2022 ASHP Midyear Clinical Meeting Roundtable and Poster Session: Pediatrics

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Development of Best Practices for Smart Pump Drug Library Pertaining to Neonatal and Infant Continuous Infusions

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BACKGROUND

- Medication errors with the potential to cause harm occur eight times more often in the NICU setting compared with adult hospital settings.[1]
- In 2003, the Joint Commission's National Patient Safety Goals program issued statement that recommended the standardization of drug concentrations.[2]
- The rule of six, which was used for years to guide IV infusions in pediatrics, was no longer allowed and hospitals transitioned to standardized concentrations for pediatrics.[3]
- Best practices in drug library development for smart pumps in adult continuous infusions were previously developed.

OBJECTIVE

Determine best practices in drug library development for smart pumps pertaining to neonatal and infant continuous infusions

METHODS

- Three multi-disciplinary focus groups of a neonatal physician, pharmacy specialists, and neonatal and pediatric nurses convened from December 2020 to March 2021 to aid in the development of best practices.
- In all, there were 3 pharmacists, 6 nurses, and 1 physician that participated in the focus groups. An IRB-approved semi-scripted focus group transcript that contained four main questions was followed by investigators.
- The questions posed were:
  - What are the determining factors in optimal infusion concentrations for continuous infusion medications?
  - What are the determining factors in optimal infusion volumes?
  - What are the determining factors in optimal syringe pump infusion rates?
  - What are the preferred dosing unit considerations?
- Qualitative results of the focus group were thematically analyzed and a summary and best practice document was created.
- Best practice document was returned to the focus group participants for feedback and was further refined.

RESULTS

- A **"Neonatal/Infant Drug Library Best Practices Development for Smart Pumps"** document was created in collaboration with the academic medical center clinicians. Important topics of the best practices document include the preferred number of concentrations per medication; pump and line rate requirements; ideal state for a continuous infusion; additional considerations for the ideal concentration of a drug; and, dosing unit considerations.

It is ideal to have one single concentration/volume for a continuous infusion:

- Single maximum concentration for all patient populations to minimize variability of concentrations, including:
  - Fluid restricted patients (minimize % of daily fluid maintenance/fluid burden)
  - All weights and doses (low and high end of the ranges including weans)
- If not attainable, add a second concentration.

The smallest volume that provides therapeutic effect and meets pump, line, and flush requirements is recommended:

- The minimum rate of fluid to maintain patency of line is 0.8 ml/hr.
- The minimum rate for syringe pump is 0.01 ml/hr (dependent upon syringe size).
- Balance must be met between concentrating medication and meeting dilution requirements for peripheral access.

In the ideal state for a continuous infusion:

- We would use the full vial, infuse the whole syringe volume, and provide the most fluid restricted volume as possible.
  - Prioritization is different per drug.
  - The syringe size and corresponding volume pharmacy sends for titratable infusions and range orders would minimize the amount of volume remaining.
  - Vial selection and amount prepared is determined by a 24-hour time period.

Additional considerations for the ideal concentration of drug used include:

- Compatibility of the drug's concentration with other drugs, particularly TPN.
- If not compatible with TPN, stopping and starting a drug (flushing the line), or getting a second line can be challenging.
- Commercially available products may be preferred.
- Stability of the drug's concentration(s) and duration for clinical use (i.e. BUD).

Dosing unit considerations:

- Minimizing options regarding dosing units is preferred due to less programming errors.
  - Epic dosing options should match pump programming options.
- Dosing unit considerations should match drug references Neofax or Lexicomp pediatric.
- Dosing safety standardizations match ISMP guidelines.
- Push to standardize with concentrations across departments (i.e. anesthesia).

CONCLUSION

- Focus groups were a quick and effective research methodology to learn a lot about best practices regarding smart pump drug library development pertaining to neonatal and infant continuous infusions.
- Differences in institutional policies and procedures make performing the focus groups with practitioners from the same hospital to be the most effective.
- The best practices developed were member-checked and were utilized as the basis to evaluate the data.

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Retrospective Review of Antibiotics Used for Surgical Prophylaxis in Pediatric Patients with Reported Penicillin and Cephalosporin Allergies

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Background

- Around 10% and 1-2% of patients in the U.S. report a penicillin and cephalosporin allergy respectively[1]
  - True IgE-mediated reactions appear to be about 1%[1]
- Penicillin to cephalosporin cross-reactivity is considered to be around 1%[2-4]
- β-lactams are the preferred peri-operative antibiotic, especially cefazolin, due to its spectrum of activity and pharmacokinetics[5-7]
- Patients with a reported penicillin allergy are at a greater risk for surgical site infections, due to use of non-β-lactam antibiotics[8-9]

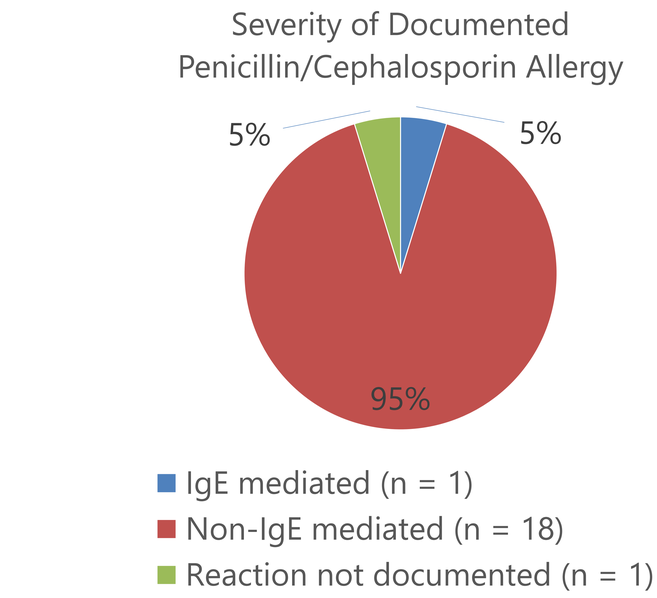
Purpose

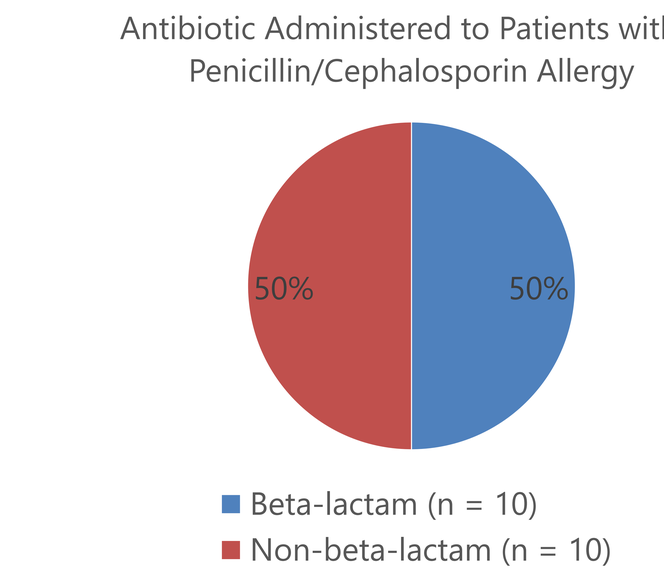
The purpose of this research is to evaluate antibiotic usage and incidence of surgical site infections in patients with documented penicillin or cephalosporin allergies

Methods

- This is a retrospective analysis of patients undergoing surgical procedures from August 1, 2021 through July 31, 2022 at Le Bonheur Children's Hospital
- Included patients will consist of those with a listed penicillin or cephalosporin allergy who had a surgical procedure and received peri-operative antibiotics for prophylaxis
- Patients will be excluded if they received antibiotics related to an ongoing infection
- Data to be collected includes type of surgery, listed drug allergy, listed reaction, type of antibiotic administered, and incidence of surgical site infections

Preliminary Results





Discussion & Conclusion

- Data collection is ongoing, and a final analysis will be performed to review the antibiotics chosen and incidence of surgical site infections for patients with a documented penicillin or cephalosporin allergy
- Only one currently collected patient had a true IgE mediated reaction
- Half of all currently collected patients with a penicillin or cephalosporin allergy received a non-beta-lactam antibiotic peri-operatively for prophylaxis
  - These patients may be at a greater risk for developing a surgical site infection

Disclosures

Authors have no conflict of interests to declare

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Evaluation of pediatric calculations and medication preparation simulation with pharmacy students

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Background

- Simulation-based learning is not a new concept in the medical field as it allows professionals to practice specific skills before experiencing real-life situations.
- Much literature has been published regarding the need for simulations with students in the medical field, but little research has been completed specifically with pharmacy students.[1]
- Of the few studies available regarding pharmacy students, the main focus has been preventing medication errors or improving communication skills.[2,3]

Objectives

Primary Objective:

- To evaluate pharmacy students' comfort level with pharmacy calculations and medication preparations following an educational session

Methods

- Pharmacy students completing a rotation at Nationwide Children's Hospital participated in a one-hour educational session reviewing pharmacy calculations and hands-on medication preparations
- A pre- and post-survey was collected from students attending the session from September to November 2022
- The survey utilized a 5-point Likert Scale to assess comfort levels with calculations and medication preparations
- Scores ranged from (1) Very Uncomfortable to (5) Very Comfortable
- Survey questions assessed students' comfort level with the following calculations:
  - Weight-based dosing
  - Pediatric renal function
  - Pediatric maintenance fluid rates
- Survey questions also assessed students' comfort level with the following medication preparations:
  - Intranasal medications
  - Intravenous medications and continuous infusions
  - Assembly of Abboject® or Leur-Jet™ medications
- Demographics were also collected
- Descriptive statistics was utilized for analysis

Results

Demographics (N = 25)	
Year in Pharmacy School	
Fourth Professional Year	25 (100%)
Any Hospital Experience	
No	0
Yes, through an internship	13 (52%)
Yes, through IPPEs	19 (76%)
Yes, through APPEs	22 (88%)
Any Compounding Experience	
Yes	19 (76%)
No	6 (24%)

IPPE = Introductory Pharmacy Practice Experience
APPE = Advanced Pharmacy Practice Experience

Respondents Who Were Comfortable or Very Comfortable (N = 25)		
	Pre-Survey	**Post-Survey**
Calculation Questions		
Weight-Based Dosing (mg/kg)	23 (92%)	24 (96%)
Pediatric Renal Function (GFR)	6 (24%)	24 (96%)
Pediatric Maintenance Fluid Rates	7 (28%)	24 (96%)
Drip Rates	8 (32%)	23 (92%)
Medication Preparation Questions		
Preparation of an Intranasal Medication	5 (20%)	24 (96%)
Administration Techniques of an Intranasal Medication	12 (48%)	24 (96%)
Preparation of an Intravenous Medication	17 (68%)	24 (96%)
Assembly of an Abboject® or Leurjet™ to Prepare a Medication	8 (32%)	23 (92%)
Preparation of a Vasopressor Drip	10 (40%)	24 (96%)

Discussion

- Overall, pharmacy students' comfort level improved in every area assessed.
- The pharmacy students were overall most comfortable in weight-based dosing prior to the educational session.
- Pediatric renal function was the most-improved calculation, as the comfort level increased by 72%.
- Students had the least amount of comfort with preparation of an intranasal medication prior to the educational session, but this increased by 76% following the session.

Limitations:

- Small sample size, only APPE students participated
- The difference in comfort for each student was not studied, so unable to say if all students' comfort increased

Conclusions

- Providing a refresher of pharmacy calculations allows students to become more comfortable with their abilities during their rotation.
- Students' comfort level with medication preparation increases when they are provided opportunities to practice this skill.
- This information can be used to guide preceptors on which calculations and medication preparations to review during clinical rotations.

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Disclosures

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.

Serotonin Syndrome in an Adolescent After Recent Discontinuation of Cyproheptadine and a Single Accidental Dose of Escitalopram

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Background

Serotonin syndrome occurs due to overactivation of serotonin receptors

- Onset: rapid (≤24 hours from medication changes)
- Risk factors: drugs that increase serotonin synthesis or decrease reuptake and/or metabolism

Cyproheptadine is an antihistamine that is utilized off-label for appetite stimulation

- Potent histamine and serotonin (5-HT2A) receptor antagonist

Escitalopram is a selective serotonin reuptake inhibitor

- Mean half-life in adolescents: 19 hours

Citalopram (CIT) → N-des methyl-CIT → N-dides methyl-CIT

CYP2C19 CYP3A4 — CYP2D6

Patient Introduction

An 11-year-old male (21.8 kg) presented to the emergency department with altered mental status and tremor

Past Medical History	Outpatient Medications
• Poor weight gain • Anxiety • Attention deficit hyperactivity disorder	Cyproheptadine 2 mg daily • Started 2 months before admission • Missed two prior doses

Ninety minutes before presentation, the patient mistakenly ingested a family member's 20 mg tablet of escitalopram instead of his nightly cyproheptadine

Clinical Course

Emergency Department

Clinical Presentation

- Agitation and confusion
- Full body clonus
- Heart rate 203 bpm
- Fever to 102 F

Laboratory Data

- Negative urine toxicology screen
- Undetectable serum acetaminophen and salicylate
- Creatine kinase (CK) 111 U/L

Medications Given

- Intermittent IV midazolam for agitation (3 doses for a total of 5 mg)
- Cyproheptadine 2 mg PO for suspected serotonin syndrome

Pediatric Intensive Care Unit

Endotracheal intubation for acute hypercarbic respiratory failure

Extubation to BiPAP

Transfer to floor

Day of ICU admission: 1 2 3 4 5 6 7 8 9 10 11 12

Sustained clonus & tremor

Persistent tremors stop & clonus improves

CK peak: 4807 U/L

Urine citalopram: >1000 ng/mL

CK: 711 U/L

Pharmacologic Management

Clonus and agitation therapies

- Midazolam 0.1-0.85 mg/kg/hour + bolus → PO lorazepam
- Hydromorphone 0.003-0.005 mg/kg/hr + bolus → Oxycodone
- Dexmedetomidine 0.1-1 mcg/kg/hr
- Intermittent IV phenobarbital 5 mg/kg — Serum concentration range: 16.4-21.7 mcg/mL

Adjunct therapies

- Cisatracurium 0.07 mg/kg/hr + bolus — Initiated with rising CK
- Magnesium 45 mg/kg PRN for serum Mg <2.5 mg/dL — For reduction of shivers
- Cyproheptadine 2 mg PO/NG daily for possible withdrawal
- Acetaminophen 15 mg/kg PO/NG q6h for hyperthermia management

Outcomes & Considerations

Genetic testing demonstrated:

- Normal activity (1*/1*): CYP2C19 and CYP3A4
- Intermediate activity (*5/*41): CYP2D6

Discharge medications:

- Oxycodone and lorazepam weans
- Erythromycin 75 mg TID for appetite stimulation in place of cyproheptadine

The patient discharged on Day 14 with non-sustained clonus

Few prior case reports describe serotonin syndrome after serotonin antagonist discontinuation:

Patient	Medication exposure
47-year-old female[2]	Discontinuation of clozapine with use of citalopram 10 mg daily
44-year-old male[3]	Taper of clozapine with use of clomipramine 150 mg daily
63-year-old female[4]	Discontinuation of cyproheptadine with use of sertraline 100 mg daily

Future Implications

Patients discontinuing serotonin antagonists and initiating serotonergic agents may be at increased risk for serotonin syndrome

- Close monitoring is recommended if used

Avoidance of abrupt cessation of cyproheptadine during initiation of serotonergic therapies is recommended

Future studies should describe receptor changes and possible risk factors for serotonin syndrome with this combination

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Evaluation of Sugammadex Use in Pediatric Surgery Patients at a Tertiary Care, Stand-Alone Children's Hospital

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Background

- Sugammadex is an antidote for the reversal of the steroidal non-depolarizing neuromuscular blockers vecuronium and rocuronium[1].
- Before sugammadex was approved by the FDA, the standard of care for neuromuscular blockade reversal was neostigmine plus an anticholinergic agent[2].
- Sugammadex was added to formulary in 2016 with its use restricted to rocuronium reversal in patients with myotonic dystrophy or in cases needing emergent reversal due to high cost.

Purpose

- To evaluate the adherence to sugammadex usage restrictions set forth by the Pharmacy and Therapeutics (P&T) Committee.

Methods

- **Study Design:** Retrospective review of the electronic medical record.
- **Inclusion Criteria:** Any patient charged-on-administration for sugammadex or neostigmine between July 1st, 2021 and June 30th, 2022.
- **Exclusion Criteria:** Received agent for reversal of neuromuscular blockers outside of the setting of the operating room (OR).
- **Data collection:** Reversal agent used, reversal indication (standard post-operative reversal, myotonic dystrophy, emergent, or unknown).
  - Unknown uses of sugammadex will be considered unapproved uses.
- A cost-saving analysis utilizing average wholesale Price (AWP) will be conducted to identify the financial impact of unapproved sugammadex use.

Preliminary Results

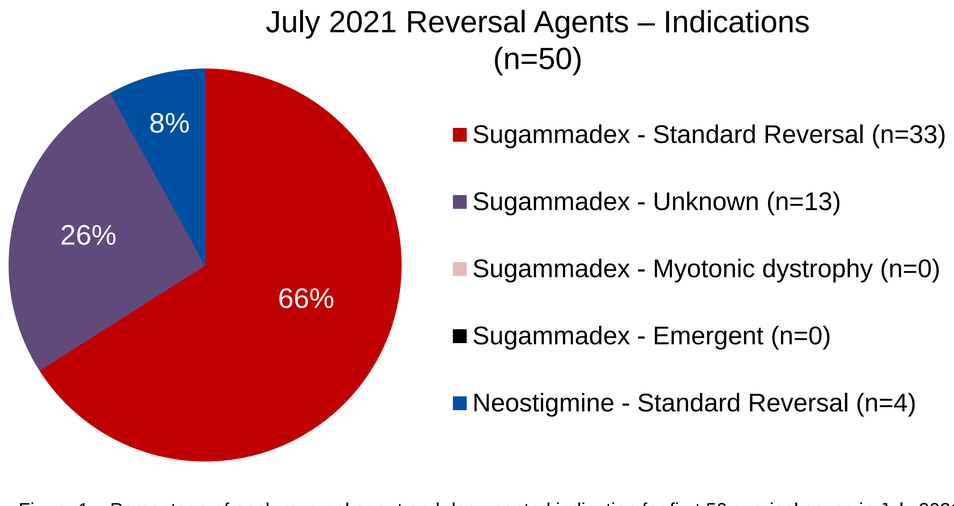

Figure 1 – Percentage of each reversal agent and documented indication for first 50 surgical cases in July 2021

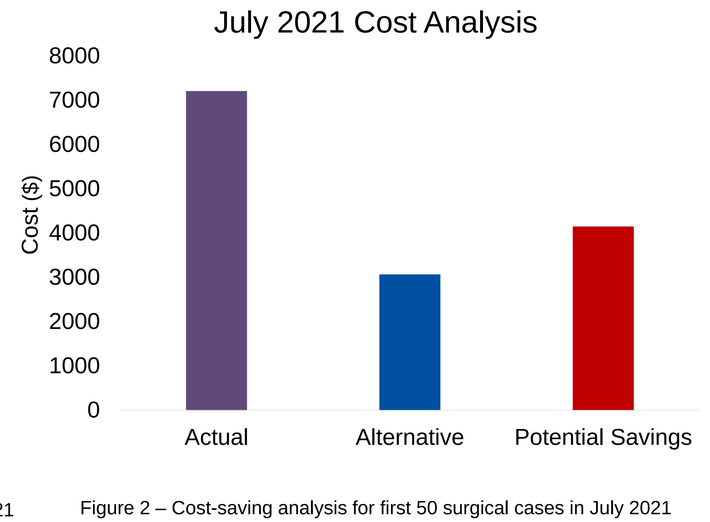

Figure 2 – Cost-saving analysis for first 50 surgical cases in July 2021

- 3885 patients were charged on administration for sugammadex or neostigmine between July 1st, 2021 and June 30th, 2022.
- 94% (3662/3885) received sugammadex and 6% (223/3885) received neostigmine.

Conclusions

- No uses of sugammadex in the first 50 surgical cases of July 2021 were for a P&T approved indication.
- Based on preliminary data, adherence to P&T criteria for sugammadex use would result in cost savings for the institution.
- Future considerations should assess if the use of sugammadex reduces OR turnover time which could offset the high cost of sugammadex.
- Further results and conclusions are pending for this research in progress.

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Disclosures

- All authors have nothing to disclose.

Incidence of acute kidney injury in pediatric intensive care unit patients exposed to antibiotics

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Background

- Patients admitted to the pediatric intensive care unit (PICU) often require combination intravenous (IV) antibiotics such as vancomycin and piperacillin/tazobactam (PTZ) or cefepime (CPE)
- Recent evidence suggests higher rates of acute kidney injury (AKI) associated with the combination of vancomycin and PTZ compared to CPE, when using serum creatinine as a marker of AKI
- PTZ is known to inhibit tubular secretion of creatinine, causing elevation in serum creatinine concentrations, and may represent a pseudonephrotoxicity

Objective

Primary Objective

- Evaluate the rates of AKI in PICU patients receiving CPE, PTZ, CPE + vancomycin, or PTZ + vancomycin using serum creatinine and cystatin C

Secondary Objectives

- Compare neutrophil gelatinase-associated lipocalin (NGAL) values between treatment groups for association with AKI
- Evaluate changes in markers of renal function
  - Urine output
  - Dialysis initiation
- Evaluate resolution of AKI and rates of renal recovery

Methods

- **Design**
  - Single center
  - Retrospective chart review
  - Institutional Review Board approved

Methods cont.

- **Inclusion**
  - Patients ≥ 28 days old
  - PICU admission between October 1, 2019 and September 30, 2022
  - Treatment with CPE or PTZ with or without IV vancomycin for a suspected infection
- **Exclusion**
  - Less than 48 hours of antibiotic treatment per group allocation
  - Monotherapy with vancomycin before transitioning to combination therapy with CPE or PTZ
  - Administration of CPE and PTZ within seven days of each other
  - Initiation of extracorporeal membrane oxygenation during antibiotic course
  - Pre-existing renal dysfunction (chronic dialysis, solitary kidney, history of a kidney transplant)
  - Missing baseline and/or follow-up serum creatinine values

Data Collection

Demographics
- Patient age, sex, race/ethnicity, weight, height

Hospital and PICU length of stay

Antibiotic indication

Baseline and follow-up renal lab values
- Serum creatinine, cystatin C, NGAL

Vancomycin trough levels

Renal replacement therapy initiation

Urine output

Concomitant nephrotoxic medications

Concomitant vasoactive medications

Discussion

Do rates of AKI differ between antibiotic treatment groups in PICU patients?

Do rates of AKI differ based on markers of renal function?

Are there other factors that may contribute to differing rates of AKI?

Are AKIs in PICU patients reversible after discontinuation of antibiotics?

Does occurrence of AKI result in a longer duration of PICU and/or hospital stay?

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Disclosures

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Medication Use Evaluation of Elexacaftor/Tezacaftor/Ivacaftor Initiation and Adherence to Standard Inhaled Therapies in a Pediatric Cystic Fibrosis Care Center

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CookChildren's

Background

Elexacaftor/tezacaftor/ivacaftor (ELX/TEZ/IVA) is a combination of three cystic fibrosis transmembrane conductance regulator (CFTR) modulators approved to treat cystic fibrosis (CF) in pediatric patients with responsive genetic mutations. Robust clinical improvements have been seen in this population after ELX/TEZ/IVA initiation, which has inadvertently resulted in a self-reported decrease in adherence to standard inhaled CF medications at this institution.

Objectives

Assess patient adherence to standard inhaled maintenance therapies after initiation of ELX/TEZ/IVA

Assess the forced expiratory volume (FEV1) of patients before and after initiation of ELX/TEZ/IVA

Methods

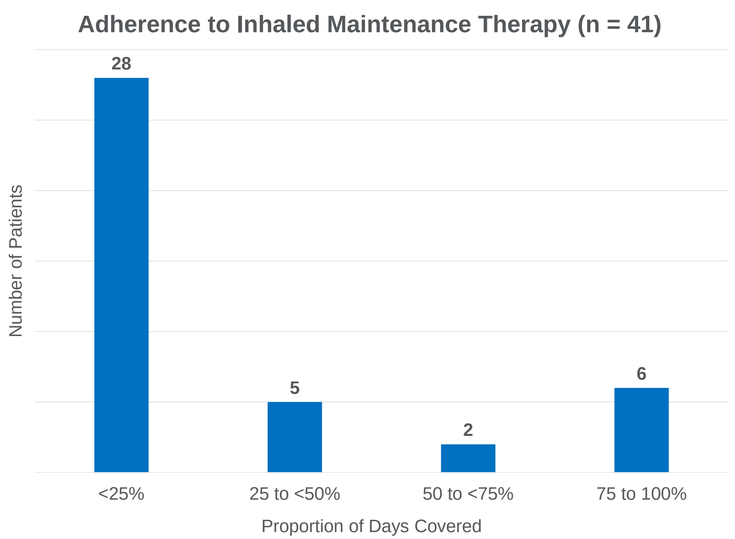
- Retrospective chart review utilizing the Cystic Fibrosis Foundation registry and electronic medical record
- Inclusion criteria: 12 to 18 years of age, diagnosed with CF, prescribed ELX/TEZ/IVA in combination with standard inhaled therapies (dornase alfa, hypertonic saline, tobramycin, aztreonam)
- The following data points were collected:
  - Age
  - Sex
  - Race/ethnicity
  - CFTR mutation
  - ELX/TEZ/IVA initiation date
  - Inhaled medications prescribed
  - Number of inhaled therapy refills
  - FEV1 (baseline and most recent)

Disclosures

The authors of this presentation disclose the following relationships with commercial interests related to the subject of this poster:
Kasaandra Ibañez, PharmD: Nothing to disclose
Kristin Bohannon, PharmD, BCPPS; Nothing to disclose

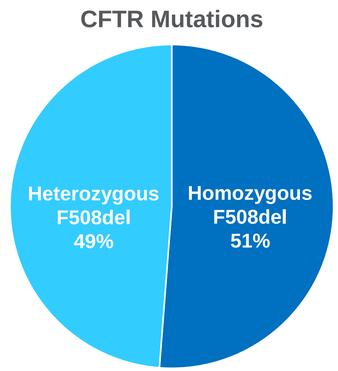
Most patients demonstrated non-adherence to standard inhaled therapies and had increased FEV1 levels after initiation of ELX/TEZ/IVA

Results



Results

Patient Characteristics (n = 41)	
Age (years), median	15
Sex, n (%)	
Male	21 (51%)
Female	20 (49%)
Race/ethnicity, n (%)	
Caucasian	39 (95%)
Hispanic	7 (17%)
African American	1 (2%)
≥2 Races	1 (2%)
Prescribed Inhaled Meds, n (%)	
1	14 (34%)
2	15 (37%)
3	11 (27%)
4	1 (2%)



Discussion

The increase in FEV1 observed after initiation of ELX/TEZ/IVA despite low adherence to inhaled therapies calls into question the utility of continuing to recommend the concomitant use of these medications.

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Novel Use of Angiotensin II for Fluid and Vasopressor Refractory Pediatric Distributive Shock

Nikolas Dotolo, PharmD; Caitlyn Luecke, PharmD, BCPPS; Kimberly Mills, PharmD, BCPPS; Caren Liviskie, PharmD, BCPPS; Neel Shah, MD; Ashley Turner, MD
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11-110

Background

- Pediatric septic shock accounts for over 50,000 hospital admissions per year. Traditionally, sepsis management includes fluid resuscitation, catecholamine vasopressors, and vasopressin. Patients refractory to these interventions have limited options that are proven to be efficacious.
- Angiotensin II (AT-II) is a novel, non catecholamine agent that has been proven to effectively reduce catecholamine requirements and increase mean atrial pressure (MAP) in adults with high output septic shock in combination with catecholamines, vasopressin, and/or other vasoactive agents.
- Data supporting the use of AT-II for pediatric septic shock is limited to two small case series, each consisting of two patients.

Objective

The primary objective is to characterize the use of Angiotensin-II for septic shock at a pediatric academic medical center.

Methods

Study procedures were approved by the Institutional Review Board of Washington University in St. Louis.

- Retrospective chart review of patients who received AT-II for septic shock at St. Louis Children's Hospital between April 1, 2019 and November 11, 2022.
- AT-II orders were evaluated for adherence to restriction criteria (Table 1). AT-II dosing, MAP response, and Vasoactive-Inotropic Score (VIS) were collected as continuous data during AT-II infusion. VIS was used to quantify the degree of vasopressor support required and is calculated continuously based on required doses of epinephrine, norepinephrine, and vasopressin.

Table 1. St. Louis Children's Hospital AT-II Medication Use Criteria

Mediation Use Criteria
High output shock with adequate cardiac function
Adequate fluid resuscitation per attending physician
Epinephrine or Norepinephrine dose ≥ 0.2 mcg/kg/min
Vasopressin dose ≥ 0.5 units/kg/min or 40 milliunits/min
Use of VTE prophylaxis (if not contraindicated)
Non-moribund patient

Results

Table 2. Patient Characteristics

Characteristic	(n=25)
Male sex, N (%)	13 (52)
Median age, years (IQR)	10 (1.8-14)
Median weight, kg (IQR)	31.3 (10-51.5)
Median initial dose, ng/kg/min (IQR)	5 (5-10)
Median maximum dose, ng/kg/min (IQR)	80 (60-80)
History of orthotopic heart transplant, N (%)	1 (4)
VTE prophylaxis, N (%)	6 (24)
Deaths, N (%)	15 (60)

Figure 1. Restriction Criteria Non-Compliance (n= 8)

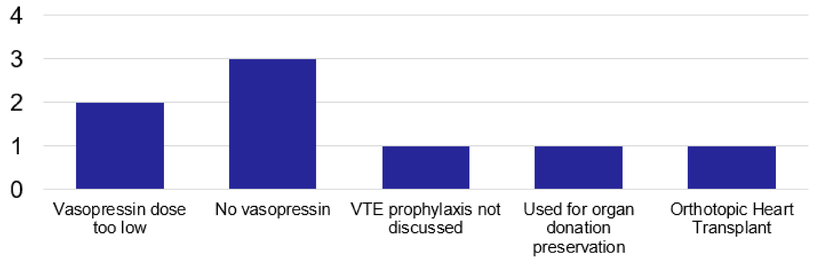


Figure 2. MAP Response to AT-II: Non-Responder, 9-year-old male

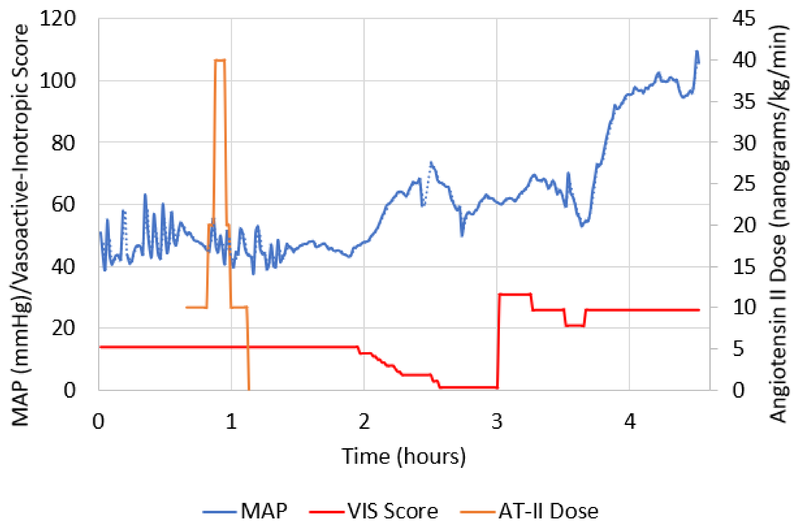
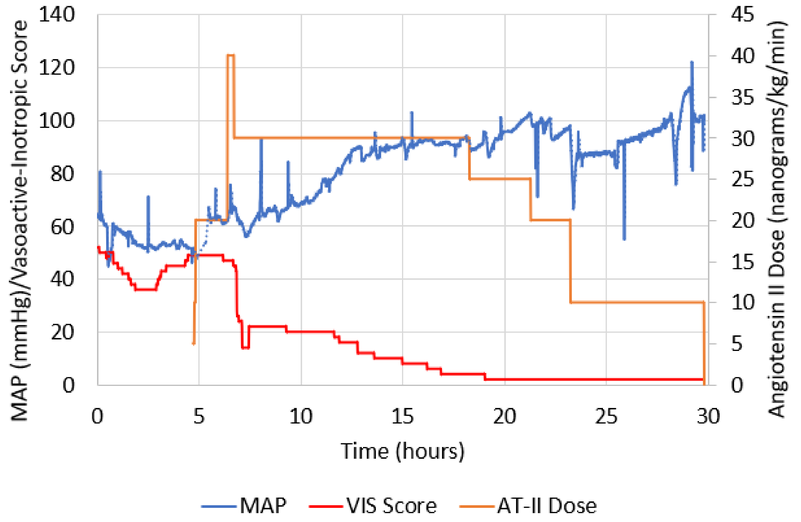


Figure 3. MAP Response to AT-II: Responder, 12-year-old male



Discussion

Ordering physician attestation to AT-II criteria

Clinical pharmacist independent review of AT-II criteria

Clinical pharmacy specialist review and documentation required if AT-II criteria not met

Further investigate clinical situation and assess if AT-II is appropriate

Research is ongoing to further characterize overall patient response to AT-II using continuous MAP, central venous pressure response, and VIS to trend changes in vasopressor support.

Disclosure

Authors of this presentation have the following 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:

All Authors: Nothing to disclose

Presented at the 2022 American Society of Health-System Pharmacists Midyear Clinical Meeting

Incidence of acute kidney injury in pediatric intensive care unit patients exposed to antibiotics

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Background

- Patients admitted to the pediatric intensive care unit (PICU) often require combination intravenous (IV) antibiotics such as vancomycin and piperacillin/tazobactam (PTZ) or cefepime (CPE)
- Recent evidence suggests higher rates of acute kidney injury (AKI) associated with the combination of vancomycin and PTZ compared to CPE, when using serum creatinine as a marker of AKI
- PTZ is known to inhibit tubular secretion of creatinine, causing elevation in serum creatinine concentrations, and may represent a pseudonephrotoxicity

Objective

Primary Objective

- Evaluate the rates of AKI in PICU patients receiving CPE, PTZ, CPE + vancomycin, or PTZ + vancomycin using serum creatinine and cystatin C

Secondary Objectives

- Compare neutrophil gelatinase-associated lipocalin (NGAL) values between treatment groups for association with AKI
- Evaluate changes in markers of renal function
  - Urine output
  - Dialysis initiation
- Evaluate resolution of AKI and rates of renal recovery

Methods

- **Design**
  - Single center
  - Retrospective chart review
  - Institutional Review Board approved

Methods cont.

- **Inclusion**
  - Patients ≥ 28 days old
  - PICU admission between October 1, 2019 and September 30, 2022
  - Treatment with CPE or PTZ with or without IV vancomycin for a suspected infection
- **Exclusion**
  - Less than 48 hours of antibiotic treatment per group allocation
  - Monotherapy with vancomycin before transitioning to combination therapy with CPE or PTZ
  - Administration of CPE and PTZ within seven days of each other
  - Initiation of extracorporeal membrane oxygenation during antibiotic course
  - Pre-existing renal dysfunction (chronic dialysis, solitary kidney, history of a kidney transplant)
  - Missing baseline and/or follow-up serum creatinine values

Data Collection

Demographics
- Patient age, sex, race/ethnicity, weight, height

Hospital and PICU length of stay

Antibiotic indication

Baseline and follow-up renal lab values
- Serum creatinine, cystatin C, NGAL

Vancomycin trough levels

Renal replacement therapy initiation

Urine output

Concomitant nephrotoxic medications

Concomitant vasoactive medications

Discussion

Do rates of AKI differ between antibiotic treatment groups in PICU patients?

Do rates of AKI differ based on markers of renal function?

Are there other factors that may contribute to differing rates of AKI?

Are AKIs in PICU patients reversible after discontinuation of antibiotics?

Does occurrence of AKI result in a longer duration of PICU and/or hospital stay?

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Disclosures

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.

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Evaluation of Override Function and Dispensing of Medications from Automated Dispensing Cabinets

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Le Bonheur Children's Hospital, Memphis, TN
The University of Tennessee Health Science Center, Memphis, TN

BACKGROUND

- Automated dispensing cabinets (ADC) are technology used in healthcare facilities to store medications and manage medication dispensing
- When used appropriately, ADCs facilitate timely medication distribution
- Utilization of the override function and administration of medications prior to pharmacy review and verification is associated with an increased risk for medication errors[1-3]
- Per medication management standards, the list of medications considered override-able should be evaluated, assessed, and updated on a regular basis to ensure appropriate use and patient safety[2,4]

PURPOSE

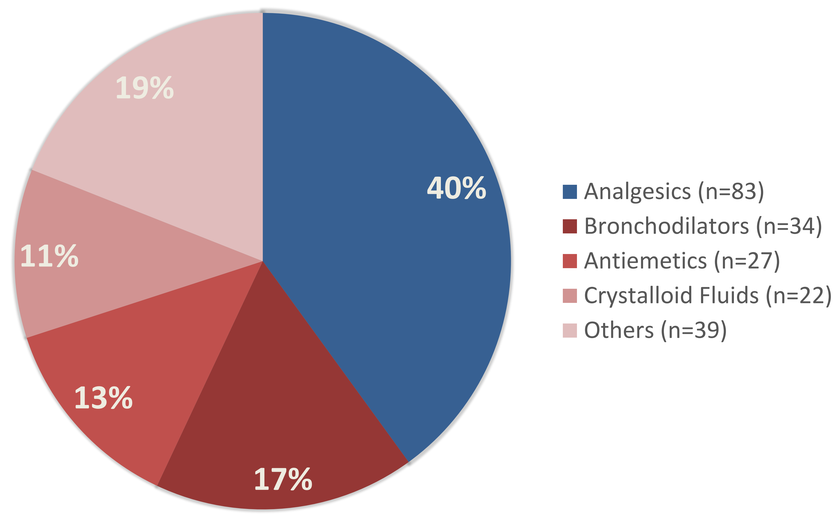
The purpose of this review is to evaluate the appropriateness and safety of medications removed from ADCs using the override function

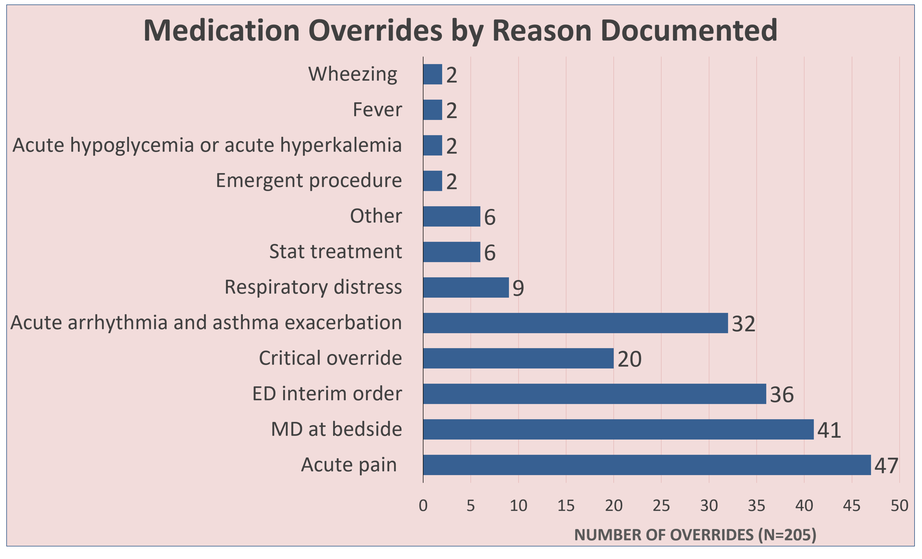
METHODS

- This is a retrospective review of override reports for medications that were dispensed from ADCs (Omnicell®) at Le Bonheur Children's Hospital (LBCH) using the override function from June 1, 2021 through June 30, 2022
- Patient's medical records will be reviewed to assess accuracy of orders and potential medication errors
- Data collection will include reason for medication override, name of medication removed, dose and strength removed, quantity removed, patient age, patient weight, medication order, accuracy of dose, and outcome of medication administration
- Inclusion Criteria:
  - ✓ Administered prior to pharmacy review
  - ✓ Dispensed from an ADC using the override function
  - ✓ Included on LBCH's list of approved override-able medications from ADCs

PRELIMINARY RESULTS

MEDICATION OVERRIDES BY DRUG CATEGORY





PRELIMINARY ANALYSIS

- Analgesics, including narcotics and non-narcotics, were the most common category of medications removed, with non-narcotics accounting for 66.2% of all analgesic medication overrides
- Acetaminophen was the most common medication removed, accounting for 16.5% of all overrides
- The most common reasons documented for medication override from the pre-specified list were acute pain, physician at bedside, and ED interim order
- Other reasons documented included vomiting, scheduled medication due, resuscitation, priming, allergic reaction, and PAS Score $\geq$ 8
- It appears there is room to improve the pre-determined options available for selection on the medication override reasons list to ensure that appropriate use of the override function is clearly documented
- No dosing errors have been observed in medication orders that were reviewed for weight-based dosing (n=15)

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DISCLOSURE

The authors of this presentation have nothing to disclose and no financial or personal relationships with commercial entities that may have direct or indirect interest in the subject matter of this presentation.

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Medication Use Evaluation of Amiodarone Induced Thyrotoxicity Screening in a Pediatric Institution

Jacob Voyles, PharmD; Olga L. Rodriguez, PharmD, BCPPS
Cook Children's Medical Center

Background

Amiodarone is a class III antiarrhythmic used to treat tachyarrhythmias. However, it is associated with a variety of side effects including hypo-and hyperthyroidism. Information in the pediatric and neonatal population is lacking. Available data demonstrates an incidence up to 39%. Cook Children's Medical Center recently implemented thyroid monitoring guidelines for patients initiating amiodarone. The objectives of this medication use evaluation are to determine the incidence of thyrotoxicity in patients receiving amiodarone as well as the proportion of patients appropriately monitored according to institutional recommendations.

Objectives

- Assess incidence of thyrotoxicity
- Assess institutional monitoring guideline adherence

Methods

- Study Design:
  - Retrospective chart review
    - Pre-implementation (01/01/2019 – 08/16/2019)
    - Post-implementation (01/01/2022 – 08/16/2022)
  - Inclusion criteria: patients 0-18 years old at amiodarone initiation during hospital admission
  - Exclusion criteria: <3 days of amiodarone therapy
- Data Collection:
  - Age at initiation of therapy
  - Indication for therapy
  - Sex
  - Weight (kg)
  - Dose of levothyroxine
  - Thyroid Stimulating Hormone
  - Free T_4
  - Amiodarone duration
  - Diagnosis of hypo/hyperthyroidism
  - Time to initiation of levothyroxine

Incidence of thyrotoxicity was similar before and after protocol implementation with 80% monitoring protocol adherence and shorter time to diagnosis

Methods

Amiodarone Lab Schedule: (TSH/ FT4/ LFT)

***Neonate to < 3 months*:**	***≥ 3 months to < 3 years*:**	***≥ 3 years*:**
- Baseline	- Baseline	- Baseline
- Weekly for 2 weeks	- Weeks 2, 4, and 8	- Week 4
- Every 2 weeks for 1 month	- Every 3 months for first year on therapy	- Every 3 months for first year on therapy
- Every 2 months thereafter	- Every 6 months thereafter	- Every 6 months thereafter
- Outpatient every 2-3 months	- 3 months after amiodarone discontinuation	- 3 months after amiodarone discontinuation

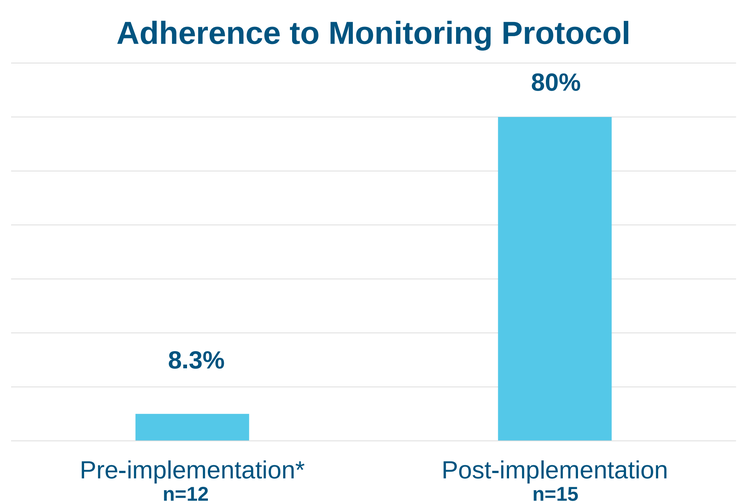
*TSH – thyroid stimulating hormone; FT4 – Free T4; LFT – liver function tests

Results

Thyrotoxicty Occurrence

	Pre-Implementation n=12	**Post-Implementation** n=15
Hypothyroid Diagnosis	3 (25%)	2 (13.3%)
Time to Diagnosis (days)	32	13.5
Average Amiodarone Duration (days)	214	111

Results



*Represents monitoring practices before protocol implementation – compared with protocol lab schedule

Most common arrhythmia diagnosis:

- Pre-Implementation: Junctional Ectopic Tachycardia (n = **4**)
- Post-Implementation: Supraventricular Tachycardia (n = **8**)

Disclosures

The authors of this presentation disclose the following relationships with commercial interests related to the subject of this poster:
Jacob Voyles, PharmD: Nothing to disclose
Olga Rodriguez, PharmD, BCPPS: Nothing to disclose

References

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Impact of a Procalcitonin Guided Antibiotic Management Strategy in Pediatric Sickle Cell Patients with Fever

Hannah Robinson, PharmD[1,2]; Andrew Gainey, PharmD[1,2]; Rob Daniels, PharmD[1,2]; Anna-Kathryn Burch, MD[1,3]; Carla Roberts, MD[1,3]

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Poster Number 12 - 422

BACKGROUND

- Patients with sickle cell disease (SCD) are at increased risks of infection due to functional asplenia
- Current evidence-based management guidelines recommend initiation of empiric antibiotics upon presentation with a fever in SCD patients
- Fever often occurs with vasoocclusive crisis (VOC) and acute chest syndrome (ACS) with non-bacterial etiologies, which poses a diagnostic challenge and may lead to the use of unwarranted antibiotics
- Unal et al. demonstrated that PCT was not significantly increased during VOC with or without fever, as opposed to CRP or WBC count
- Razazi et al found when utilizing a PCT-guided antibiotic prescribing regimen in SCD patients, more patients received ≤ 3 days of antibiotics in the PCT cohort (31% vs 9%; p<0.01) with no increase in adverse events
- There is limited data utilizing procalcitonin (PCT) in pediatric sickle cell patients who are being evaluated for an infectious process

PURPOSE

- The purpose of this study intends to evaluate the utility of procalcitonin to predict bacterial infections in pediatric sickle cell patients presenting with fever and demonstrate how a procalcitonin-guided antibiotic management strategy can decrease antibiotic duration, thereby decreasing future antimicrobial resistance.

METHODS

- Design: multicenter, retrospective, observational cohort study
- Timeline: patients admitted from March 1, 2021 to October 31, 2022

Inclusion Criteria

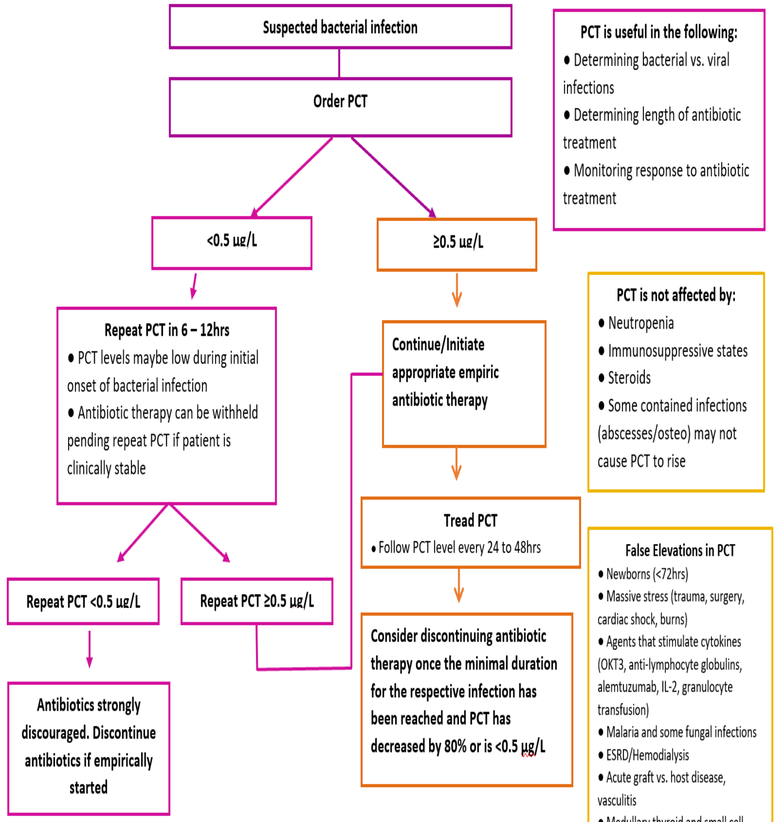
- Admitted SCD patients with a fever (≥ 101 F or 38.3 C) or concern for a bacterial infection and started on empiric antibiotics

Exclusion Criteria

- Diagnosed with osteomyelitis or other confirmed infections requiring > 15 days of antibiotic therapy

FACILITY PROTOCOL

Prisma Health Children's Hospital–Midlands Procalcitonin (PCT) Algorithm



OUTCOME MEASURES

Primary Objective

- Compare antibiotic duration between procalcitonin and no procalcitonin cohorts

Secondary Outcomes

- Confirmed bacterial infection
- Re-initiation of antibiotics for a bacterial infection within 30-days of antibiotic discontinuation
- Length of hospital stay
- Number of Vaso-occlusive crisis (VOC) and acute chest syndrome (ACS) cases
- 30-day mortality
- Protocol adherence
- Rates of antibiotic-associated complications (i.e. rash, neutropenia, thrombocytopenia, or C. difficile infection, or acute kidney injury , hepatotoxicity)

STATSITICAL ANALYSIS

- Categorical variables: reported using descriptive statistics, Chi-square or Fisher's exact tests
- Continuous variables: t-tests or Wilcoxon (Mann-Whitney-U)
- Both simple and multivariable logistic regression models will be used to assess outcomes

RESULTS

- This is research in progress. Results are not available at this time

DISCLOSURES

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

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SCAN ME

2022 ASHP MCM · Las Vegas, NV · December 3rd – 8th

Remdesivir Medication Utilization Evaluation at a Free-standing Children's Hospital

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Background

- Remdesivir is an RNA polymerase antiviral with inhibitory activity against SARS-CoV-viruses.[1,2]
- In April 2022, the U.S. Food and Drug Administration (FDA) expanded remdesivir approval for the treatment of COVID-19 in pediatric patients ≥ 28 days weighing at least 3kg with a positive SARS-CoV-2 test.[3]
- Prior to the FDA's approval in 2022, remdesivir use in the pediatric population was limited and only available through Gilead Sciences compassionate use program, allowing use in only hospitalized pediatric patients with severe COVID-19 infection who met specific criteria.
- Gilead's compassionate programs was soon followed by an FDA issued Emergency Use Authorization (EUA) which eventually allowed for remdesivir use for the treatment of COVID-19 in hospitalized and non-hospitalized pediatric patients with positive SARS-CoV-2 viral testing weighing at least 3.5 kg meeting specific criteria.
- Remdesivir use at our institution requires approval by a member of the Pediatric Infectious Diseases (ID) Division.
- Prior to the "CARAVAN study", data on remdesivir utilization in patients less 18 years was limited leading our evaluation of remdesivir prescribing and monitoring practice at our institution.[4]

Objective

To evaluate the prescribing and monitoring practice of remdesivir at a free-standing children's hospital.

Methods

- Retrospective chart review of all patients ≤ 18 years of age who tested positive for SARS-CoV-2 and received remdesivir for the treatment of COVID-19 infection between April 1, 2020, to February 28, 2022.
  - Pregnant patients were excluded
- Remdesivir prescribing data were captured to include dose, duration, and patient characteristics such as COVID severity, and comorbid high-risk conditions at baseline upon remdesivir initiation.[5-6]
  - COVID-19 severity was defined using WHO disease severity classifications
    - Mild disease: Fever, cough, fatigue, anorexia, shortness of breath, myalgias, and/or other non-specific symptoms without hypoxia.
    - Moderate disease: Symptoms of mild diseases with clinical signs of non-severe pneumonia (SpO_2 ≥ 90% on room air) and/or tachypnea.
    - Severe disease: Clinical signs of severe pneumonia, hypoxia on room air and/or oxygen requirements.
- Within 24 hours of remdesivir's initiation (before or after), baseline laboratory values including serum alanine aminotransferase (ALT), serum aspartate aminotransferase (AST), serum creatinine (SCr), and prothrombin time were evaluated for monitoring practice
  - Adverse events evaluated include increase in SCr by ≥0.3 mg/dL within 48 hours), elevation in AST and ALT levels > upper limit of normal (UNL), elevation in prothrombin time >14.7 sec, and hypersensitivity reactions within one hour of the end of the infusion.

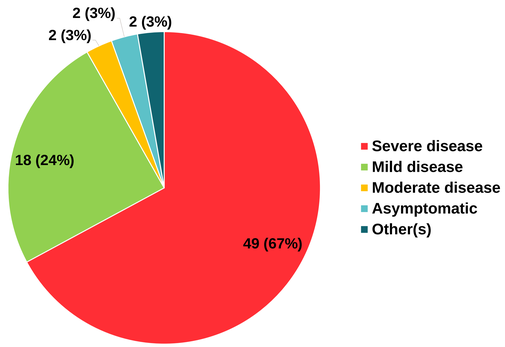
Results

Patient characteristics at baseline	N=73
Median age (IQR) – years	8.0 (4.0-14.0)
Female sex (%)	40.0 (54.8)
Median weight (IQR) – kg	27.6 (14.5-46.7)
Median body mass index (IQR) – kg/m^2	19.1 (16.2-25.9)
Median length of stay (IQR) – days	6 (4.0-17.0)
Mechanically ventilated (%)	14 (19.2)
Patient with confirmed COVID prior to or during treatment (%)	71 (97.3)
Pre-existing high-risk conditions (%)	64 (87.7)
One high risk condition	41 (56.2)
Immunocompromised conditions	19 (26)
Cardiovascular disease	11 (15.1)
Obesity	5 (6.8)
Chronic lung disease	4 (5.5)
Postpartum	1 (1.4)
Sickle cell disease	1 (1.4)
Two or more high risk conditions	23 (31.5)
Death during hospitalization (%) [a]	9 (12.3)

a. Four patients died from COVID-19 complication

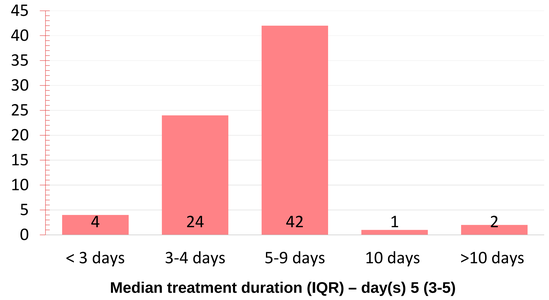
Remdesivir Prescribing Practices	N=73
All patients received a loading dose of 5 mg/kg (max: 200mg) on day one, followed by a maintenance dose of 2.5mg/kg (max: 100mg)	
Median time from COVID-19 diagnosis to remdesivir initiation (IQR) – day(s)	3 (1-5)
Patients with baseline labs (%)	68 (93.2)
Patients with subsequent labs (%)	62 (84.9)
Received dexamethasone or steroid equivalent (%)	47 (64.4)
Remdesivir allocation (%)	
EUA	49 (67.1)
FDA	21 (28.8)
Compassionate use	3 (4.1)

Disease severity at baseline (N=73)



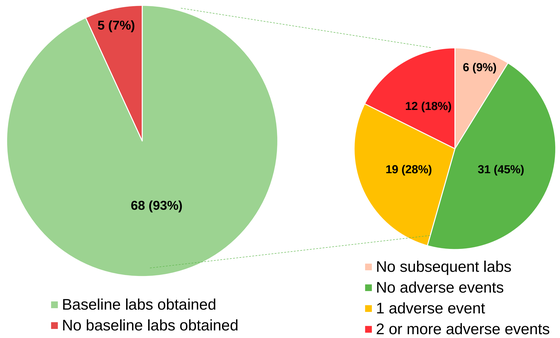
Asymptomatic patients were treated due to their risk factors
Other includes : 1 false positive patient and 1 immunosuppressed patient who was exposure to COVID-19

Duration of remdesivir therapy (N=73)



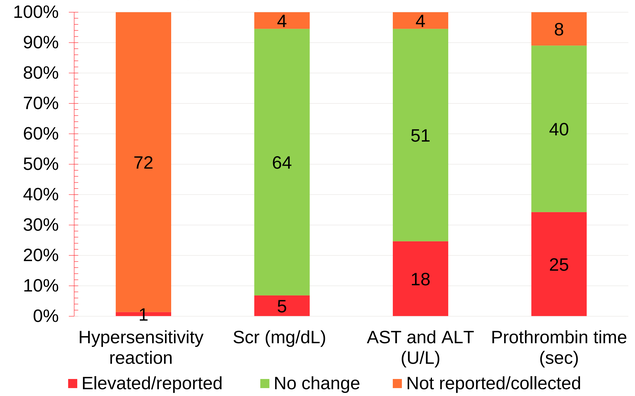
Median treatment duration (IQR) – day(s) 5 (3-5)

Adverse events (N=73)



Results (continued)

Types of adverse events N=73



Conclusions

- Remdesivir was dosed appropriately in our pediatric population with the majority of patients receiving the proper duration of therapy
- The frequency and type of monitoring laboratory values obtained for each patient was inconsistent and absent for some, resulting in an under-estimation of adverse events reported.
- Limitations of our study include this was as a single-centered study with a small sample size

Future Direction

- Improve frequency and consistency of monitoring while on remdesivir through provider education.

Disclosures

The presenters have no disclosures related to this study topic.

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Evaluation of Vancomycin Area Under the Curve Therapeutic Drug Monitoring in Pediatric Patients

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Background

- In 2020, a revised consensus guideline, endorsed by Pediatric Infectious Disease Society, recommended monitoring vancomycin's area under the curve to minimum inhibitory concentration ratio (AUC/MIC) as opposed to a surrogate parameter (i.e. trough)[1]
- Studies in neonatal and pediatric populations are limited to retrospective chart reviews with and without pharmacokinetic modeling[1]
- There continues to be a paucity of pediatric efficacy and toxicity data associated with vancomycin therapy when targeting AUC/MIC of 400-600 mg x h/L

Objectives

Primary Objective

- Assess the proportion of patients attaining AUC/MIC of 400-600 mg x h/L with institutional empiric vancomycin dosing regimens

Secondary Objectives

- Assess incidence of vancomycin-induced acute kidney injury (AKI)
- Identify the time to microbiological clearance in patients with bacteremia

Methods

Design:

- Single-center, retrospective chart review
- July 1, 2021 – June 30, 2022
- Nationwide Children's Hospital, Columbus, Ohio

Inclusion Criteria:

- Received ≥ 2 doses of vancomycin ≤ 250 mg doses
- Vancomycin AUC/MIC therapeutic drug monitoring (TDM) was obtained during the course of therapy

Exclusion Criteria:

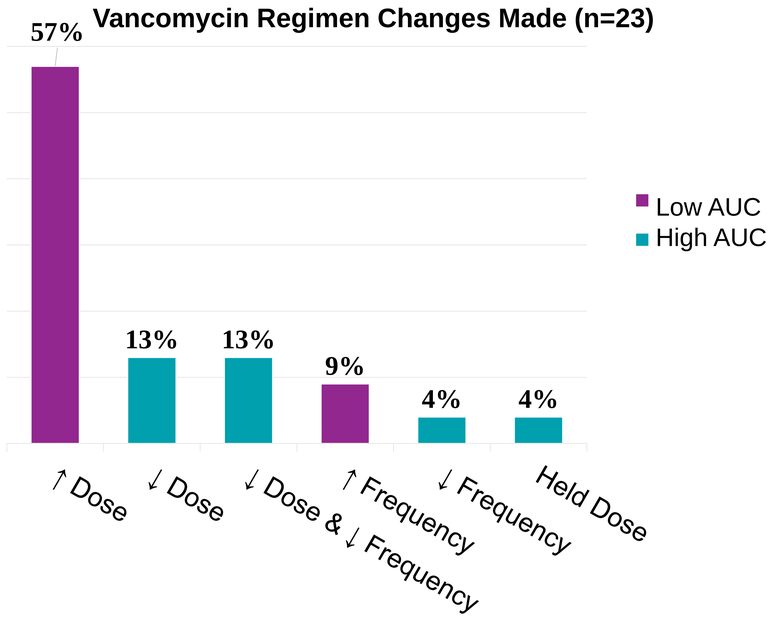
- Incomplete data surrounding vancomycin dosing, levels, time of administration, weight, urine output, or serum creatinine for time points evaluated
- Patients with a trough level obtained resulting in vancomycin therapy adjustment prior to AUC/MIC assessment

Results

Demographics N=42	NICU n=6	Non-NICU n=36
Age, median (IQR)	26 (24,30) weeks GA	1 (0.5,2.5) years
Race, n (%)		
White	2 (33)	27 (75)
Black	2 (33)	4 (11)
Bi-racial	1 (17)	2 (6)
Other	1 (17)	3 (8)
Sex, male, n (%)	2 (33)	17 (47)
Vancomycin Initial Dosing, median, mg/kg (IQR)	15 (15, 15)	20 (15, 20)
Vancomycin Initial Frequency, n (%)		
Every 6 hours	1 (17)	28 (78)
Every 8 hours	4 (67)	7 (19)
Every 12 hours	1 (17)	1 (3)

NICU: neonatal intensive care unit; GA: gestational age; IQR: interquartile range

55% of patients did not achieve AUC/MIC goal



Results Continued

Incidence of AKI

- No incidences of AKI occurred
- Serum creatinine remained at baseline or decreased on day of levels
- On average, urine output increased by ~1 ml/kg/h on day of levels

Time to Microbiological Clearance (n=10)

- Seven patients (70%) obtained microbiological clearance 24 hours after vancomycin initiation with no recurrence
- Two patients (20%) cleared bacteremia within 48 hours
- One patient (10%) cleared bacteremia in 5 days and had an AUC/MIC of 266

Limitations

- Calculations of AUC/MIC TDM by pharmacists were not cross-referenced by any Bayesian software
- AUC was not done on every patient; this single-center cohort may not represent the larger patient population

Discussion & Conclusions

- More than half of total patients did not achieve AUC/MIC TDM goals with empiric dosing
- Around 35% of patients not achieving AUC/MIC TDM goal was due to AUCs higher than desired leading to a dose or frequency reduction
- Further evaluation of more patients along with verifying pharmacist calculations could help with optimizing empiric vancomycin dosing regimens

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Disclosures: 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

ashp Accredited

Assessment of Errors Following Implementation of a Clinical Pharmacist Medication Reconciliation Process in Medically Complex Children Transitioning Between a Post-acute Facility and Acute Care Hospital

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Background

- Medication errors are common among pediatric patients due to various factors that put them at risk, such as weight-based dosing and communication barriers
- Those at increased risk for experiencing these errors and ultimately potential adverse drug events (PADEs) include children managing chronic conditions with multiple medications and those who are transitioning between different locations and levels of care
- An especially complex population includes children and young adults who reside in post-acute or long-term care settings who require frequent transitions to acute care settings
- Frequently children are transferred from a nonprofit specialty hospital [Bethany Children's Health Center (BCHC)] to our tertiary care academic health system [Oklahoma Children's Hospital at OU Health (OCH)]
- A pediatric clinical pharmacist medication reconciliation process has been established for patients transitioning from BCHC to OCH (Figure 1)
- The purpose of this study is to determine the type and frequency of medication errors identified by the pediatric clinical pharmacist team for children and young adults transitioning from a post-acute and long-term care facility to an acute care children's hospital after implementation of the pharmacist medication reconciliation process

Figure 1: Steps of Pharmacist Medication Reconciliation Process

1. Obtain medication list from BCHC in-patient pharmacy
2. Perform review of OCH and BCHC medication lists and identify discrepancies
3. Notify providers of discrepancies
4. Document discrepancies in electronic note
5. Update medication reconciliation tab in electronic medical record

Objectives

- **Primary objective:** Identify the number of unintentional medication reconciliation errors identified by the pediatric clinical pharmacist
- **Secondary objectives**: Identify risk factors for medication reconciliation errors, characterize the severity of errors, determine if the errors were detected by the pharmacist within 24 hours of admission, and identify the incidence of PADEs due to unintentional errors

Methods

- IRB-approved descriptive, retrospective review study
- **Inclusion criteria**:
  - Patients ≤21 years of age
  - Residents of a pediatric post-acute and long-term care facility
  - Patients admitted to an acute care hospital between October 1, 2020 and September 30, 2021

Methods Continued

- **Exclusion criteria**:
  - Admitted for <24 hours
  - No chronic medications prior to admission
  - Incomplete medical records
- **Data collection:**
  - Patient demographics
  - Number of and AHFS category of pre-admission medications.
  - Number and type of coexisting chronic conditions and of chronic technology dependence.
  - The admitting service and location of care
  - Number of transitions between services and locations during hospital stay.
  - Any error identification; including type, severity and reasoning (i.e. formulary difference or holding).

Statistical Analysis

- Descriptive statistics were performed
- Adjusted rate ratios (95% confidence intervals) will be produced
- For medication reconciliation, each medication will be classified by major AHFS class, frequency, formulation, and dose
  - Regression will be performed to examine multiple variable associations
  - Negative binomial/Poisson model will be used with a random statement added to account for repeat hospitalizations

Preliminary Results

Table 1: Demographics (n=77)

Characteristics	Median (IQR) or Number (%)
Male	42 (54.5)
Age (years)	5.3 (1.9-11.6)
Weight (kg)	20.5 (3.1-153)
Length/height (cm)	106 (9.5-182.8)
Chronic technology dependence	67 (87.0)
Types of chronic technology dependence (n=32):	
Gastrostomy or Jejunostomy tube	61 (92.4)
Tracheostomy and ventilator dependence	17 (22.5)
Non-invasive ventilation	26 (34.7)
Admitting service:	
Hospitalist	22 (29.3)
PICU/CICU	41 (54.6)
Surgery	12 (16.0)
Transferred services during admission:	
Number of patients transferred to different services during admission	30 (76.9)
Number of transfers	1 (1-2)

IQR= Interquartile range; PICU= Pediatric intensive care unit; CICU = Cardiac intensive care unit

Preliminary Results Continued

Table 2: Medication Reconciliation Results Per Patient (n=77)

Characteristics	Median (IQR) or Number (%)
Number of medications	21.0 (7.0-50.0)
Number of interventions made to medical team	3 (1.0-5.0)
Number of interventions accepted	2 (0.5-3.0)
Number of updates to medication reconciliation tab	6 (3.0-10.5)
Time needed to perform medication reconciliation process (minutes)	40.0 (32.5-60.0)

IQR= Interquartile range

Medication errors reconciliation process:

- Medication errors identified by the clinical pharmacist team:
  - Sixty-one patients (79.2%) had ≥1 medication error
  - Thirty-eight patients (49.3%) had ≥3 medication errors
  - Seventy-three patients (94.8%) had ≥1 medication update to the medication reconciliation tab by the clinical pharmacist

Limitations

- Small sample size
- Retrospective study
- Single center

Preliminary Conclusions

- Patients had a median of 21 chronic medications upon transfer
- A median of 3 unintentional errors per admission were identified during the pharmacist medication reconciliation
- The majority (79%) of patients required a pharmacist intervention to the medical team upon completion of the medication reconciliation

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Disclosure Statement

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.

Pediatric stress ulcer prophylactic therapy; a review and education (PSTRESS-Version 2)

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BACKGROUND

Stress ulcers are lesions that can develop in the gastric mucosa due to a disruption in the cellular defense mechanism. These lesions can lead to bleeding. Stress ulcer prophylaxis (SUP) is given to reduce the formation of stress-related gastrointestinal (GI) ulcers.[1] Medications used for SUP in children include histamine 2 receptor antagonists (H2RAs) and proton pump inhibitors (PPIs).

Prescribing rates of SUP are increasing, especially in the pediatric population. A study conducted in children admitted to the pediatric intensive care unit (PICU) for critical asthma found rates grew from 25.5% in 2010 to 42.1% in 2019.[2] In a smaller study, children admitted for status asthmaticus with or without SUP had no observed incidence of clinically important bleeding.[3]
Lastly, a small study conducted in five PICUs in Brazil found mechanical ventilation (22.3%) was the most common rationale provided for SUP, followed by informal routine use of prophylaxis (21.4%).[4]

Routine use of SUP needs to be re-examined if there is not a difference between length of hospitalization or GI bleeding.[5,6] It is important to remember that medications can also cause unwanted side effects.[7] Education about SUP can potentially improve prescribing rates and proper discontinuation evaluation. One study found prescribed PPIs decreased significantly from 51% to 30% after dissemination of PPI prescribing guidelines in the PICU.[8] No patients experienced upper GI bleeding before or after.

Initiation or continuation of medications for SUP is inappropriate when the patient does not present any risk factors. Emphasizing criteria for stress ulcer prophylaxis can potentially decrease the overuse of these medications. A previous study completed in 2021 at JSUMC found 66% of patients were inappropriately SUP.[9]

OBJECTIVES

To compare facility use of stress ulcer prophylaxis in the pediatric population.

METHODS

This study is a continuation of a study conducted in 2021 (PSTRESS).

- **Design:** Retrospective and prospective chart review
- **Setting:** Jersey Shore University Medical Center general pediatric units and pediatric intensive care units
- **Intervention:** Pharmacist-led education on the appropriate use of SUP in pediatrics to various healthcare team members.

METHODS & DESIGN

Primary Outcome

Percent change in inappropriate use of stress ulcer prophylaxis in the pediatric units for patients who do not have risk factors for stress ulcer development

Inclusion Criteria

- Aged 18 years and younger
- Admitted to general pediatric unit or pediatric intensive care unit
- Received at least one acid suppressive medication for SUP (IV or PO):
  - Esomeprazole
  - Omeprazole
  - Pantoprazole
  - Famotidine

Exclusion Criteria

- Over 18 years of age
- Admitted to the neonatal intensive care unit
- Use of acid suppressive medication for an indication other than stress ulcer prophylaxis, including:
  - GI bleed
  - Helicobacter pylori eradication
  - Peptic ulcer disease
  - Pathological hypersecretory conditions (i.e. zollinger-ellison syndrome)
  - Gastroesophageal reflux disease
  - Erosive esophagitis
  - Barrett esophagus
  - Eosinophilic esophagitis
  - Treatment of NSAID-induced gastric ulcers

Stage 1 - Education	
November 2022	Provide education to nursing, pharmacy, and providers about stress ulcer prophylaxis in pediatrics

Stage 2 - Post Education	
November 2022 - March 2023	Retrospective chart review of pediatric patients receiving medications for stress ulcer prophylaxis

Criteria for Stress Ulcer Prophylaxis

- Mechanical ventilation > 48 hours
  - Coagulopathy
  - Platelets <50,000
  - INR >1.5
- PTT of >2 times the control value
- Shock
- Surgery >3 hours
- Trauma
- Pneumonia
- Pediatric Risk of Mortality Score ≥10
- Thermal injury >35% of BSA
- Multiple Organ System Failure
- Renal failure
  - SCr ≥2 times upper limit of normal for age or
  - SCr x2 increase in baseline
- Hepatic failure:
  - Total bilirubin ≥4 mg/dL or
  - ALT ≥2x ULN for age
- Neurologic failure:
  - Glasgow Coma Score (GCS) ≤11 or
  - Acute change in mental status with a decrease in GCS 3 points from baseline
- Corticosteroid administration
- Respiratory Failure

ANTICIPATED OUTCOMES

This study will include approximately 500 patient charts. The authors hypothesize that pharmacist-led education will lead to decreasing incidence of inappropriate stress ulcer prophylaxis in the pediatric population.

LIMITATIONS

- Retrospective chart review
- Single center study design
- Shorter study duration

NEXT STEPS

- Data collection and analysis
- Pending IRB approval

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DISCLOSURES

All authors 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.

Evaluation of Ketorolac Ceiling Dose Effects in Pediatrics in the Emergency Department

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Children's Hospital Colorado
Affiliated with University of Colorado Anschutz Medical Campus

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Background

- Ketorolac is a non-steroidal anti-inflammatory drug commonly used for analgesia in the emergency department (ED)
- The Children's Hospital Colorado (CHCO) ED dispensed 1600 doses of intravenous (IV) ketorolac over one year
- Ceiling analgesic effect of ketorolac is established in adult literature[1,2]
- Limited information is available on a ceiling analgesic effect of ketorolac in pediatric patients
- Benefits of using ketorolac:
  - Not associated with tolerance, withdrawal, euphoria, respiratory depression, or sedation
  - Spares opioid usage
- Limitations of using ketorolac:
  - Dose dependent side effects including nephrotoxicity, gastrointestinal adverse events, and bleeding
  - Limited duration of use

Current CHCO Pain Management Dosing

Age	Recommended IV Dose
< 2 years old	0.5 mg/kg/dose Max: 15 mg/dose
2-16 years old	0.5 mg/kg/dose Max: 30 mg/dose
≥ 17 years old	< 50 kg: 15 mg Max: 60 mg/day ≥ 50 kg: 30 mg Max: 120 mg/day

Objectives

Primary

- Change in pain score within one hour of ketorolac administration

Secondary

- Patients requiring rescue analgesia due to inadequate pain reduction with ketorolac
- Incidence of adverse effects in patients receiving ketorolac
  - Bleeding events and nephrotoxicity
- Sub-analysis of patients who receive < 0.5 mg/kg vs 0.5 mg/kg

Methods

Purpose: compare the analgesic effect of IV ketorolac maximized at a dose of 15 mg versus doses greater than 15 mg in patients presenting to a pediatric ED with acute pain

Study Design:
Single-center, retrospective chart review, approved by the Colorado Institutional Review Board

Time Period:
July 1, 2021 – June 30, 2022

Statistical Analysis:
Student T-Test and Chi Squared Test

Inclusion Criteria

- Patients less than 18 years old presenting to the CHCO ED with acute pain and being treated with monotherapy ketorolac for analgesia at a minimum dose of 15 mg

Exclusion Criteria

- Receiving chronic pain medications at home
- Received analgesic medications within the previous 12 hours other than acetaminophen or ibuprofen
- Being treated for headache
- Contraindication to ketorolac
- No reported pain score
- Received a weight-based dose > 0.5 mg/kg
- Patients with Sickle Cell Disease

Data Collection

- Demographics
- Reason for ED visit
- Recent previous surgeries or inpatient hospital stays
- Time to ketorolac administration
- Dose given
- Calculated weight-based dose
- Pain scores:
  - Prior to ketorolac administration
  - 30 minutes after ketorolac administration
  - 60 minutes after ketorolac administration
- Rescue analgesia use:
  - Time given in comparison to ketorolac
  - Medication used
- Adverse effects:
  - Bleeding events and nephrotoxicity

Next Steps

- Data collection currently in progress with results to follow
- Evaluate the dosing strategies currently utilized for ketorolac in the ED
- Implement dosing strategies for the ED to guide safe prescribing practices in order to limit side effects from ketorolac administration

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The authors have no conflicts of interest to disclose

Medication Use Evaluation of Famotidine in a Neonatal Intensive Care Unit

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Background

Famotidine is a histamine-2 receptor antagonist that may be prescribed for evidence-based indications such as complicated gastroesophageal reflux (GER), gastric acid hypersecretion, esophageal atresia, gastrointestinal (GI) bleeds, vocal cord edema with airway compromise, laryngomalacia, post-otolaryngologic procedures, and with diagnoses requiring high-dose steroids. Data regarding the efficacy of famotidine in neonates is lacking; however, acid blocker therapy has been associated with adverse outcomes such as necrotizing enterocolitis and late-onset sepsis. Appropriate utilization of famotidine after a clinical diagnosis is important to mitigate adverse effects.

Objectives

Determine if an indication for use exists for patients that are prescribed famotidine

Elucidate the prescribing practices of famotidine in the NICU

Methods

- Retrospective chart review to determine appropriate utilization of famotidine therapy
- Inclusion criteria: received at least 1 dose of famotidine in the NICU between February 1st, 2022 – July 31st, 2022
- Information to collect: gestational age (GA), birth weight (BW), corrected gestational age (CGA) at famotidine initiation, indication for famotidine use, authorizing provider, and consulting specialty

3.9% of patients in the NICU were exposed to famotidine

Of those patients, 86% had an evidence-based indication

Patient Demographics

Average GA: 35 weeks 0 days
Average BW: 2518 grams
Average CGA at initiation: 40 weeks 2 days
Percent of patients age <1 month at initiation: 41%

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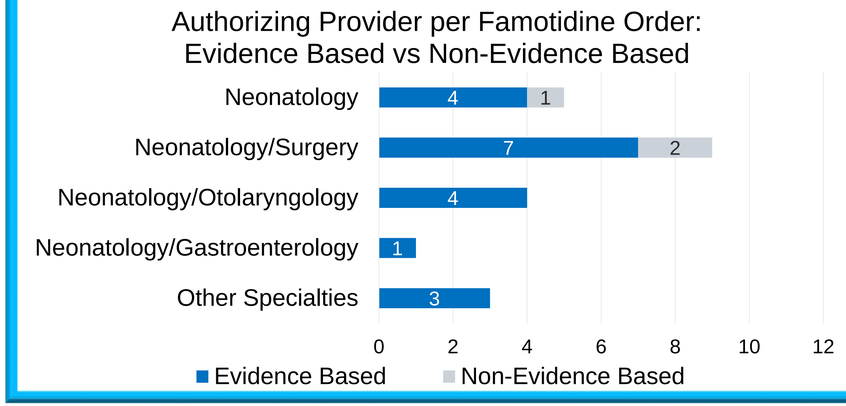
Disclosures

The authors of this presentation disclose the following relationships with commercial interests related to the subject of this poster:
Andre Castaneda – nothing to disclose
Kimberly Tobin – nothing to disclose

Results

Patient Diagnosis	Famotidine Use per Diagnosis
Evidence based	
Complicated GER*	4
Diagnosis Requiring High-Dose Steroids	2
Gastric Acid Hypersecretion	2
Esophageal Atresia	1
GI Bleed	4
Vocal Cord Edema with Airway Compromise / Laryngomalacia / Otolaryngologic Procedure	6
Non-evidence based	
Uncomplicated GER	1
Gastritis	1
Not-Specified	1

pH probe testing completed in 100% of GER diagnosis patients who received famotidine
*Complicated GER includes documented poor growth and/or severe respiratory symptoms



Evaluation of Medication Preparation in the Emergency Department at a Pediatric Tertiary Care Hospital

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BACKGROUND

Role of the Pharmacist in the Emergency Department:

- According to ASHP, emergency medicine pharmacists should be an integral part of the medication procurement and preparation process for medications used in the emergency department.[1]
- As dispensing medications is one of the 5 stages of the medication-use process, emergency medicine pharmacists can influence this stage to prevent medication errors. [1]
- Emergency medicine pharmacists should be involved in the decision-making process regarding which medications will be made available immediately within the emergency department. [1]

Medication Errors in the Emergency Department:

- In the emergency department, medication error risk is estimated to be from 4% to 14%.[2]
- A select few medications may be overridden, prepared, and administered without pharmacist intervention, particularly in code or trauma situations.
- In the emergency department at our institution, intravenous medications are verified by a pharmacist and can either be prepared by pharmacy staff or at the bedside by nurses prior to administration.

PURPOSE

To quantify and categorize the intravenous medications being prepared by either pharmacy or nursing staff in the emergency department.

METHODS

Study Design: IRB approved retrospective review of electronic medical record of infants and children treated in the emergency department at LBCH.

Inclusion Criteria: All medications intended for intravenous administration that were dispensed from automated dispensing cabinets between August 1, 2022 and August 31, 2022.

Exclusion Criteria: Medications on the override list, medications dispensed for trauma patients, or medications dispensed outside of regular pharmacist staffing hours for the emergency department.

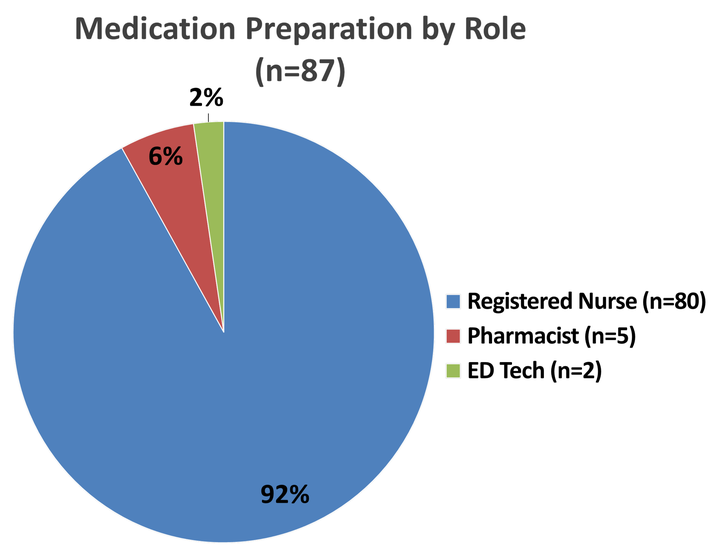
All transactions will be assessed for accuracy, indication, and healthcare role preparing the medication. Data collected will include the location, time, medication name, quantity dispensed, and user title.

PRELIMINARY RESULTS

N = 87 medication orders for intravenous administration

Indication	Number of Medication Orders
Antibiotic	74 (85.1%)
Pain	2 (2.3%)
Other	11 (12.6%)

PRELIMINARY RESULTS



CONCLUSIONS

- Preliminary data indicates that the majority of intravenous medications that are available in the emergency department at our institution are largely prepared by nursing staff.
- Antibiotics are the main class of intravenous medications that are prepared and administered by nursing staff.
- Data collection for this evaluation is ongoing and the results are subject to change.

DISCLOSURE

The authors of this presentation have nothing to disclose.

REFERENCES

1. Ortmann, Melinda J et al. "ASHP Guidelines on Emergency Medicine Pharmacist Services." American journal of health-system pharmacy : AJHP : official journal of the American Society of Health-System Pharmacists vol. 78,3 (2021)
2. Di Simone, Emanuele et al. "Medication Errors in the Emergency Department: Knowledge, Attitude, Behavior, and Training Needs of Nurses." *Indian journal of critical care medicine : peer-reviewed, official publication of Indian Society of Critical Care Medicine* vol. 22,5 (2018)

Pediatric Diabetic Ketoacidosis
Expanding Pharmacist Knowledge Within a Primarily Adult Community Hospital

Kimberly James, PharmD; Chris Ward, RPh, BCPS; and Nicole Vettese, PharmD, BCPS
PeaceHealth St. Joseph Medical Center, Bellingham, WA

PeaceHealth
St. Joseph MedicalCenter

Purpose/Background

When evaluating the ability to expand care for pediatric patients, a knowledge gap was identified within the pharmacy department regarding recognizing and treating diabetic ketoacidosis. With the implementation of updated treatment plans, it is vital that pharmacists are provided education as the transition to expand care within the community is occurring and will continue in the near future.

This project was designed to correct gaps in knowledge that pharmacists need for safe verification, preparation, and dispensing in select patients who present with diabetic ketoacidosis.

Study Design/Methodology

Study Design: Provide clinical pharmacy staff with comprehensive education regarding safe and efficacious use of institution-specific diabetic ketoacidosis treatment plans for pediatric patients using interactive, computer-based learning modules**.**

Inclusion Criteria: Pharmacists currently employed at PeaceHealth St. Joseph Medical Center

Exclusion Criteria: Pharmacists who do not complete the pre- and post- assessments for the corresponding material.

Statistical Considerations: The questions will be asked in multiple-choice format. Pre- and post- module assessments and surveys will be used to qualitatively assess the learning material. Data will be analyzed using an appropriate statistical test.

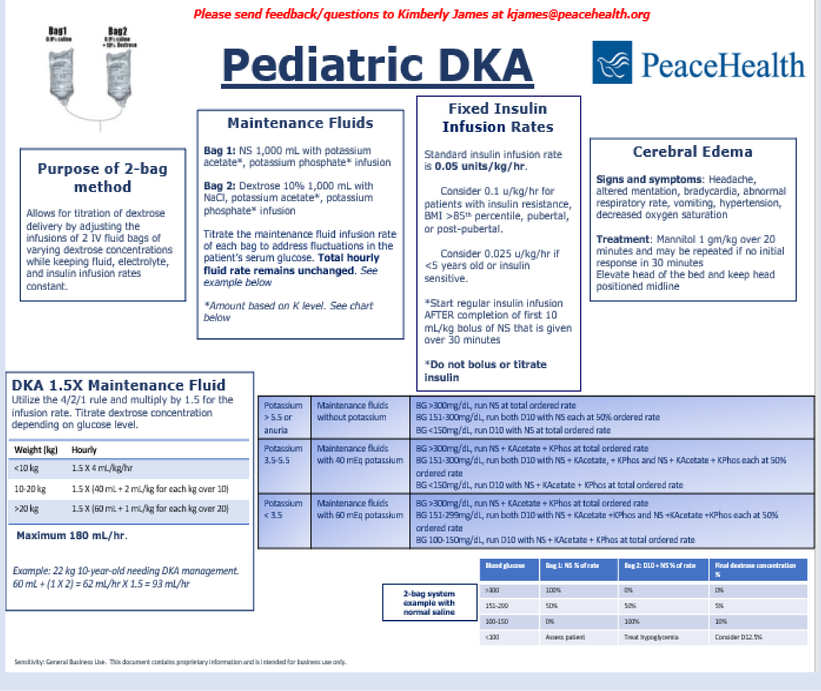
Learning Module Components

Pre-test that will ask pharmacists questions to gain an understating of training, number of years worked in a pharmacy, and prior knowledge about the subject.

Module that will consist of recorded voice over a PowerPoint video. The study subject will have as much time with the video that they deem prudent.

Post- test will mirror the pre- test without the educational background questions repeated. There will be questions to test competency and level of comfort with subject material.

Informational Handout



Please send feedback/questions to Kimberly James at kjames@peacehealth.org

Pediatric DKA

PeaceHealth

Purpose of 2-bag method

Allows for titration of dextrose delivery by adjusting the infusions of 2 IV fluid bags of varying dextrose concentrations while keeping fluid, electrolyte, and insulin infusion rates constant.

Maintenance Fluids

Bag 1: NS 1,000 mL with potassium acetate*, potassium phosphate* infusion

Bag 2: Dextrose 10% 1,000 mL with NaCl, potassium acetate*, potassium phosphate* infusion

Titrate the maintenance fluid infusion rate of each bag to address fluctuations in the patient's serum glucose. **Total hourly fluid rate remains unchanged**. *See example below*

**Amount based on K level. See chart below*

Fixed Insulin Infusion Rates

Standard insulin infusion rate is **0.05 units/kg/hr**.

Consider 0.1 u/kg/hr for patients with insulin resistance, BMI >85th percentile, pubertal, or post-pubertal.

Consider 0.025 u/kg/hr if <5 years old or insulin sensitive.

*Start regular insulin infusion AFTER completion of first 10 mL/kg bolus of NS that is given over 30 minutes

***Do not bolus or titrate insulin**

Cerebral Edema

Signs and symptoms: Headache, altered mentation, bradycardia, abnormal respiratory rate, vomiting, hypertension, decreased oxygen saturation

Treatment: Mannitol 1 gm/kg over 20 minutes and may be repeated if no initial response in 30 minutes
Elevate head of the bed and keep head positioned midline

DKA 1.5X Maintenance Fluid

Utilize the 4/2/1 rule and multiply by 1.5 for the infusion rate. Titrate dextrose concentration depending on glucose level.

Weight (kg)	Hourly
<10 kg	1.5 X 4 mL/kg/hr
10-20 kg	1.5 X (40 mL + 2 mL/kg for each kg over 10)
>20 kg	1.5 X (60 mL + 1 mL/kg for each kg over 20)

Maximum 180 mL/hr.

Example: 22 kg 10-year-old needing DKA management.
60 mL + (1 X 2) = 62 mL/hr X 1.5 = 93 mL/hr

Potassium > 5.5 or anuria	Maintenance fluids without potassium	BG >300mg/dL, run NS at total ordered rate BG 151-300mg/dL, run both D10 with NS each at 50% ordered rate BG <150mg/dL, run D10 with NS at total ordered rate
Potassium 3.5-5.5	Maintenance fluids with 40 mEq potassium	BG >300mg/dL, run NS + KAcetate + KPhos at total ordered rate BG 151-300mg/dL, run both D10 with NS + KAcetate, + KPhos and NS + KAcetate + KPhos each at 50% ordered rate BG <150mg/dL, run D10 with NS + KAcetate + KPhos at total ordered rate
Potassium < 3.5	Maintenance fluids with 60 mEq potassium	BG >300mg/dL, run NS + KAcetate + KPhos at total ordered rate BG 151-299mg/dL, run both D10 with NS + KAcetate +KPhos and NS +KAcetate +KPhos each at 50% ordered rate BG 100-150mg/dL, run D10 with NS + KAcetate + KPhos at total ordered rate

2-bag system example with normal saline

Blood glucose	Bag 1: NS % of rate	Bag 2: D10 + NS % of rate	Final dextrose concentration %
>300	100%	0%	0%
151-299	50%	50%	5%
100-150	0%	100%	10%
<100	Assess patient	Treat hypoglycemia	Consider D12.5%

Sensitivity: General Business Use. This document contains proprietary information and is intended for business use only.

Implementation Timeline

August 2022: Handout given to ED pharmacists

December 2022: Upload materials onto the computer-based learning platform

January 2023: All clinical pharmacy staff complete learning module

Outcome

Expected Outcome of the Study: Increase education and confidence of the clinical pharmacist in a quantifiable fashion, as well as identify additional gaps in knowledge regarding pediatric diabetic ketoacidosis.

References

1. Haas NL, Gianchandani RY, Gunnerson KJ, Bassin BS, Ganti A, Hapner C, Boyd C, Cranford JA, Whitmore SP. The Two-Bag Method for Treatment of Diabetic Ketoacidosis in Adults. J Emerg Med. 2018 May;54(5):593-599. doi: 10.1016/j.jemermed.2018.01.004. Epub 2018 Apr 5. PMID: 29628184.
2. Wolfsdorf J, Glaser N, Sperling M, American D. Diabetic ketoacidosis in infants, children, and adolescents: A consensus statement from the American Diabetes Association. *Diabetes Care*. 2006;29(5):1150-1159. .

Disclosures

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.

IRB Exempt

Medication Use Evaluation of Oral Ketamine Dosing in a Free-Standing Pediatric Hospital

Savannah Pullin, PharmD; Lauren Duran, PharmD, BCPPS
Cook Children's Medical Center

Background

Ketamine is a centrally-acting N-methyl-D-aspartate receptor antagonist commonly used as an anesthetic. Off-label, oral ketamine is used for its analgesic and anxiolytic properties at sub-dissociative and sub-anesthetic dosing. It can be used as an adjunct agent to opioid analgesics and has a more favorable side effect profile. Limited recommendations regarding oral ketamine dosing exist. Doses between 0.25 mg/kg to 1 mg/kg, given three times daily for up to fourteen days, are considered safe and tolerable for pediatric use. The objective of this medication use evaluation is to identify dosing trends of oral ketamine for analgesia in inpatient pediatric patients.

Objectives

Assess starting dose of oral ketamine throughout the medical center

Assess the maximum dose administered

Methods

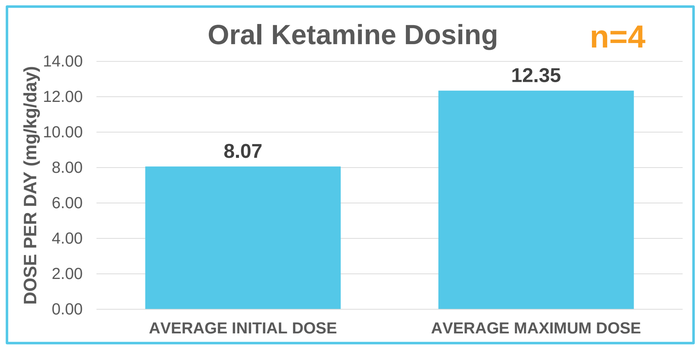
- Study Design:
  - Retrospective chart review to evaluate prescribing patterns of oral ketamine from August 1, 2021 through July 31, 2022
  - Inclusion criteria:
    - 0-18 years of age
    - Initiated on oral ketamine while at Cook Children's
    - Duration greater than 24 hours
- Data Collection:
  - Age
  - Weight (kg)
  - Sex
  - Ordering provider group
  - Doses ordered (mg/kg)
  - Indication
  - Concomitant opioid use

Disclosures

The authors of this presentation disclose the following relationships with commercial interests related to the subject of this poster:
Savannah Pullin, PharmD: Nothing to disclose
Lauren Duran, PharmD, BCPPS; Nothing to disclose

Average starting dose for oral ketamine was greater than the recommended dosing range

Results



The average maximum dose was 1.5 times higher than the average initial dose

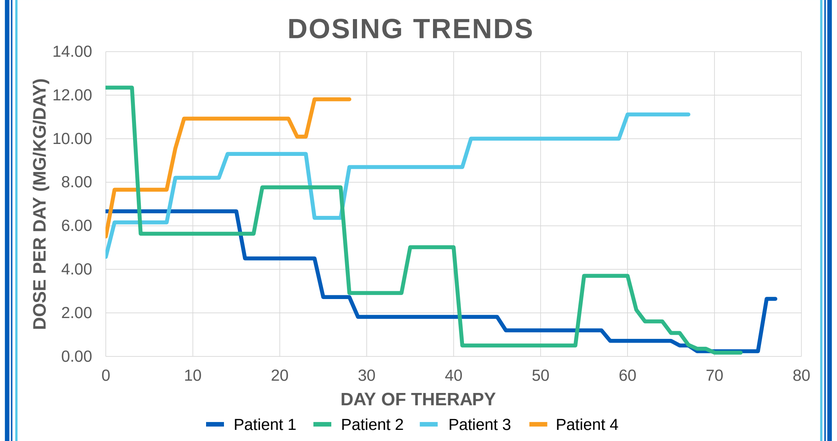
All evaluated patients were receiving concomitant scheduled opioids

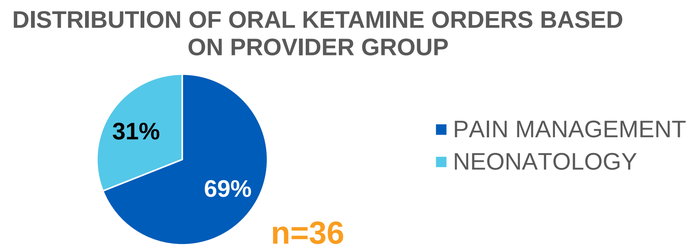
Four patients met inclusion criteria; ages ranged from 3 to 7 months of age

References

1) Product Information: KETALAR(R) intravenous, intramuscular injection, ketamine HCl intravenous, intramuscular injection. Par Pharmaceutical (per FDA), Chestnut Ridge, NY, 2020.
2) Ketamine. In: Lexi-drugs online [database on the internet]. Hudson, Ohio: Wolters Kluwer Clinical Drug Information, Inc Accessed August 10, 2021.
3) Bredlau AL, McDermott MP, Adams HR, et al. Oral ketamine for children with chronic pain: a pilot phase 1 study. J Pediatr. 2013;163(1):194-200.e1. doi:10.1016/j.jpeds.2012.12.077

Results





Discussion

The average starting dose of oral ketamine was 8.07 mg/kg/day which is higher than the recommended 0.75 to 3 mg/kg/day. These results may be explained by the use of oral ketamine for adjunct sedation and sedation wean management in addition to pain management. Furthermore, higher starting doses were used for adjunct sedation management and doses decreased over time. Concomitant use of scheduled opioids in all patients was expected as oral ketamine is recommended as an adjunct agent for analgesia. Prescribing patterns based on provider groups were appropriate to the patient population and indication. To further evaluate dosing trends at this pediatric institution, additional evaluation of a broader period of time may be indicated.

Peace and Quiet in the PENThouse: Medication Use and Dosing Strategies of PENTobarbital Continuous Infusion in Pediatric Patients at a Children's Hospital

Jillian M. Connolly, PharmD[A]; Jeffrey Moss, PharmD, BCCCP[A]; Saraswati Kache, MD[B]

[A]Lucile Packard Children's Hospital Stanford, Palo Alto, CA; [B]Stanford School of Medicine, Palo Alto, CA

Introduction

- Pentobarbital is a barbiturate with sedative, hypnotic, and anti-seizure properties that can be utilized in the pediatric intensive care unit for multiple indications including elevated intracranial pressure, refractory status epilepticus, and sedation refractory to standard therapy[1]
- Pentobarbital has a fast onset of action (3-5 minutes) after IV administration with a prolonged half-life of 15 to 50 hours[1]
- Best practices of CI pentobarbital administration include administration of a loading dose to overcome the prolonged half-life and time to steady state therapeutic effect, as well as gradual dose titration upon discontinuation[2]

Objective

- To assess the use of continuous infusion (CI) pentobarbital in pediatric patients and identify areas for improvement in administration, dosing, ordering, monitoring, and management of this high risk medication

Disclosures

- The presenters have no disclosures relating to the study topic.

Methods

- Retrospective chart review of patients admitted to the pediatric or cardiovascular intensive care units at LPCH between September 1, 2017 and September 1, 2022

Inclusion Criteria

- Ordered continuous infusion pentobarbital between September 1, 2017 and September 1, 2022

Exclusion Criteria

- Primary indication for CI pentobarbital other than refractory SE or increased ICP

Results

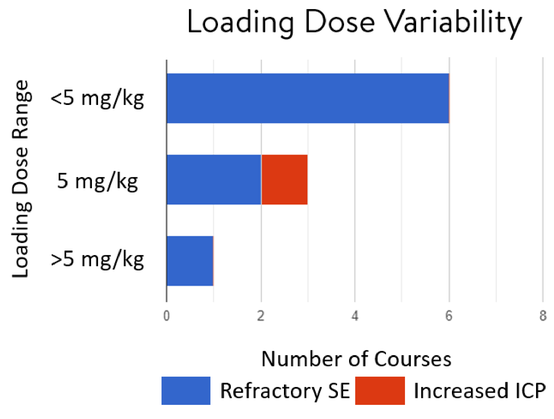
- 19 patients received 23 discrete courses of pentobarbital as continuous infusion over a 5 year period
- 5/23 courses were excluded as the primary indication for CI pentobarbital was sedation
- 18 pentobarbital courses across 14 individual patients were included in the final analysis

Baseline Characteristics (N=14)

Age (years), mean (± SD)	8.1 (± 6.9)
Sex (female), n (%)	7 (50)
Primary Indication, n (%) (N=18) •Elevated ICP •Refractory SE	 3 (17) 15 (83)

Results (N=18)

Duration of therapy (days), mean (range)	3.1 (0.03 – 8.1)
Loading dose utilized (Yes), n (%)	10 (55)
Loading dose (mg/kg), mean (range)	3.4 (0.8 -10)
Dose tapered before discontinuation (Yes), n (%)	13 (72)
Starting dose of pentobarbital CI (mg/kg/hr), mean (range)	0.98 (0.1 – 3)



Discussion

- The primary indication for initiation of CI pentobarbital at our institution was for refractory status epilepticus
- The management of initiation, dosing, and discontinuation of pentobarbital at our institution was highly variable between patients, providers, and potentially specialties
- There is significant under-dosing of the initial bolus loading dose compared to recommended dosing of 5 mg/kg for refractory SE and 10 mg/kg for elevated ICP

Limitations

- Retrospective nature of analysis made it impossible to collect monitoring parameters (i.e., EEG data, ICP)

Conclusions

- Our pediatric institution will benefit from the development of a clinical practice guideline and order sets to outline best practices regarding the management of patients on continuous infusion pentobarbital for refractory status epilepticus or elevated intracranial pressure in the intensive care unit

Future Directions

- Discussions with the neurocritical care team about results and interest in development of improved clinical decision making and ordering tools
- Inclusion of description of prior therapies (i.e., midazolam CI for refractory SE and hyperosmolar therapies for increased ICP) for more robust data comparison

References

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2. Kim Sj, Lee DY, Kim JS. Neurologic outcomes of pediatric epileptic patients with pentobarbital coma. *Pediatr Neurol.* 2001; 25:217-20.

Evaluation of the clinical impact of decreasing the maximum osmolarity of neonatal peripheral parenteral nutrition

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[1] Department of Pharmacy, The Johns Hopkins Hospital, Baltimore, MD, USA; [2] Department of Pharmacy, Children's Hospital Colorado, Aurora, Colorado, USA; [3] Department of Neonatology, Johns Hopkins Hospital Bayview Medical Center, Baltimore, MD, USA; [4] Department of Clinical Nutrition, The Johns Hopkins Hospital, Baltimore, MD, USA; [5]Department of Pharmacy, Johns Hopkins Bayview Medical Center, Baltimore, MD, USA

Background

- Current American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines recommend an upper osmolarity limit for peripheral parenteral nutrition (PPN) of 900 mOsm/L
- Few retrospective cohort studies have been conducted in the pediatric population suggesting that osmolarity limits above 900 mOsm/L may be safely tolerated
- On October 1st, 2020, two neonatal intensive care units (NICUs) in a single health-system adopted an osmolarity limit of 900 mOsm/L for neonatal and pediatric PPN, which was a reduction from the previous limit of 1000 mOsm/L

Objective

The objective of this study was to describe the clinical impact of lowering the PPN maximum osmolarity limit from 1000 mOsm/L to 900 mOsm/L in patients in two NICUs

Methods

- An institutional review board approved retrospective, observational, cohort study was conducted
- Data was collected between August 9th, 2020 and September 30th, 2021 at The Johns Hopkins Hospital (JHH) and Johns Hopkins Bayview Medical Center (JHBMC) NICUs
- Inclusion criteria:
  - Inborn neonates to JHH or JHBMC admitted to the NICU
  - Received PPN for at least 3 consecutive days within the first 14 days of life
- Exclusion criteria: fluid restriction defined as an initial combined intravenous lipid emulsion and PPN order volume of < 60 mL/kg/day
- Primary outcome: the percentage of patients who met goal daily macronutrient doses from PPN
- Secondary outcomes:
  - Percentage of goal daily calories met
  - Incidence of clinically significant peripheral intravascular (PIV) infiltrates

Methods *(continued)*

	Goal daily amino acid dose (g/kg/day)	Goal daily dextrose (GIR*, mg/kg/min)	Goal daily lipid dose (g/kg/day)	Goal daily calories (kcal/kg/day)
0-24 hours of life	Preterm: 2-3 Term: 2-3	> 4	0-1	90-110
24-48 hours of life	Preterm: 3-4 Term: 2-3	6-8	2-3	90-110
> 48 hours of life	Preterm: 3-4 Term: 2-3	> 8	2-3	90-110

*GIR: glucose infusion rate

- Pre-implementation cohort: PPN orders between August 9th, 2020 and September 30th, 2020 (osmolarity limit of 1000 mOsm/L)
- Post-implementation cohort: PPN orders between October 1st, 2020 to January 3rd, 2021 (osmolarity limit of 900 mOsm/L)

Results

Total of 200 PPN orders representing 57 patients were included

- Pre-implementation cohort: 100 PPN orders and 25 patients
- Post-implementation cohort: 100 PPN orders and 32 patients

	Total Patients (n=57)	Pre-Implementation Cohort (n=25)	Post-Implementation Cohort (n=32)	P value
Gender, n (%) Male	29 (51)	9 (36)	20 (63)	0.06
Gestational age (weeks), median (IQR)	33.7 (32.3-34.4)	33.2 (32.1-34.4)	34.0 (32.8-34.4)	0.1
Race, n (%) White Black Hispanic Asian Other	 26 (46) 19 (33) 1 (2) 4 (7) 7 (12)	 10 (40) 7 (28) 1 (4) 2 (8) 5 (20)	 16 (50) 12 (38) 0 (0) 3 (9) 4 (13)	0.4

	Total Orders (n=200)	Pre-Implementation Cohort (n=100)	Post-Implementation Cohort (n=100)	P value
Dispense unit, n (%) JHH NICU JHBMC NICU	 145 (73) 55 (27)	 63 (63) 37 (37)	 82 (82) 18 (18)	0.004
PMA at PPN order (weeks), median (IQR)	33 (32-34)	33 (32-34)	34 (33-34)	0.4
Order dosing weight (kg), median (IQR)	1.96 (1.65-2.36)	1.84 (1.43-2.82)	2.10 (1.73-2.33)	0.05

*PMA: post-menstrual age

Results *(continued)*

	Pre-Implementation Cohort (n=100)	Post-Implementation Cohort (n=100)	P value
Osmolarity (mOsm/L), median (IQR)	990.4 (981.2-996.4)	892.8 (884.2-896.3)	< 0.001
Amino acid dose at goal, n (%)	45 (45)	24 (24)	0.003
GIR at goal, n (%)	30 (30)	23 (23)	0.3

	Pre-Implementation Cohort (n=100)	Post-Implementation Cohort (n=100)	P value
Calories from PPN and lipids (kcal/kg/day), median (IQR)	52.6 (44.0-64.3)	46.9 (37.4-57.7)	0.2
Calories from PPN and lipids at goal, n (%)	1 (1)	1 (1)	1.0
Calories from PPN, lipids, and enterals (kcal/kg/day), median (IQR)	64.2 (51.8-76.4)	57.9 (46.2-72.6)	0.05
Calories from PPN, lipids, and enterals percent of goal, median (IQR)	71.3 (57.5-84.9)	64.3 (51.4-80.6)	0.05
Hyaluronidase administration for PPN infiltration, n (%)	2 (2)	1 (1)	0.6

Conclusion

- Limitations include the inability to control for confounding factors such as differences in dispensing unit between groups and data collection limitations including breastmilk fortification
- The lower PPN osmolarity limit of 900 mOsm/L significantly limited the ability to provide goal amino acid and lipid doses to NICU patients compared to an osmolarity limit of 1000 mOsm/L
- A PPN osmolarity limit of 1000 mOsm/L may be more appropriate for neonatal patients to optimize clinical nutrition outcomes

References

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Melatonin Utilization and Prescribing Practice Patterns Among Pediatric Healthcare Providers

Kelsey Molotsky, PharmD, Tracee L Ridley-Pryor, DNP, APRN, PMHNP-BC, Tasha Bedwell, PharmD, Jasmine Sahni, PharmD, MBA, BCPS, and William A. Mabry, PharmD, MBA

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BACKGROUND

- The American Academy of Pediatrics recommends that melatonin treatment be evaluated on a case-by-case basis[1]
- Melatonin appears to be a safe and effective pharmaceutical treatment for a wide range of sleep-related symptomology in the pediatric population[2]
- Since melatonin is considered a dietary supplement and is often used off-label, there are no established guidelines or long-term studies evaluating dosing, quality, and safety[3]
- There are limited reports of use in hospitalized pediatric patients

PURPOSE

To assess melatonin utilization and prescribing practice patterns among pediatric healthcare providers in both the inpatient and outpatient settings at Le Bonheur Children's Hospital (LBCH)

METHODS

IRB approved retrospective review of the electronic medical record

Inclusion Criteria

- Patients 0-18 years of age in both inpatient and outpatient settings at LBCH from January 1, 2019 to December 31, 2021
- Sample obtained by including data from first week of each month
- Received ≥ 1 dose melatonin with documentation on electronic medical record, or received ≥ 1 prescription outpatient

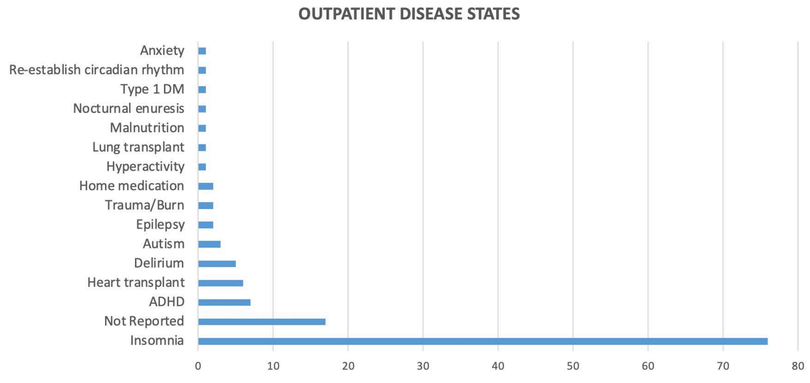
Information Collected

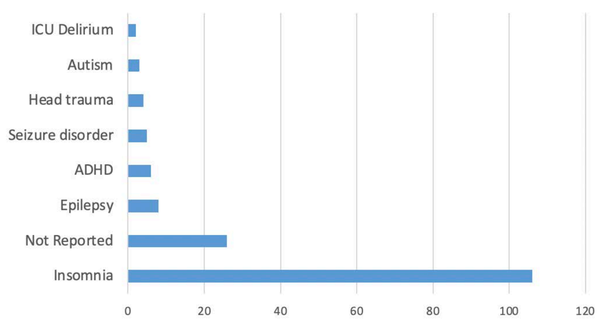
- Patient demographics: sex, age, weight
- Associated disease state with melatonin therapy
- Dose (total and mg/kg)
- Patient unit
- Continued from the ICU (intensive care unit)
- Prescribed at discharge

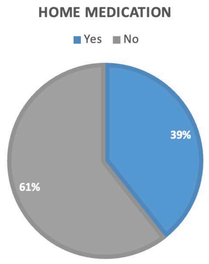
DISCLOSURE

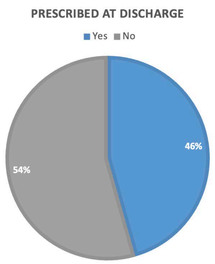
The authors of this presentation have nothing to disclose and no financial or personal relationships with commercial entities that may have direct or indirect interest in the subject matter of this presentation

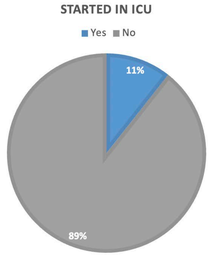
RESULTS











DISCUSSION

Outpatient

- 127 prescriptions were evaluated (57 female, 70 male)
- Doses ranged from 1 – 10 mg (mean 0.15 mg/kg)
- 76/127 (59%) were for insomnia

Inpatient

- 160 orders were evaluated (68 female, 92 male)
- Doses ranged from 0.2 – 20 mg (mean 0.13 mg/kg)
- 106/160 (66%) were for insomnia
- 63/160 (39%) were continued inpatient as a home medication
- 17/160 (11%) were started in the ICU
- 73/160 (46%) were prescribed melatonin at discharge

CONCLUSIONS

- Melatonin is a frequently prescribed medication in both the inpatient and outpatient settings at LBCH
- The most common associated disease state for melatonin is insomnia, followed by others such as epilepsy, attention deficit hyperactivity disorder (ADHD), seizure disorder, delirium, and more
- Continued research and long-term studies regarding melatonin treatment in pediatric patients is needed

FUTURE DIRECTIONS

- A survey will be sent to both inpatient and outpatient providers at LBCH to assess current knowledge and confidence in prescribing or recommending melatonin in pediatric patients
- Learning the current prescribing and recommendation practices by all different types of providers will develop educational opportunities and potentially evidence-based treatment for the pediatric population

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Evaluation of Azithromycin Prescribing Practices in Pediatric Patients at a Community Teaching Hospital

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Background

- Azithromycin (AZM) is a broad-spectrum antibiotic used for the treatment of pediatric infections including[1]:
  - Community acquired pneumonia (CAP)
  - Pertussis
  - Sexually transmitted infections (STIs)
  - *Salmonella* infections
- Inappropriate use of azithromycin has been implicated in the emergence of macrolide resistant organisms, such as *S. pneumoniae, S. pyogenes and M. pneumoniae*[2,3,4,5]
- Recent literature has investigated the use of AZM in the treatment of respiratory syncytial virus (RSV) and asthma, however the evidence is insufficient to include these indications in national guidelines[6,7,8]

Objective

- Assess institutional appropriateness of AZM prescribing practices compared to national guidelines for CAP, Pertussis, STIs and *Salmonella* infections

Methods

Study design:
- Single center, Institutional Review Board approved retrospective chart review of patients receiving AZM from January 2021 to September 2022

Inclusion criteria:
- Pediatric patients ≤ 18 years
- Received at least one dose of AZM

Exclusion criteria:
- Patients ordered AZM who did not receive any doses

Data points:
- Demographic characteristics
- AZM dose
- Patient history (past medical, social, travel)
- Vaccination status
- White blood cell count (WBC), C-reactive protein (CRP), procalcitonin, and erythrocyte sedimentation rate (ESR)
- Microbiology culture and respiratory viral panel (RVP)
- Diagnostic imaging

Criteria for appropriate therapy:
- CAP: Children ≥ 5 years with clinical and radiologic evidence of pneumonia or < 5 years with worsening symptoms on first line antibiotic therapy
- Pertussis: Clinical whooping cough with or without a positive *Bordetella pertussis* PCR
- Infection: Positive culture results for *Salmonella*, *Chlamydia trachomatis*, other food borne pathogens, or STI typically treated with AZM

Primary Outcome:
- Appropriateness of AZM therapy

Secondary Outcomes:
- Age stratification of AZM prescribing
- Adverse effects associated with AZM

Results

Table 1: Baseline Characteristics

Characteristics	N = 101
	median, (IQR)
Age – y	3 (1.25, 6)
Weight – kg	14.10 (10.32, 25.38)
Loading Dose– mg/kg	9.92 (9.66, 10.10)
Maintenance Dose – mg/kg	5 (4.85, 5.24)
	n (%)
Gender – male	52 (51.4%)
Hospital Unit	
- Intensive Care (PICU)	54 (53.5%)
- General Medicine	8 (8%)
- Emergency Room (ER)	36 (36%)
- Hematology/ Oncology	3 (3%)

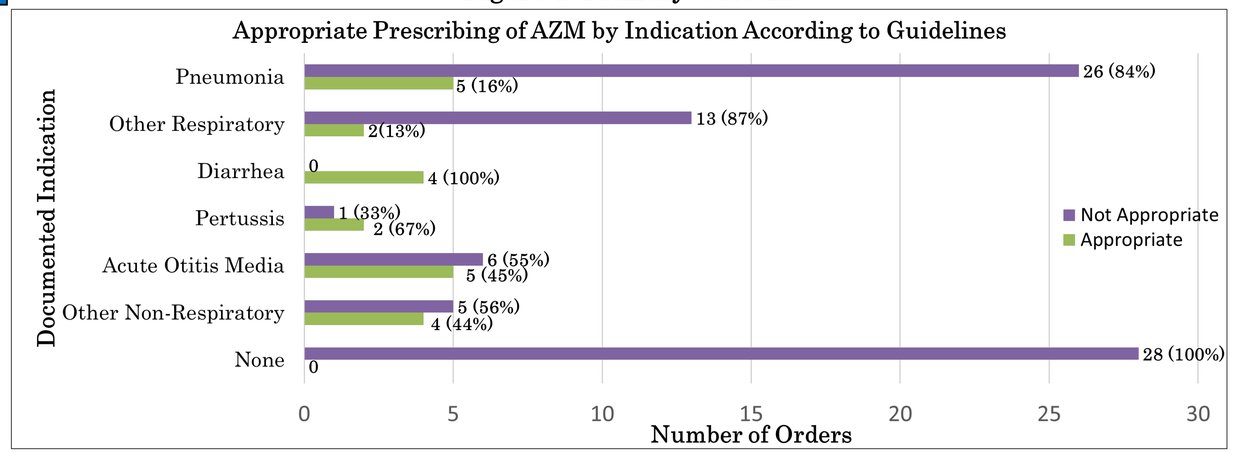
IQR = Interquartile range

Table 2: Secondary Outcome Respiratory Illness Age Stratification

Characteristics	< 5 Years (N = 53)	≥ 5 Years (N=28)
	n (%)	
Vaccination Status		
- Up to date	46 (87%)	24 (86%)
- Not up to date	5 (9.4%)	1 (3.5%)
- Unknown	2 (3.8%)	3 (11%)
History of Asthma	4 (7.5%)	10 (36%)
Multiple viruses	21 (40%)	5 (18%)
Procalcitonin > 2	3 (5.7%)	1 (3.6%)
Chest X-Ray Suggestive of Pneumonia	19 (36%)	10 (36%)
Appropriate Use of AZM*	5 (9.4%)	7 (25%)

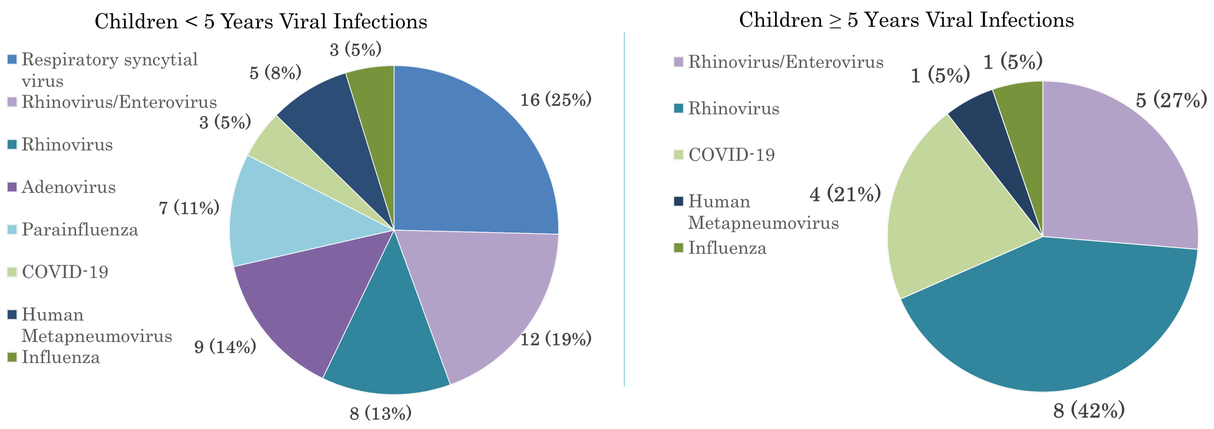
*Assessed by pediatric infectious diseases attending

Figure 1: Primary Outcome



Other Respiratory: bronchiolitis, asthma exacerbations, acute chest syndrome, and cough
Other Non-Respiratory: *Chlamydia* conjunctivitis, fever, bullous myringitis, empiric *Bartonella*, and mouth injury

Figure 2: Viral Infection Age Stratification



Results

Enrollment
- 101 of the 104 charts reviewed met inclusion criteria

Adverse Events
- One patient had a prolonged QTc interval, and three patients had mild increase in transaminases
- Adverse events were not solely attributed to AZM

Prescribing by Unit
- 48 of 54 orders (89%) and 25 of 36 orders (69%) for AZM prescribed in the PICU and ED, respectively, were determined to be inappropriate

Pneumonia and Viral Infections
- 23 of 26 (88%) patients inappropriately treated for pneumonia had a known viral infection

Limitations

- Retrospective chart review
- Details of patient's clinical course not always available due to EMR limitations
- Missing information from outside hospital records
- Majority of patients seen in the ER did not have labs or RVPs
- Only one pediatric infectious diseases physician available to determine appropriateness of therapy

Discussion/Conclusions

- Respiratory illness was the most common reason for the use of azithromycin in pediatric patients
- Most of the inappropriate prescribing of AZM occurred in the PICU and ED
- AZM was over prescribed in patients under 5 years who were admitted with documented viral infections, and insufficient evidence to suggest bacterial co-infections

Future Directions

- Providing education to the ER and PICU on appropriate indications for azithromycin
- Developing institutional guidelines for acute otitis media and community acquired pneumonia
- Case control study comparing patients who received AZM versus those who did not in the setting of respiratory illness and viral infection

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The authors have nothing to disclose

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Evaluating Initial Antibiotic Duration and Safety Outcomes in the Neonatal ICU

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Background

- Antibiotics in the neonatal ICU (NICU) are used to treat early and late onset sepsis (EOS & LOS)
  - o EOS antibiotic regimen → ampicillin + gentamicin utilized at Kentucky Children's Hospital (KCH)
- Adverse events related with antibiotic use in neonates:
  - o Alters gastrointestinal microbiome, increasing risk of necrotizing enterocolitis (NEC)
  - o Renal function impairment (gentamicin)
  - o Antibiotic resistance
- KCH antimicrobial stewardship initiative – automatic 48 hour stop date on all antibiotics while awaiting culture results

Incidence of EOS – 0.8 per 1000 live births[1]

Incidence of NEC – 1 to 3 per 1000 live births[2]

NEC is ~2 times as likely with prolonged initial empiric antibiotics[3]

Research Objective

To evaluate the duration of antibiotics and subsequent adverse outcomes of antibiotic utilization before and following the implementation of a 48 hour stop date in the neonatal ICU

Methods

October 1, 2021 to **March 31, 2022**

April 24, 2022 – automatic stop date implemented

May 1, 2022 to **October 31, 2022**

Retrospective and prospective, IRB-approved, single center chart review

Neonate admitted to (born at or transferred to) KCH NICU

Received at least one dose of ampicillin or gentamicin within 48 hours of birth

Variables and Outcomes of Interest

Gestational age · Date of birth · Sex · Birth weight · Length of stay · Antibiotic drug, dose, frequency, duration · WBC · CRP · Temperature · Cultures · NEC diagnosis · Serum creatinine · Order set utilization · Maternal factors (GBS, c-section vs vaginal delivery, PROM, antibiotics)

1 **Efficacy**: total duration & appropriate duration of antibiotics

2 **Safety**: necrotizing enterocolitis & renal function

The authors have no actual or potential conflicts of interest

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Patient Characteristics

706 NICU patients in the NICU from October 1, 2021 to March 31, 2022

Excluded (n = 134)

572 NICU patients **admitted** to the NICU from October 1, 2021 to March 31, 2022

Excluded (n = 360)

212 NICU patients received at least one dose of ampicillin or gentamicin

Median (IQR) Gestational Age	**Median (IQR) Birth Weight**	**Sex**
37 (35,38) weeks & 2 (1,4) days	2.985 (2.295,3.408) kg	120 (57%) Male

Preliminary Results & Conclusions

Duration of ampicillin*	**Duration of gentamicin***	**Blood culture results**	**Number of NEC diagnoses**
2.7 ± 2.1 days	1.8 ± 1.7 days	239 cultures	n = 4 (1.9%)
*Mean ± SD	*Mean ± SD		
• ≤ 48 hours (n=127) • 3-6 days (n=60) • ≥ 7 days (n=24)	• ≤ 48 hours (n=159) • 3-6 days (n=43) • ≥ 7 days (n=9)	• Coagulate negative staphylococcus (n=1) • Micrococcus (n=1)	• Diagnosed 7.5, 9.4, 40.0, and 67.7 days after initial antibiotics

Future Directions

- Complete collection of data from October 1, 2021 through March 31, 2022
  - o Renal function (urine output in mL/kg/hour)
- Collect and analyze data from May 1, 2022 through October 31, 2022
- Utilize SPSS to compare pre- and post-automatic stop date implementation data
- Bring findings to neonatal providers at KCH

Detectable Concentrations with Inhaled Tobramycin in Critically Ill Infants and Children Following Implementation of a Standardized Protocol

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Background

- Inhaled tobramycin has been used off-label in critically ill patients without cystic fibrosis (CF) in the intensive care unit (ICU) with limited evidence on efficacy and some safety concerns.
  - Several **case reports and studies** have noted patients with detectable trough concentrations and acute kidney injury (AKI)[1-2] .
  - Previous study found half of critically ill children who had a trough concentration checked had a detectable concentration (>0.5 mcg/mL), with three developing AKI.[2]
  - Droege and colleagues[3] (N=53 patients) conducted a retrospective study evaluating inhaled tobramycin in adult patients and found that positive end expiratory pressure and age were independent risk factors for AKI.
- In 2016, our institution developed a **standardized protocol** in children without CF receiving inhaled tobramycin in the ICU setting including the following:
  - 300 mg twice daily dosing administered via the jet nebulizer, 30 centimeters from the endotracheal tube in the inspiratory loop of the ventilator.
  - Trough concentrations were checked weekly, and timed 1-3 hours before the 3rd dose to assess systemic accumulation.
- The **purpose** was to describe the incidence and clinical characteristics of critically-ill infants and children with detectable concentrations receiving inhaled tobramycin post implementation of the standardized protocol.

Objectives

- **Primary objective:**
  - Determine the incidence of detectable tobramycin serum trough concentrations >0.5 mcg/mL following implementation of our standardized protocol.
- **Secondary objectives:**
  - Identify potential risk factors for development of detectable tobramycin serum trough concentrations in critically ill infants.
  - Identify the number of patients who developed AKI while receiving inhaled tobramycin as defined by the Kidney Diseases: Improving Global Outcomes (KDIGO) criteria.

Methods

- IRB-approved retrospective, cohort study.
- **Inclusion criteria:**
  - Patients < 18 years of age admitted to the PICU, CVICU, and NICU between July 1, 2016 - September 4, 2020.
  - Received at least 1 dose of inhaled tobramycin 300 mg twice daily.
- **Exclusion criteria:**
  - CF diagnosis.
  - Absence of tobramycin concentration.
  - Concomitant administration of IV tobramycin.
  - Pre-existing kidney disease/injury.
- **Data collection**:
  - Patient demographics including age, gender, weight.
  - Tobramycin data: regimen, serum concentrations, duration of therapy, dose change.
  - Respiratory data: respiratory status, ventilator settings, endotracheal tube size, humidification status.
  - Renal function: serum creatinine (SCr), urine output (UOP), concomitant nephrotoxins.

Statistical Analysis

Categorical variables were compared between groups by a Chi-squared test or Fisher's exact test.

Statistical Analysis Continued

- Interval and continuous variables were assessed using a Student's t-test or the Wilcoxon-Mann-Whitney test.
- Two multivariable logistic regressions with independent variables of detectable concentrations and AKI with independent variables including age, total dose (mg/kg), first serum trough concentration.
- Analyses was performed using SAS 9.4 for analyses, with a p<0.05.

Results

- Overall, 44 patients and 66 courses were analyzed
- There were 30 (68%) patients with detectable concentrations
- No statistical differences between demographics per admission or admission diagnoses/respiratory support per course in those with and without detectable concentrations (Tables 1 and 2).

Table 1: Baseline Demographics per Patient

Variables	No Detectable Concentrations (n=14)	Detectable Concentrations (n=30)
	Number (%) or Median (IQR)	
Males	6 (42.9)	16 (53.3)
Prematurity	8 (57.1)	15 (50.0)
Age (years)	0.79 (0.64-3.30)	0.92 (0.52-3.00)
Weight (kilograms)	8.7 (7.8-14.0)	8.7 (7.0-14.0)

Table 2: **Admission Diagnoses and Respiratory Support Per Course**

Variables	No Detectable Concentrations (n=14)	Detectable Concentrations (n=30)
	Number (%) or Median (IQR)	
Admission diagnoses:		
Respiratory failure	11 (78.6)	23 (76.7)
Pneumonia	2 (14.3)	3 (10.0)
Cardiothoracic surgery	1 (7.1)	3 (10.0)
Cardiac arrest	0	1 (3.3)
Mode of delivery:		
No ventilation	1 (7.1)	--
Endotracheal tube	2 (12.3)	7 (23.3)
Tracheostomy	11 (78.6)	23 (76.7)
Ventilation status:		
Trach collar/no vent	0	1 (3.3)
Conventional vent	13 (92.9)	29 (96.7)
Non-invasive ventilation	1 (7.1)	--
Peak End Expiratory Pressure (PEEP)	9 (8.0-12.0), n=13	9 (7.0-10.0), n=29
Mechanical ventilation prior to treatment	14 (100)	29 (26.7)
Duration of mechanical ventilation prior to treatment (days)	98 (27-237)	58 (18-118)

- Table 3 provides a comparison of the inhaled tobramycin dosage regimen data per course in patients with and without detectable concentrations. The only statistical difference noted was the total duration (p<0.001).
- Table 4 provides a comparison of renal function data and nephrotoxins per course in patients with and without detectable concentrations. No statistical differences were noted between groups.

Results (Continued)

Table 3: Comparison of Inhaled Tobramycin Regimens Per Course

Variables	No Detectable Concentrations (n=14)	Detectable Concentrations (n=30)
	Number (%) or Median (IQR)	
Initial tobramycin dose		
mg/kg (mean, SD)	31.5 (14.3)	34.6 (15.9)
Duration (days)	13.0 (7.0-27.5)	2.5 (2.0-7.0)
Subsequent tobramycin dose		
mg/kg (mean, SD)	--	34.7 (16.9)
Duration (days)	--	10 (5.0-23.0)
Every 12 hours	--	2 (8.0)
Every 24 hours	--	23 (92.0)
Duration of tobramycin	13.0 (7.0-27.5)	11.3 (7.0-28.0)

Table 4: Comparison of Renal Function Data and Nephrotoxins

Variables	No Detectable Concentrations (n=14)	Detectable Concentrations (n=30)
	Number (%) or Median (IQR)	
Received ≥1 nephrotoxin	9 (64.3)	19 (63.3)
# of nephrotoxins per patient:		
0	5 (35.7)	12 (40.0)
1	6 (42.9)	12 (40.0)
2	3 (21.4)	6 (20.0)
Nephrotoxic medications:		
Vancomycin	4 (28.6)	13 (43.3)
Ibuprofen	4 (28.6)	7 (23.3)
Angiotensin converting enzymes	3 (21.4)	4 (13.3)
IV contrast	1 (7.1)	0
Renal dysfunction:		
None	12 (85.7)	23 (79.3)
AKI	2 (14.3)	5 (17.2)
Chronic kidney disease (CKD)	0	1 (3.5)

- A multivariable logistic regression was employed to assess the effect of detectable concentrations with independent variables including age, mechanical ventilation days before tobramycin, AKI/CKD, and PEEP. The only variable associated with detectable concentrations was mechanical ventilation days (OR 0.99, 95% CI: 0.99-1.00; p=0.043).
- A multivariable logistic regression was employed to assess the effect of AKI with independent variables including age, total daily dose (mg/kg) in tobramycin, and first serum tobramycin concentration. No variables were associated with AKI.

Conclusions

- The majority of cases had detectable concentrations.
- Overall, 16% of tobramycin courses included patients that developed AKI..
- The only variable associated with detectable concentrations was days of mechanical ventilation prior to the first detectable concentration.
- Clinicians should consider utilizing trough monitoring for all mechanically ventilated critically-ill children receiving inhaled tobramycin.

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