Emergency Medicine Research: A Review of Resident Research Session #1

June 9, 2021
This is a compilation of the Emergency Medicine Research: A Review of Resident Research Session webinar in June 2021. Inclusion in this document does not imply endorsement by ASHP, the ASHP Section Advisory Group on Emergency Medicine, or its members.

For more information and resources on Emergency Care Pharmacy, visit the ASHP Emergency Care Resource Center

https://www.ashp.org/Pharmacy-Practice/Resource-Centers/Emergency-Care
Presenters

- Hina Anwar, Pharm.D., PGY-1 Pharmacy Practice Resident, Reading Hospital
- Kathy Currie, Pharm.D., PGY-1 Pharmacy Resident, Swedish Medical Center
- Erin Gordon, Pharm.D., PGY-2 Pharmacy Resident, OhioHealth Grant Medical Center
- Gabriella Hernandez, Pharm.D., PGY-2 Emergency Medicine Pharmacy Resident, Huntington Memorial Hospital
- Sarah Jesse, Pharm.D., PGY-1 Pharmacy Resident, Blount Memorial Hospital
- Kristin Liveris, Pharm.D., PGY-1 Pharmacy Resident, CHI Memorial Hospital
- Briana Negaard, Pharm.D., PGY2 Emergency Medicine Pharmacy Resident, University of Iowa Healthcare
- Abigail Sharpe, Pharm.D., PGY2 Emergency Medicine Pharmacy Resident, Froedert and the Medical College of Wisconsin
Relevant Financial Relationship Disclosure

No one in control of the content of this activity has a relevant financial relationship (RFR) with an ineligible company.

As defined by the Standards of Integrity and Independence definition of ineligible company.
Management of hyperkalemia with insulin and dextrose: Using a pharmacist developed order set to identify, monitor, and treat hypoglycemia

Hina Anwar, PharmD
PGY-1 Pharmacy Practice Resident
Reading Hospital
Research Advisor: Regine Ghoubrial-Waibel, PharmD
hina.anwar@towerhealth.org
Disclosure

• Authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.
Background

- Hyperkalemia is an electrolyte imbalance defined as a serum potassium level greater than 5.0 mmol/L\(^1\).
  - Risk factors\(^2\):
    - Renal impairment
    - Diabetes
    - Caucasian race
  - Acute vs chronic hyperkalemia\(^3\)

---


Background

Acute Hyperkalemia

- EKG Changes
  - Calcium Gluconate
  - Potassium Binder
- Increased K⁺ Excretion
  - Furosemide
  - Dialysis
- Shift K⁺ Intracellularly
  - Albuterol
  - Sodium Bicarbonate
  - Insulin and Dextrose

Risk of Insulin Therapy

- **Hypoglycemia**\(^5,6\)
  - Occurrence within 3 to 6 hours
  - Increased length of hospital stay
  - Morbidity and mortality
- **Incidence of hypoglycemia varies from 6% to 75%**\(^5,6\)
  - Pre-disposing factors\(^7\)

---

Objective

• Evaluate the impact of a pharmacist developed order set on identification and treatment of hypoglycemia secondary to the administration of insulin in patients presenting with hyperkalemia
Methods

Study design
• Single-center, retrospective, chart review pre- and post-protocol

Study period
• Pre-protocol: July 21, 2019 – August 10, 2020
• Post-protocol: August 11, 2020 – March 31, 2021
Methods

Inclusion criteria
- Patients ≥ 18 years old
- Emergency department
- Inpatient
- Serum potassium > 5.0 mmol/L

Exclusion criteria
- Patients with serum potassium > 5.0 mmol/L that did not receive treatment with insulin

Statistical analysis
- Descriptive statistics
## Methods

<table>
<thead>
<tr>
<th>Pre-Protocol Order Set</th>
<th>Post-Protocol Order Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol Nebulizer Solution</td>
<td>Albuterol Nebulizer Solution</td>
</tr>
<tr>
<td>Calcium Gluconate</td>
<td>Calcium Gluconate</td>
</tr>
<tr>
<td>Insulin Regular U-100</td>
<td>Insulin Regular U-100</td>
</tr>
<tr>
<td>Dextrose 50% x 1 dose</td>
<td>Dextrose 50%</td>
</tr>
<tr>
<td>Furosemide</td>
<td></td>
</tr>
<tr>
<td>Sodium Bicarbonate 8.4%</td>
<td>Fingerstick Glucose Every Hour x 6</td>
</tr>
<tr>
<td>Sodium Polystyrene</td>
<td>Furosemide</td>
</tr>
<tr>
<td></td>
<td>Sodium Bicarbonate 8.4%</td>
</tr>
<tr>
<td></td>
<td>Potassium Binder*</td>
</tr>
</tbody>
</table>

*Potassium binders include sodium zirconium cyclosilicate, sodium polystyrene, patiromer calcium sorbitex
Endpoints

Primary

- Order set use
- Fingerstick glucose collection
- Incidence of hypoglycemia
  - Blood glucose $\leq 70$ mg/dL
Endpoints

Secondary

- Total insulin dose administered
- Total dextrose dose administered
- Time to hypoglycemia
- Use of potassium binders
- Time to potassium in range
  - Serum potassium ≤ 5.0 mmol/L
- Time to potassium in range with insulin therapy alone
  - Serum potassium ≤ 5.0 mmol/L
- Patients who received additional treatment for hyperkalemia
  - Dialysis, potassium binders, albuterol, furosemide, sodium bicarbonate
Results

Patients screened (N =180)

Pre-protocol (n = 118)
- Excluded (n = 4)
  - No insulin treatment for hyperkalemia
- Included (n = 114)

Post-protocol (n = 62)
- Excluded (n = 1)
  - No insulin treatment for hyperkalemia
- Included (n = 61)
## Baseline Demographics

<table>
<thead>
<tr>
<th></th>
<th>Pre-Protocol (n=114)</th>
<th>Post-Protocol (n=61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)*</td>
<td>61 (33-89)</td>
<td>63 (33-101)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>50 (43)</td>
<td>20 (33)</td>
</tr>
<tr>
<td>History of diabetes, n (%)</td>
<td>68 (60)</td>
<td>39 (64)</td>
</tr>
<tr>
<td>Renal dysfunction, n (%)</td>
<td>53 (47)</td>
<td>26 (43)</td>
</tr>
<tr>
<td>Pre-treatment potassium (mmol/L)*</td>
<td>6.3 (5.2-8.8)</td>
<td>6.5 (5.1-9.1)</td>
</tr>
<tr>
<td>Pre-treatment glucose (mg/dL)*</td>
<td>148 (58-556)</td>
<td>138 (79-560)</td>
</tr>
<tr>
<td>Patients without pre-treatment glucose, n (%)</td>
<td>56 (49)</td>
<td>29 (48)</td>
</tr>
</tbody>
</table>

*Median (range)
# Primary Endpoints

<table>
<thead>
<tr>
<th></th>
<th>Pre-Protocol (n=114)</th>
<th>Post-Protocol (n=61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order set use, n (%)</td>
<td>81 (71)</td>
<td>44 (72)</td>
</tr>
<tr>
<td>Fingerstick glucose collection, n (%)</td>
<td>76 (67)</td>
<td>52 (85)</td>
</tr>
<tr>
<td>Incidence of hypoglycemia, n (%)</td>
<td>11 (10)</td>
<td>8 (13)</td>
</tr>
</tbody>
</table>
Fingerstick Glucose Collection

Percentage of Patients (%)

Total Number of Fingersticks Collected

Pre-Protocol (n=114)  Post-Protocol (n=61)
**Hypoglycemia Management**

*Two patients received both dextrose and juice*
## Secondary Endpoints

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre-Protocol (n=114)</th>
<th>Post-Protocol (n=61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin dose administered (units)*</td>
<td>10 (4-40)</td>
<td>10 (5-40)</td>
</tr>
<tr>
<td>Dextrose dose administered (grams)*</td>
<td>25 (0-50)</td>
<td>25 (0-100)</td>
</tr>
<tr>
<td>Time to hypoglycemia (hours)*</td>
<td>1.8 (1.1-4.5)</td>
<td>2.5 (1.2-3.4)</td>
</tr>
<tr>
<td>Use of potassium binder, n (%)</td>
<td>42 (37)</td>
<td>37 (61)</td>
</tr>
<tr>
<td>Time to potassium in range (hours)*</td>
<td>14.9 (0.7-141.7)</td>
<td>22.3 (0.6-82.9)</td>
</tr>
<tr>
<td>Time to potassium in range with insulin therapy alone (hours)*</td>
<td>7.7 (3.1-109.8)</td>
<td>6.7 (4.5-11.4)</td>
</tr>
<tr>
<td>Patients who received additional treatment for hyperkalemia, n (%)</td>
<td>93 (82)</td>
<td>56 (92)</td>
</tr>
</tbody>
</table>

*Median (range)
Discussion

• Fingerstick collection increased
• Increased incidences of hypoglycemia
• Majority of patients who developed hypoglycemia had renal dysfunction
Limitations

• Single-center, small sample size
• Patients received additional insulin therapy
• Quantifying time to potassium in range
• Fingerstick glucose order reconciliation
Conclusions

• Modification of the hyperkalemia order set increased the amount of fingerstick collection
  • Identify and treat hypoglycemia
References


Impact of a Multidisciplinary Sepsis Huddle in the ED

Presented by: Kathy Currie, PharmD
PGY-1 Pharmacy Resident
Co-investigators: Hend Barry, PharmD, BCPS, BCCCP
and Eric Harvey, PharmD, MBA
Swedish Medical Center, Seattle, WA
Learning objectives

**Recognize**

- The importance of prompt recognition and effective treatment of sepsis patients.

**Explain**

- The impact of a multidisciplinary sepsis huddle in the Emergency Department on the early identification and treatment of sepsis patients according to Surviving Sepsis Campaign (SSC) recommendations.
Background: Sepsis

Leading cause of death in hospitals

At least 1.7 million cases per year\(^1\)

Sepsis bundle is the cornerstone of care and quality measures\(^2\)

1-hour of antibiotic delay = 7.6% increase in mortality\(^3\)
**Background: 1-Hour Sepsis Bundle**

<table>
<thead>
<tr>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring of lactate level</td>
</tr>
<tr>
<td>Obtaining blood cultures before antibiotic administration</td>
</tr>
<tr>
<td>Administering broad-spectrum antibiotics</td>
</tr>
<tr>
<td>Begin administration of 30 mL/kg crystalloid for hypotension or lactate $\geq 4$ mmol/L</td>
</tr>
<tr>
<td>Application of vasopressors if hypotensive during or after fluid resuscitation to maintain MAP $\geq 65$ mmHg</td>
</tr>
</tbody>
</table>
Methods

Objective
• Evaluate the impact of a multidisciplinary sepsis huddle in the ED in early identification of sepsis patients as measured by the difference of code sepsis activation pre-implementation versus post-implementation of huddle

Setting
• Swedish Medical Center Ballard Campus, Emergency Department

Design
• Single center, retrospective cohort study

Inclusion Criteria
• Age ≥ 18 years old
• Pre-huddle: Patients were identified via Best Practice Advisory (BPA)
• Post-huddle: Sepsis huddle activation

Exclusion Criteria
• Patients determined to not have sepsis
Methods: Outcomes

Primary
- Difference in code sepsis activation

Secondary
- Completion of 1-hour sepsis bundle from time zero
Results: Patient Selection

- n = 116
  - ≥ 18 years old and meet inclusion criteria

  - n = 30
    - Pre-huddle implementation
      - Patients determined to not have sepsis, n = 9
      - Patients included in analysis = 21

  - n = 86
    - Post-huddle implementation
      - Patients determined to not have sepsis, n = 6
      - Patients included in analysis = 80
Results: Code Sepsis

Code Sepsis Activation at SMC Ballard ED

P-value: < 0.0001

Pre-huddle implementation, n=21  Post-huddle implementation, n=80
Results: Sepsis Bundle

Sepsis Bundle Completion Within 1 Hour

P-value: < 0.0001

Pre-huddle implementation, n=21
Post-huddle implementation, n=80
Discussion

- The sepsis huddle significantly improved early identification of sepsis patients based on the increase in code sepsis activation.
- The sepsis huddle significantly improved bundle completion within 1 hour.
- Next step is expansion into other Swedish Medical Center campuses.
Discussion

**Strengths**
- First study to evaluate impact of sepsis huddle on early identification of sepsis patients

**Limitations**
- Small sample size
- Single center
- Observational study
Conclusion

A multidisciplinary sepsis huddle in the emergency department is effective for **early identification** of sepsis patients and **improves sepsis bundle compliance**.
References


FIXED VERSUS CONVENTIONAL DOSING OF 4-FACTOR PROTHROMBIN COMPLEX CONCENTRATE IN URGENT WARFARIN REVERSAL

ERIN GORDON, PHARMD
PGY-2 Emergency Medicine Resident
OhioHealth Grant Medical Center
WEIGHT BASED / CONVENTIONAL DOSING

- FDA approved dosing – not based on dose-finding studies
- Optimal dosing remains unclear

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Dose of 4F-PCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>INR 2.0 - 3.9</td>
<td>25 units/kg (max 2,500 units)</td>
</tr>
<tr>
<td>INR 4 - 5.9</td>
<td>35 units/kg (max 3,500 units)</td>
</tr>
<tr>
<td>INR &gt; 6.0</td>
<td>50 units/kg (max 5,000 units)</td>
</tr>
</tbody>
</table>

Lower Doses: Similar efficacy? Reduce thromboembolic complications? Reduce costs to patients & health system?
FIXED DOSING PROTOCOL

Patients that failed to achieve INR goal in fixed dosing studies were often obese and had higher baseline INRs.

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Dose of 4F-PCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>INR ≤ 7.5 &amp; TBW ≤ 100 kg</td>
<td>1,500 units</td>
</tr>
<tr>
<td>INR &gt; 7.5 OR TBW &gt; 100 kg</td>
<td>2,000 units</td>
</tr>
</tbody>
</table>

OhioHealth protocol based on the best available literature
METHODS

Inclusion
- Age 18+
- Received 4F-PCC for warfarin reversal due to severe bleeding or need for urgent procedure
- Presented to OhioHealth GMC during study time frame

Exclusion
- Given 4F-PCC for reversal of any drug besides warfarin
- Missing pre- or post-infusion INR data

Conventional dose cohort
Jan. 1, 2019 – Dec. 31, 2019

Protocol change

Fixed dose cohort
RESULTS

ERIN GORDON, PHARMD
PGY-2 Emergency Medicine Resident
OhioHealth Grant Medical Center
### Study Population

124 patients screened
74 excluded

15 Patients in weight based cohort

35 Patients in fixed dose cohort

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Weight Based (n = 15)</th>
<th>Fixed Dosed (n = 35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>10 (66.7)</td>
<td>18 (51.4)</td>
</tr>
<tr>
<td>Age, mean ± sd</td>
<td>70.9 ± 14.6</td>
<td>74.4 ± 10.0</td>
</tr>
<tr>
<td>Indication for warfarin, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>9 (60.0)</td>
<td>26 (74.3)</td>
</tr>
<tr>
<td>DVT/PE</td>
<td>3 (20.0)</td>
<td>7 (20.0)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (20.0)</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td>INR goal, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0-3.0</td>
<td>14 (93.3)</td>
<td>33 (94.3)</td>
</tr>
</tbody>
</table>
INDICATIONS FOR REVERSAL

WEIGHT BASED

- Traumatic hemorrhagic shock
- Abdominal hematoma
- Hemopericardium
- IR-abscess drainage
- IR-pelvic hematoma
- Spinal surgery x 3
- Femur repair
- CVC insertion
- Retroperitoneal bleed
- Colectomy
- Myelogram
- Ankle repair
- Laminectomy

FIXED DOSE

- Traumatic ICH (60%)
- Spontaneous ICH (0%)
- GI Bleed (6%)
- Urgent Procedure (27%)
- Other (13%)

- IR-abscess drainage
- IR-pelvic hematoma
- Spinal surgery x 3
- Femur repair
- Traumatic hemorrhagic shock
- Abdominal hematoma
- Hemopericardium
OUTCOMES

Primary
- Post-infusion
  INR ≤ 1.5
OUTCOMES

Primary
- Post-infusion INR ≤ 1.5

FIXED DOSE INR CHANGE
OUTCOMES

Safety
- Thromboembolic events
- Mortality

THROMBOEMBOLIC COMPLICATIONS

IN-HOSPITAL MORTALITY

<table>
<thead>
<tr>
<th>N=2</th>
<th>Mortality</th>
<th>N=12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time from admit until death</td>
<td>15 days</td>
</tr>
<tr>
<td>8 days</td>
<td>INR prior to reversal</td>
<td>3.8</td>
</tr>
<tr>
<td>4.7</td>
<td>GCS prior to reversal</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Post infusion INR</td>
<td>1.3</td>
</tr>
<tr>
<td>1.3</td>
<td></td>
<td>1.4</td>
</tr>
</tbody>
</table>
OUTCOMES

Economic
- Cost to health system
- Cost to patient
- Time to infusion

FIXED DOSING

4F-PCC dose was reduced on average by 964 units

$ Drug costs were reduced on average by $6,400 per patient
• Differences in severity of presentation
  • Initial GCS: 15 (11-15) vs. 14 (3-15)
• INR goal may not be a true surrogate for hemostasis
  • Of the 14 patients that died, only 2 did not achieve initial INR goal
• No patients in this study received a supplemental dose of 4F-PCC
CONCLUSIONS

• Fixed dosing appears to not achieve an INR ≤ 1.5 as frequently as weight based dosing
  • This is difficult to interpret in the setting of unequal sample sizes as well as baseline severity
• No significant difference in complications or mortality
• Fixed dosing was associated with lower drug exposure and costs
• This study demonstrates comparable results to other small retrospective studies
  • Unique population of traumatically injured patients
Comparing the Effect of Prehospital Intravenous and Intranasal Midazolam Dosing on Prehospital and Emergency Room Seizure Recurrence

GABRIELLA HERNANDEZ, PHARMD
PGY2 EMERGENCY MEDICINE PHARMACY RESIDENT
HUNTINGTON MEMORIAL HOSPITAL
MAY 25, 2021
Background

- Intravenous (IV) lorazepam and intramuscular (IM) midazolam are guideline recommended first-line treatment options for prehospital seizures
- IV and intranasal (IN) midazolam are also valid treatment options per Los Angeles County Department of Public Health (LAC DPH) treatment protocols
- There is no strong evidence to support IV or IN midazolam use for prehospital seizure cessation
- This creates a significant disconnect between current practice and guideline recommendations
- The following study adds to a growing body of literature investigating the impact of prehospital IV and IN midazolam dosing for seizure on inpatient clinical outcomes
Objective

• To directly compare the efficacy and safety of prehospital IV and IN midazolam on prehospital and emergency department (ED) seizure recurrence

Primary Outcome

• Rate of seizure recurrence between IV and IN midazolam within 120 minutes of ED arrival

Secondary Outcomes

• Rescue AED administration, ADRs, intubations ICU admission, time to seizure recurrence, and adherence to protocolized midazolam dosing
### Methods

#### Design
- Retrospective, observational cohort study

#### Setting
- Huntington Hospital between January 2016 and July 2020

#### Population
- **Inclusion Criteria:** Adult and pediatric patients transported by Pasadena Fire Department with documented administration of IV or IN midazolam for active seizure
- **Exclusion Criteria:** Patients who are pregnant, <1 month of age, in police custody, or have incomplete prehospital records
Methods

Treatment

- Protocolized midazolam dose is defined per LAC DPH seizure protocols
- Adult patients receive midazolam 5mg IV/IN (may repeat x1)
- Pediatric patients receive midazolam 0.1 mg/kg IV or 0.2 mg/kg IN (may repeat x1)
- To allow for 10% error, this study accepted 0.18-0.22 mg/kg IN and 0.09-0.11 mg/kg IV as per protocol dosing

Statistical Analysis

- Mann Whitney U test was used to assess continuous data and Fisher’s exact test for categorical data
### Results

#### Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>IV group N=66</th>
<th>IN group N=44</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n</td>
<td>38 (58%)</td>
<td>30 (68%)</td>
<td>0.3184</td>
</tr>
<tr>
<td>Age, median (IQR), years</td>
<td>58 (35-72)</td>
<td>56 (26-63)</td>
<td>0.1083</td>
</tr>
<tr>
<td>Weight, median (IQR), kg</td>
<td>68 (55-79)</td>
<td>75 (63-90)</td>
<td><strong>0.0352</strong></td>
</tr>
<tr>
<td>PMH Seizure, n</td>
<td>31 (47%)</td>
<td>29 (66%)</td>
<td>0.0545</td>
</tr>
<tr>
<td>Etiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epilepsy, n</td>
<td>35 (53%)</td>
<td>23 (52%)</td>
<td>0.9999</td>
</tr>
<tr>
<td>TBI, n</td>
<td>10 (12%)</td>
<td>4 (9%)</td>
<td>0.3981</td>
</tr>
<tr>
<td>Other, n</td>
<td>21 (32%)</td>
<td>17 (39%)</td>
<td>0.5406</td>
</tr>
</tbody>
</table>

PMH = past medical history; TBI = traumatic brain injury; IQR = interquartile

---

**Figure 1. Patients receiving prehospital midazolam**

- Excluded (n=114):  
  - Medication not given (n=14)  
  - Police custody (n=35)  
  - Alternate indication (n=54)  
  - Intramuscular administration (n=11)  

- Patient treated with prehospital intravenous midazolam (n=66)  
  - Patient treated with prehospital intranasal midazolam (n=44)
# Results

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>IV group N=66</th>
<th>IN group N=44</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent Seizure, n</td>
<td>21 (31.8%)</td>
<td>14 (31.8%)</td>
<td>0.9999</td>
</tr>
<tr>
<td>Rescue AED, n</td>
<td>24 (36.4%)</td>
<td>21 (47.7%)</td>
<td>0.2436</td>
</tr>
<tr>
<td>ICU Admission, n</td>
<td>21 (31.8%)</td>
<td>12 (27.3%)</td>
<td>0.6746</td>
</tr>
<tr>
<td>Intubation, n</td>
<td>19 (28.8%)</td>
<td>11 (25.0%)</td>
<td>0.8273</td>
</tr>
<tr>
<td>ADRs, n</td>
<td>21 (31.8%)</td>
<td>14 (31.8%)</td>
<td>0.9999</td>
</tr>
<tr>
<td>Time to Seizure Recurrence, median (IQR)</td>
<td>34 min (21-53)</td>
<td>19 min (10-32)</td>
<td>0.0487</td>
</tr>
<tr>
<td>Deviations from Protocol, n</td>
<td>25 (38.5%)</td>
<td>4 (9.3%)</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

AED = antiepileptic drug; ICU = intensive care unit; ADRs = adverse drug reactions, IQR = interquartile
Limitations

- Retrospective chart review
- Population size
- Unable to assess IM midazolam
- Limited to Pasadena, California
- Baseline weight significantly higher in IN group
- Prehospital IN administration technique
• Seizure recurrence rates were similar between IV and IN

• Time to seizure recurrence was significantly shorter in the IN group which likely highlights the 93% of patients who received subtherapeutic IN weight-based dosing

• Higher weight-based dosing in both groups led to improved clinical outcomes and no increase in ADRs

• There is a clear disconnect between guideline recommendations and prehospital practice

• Further research should focus on identifying the most effective IV midazolam dose and revising current prehospital protocols to allow for higher initial IN doses
Disclosure & References

The authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

Thank you

• Diana Park, PharmD, BCCCP
  • Emergency Medicine Pharmacy Residency Primary Preceptor
• Huntington Memorial Hospital
• American Society of Health-System Pharmacists

Questions?
• Email me at GabriellaHernandezRx@gmail.com
• @GabiHern
Improvement of Antibiotic Prescribing for Outpatient Community Acquired Pneumonia in the Emergency Department

Sarah Jesse, PharmD
PGY-1 Pharmacy Resident
Blount Memorial Hospital, Maryville, TN
sarah.jesse@bmnet.com
Acknowledgements

Patrick Blankenship, PharmD, BCPS
Fern Pruss, PharmD, BCPS
Madison Iman, PharmD
Lauren Ladd, PharmD
Crystal Laudermilk, PharmD
Disclosure

Disclosure statement: these individuals have the following to disclose concerning possible financial or personal relationships with commercial entities (or their competitors) that may be referenced in this presentation.

• Resident: nothing to disclose
  Sarah Jesse, PharmD

• Project director and advisors: nothing to disclose
  Patrick Blankenship, PharmD, BCPS
  Fern Pruss, PharmD, BCPS
  Madison Iman, PharmD
  Lauren Ladd, PharmD
  Crystal Laudermilk, PharmD
Background

### Antimicrobial Therapy for Outpatient CAP

<table>
<thead>
<tr>
<th>No Comorbidities</th>
<th>2007 Guidelines</th>
<th>2019 Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macrolide OR Doxycycline</td>
<td>Amoxicillin OR Doxycycline OR Macrolide*</td>
<td></td>
</tr>
</tbody>
</table>

*if local resistance to *S. pneumoniae* < 25%

Blount Memorial Hospital (BMH) Interventions:
- Discharge pathway optimization/implementation
  - Discharge 1-2-3™ software
- Physician-led education to ED providers

Study Purpose & Objectives

Measure the impact of a discharge pathway and provider education on rates of appropriate antibiotic prescribing for outpatient CAP treated in the BMH ED.

**Primary**

- Evaluate the difference in rates of appropriate antibiotic prescribing before and after the intervention period

**Secondary**

- Compare the rates of treatment failure and severe treatment-associated adverse events
Methodology

IRB-approved, single-center, retrospective, pre-post analysis

Oct 1 2019
IDSA CAP Guidelines Published

Nov 1 – Dec 1 2019
Pre-Intervention Group

Dec 5 2019
Discharge Pathway Implementation

Dec 6 2019
ED Provider Education

Jan 1 – Feb 1 2020
Post-Intervention Group
Methodology

**Inclusion Criteria**
- Primary discharge diagnosis of CAP
- Discharged home from ED during prespecified time periods
- Received an antibiotic prescription for CAP

**Exclusion Criteria**
- < 18 years old
- Immunocompromised
- Already receiving antibiotics
- Missing documentation of discharge antibiotic therapy
Methodology

Data and Statistics

• Patient identification
  • ICD-10 codes

• Data collected
  • Patient demographics and comorbid disease states
  • Discharge prescription information

• Statistical analyses
  • Descriptive statistics for baseline characteristics
  • Fisher’s Exact Test & 95% CI for primary outcomes
Results

Pre
N = 37

Excluded
n = 18 (49%)
Included
n = 19 (51%)

Post
N = 58

Included
n = 43 (74%)
Excluded
n = 15 (26%)
## Results

### Baseline Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pre (n = 19)</th>
<th>Post (n = 43)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female, No. (%)</strong></td>
<td>16 (84)</td>
<td>26 (60)</td>
</tr>
<tr>
<td><strong>Age, Median</strong></td>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td><strong>BMI, Median</strong></td>
<td>27.5</td>
<td>32</td>
</tr>
<tr>
<td><strong>Comorbidity - Any, No. (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>8 (42)</td>
<td>18 (42)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3 (16)</td>
<td>10 (23)</td>
</tr>
<tr>
<td>CHF</td>
<td>0 (0)</td>
<td>4 (9)</td>
</tr>
<tr>
<td>CAD</td>
<td>0 (0)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>COPD</td>
<td>1 (5)</td>
<td>6 (14)</td>
</tr>
<tr>
<td>Asthma</td>
<td>2 (11)</td>
<td>4 (9)</td>
</tr>
<tr>
<td>Chronic Liver Disease</td>
<td>2 (11)</td>
<td>5 (12)</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>0 (0)</td>
<td>2 (5)</td>
</tr>
</tbody>
</table>
Results

Primary Outcome - Overall Appropriateness

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre (n = 19)</th>
<th>Post (n = 43)</th>
<th>Δ</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate Therapy, No. (%)</td>
<td>3 (16)</td>
<td>13 (30)</td>
<td>14%↑</td>
<td>-0.07 to 0.35</td>
<td>0.19</td>
</tr>
</tbody>
</table>
Results

Secondary Outcome – Treatment Failure

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre (n = 19)</th>
<th>Post (n = 43)</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Failure, No. (%)</td>
<td>1 (5)</td>
<td>3 (7)</td>
<td>-0.10 to 0.14</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Secondary Outcome – Severe Treatment-Associated Adverse Events

- None
# Results

## Post hoc analyses – Macrolide Monotherapy

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre (n = 19)</th>
<th>Post (n = 43)</th>
<th>Δ</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macrolide Monotherapy, No. (%)</td>
<td>9 (47)</td>
<td>2 (4)</td>
<td>43% ↓</td>
<td>0.2 to 0.7</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

**Pie Charts**

- **Pre (n=19)**: 47% Macrolide Monotherapy, 53% No Macrolide Monotherapy
- **Post (n=43)**: 2% Macrolide Monotherapy, 98% No Macrolide Monotherapy
Results Summary & Discussion

• Improvement seen in overall rates of appropriate prescribing
  • 16% vs. 30%

• Statistically significant decrease in macrolide monotherapy
  • 47% vs. 4%

• No major differences in treatment failures
  • 1 patient in the pre-group and 3 in the post-group (5% vs 7%)

• No observance of any severe treatment-associated adverse events
Limitations

• Small sample size
  • Unequal cohorts
  • 2 months of data – uncertain durability of interventions

• Only BMH data
  • Unable to determine if admitted to another facility/ED
  • No access to outpatient prescription fill data
  • Only assessed for adverse events that would have resulted in another ED visit or hospital admission
Conclusions & Future Directions

• Implementation of a discharge pathway + provider education was associated with a nonsignificant increase in appropriate prescribing for outpatient CAP treated in the ED

• Further analyses/interventions should be explored
References


Thank You!  

Questions?  
sarah.jesse@bmnet.com
Assessment of the Time to First Antibiotic Dose for Patients Presenting with Febrile Neutropenia in the Emergency Department

Kristin Liveris, PharmD
CHI Memorial Hospital
Chattanooga, TN

June 9, 2021
Background

Fever is often the first sign of an underlying infection in patients undergoing cytotoxic chemotherapy.

This complication of cytotoxic chemotherapy carries a high mortality rate, especially for patients with multiple comorbidities.

Due to increased mortality in these patients, various guidelines have endorsed prompt delivery of broad spectrum antibiotics after presentation.

Many of these patients present to the Emergency Department after detecting a fever at home.

Several factors and logistic barriers to care make the prompt initiation of broad spectrum antibiotics difficult in the Emergency Department.
Objective

To determine compliance to National Comprehensive Cancer Network (NCCN) and Infectious Disease Society of America (IDSA) febrile neutropenia guidelines in regard to first antibiotic dose, appropriate empiric antibiotic selection, and appropriate blood collection for culture results.
Methodology

• Single-center retrospective chart review
  • Catholic Health Initiatives (CHI) Memorial
    • 369 bed, community-based hospital

• Inclusion Criteria
  • Age > 18 years old
  • Cytotoxic chemotherapy within prior 30-days

• Exclusion Criteria
  • Direct admission
  • Neutropenia attributed to other causes
  • Subjective fever, not confirmed upon triage
## Baseline Characteristics

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>45%</td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td>54%</td>
</tr>
<tr>
<td>Age (in years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40—50</td>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>50—60</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>60—70</td>
<td>6</td>
<td>27%</td>
</tr>
<tr>
<td>70—80</td>
<td>11</td>
<td>50%</td>
</tr>
<tr>
<td>80—90</td>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>Cancer Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AML</td>
<td>4</td>
<td>18%</td>
</tr>
<tr>
<td>APL</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td>6</td>
<td>27%</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>3</td>
<td>13%</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>4</td>
<td>18%</td>
</tr>
<tr>
<td>Myelodysplastic Syndrome</td>
<td>3</td>
<td>13%</td>
</tr>
<tr>
<td>Neuroendocrine Carcinoma</td>
<td>1</td>
<td>4%</td>
</tr>
</tbody>
</table>
Results

35 admissions for Febrile Neutropenia during study

3 patients excluded with Febrile Neutropenia attributed to a cause other than chemotherapy

10 Patients excluded due to subjective fever not confirmed at admission

22 Patients included
# Results

![Bar Chart: Elapsed Time from Admit to Blood Draw](image)

### Time To First Antibiotic Administration

<table>
<thead>
<tr>
<th>Description</th>
<th>Time</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Time to First Antibiotic Administration</td>
<td>3 hours, 34 minutes</td>
<td>Patients that received antibiotics within 90 minutes = 4 (18%)</td>
</tr>
<tr>
<td>Median Time to First Antibiotic Administration</td>
<td>2 hours, 19 minutes</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

Labs were drawn within one hour for 63% of patients. Only 18% of patients received antibiotics within 90 minutes of presentation.

The most common antibiotic used for the empiric treatment of febrile neutropenia was cefepime.

Most patients received appropriate broad-spectrum antibiotics.

Educational opportunity exists for prompt initiation of laboratory blood draws and delivery of broad-spectrum antibiotics in these patients.
References


Evaluation of prophylactic antibiotics for open fractures in trauma patients

Briana Negaard, PharmD
PGY2 Emergency Medicine Pharmacy Resident
June 3, 2021
Disclosures

• Research Team
  • Briana Negaard, PharmD
  • Brett Faine, PharmD, MS
  • Poorani Sekar, MD
  • Morgan Kimball, PharmD Candidate
  • Caelee Batterson, PharmD Candidate
  • Anne Zepeski, PharmD, BCPS

• Research Site: University of Iowa Hospitals & Clinics

• No financial interest or affiliation concerning material discussed in this presentation
Background – Gustilo-Anderson Classification

- Open fracture – fractured bone is exposed to the external environment via a traumatic violation of the skin/soft tissue

<table>
<thead>
<tr>
<th></th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type III with Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wound Size</strong></td>
<td>&lt; 1 cm</td>
<td>1-10 cm</td>
<td>&gt; 10 cm</td>
<td>&gt; 10 cm</td>
</tr>
<tr>
<td><strong>Soft Tissue Damage</strong></td>
<td>Minimal</td>
<td>Moderate</td>
<td>Extensive</td>
<td>Extensive</td>
</tr>
<tr>
<td><strong>Vascular Injury</strong></td>
<td>No</td>
<td>No</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td><strong>Incidence of Wound Infections</strong></td>
<td>0-2%</td>
<td>2-10%</td>
<td>10-50%</td>
<td></td>
</tr>
</tbody>
</table>

# Background – Institutional Protocol

<table>
<thead>
<tr>
<th>Fracture</th>
<th>Antibiotic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type I and II</strong></td>
<td><strong>Cefazolin</strong> 2 g (3 g if &gt;120 kg)</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>• Severe beta-lactam allergy: Clindamycin 900 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Type III</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Cefazolin</strong> 2 g (3 g if &gt;120 kg) + <strong>Gentamicin</strong> 5 mg/kg</td>
<td>72 hours or 24 hours after wound closure, whichever is shortest</td>
</tr>
<tr>
<td></td>
<td>• Severe beta-lactam allergy: Clindamycin 900 mg + Gentamicin 5 mg/kg</td>
<td></td>
</tr>
<tr>
<td><strong>Type III with gross contamination</strong></td>
<td><strong>Cefazolin</strong> 2 g (3 g if &gt;120 kg) + <strong>Gentamicin</strong> 5 mg/kg + <strong>Penicillin G</strong> 5 million unit bolus then 18 million units/24 hr infusion</td>
<td>72 hours or 24 hours after wound closure, whichever is shortest</td>
</tr>
<tr>
<td></td>
<td>• Severe beta-lactam allergy: Clindamycin 900 mg + Gentamicin 5 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

If known MRSA colonization: add vancomycin  
Administer antibiotic(s) within **1 hour** of presentation to ED
Methods

• Purpose: assess the use of prophylactic antibiotics for open fractures in trauma patients at our institution

• Retrospective observational cohort study
  • Trauma patients presenting to the ED from 1/1/17 to 8/19/20

Inclusion:
• Long-bone fracture
• ICD-10 diagnosis code including “open fracture”

Exclusion:
• <18 years old
• Transferred from an outside facility
• Discharged directly from the ED
Outcomes

Primary Outcome

• Adherence rate to the prophylactic antibiotic protocol
  • Adherence = correct antibiotic and dose within goal time

Secondary Outcomes

• Duration of antibiotic therapy
• Open fracture infections at 90 days
Results – Protocol Adherence

Overall Protocol Adherence (n=44) - 38%

Correct Antibiotic Selection (n=93) - 80%

Correct Antibiotic Dose (n=85) - 73%

Time to Initiation within 1 Hour (n=78) - 67%
Results – Gentamicin

- Median time to gentamicin administration = 1:46

- 45 Gentamicin Administrations
  - 22 Correct Dose
  - 23 Incorrect Dose
    - 15 Incorrect Dosing Weight
    - 8 Incorrect Weight-Based Dose
Results – Wound Infections

15 Wound Infections at 90 Days

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Protocol Adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I/II: 4</td>
<td>Yes: 5</td>
</tr>
<tr>
<td>Type III: 11</td>
<td>No: 10</td>
</tr>
</tbody>
</table>
**Discussion**

<table>
<thead>
<tr>
<th>Medication Availability</th>
<th>Familiarity with Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cefazolin administered first in 98%</td>
<td>• Low utilization of gentamicin and penicillin G in the ED</td>
</tr>
<tr>
<td>• Cefazolin stocked in ED</td>
<td>• Gentamicin</td>
</tr>
<tr>
<td>• Gentamicin and penicillin G not stocked in ED</td>
<td>• Specific dosing weight</td>
</tr>
<tr>
<td>• Can lead to potential delays in treatment</td>
<td></td>
</tr>
<tr>
<td>Fracture Type</td>
<td>Example 1</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Type I and II</td>
<td>Cefazolin</td>
</tr>
<tr>
<td>Type III</td>
<td>Ceftriaxone</td>
</tr>
<tr>
<td>Type III with gross contamination</td>
<td>Ceftriaxone + Metronidazole</td>
</tr>
<tr>
<td>Type III with standing water</td>
<td>Piperacillin/Tazobactam</td>
</tr>
</tbody>
</table>
Limitations

- Retrospective study
- Single center study
- Large number of excluded patients that were transferred to our institution
- Did not power our study to evaluate for changes in outcomes
Conclusion

Our antibiotic prophylaxis guidelines were followed in the minority of patients which was largely driven by **time to first antibiotic**

Factors identified that may contribute to delays in antibiotic administration include **antibiotic accessibility** and **familiarity** with antibiotic dosing and administration.
Vasopressor Initial Dosing Impact on Survival and Cardiac Re-Arrest Likelihood

ABIGAIL SHARPE, PHARM.D
PGY2 EMERGENCY MEDICINE PHARMACY RESIDENT
FROEDTERT & THE MEDICAL COLLEGE OF WISCONSIN
FROEDTERT HOSPITAL
JUNE 2021
Background

- In the United States, cardiac arrest occurs in approximately 350,000 patients each year outside the hospital setting.

- Current ACLS guidelines recommend maintaining a mean arterial pressure (MAP) of >65mmHg once ROSC is achieved.

- A general starting dose of 0.05-0.5 mcg/kg/min for norepinephrine (NE) and epinephrine (EPI) infusions is recommended.

- Risks to both aggressive and cautious initial dosing of vasopressors.
Background

- Risks of aggressive initial dosing of vasopressors

  - Peripheral Ischemia
  - Malignant Hypertension
  - Cardiac Dysrhythmias

- Risks of cautious initial dosing of vasopressors

  - Inadequate hemodynamic support
  - Cardiac re-arrest
  - Increased mortality rate
Project Outcomes

**Primary Outcome**
- Incidence of cardiac re-arrest within one hour of initiating vasopressor

**Secondary Outcomes**
- Need for second vasopressor in ED
- Percent of MAPs at goal in ED
- Incidence of malignant hypertension (SBP>180mmHg) in ED
- Incidence of arrhythmia after vasopressor initiation
- Survival to ICU admission
- Survival to hospital discharge
Methods

• Study design
  • Single center, retrospective medical record analysis
  • Patients sorted into one of four groups based on initial dose of NE or EPI
  
  - **LOW**
    - $<0.25$ mcg/kg/min
  - **MEDIUM**
    - $0.25 – 0.49$ mcg/kg/min
  - **HIGH**
    - $0.5 – 0.99$ mcg/kg/min
  - **VERY HIGH**
    - $>1$ mcg/kg/min

• Study period: November 2015 to November 2020 to align with a single ACLS cycle
Methods

• Study design
  • Single center, retrospective medical record analysis
  • Patients sorted into one of four groups based on initial dose of NE or EPI

  LOW
  <0.25 mcg/kg/min

  MEDIUM
  0.25 – 0.49 mcg/kg/min

  HIGH
  0.5 – 0.99 mcg/kg/min

  VERY HIGH
  >1 mcg/kg/min

• Study period: November 2015 to November 2020 to align with a single ACLS cycle

Inclusion Criteria
(all 4 criteria must be met)

• Age >18 years
• Cardiac arrest prior to arrival or within the ED
• ROSC achieved
• Started on NE or EPI infusion within 1 hour post-ROSC

Exclusion Criteria
(any criteria may be met)

• Age <18 years
• Pregnant
• Do not resuscitate (DNR) status
• Transfer from another institution
• Vasopressor started >1 hours post-ROSC
• Any vasopressor started prior to ED arrival
Results

173 patients included

- LOW: N=88 patients
- MEDIUM: N=26 patients
- HIGH: N=44 patients
- VERY HIGH: N=15 patients
Results

Incidence of cardiac re-arrest within one hour of vasopressor initiation

- LOW: 26.1%
- MEDIUM: 13.6%
- HIGH: 27.1%
- VERY HIGH: 40%

p = 0.359
Results

Statistically significant secondary outcomes

Need for Second Vasopressor Survival to Hospital Discharge

Percent Per Group

Secondary Outcomes

LOW
MEDIUM
HIGH
VERY HIGH

p=0.003
p=0.007
Discussion

• **No difference** in the primary outcome

• Patients receiving high initial doses
  • More likely to require a second vasopressor
  • Less likely to survive to hospital discharge
  • No increased risk of malignant hypertension or arrhythmia

• Limitations
  • Single-center, retrospective study with small number of patients
  • Inconsistent charting of initial ROSC date/time by EMS
Conclusions

• Patients receiving higher initial doses of vasopressors *appeared* to be significantly more ill and were *less likely to survive* despite similar rates of cardiac re-arrest

• Larger studies need to be run to determine optimal initial dosing strategies in this patient population
Acknowledgements

• **Ryan Feldman, PharmD, BCPS, DABAT**
• Kelly Richardson, PharmD
• Matthew Stanton, PharmD, BCPS, DABAT
• Jessica Feih, PharmD, BCCCP
• Cathyyen Dang, PharmD, BCPS
• Chetna Patel, PharmD
• Danielle Mabrey, PharmD, BCCCP
QUESTIONS
Thank you for attending!

• No CE credit is offered for this activity.
• Please send any remaining questions to sections@ashp.org