohsnapimginger
Propofol Pharmacology

- Mechanism: causes global central nervous depression via activation of GABA$_A$ receptors

- Onset: approximately 30 seconds

- Activity in MHA:
  - Agonist properties on GABA receptor
  - Reduce central sensitization and cortical spreading depression in MHA
  - Central nervous system depression potentially affects trigeminal pathway associated with MHA

## Preliminary Data

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
</table>
| Krusz, et al. 1999.10 | Retrospective cohort study 77 outpatients with out-of-control or refractory MHA with VAS ≥7 (without aura) | Propofol 20-30mg IVP q3-5min up to 1hr  
Average dose = 110mg | 81.8% total relief  
Average severity reduction was 95.4%  
Average time to maximum severity reduction was 20-30 mins |
| Mendes, et al. 2002.11 | Retrospective chart review 18 inpatient females (21-57 yo), refractory chronic daily HA (77.8% w/ MHA) | Propofol 20-30mg IVP q3-5min  
Dose range: 40-300mg (max 380mg; average 233.8mg ± 74.4mg) | 28.6% total relief  
Average pain decrease of 58.92% |

## Head-to-Head Trials

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
</table>
| **Soleimanpour, et al. 2012.** | 90 Iranian patients (≥18 yo) in ED with MHA in 2 equal groups | Treatment Groups:  
1. dexamethasone 0.15mg/kg IVP (max 16mg)  
2. propofol 10mg IVP q5-10min (max 80mg)  
VAS at presentation and 10, 20, and 30 mins after treatment recorded | Mean Dexamethasone VAS  
Baseline: 8.11  
10 mins: 5.13  
20 mins: 3.73  
30 mins: 3.06  
Mean Propofol VAS  
Baseline: 8  
10 mins: 3.08  
20 mins: 1.87  
30 mins: 1.44  
Patients treated with propofol had higher response rates at each time interval (p<0.001) |
| **Moshtaghion, et al. 2015.** | 90 Iranian cases of acute MHA in ED in 2 equal groups | Treatment Groups:  
1. sumatriptan 6mg SQ  
2. propofol 30-40mg IVP with 10-20mg q3-5 mins  
VAS at presentation and 0.5, 1, and 2 hrs after treatment recorded | Mean Sumatriptan VAS  
Baseline: 8.71  
0.5 hr: 3.69  
1 hr: 2.36  
2 hrs: 1.36  
Mean Propofol VAS  
Baseline: 9.09  
0.5 hr: 2.62  
1 hr: 2.69  
2 hrs: 1.62  
Pain intensity in propofol group significantly lower at 0.5 hr (p<0.05) |

VAS = visual analogue scale

Key Takeaways

• For patients in ED with refractory MHA
  – Need more research on safety and efficacy

• Multidisciplinary protocol development to standardize:
  – Patient criteria
  – Dosing strategy
    • Including maximum dose and number of doses
  – Administration
  – Monitoring
    • Similar monitoring for patients undergoing procedural sedation
      – Ensure mitigation of hypotension

• Discharge planning to mitigate return visits to the ED
Alternatives to Lidocaine for Topical Anesthesia

Shannon Sullivan, Pharm.D.
Emergency Medicine Clinical Pharmacist
University of Maryland- Baltimore Washington Medical Center
Twitter: @SSullivanpharma
Learning Objectives

• Describe potential alternatives to lidocaine for local anesthesia in the emergency department.
A Brief History Lesson...

Lucas RC. *The Lancet*. 1876;107(2740):344-46
Alternative Agent: Diphenhydramine

• Use as local anesthetic dates back to 1940s
  – Acts as a sodium channel blocker leading to inhibition of nerve cell depolarization

• May be more painful on injection than lidocaine
• Shorter duration of action
• Side effects: sedation, prolonged injection site pain (up to 3 days), local erythema, skin sloughing

How to Prepare?

- Most studies looked at a 1% diphenhydramine solution
- Higher concentrations may be associated with tissue necrosis and skin sloughing

4 ml of 0.9% sodium chloride

5 ml of 1% diphenhydramine solution

Alternative Agent: Benzyl Alcohol

- Discovered in the early 1900s to exhibit similar properties to opium alkaloids
  - Inhibits smooth muscle contraction and may prevent conduction of nerve impulses
- Less pain on injection than lidocaine
- No significant toxicities noted at low doses
- Shorter duration than lidocaine
  - 2-3 minutes; may be prolonged with epinephrine

Macht DI. *Journal of Pharmacology and Experimental Therapeutics*. 1918;11:263
How to Prepare?

• Benzyl alcohol is a preservative in bacteriostatic normal saline (NS)

-Add 0.2 ml of 1:1000 epinephrine to 20 ml of bacteriostic NS = 0.9% benzyl alcohol with 1:100,000 epinephrine

Key Takeaways

Key Takeaway #1
Diphenhydramine and benzyl alcohol can be used as alternatives to lidocaine if there are drug shortages or serious allergies.

Key Takeaway #2
Diphenhydramine has a shorter duration of action and more pain on injection than lidocaine and can cause tissue necrosis at high concentrations.

Key Takeaway #3
Benzyl alcohol has a shorter duration of action but less pain on injection than lidocaine and has relatively few side effects.
Gabapentin Use and Misuse

Larissa Woloszczuk, Pharm.D.
Clinical Pharmacist – Emergency Medicine
Atlanticare Regional Medical Center
Twitter: @LarsWolo
Learning Objective

• Describe the risks and effects of gabapentinoid abuse as well as its legal status across the nation.
Introduction

- Gabapentin
- Pregabalin
- Concerns with increased rate of prescriptions associated with overdoses
Pharmacology

GABA

Gabapentin

Pregabalin


@LarsWolo
Main Effects and Use

Gabapentin
(800-6000mg/day)

## Legal Status

<table>
<thead>
<tr>
<th>Gabapentin</th>
<th>Schedule V</th>
<th>Kentucky</th>
<th>Tennessee</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDMP monitoring</td>
<td>Massachusetts</td>
<td>Minnesota</td>
<td>New Jersey</td>
</tr>
</tbody>
</table>

@LarsWolo
Key Takeaways

• Key Takeaway #1
  – Gabapentin abuse is an increasing concern across the nation

• Key Takeaway #2
  – Effects can range from “buzzed” feeling, to black out and often taken to cope with heroin or opiate addiction

• Key Takeaway #3
  – While gabapentin is not an FDA scheduled medication (except in Kentucky) many states are adding it to state PMP
References

• Schifano F. Misuse and abuse of pregabalin and gabapentin: cause for concern?. CNS Drugs. 2014;28:491–496.
Q&A Session

@ASHP_EMPharm
#EMpearls
#ASHP18
Questions?

Paris Cook, PharmD  @EmergencyPharmD
Kevin Mercer, PharmD  @ohsnapimginger
Shannon Sullivan, PharmD  @SSullivanpharma
Larissa Woloszuzuk, PharmD  @LarsWolo
IN Ketamine

Heather Tilley, Pharm.D.
PGY2 Emergency Medicine Resident
Banner—University Medical Center Tucson
University of Arizona
Twitter: @hthrpt
Learning Objectives

• Describe intranasal ketamine use for various indications and patient populations.
Ketamine Uses

**Parenteral**
- Analgesia
- Depression, suicidality
- Migraines
- Sedation
- Seizures

**Intranasal**
- Acute pain
- Procedural sedation


@hthrpt
Intranasal Administration Considerations

- Volume
- Concentration
- Pharmacodynamics/kinetics
- Delivery device
- Mucosal absorptive surface area
- Guided dissociation
Why Intranasal Ketamine?

• Intranasal vs. intravenous vs. intramuscular
• Versatility
• Efficacy
• Safety
• Hemodynamics
Intranasal Indications and Dose

• Acute pain
  – 0.7 – 1.5 mg/kg
  – ± repeat doses

• Procedural sedation
  – 2-10 mg/kg

https://thesports.physio/2015/08/03/snugging-not-shrugging/
Pediatric Intranasal Dosing Study

10 mg/kg procedural sedation (20 kg max)

- 10 subjects, ongoing
- Indications for sedation: laceration repair, fracture or dislocation, foreign body removal
- Re-dosing required (50%)
- Unanswered questions: positioning, onset
Now What?

- Monitoring
- Bi-phasic reactions
Key Takeaways

• Step 1
  – Technique matters

• Step 2
  – Right patient, right dose

• Step 3
  – You’re not done yet
Awake Intubations

*When you don’t want to sedate, but still need to intubate*

Rachel E. Wein, Pharm.D., BCPS
Clinical Pharmacist Specialist – Emergency Medicine
Detroit Receiving Hospital
Twitter: @wein_rachel
Learning Objectives

• Describe the proper scenarios and patients for awake intubation.

• Identify the pharmacological agents necessary for awake intubation.
Audience Poll

• How many of you have ever been involved in an awake intubation?
Incidence Across Emergency Departments

- Rapid sequence intubation: 19%
- Nasotracheal: 6.4%
- Sedation without paralysis: 5%
- Oral without medication: 1%
- Awake intubation: 0.31%
- Other: 69%


@wein_rachel
Introduction

• What is it?
  – Endotracheal tube (ET) placed while patient is awake and continues to breathe

• Who gets it?
  – Non-crashing patient with difficult airway features
Awake Intubation vs. Rapid Sequence Intubation

Advantages to Awake

• Maintain respirations
• Maintain airway reflexes
• Avoidance of adverse drug events with RSI medications

Disadvantages to Awake

• Movement from patient
• View of cords may be not as clear
• Gagging/vomiting
• Preparation

The Process

Dry  Topicalize  Sedate  Intubate
Pharmacist Role: DRY

• 15 minutes prior:
  – 0.2 mg glycopyrrolate IM/IV or 0.01 mg/kg atropine IM/IV

• Suction oral cavity and dab with gauze

• Ondanestron 4 mg IV

Image from: www.americanregent.com
Pharmacist Role: TOPICALIZE

- 5-10 mL of nebulized 4% lidocaine at 5 lpm
- Gargle with 3 mL of 2% topical viscous lidocaine
- Can administer more topical 4% lidocaine with atomizer

Emcrit Podcast 194: [https://emcrit.org/emcrit/awakeintubation](https://emcrit.org/emcrit/awakeintubation)
Image from - EZ Atomizer: alcovemedicine.com
Image from – MADgic Atomizer: teleflexarcatalog.com
Pharmacist Role: SEDATE

• Cooperative patients:
  – May not need any sedation

• Uncooperative patients:
  – Ketamine is drug of choice
    • Sub-dissociative dose (0.1-0.3 mg/kg IV)

• Agitated patients:
  – Full dissociative dose of ketamine

emDOCS, http://www.emdocs.net/awake-endotracheal-intubation/
Image from: acesurgical.com
Pharmacist Role: Other Sedation Options

- Ketamine + Propofol ("Ketofol")
- Dexmedetomidine
- Midazolam
- Remifentanil or Fentanyl

INTUBATE
Key Takeaways

• Awake intubation preserves the patient’s respirations and airway reflexes
• Awake intubation is mostly used for patients who are deemed difficult to intubate and can withstand preparation
• Pharmacists should make sure the necessary medications are available
• Ketamine is the sedation of choice if patient uncooperative
Two Bag Method

Gregory Kelly, Pharm.D.
Emergency Medicine Clinical Pharmacist
Hospital of the University of Pennsylvania
Twitter: @GregKellyPharmD
Learning Objective

• Describe the two-bag method for the management of diabetic ketoacidosis.
Conventional “One” Bag Method
Two Bag Method

Bag #1
- Medication Added
- 1/2NS
- + 20 mEq KCl
- + 20 mEq K$_2$PO$_4$

Bag #2
- Medication Added
- D10 1/2NS
- + 20 mEq KCl
- + 20 mEq K$_2$PO$_4$

1000mL contains 9000mg of sodium, mEq/L pH 5.0 (4.5 to 7.0), Sodium 154 Chloride, Osmolarity 308 mOsm/L, Sterile nonpyrogenic single dose container, additives may be incompatible, Consult with pharmacist when available before introducing additives.
How It Works

<table>
<thead>
<tr>
<th>Blood Glucose Value</th>
<th>Bag #1 (1/2NS + Electrolytes)</th>
<th>Bag #2 (D\textsubscript{10}1/2NS + Electrolytes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;250</td>
<td>250 mL/h</td>
<td>0 mL/h</td>
</tr>
<tr>
<td>150-250</td>
<td>125 mL/h</td>
<td>125 mL/h</td>
</tr>
<tr>
<td>&lt;150</td>
<td>0 mL/h</td>
<td>250 mL/h</td>
</tr>
</tbody>
</table>

0.1 units/kg/h Continuous

@GregKellyPharmD
## Pediatrics Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of IV Bags</strong></td>
<td>↓ 50%</td>
<td>↑ 28%</td>
<td>Not reported</td>
</tr>
<tr>
<td><strong>Duration of IV Therapy</strong></td>
<td>⇔</td>
<td>⇔</td>
<td>⇔</td>
</tr>
</tbody>
</table>


@GregKellyPharmD
Haas et al. 2018

Retrospective before and after comparison study (n = 175)

Safety
• No difference in hypoglycemia, hypokalemia or hyperkalemia

Efficacy
• More patients discharged from ED: 44.1% vs. 15%
• Less patients admitted to ICU: 0% vs. 15.9%
• Less IV fluid bags used: 5.2 vs. 29.7
• Less time on insulin infusion: 14.7 vs. 21.8 hours
Key Takeaways

• Two-bag method offers a safe and more efficient method of managing DKA
• Evidence does not exist at this time to suggest that the two-bag method is superior to traditional method in clinical outcomes
• Two-bag method may improve workflow and throughput for patients with DKA.

**Bottom line**

Two-bag method should be considered for implementation to improve resource utilization and workflow for patients with DKA.
Hydroxocobalamin for Refractory Vasoplegia

Colgan “Cole” Sloan, Pharm.D., BCPS
Program Director, PGY2 Emergency Medicine
Clinical Pharmacist – Emergency Medicine
University of Utah Health
Twitter: @DrugInfoGeek
Learning Objective

• Identify the risks and benefits of administration of hydroxocobalamin for refractory vasoplegia.
Introduction

Vasoplegia ‘uncontrolled vasodilation’ seen in advanced shock states

Hemodynamic definitions vary
- Mean Arterial Pressure (MAP)
- Minimal effect of vasopressors
- Systemic Vascular Resistance (SVR)
- Cardiac Index (CI)

Jentzer. Chest 2018 (18)30072-2
Home Alone (1990)

@DrugInfoGeek
Management

Ensure adequate resuscitation prior to rescue therapies

- Identify/treat etiology
- Assess fluids/electrolytes
- Vasopressor(s)
- Corticosteroid
- Adjunct therapies
Mechanism

- Nitric oxide scavenger
- Inactivates hydrogen sulfide
- Binds carbon monoxide

Dimitri Markine (photo)
Patient Selection

• Several reports after cardiac bypass surgery

• Vasoplegia during liver transplantation

• Nifedipine toxicity (porcine)
Hydroxocobalamin Heads Up

5 g IV bolus (adult)

- Administration pearls (BYOF)
- Colorimetric interference
- ADRs, cost, availability
- Relatively less evidence

@DrugInfoGeek
Caveats Galore

• Which patients benefit
• When to re-dose
• Too much of a good thing
• Disease-drug interactions not yet elucidated
Unanswered Questions

• Which rescue therapy is “best”

• Indication(s) and study design barriers

• Limited data combining methylene blue and hydroxocobalamin
  – Untoward effects possible
References

- Poster: Murphy CM, et al. Efficacy of Hydroxocobalamin as Treatment for Nifedipine-Induced Shock. American College of Medical Toxicology (ACMT) Annual Scientific Meeting 2016. Link to poster
Q&A Session

@ASHP_EMPharm
#EMpearls
#ASHP18
Questions?

Heather Tilley, PharmD @hthrpt
Rachel Wein, PharmD, BCPS @wein_rachel
Greg Kelly, PharmD @GregKellyPharmD
Cole Sloan, PharmD, BCPS @DrugInfoGeek
Qtc Prolonging Meds: How Long Does It Matter?

Marianne Pop, Pharm.D., BCPS
Clinical Assistant Professor/Clinical Pharmacist
Emergency Medicine
University of Illinois College of Pharmacy Rockford
OSF Saint Anthony Medical Center
Twitter: @MPopEMPHARMD
Learning Objective

• Review the presentation of QTc prolonging drug interactions and its management
Introduction

• Very commonly assessed drug interaction

• QT interval $\rightarrow$ QTc

• QTc prolongation?
  – Males > 450 ms
  – Females > 460 ms

Li. P T. 2017; 42 (7): 473-77.
Evidence

- QTc prolongation ≠ torsades de pointes

- Common classes
  - Anti-arrhythmics, calcium channel blockers, psychiatric medications, antihistamines, antimicrobials, prokinetics, antiemetics
Interpretation Considerations

- When the QTc doesn’t add up
  - Calculate your own
    - QTc = QT / √RR interval (sec)
  - Eyeball it!

@MPopEMPHARMD

Who is a Target?

**Non-modifiable risk**
- Elderly
- Females
- Heart failure
- Home medications
- Hypertrophy
- QTc > 500 ms or > 60 ms from baseline
- Ventricular arrhythmia

**Modifiable risk**
- Bradycardia
- Home medications
- Hypokalemia
- Hypomagnesemia

Li. P T. 2017; 42 (7): 473-77.

@MPopEMPHARMD
Management

• Review your resources

• Change therapy

• Repeat EKG’s

Li. P T. 2017; 42 (7): 473-77.
Key Takeaways

• #1
  – When evaluating the risk for QTc prolongation consider whether the drug will cause prolongation at therapeutic levels or elevated levels

• #2
  – Adopt a relevant resource for interpretation

• #3
  – When in doubt, change therapy

@MPopEMPHARMD
CCB for SVT

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Clinical Pharmacy Specialist – Emergency Medicine
Mount Sinai Hospital
Twitter: @EMRxJaxson
Learning Objectives

• Explain the role of Calcium-Channel Blockers (CCBs) for Supraventricular Tachycardia.

• Compare the use of CCBs and adenosine for treatment of Supraventricular Tachycardia.

Image accessed: [http://www.alertdiver.com/?articleNo=1563](http://www.alertdiver.com/?articleNo=1563) July 10, 2018
Supraventricular Tachycardia (SVT)

• Common arrhythmia in Emergency Department
• Variety of presentations
• Adenosine
  – 6-12-12 method
  – Negative side effect profile
  – Administration quirks
  – $$$
  – Onset: 20-30 seconds
  – Duration: <10 seconds
CCBs

**Diltiazem**
- 0.25 mg/kg IV Push over 2 minutes
- Repeat dose: 0.35 mg/kg IV Push
- Proceed to infusion if necessary
- Onset: ~ 3 minutes
- Duration: 3-4 hours

**Verapamil**
- 2.5 – 5 mg IV Push over 2 minutes
- Repeat dose: 5 – 10 mg IV Push
- Proceed to infusion if necessary
- Onset: ~ 2 minutes
- Duration: 2-5 hours
BUT...Does it work??

Multiple trials and meta-analyses, but bottom line conversion rates

Adenosine Efficacy  CCB Efficacy
85-90%           90-98%
**On the horizon...**

**Intranasal etripamil**
- Phase II, placebo-controlled studies
  - Conversion dose-dependent
  - 65-95%
  - Placebo 35%
- NOT FDA approved (yet)
- Outpatient, stable SVT

Image accessed: [https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQXLUotq_Kjvlx-HxnXNi3YWhOJ47fwKscAm0uXf_cCIM5bqV4SA](https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQXLUotq_Kjvlx-HxnXNi3YWhOJ47fwKscAm0uXf_cCIM5bqV4SA) August 8, 2018

@EMRxJaxson
Key Takeaways

• Takeaway #1
  – CCBs have similar efficacy rates and are less expensive than adenosine

• Takeaway #2
  – CCBs have less administration quirks and are less uncomfortable for patients than adenosine
References


Nitro for SCAPE

Krisi Stemple, Pharm.D., M.B.A.
PGY2 EM Pharmacy Resident
UVM Medical Center
Twitter: @stEMple_pharmd
Learning Objective

• Describe effective nitroglycerin (NTG) dosing for the management of sympathetic crashing acute pulmonary edema (SCAPE).
SYMPATHETIC

RASHING

ACUTE

PULMONARY

DEMA
↑AFTERLOAD

↑PULMONARY EDEMA

STRESS RESPONSE
BP 190/104
HR 100
RR 29
+RALES
Management Principles

NIV + HIGH DOSE NTG

NIV = noninvasive ventilation
LOW DOSE NTG <100 mcg/min

Am Heart J 1984;108:141-149
LOW DOSE NTG <100 mcg/min

HIGH DOSE NTG ≥100 mcg/min

Am Heart J 1984;108:141-149
SAFE & EFFECTIVE
BOLUS
2 mg every 3-5 min

INFUSION
100-400 mcg/min
INTUBATION

0% 4% 14%

HYPOTENSION

0% 3%

Paone, et al | N = 1
Levy, et al | N = 29
Nashed, et al | N = 24
BOLUS
2 mg every 3-5 min

INFUSION
20 mcg/min

COMBO
20 mcg/min + 2 mg every 3-5 min

n = 124

n = 182

n = 89
**BOLUS**

400-600 mcg/min

**INFUSION**

20 mcg/min
<table>
<thead>
<tr>
<th></th>
<th>Bolus</th>
<th>Infusion</th>
<th>Combo</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICU ADMISSION</strong></td>
<td>48%</td>
<td>69%</td>
<td>83%</td>
</tr>
<tr>
<td><strong>HOSPITAL LOS</strong></td>
<td>3.7</td>
<td>4.7</td>
<td>5</td>
</tr>
<tr>
<td>(days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HYPOTENSION</strong></td>
<td>2%</td>
<td>1%</td>
<td>6%</td>
</tr>
</tbody>
</table>

PROMPT RECOGNITION

NTG >100 MCG/MIN

LOW INCIDENCE OF HYPOTENSION
REFERENCES


Afterload Reduction for Critically Ill Patients with Severe Aortic Stenosis

Mike O’Brien, Pharm.D.
PGY2 Emergency Medicine Resident
Massachusetts General Hospital, Boston, MA
Twitter: @MikeEMPharmD
Learning Objective

• Discuss treatment modalities for patients with severe aortic stenosis.
Aortic Stenosis - Background

• Narrowing of the aortic valve
• Aortic valve area <1.0 cm²
• Aortic valve index <0.6 cm²/m²

Severe aortic stenosis

@MikeEMPharmD
Determinants of Cardiac Output

\[ CO = HR \times (EDV - ESV) \]

- **Increase HR**
- **Increase EDV**
- **Increase Preload**
- **Increase Inotropy**
- **Decrease ESV**
- **Decrease Afterload**

CO=cardiac output  HR=heart rate  EDV=end diastolic volume  ESV=end systolic volume  

@MikeEMPharmD
Opposing Views

Afterload is fixed

- Decreased SVR
- Fixed afterload
- Decreased CO

V.S.

Resistance is additive

- Decreased SVR
- Decreased afterload
- Decreased ESV
- Increased CO

@MikeEMPharmD
Guideline Recommendations

• Class IIb
  – Vasodilator therapy may be reasonable if used with **invasive hemodynamic monitoring** in the acute management of patients with severe decompensated AS (stage D) with New York Heart Association class IV heart failure symptoms. *(Level of Evidence: C)*
Nitroprusside in Critically Ill Patients with Left Ventricular Dysfunction and Aortic Stenosis

- 25 patients with severe aortic stenosis and left ventricular systolic dysfunction
- Nitroprusside titrated to MAP 60-70 mmHg
- Primary endpoint:
  - Change in cardiac index
- No patients experienced EKG changes, hypotension, or decreased cardiac index

Clevidipine

- Selective arterial vasodilation
- No concern for severe toxicity
- No dose adjustments
- No risk of coronary steal

Nitroprusside

- Mixed venous/arterial vasodilation
- Cyanide/thiocyanate toxicity
- Thiocyanate renally eliminated
- Coronary steal may occur

@MikeEMPharmD

Awad AS, Goldberg ME. Vasc Health Risk Manag. 2010;6:457-64. PMID: 20730061
Subgroup Analysis of Clevidipine for Severe Hypertension in Patients with Acute Heart Failure

• 19 patients with acute heart failure included in VELOCITY trial

• Mean heart rate:
  – Baseline: 92 bpm
  – 3 mins: 88 bpm
  – 30 mins: 101 bpm

AHF=acute heart failure
Key Takeaways

1. Afterload reduction may be well-tolerated and likely beneficial in patients with severe aortic stenosis and severe heart failure symptoms

2. Clevidipine seems to offer similar benefits as nitroprusside and has more desirable properties