Nursing and Antimicrobial Stewardship Collaboration

Dan Pak, PharmD
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Speaker Disclosure

• No relevant financial or nonfinancial relationships

• I will not be discussing “off-label” or investigational uses of medications

• I have no actual or potential conflict of interest in relation to the presentation
Objectives

1. Define antimicrobial stewardship (ASP)
2. Differentiate broad versus narrow spectrum antibiotics and rationale for selection
3. Discuss ASP intentions and goals
4. Demonstrate ASP’s partnership with Nursing
5. Identifying Nursing and ASP collaborative opportunities
What is Antimicrobial Stewardship?

“...The right antibiotic, at the right dose, at the right time, and for the right duration.”

CDC’s “Get Smart for Healthcare” program materials
What do we do?

7am-3:30pm

Drink lots of coffee / tea

Blood & Sterile site culture surveillance

Drink more coffee / tea

Antibiotic surveillance
Antimicrobial Stewardship Mission Statement

We will ensure that we are giving every patient in our care the optimal anti-infective therapy for their condition every day.
Measuring Antibiotic Usage: Days of Therapy (DOT)

A Patient is on the following Antibiotic Regimen:

**Ceftazidime 100mg IV Q6 + Ampicillin 500mg IV Q6 =**

2 DOTs Per Day

**Vancomycin 1 gram Q6 + Metronidazole 500mg Q8 + Ceftazidime 2 grams IV Q8 =**

3 DOTs Per Day
NICU Antibacterial Days of Therapy (DOT)

Days of therapy/1000 pt-days

- ASP launched Jan 2013

FY 2011 - FY 2019
Hospital Antibacterial Days of Therapy (DOT)

Antibiotics by Hospital

Dates: Jan 01, 2012 - Dec 31, 2012

Target Hospital Campuses Included: Seattle Children's, See Report Information Page for details on prompt values selected and patient population definitions. Denominator for calculating DOT/1,000 patient days is based upon total patient days across the entire hospital.

Days of Therapy per 1,000 patient days

Black lines represent 25th, Median and 75th percentile

NICU Antibacterial Days of Therapy

- Raw Tonnage
- Comparator?

Need better analysis
- What & Why: Indication
- How: Duration
ASP Interventions
ASP Interventions

- Dual Anaerobic Therapy – i.e. Augmentin + Clindamycin
- Piperacillin-Tazobactam + Vancomycin
- Meropenem & Non-formulary antibiotics

- 24 hour and 48-96 hour rule out
Duplicate Anaerobic Therapy

- Adverse events: allergy, toxicity
  - ~28,000 ED visits/yr\(^1\)
- *C. difficile* infection
- Inflammatory Bowel Disease\(^2\)
- Autoimmune diseases

1 – Shehab, *Clin Infect Dis* 2008
2 – Kronman, *Pediatrics* 2012
Piperacillin/tazobactam + Vancomycin

Incidence of Nephrotoxicity Among Pediatric Patients Receiving Vancomycin With Either Piperacillin–Tazobactam or Cefepime: A Cohort Study

Kathryn M. Cook,1 Jessica Gillon,1 Alison G. Grisso,1 Ritu Banerjee,2 Natalia Jimenez-Truque,2 Elizabeth J. Phillips,3 and Sara L. Van Driest2,3
Departments of 1Pharmaceutical Services, 2Pediatrics, and 3Medicine, Vanderbilt University Medical Center, Nashville, Tennessee

Pip-tazo (PTZ) + Vanco associated with higher rates of acute kidney injury (AKI) than cefepime + vanco (RR 2.5)

AKI developed almost 3 times sooner in the PTZ group than in the cefepime group (HR 2.9)

In March 2018, the SCH Central Line Infection pathway replaced PTZ with cefepime, thus ending PTZ + Vanco as a recommended standard regimen
Carbapenems and Newer, Non-formulary Antibiotics

- Microbiome
- “Antibiotic Pressure” – Candida and other fungal infections

Carbapenem-resistant Enterobacteriaceae (CRE) are a major concern for patients in healthcare facilities. Some bacteria in this family are resistant to nearly all antibiotics, leaving more toxic or less effective treatment options.
Carbapenems and Newer, Non-formulary Antibiotics

NICU MDRO Data

- Jordan NICU reported MDRO sepsis mortality rate to be 60% versus non-MDRO sepsis as 13%
- Taiwan NICU reported MDR *Acinetobacter baumannii* mortality as 26%

Carbapenem-resistant Enterobacteriaceae (CRE) (cdc.gov)
Broad Antibiotics

Meropenem, Vancomycin, Piperacillin-Tazobactam (Zosyn®), Levofloxacin (Levaquin®), Moxifloxacin (Avelox®), Amoxicillin-clavulanate (Augmentin®), etc.
Broad Antibiotics

- Empiric = Patient status unknown, risk factors
- Unable to differentiate between good and bad bacteria
- Adverse Drug Reactions
- Lab monitoring for efficacy and toxicity

VANCOMYCIN
Narrow Antibiotics

Cefazolin, Cephalexin (Keflex®), Ampicillin, Nafcillin, Trimethoprim-sulfamethoxazole (Bactrim®), Nitrofurantoin (Macrobid®), etc.
Narrow Antibiotics

- Targeted towards infectious pathogen
- Less collateral damage towards microbiome
- Less adverse drug reactions

- **VANCOMYCIN**
- **Nafcillin / Cefazolin**
  - First line therapy for MSSA
  - ↓ Nephrotoxicity
  - Creatinine
  - Vancomycin levels
ASP Engagements
Engagements with Provider groups

- Bone Marrow Transplant - Individualized Antibiotic Plans (IAP)
- ICU & Hospitalists - Individualized Provider Feedback (IPF)
- General Surgery & NICU - Biliary atresia, Surgical NEC and Spontaneous intestinal perforation guidelines
- Outpatient Parenteral Antibiotic Therapy (OPAT)
**Specialty Problems**

**Problem(s) triggering "Individualized Antibiotics" precaution:**

**Care Plan - Individualized Antibiotics**

Individualized Antibiotic Plan

The following represents the antibiotic plan formulated for this patient by [Name], NP, Division of Infectious Diseases, on 01/05/21 and updated 2/26/21.

<table>
<thead>
<tr>
<th>Pre-engraftment neutropenia (prophylaxis)</th>
<th>Cefepime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever, stable (empiric)</td>
<td>Cefepime</td>
</tr>
<tr>
<td>Fever, hemodynamically unstable (empiric, &quot;sepsis plan&quot;)</td>
<td>Cefepime + Gentamicin + Vancomycin</td>
</tr>
</tbody>
</table>

Note: For patients presenting to SCCA Outpatient Dept (OPD) with unstable fever to expedite IV delivery of combination antibiotics, order the SCCA "STAT Pack", rather than the SCH IAP agents.

| Drug allergies: Vancomycin, Ceftaz-dizavactam, Benadryl, Adhesive tape, Morphine |
|-------------------------------|-----------------|-----------------|
| Date                          | Agent           | Description     | Antibiotic modification |
| 3/21/16                       | Vancomycin      | "Redman's syndrome" | Run over 2 hours. |
|                               | Ceftaz-dizavactam | Rash, facial swelling | Cefepime backbone to IAP |

| Clinical microbiology data, last 6 months: bacteria |
|---------------------------------|-----------------|-----------------|
| Date                            | Specimen        | Description     | Antibiotic modification |
| 12/29/20                        | Rectal swab     | Moderate MSSA   | None |
| 12/29/20                        | Nose swab       | Mixed oral flora | None |
| 2/18/21                         | Urine cx        | E falcavis      | None |

<table>
<thead>
<tr>
<th>Clinical microbiology data, last 6 months: fungi and mold: None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Individualized Provider Feedback (IPF)
PICU, CICU and Hospitalists

CDC Guidelines

1. Does your antibiotic stewardship program share facility and/or individual prescriber-specific reports on antibiotic use with prescribers?

- Yes
- No

Goal: Use personalized data that allows providers to visualize how they compare to their peers in attempt to improve antibiotic prescribing behaviors
Individualized Provider Feedback (IPF)

- Antimicrobial days of therapy (DOT)
  - Meropenem, Beta-lactam / beta-lactamase combination, 3rd/4th generation cephalosporin, IV vancomycin
- Intravenous use of highly bioavailable antibiotics (IV → PO)
  - Highly bioavailable antibacterials DOT:
    - Clindamycin, Ampicillin, Ampicillin-sulbactam, Fluoroquinolone
- Dual anaerobic coverage DOT
- Piperacillin-tazobactam and vancomycin co-administration
- Number of tracheal aspirate cultures
Individualized Provider Feedback (IPF)

Peer Comparison Visualization – FY 2018 – Q4

Pediatric Critical Care PTZ/VAN Use FY 2018 Q4
Individualized Provider Feedback (IPF)
Peer Comparison Visualization – FY 2019 – Q4

Pediatric Critical Care PTZ/VAN Use FY 2019 Q4

- Peer Group Rate
- Housewide Rate

Denominator Count
- 8
- 50
- 100
- 159
## Individualized Provider Feedback (IPF)

<table>
<thead>
<tr>
<th>Peer group</th>
<th>Prescribing behavior</th>
<th>Change in %</th>
<th>Decrease &gt;10%?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Critical Care</td>
<td>Double Anaerobic Coverage Use</td>
<td>-100%</td>
<td>Yes</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>PTZ/VAN Use</td>
<td>-18%</td>
<td>Yes</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Overall Antibacterial Use</td>
<td>5%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Carbapenem Use</td>
<td>1%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>3rd/4th Generation Cephalosporin Use</td>
<td>-28%</td>
<td>Yes</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Beta-lactam/Beta-lactamase Inhibitor Use</td>
<td>-13%</td>
<td>Yes</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>IV Vancomycin Use</td>
<td>-34%</td>
<td>Yes</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>IV PO</td>
<td>4%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Clindamycin IV PO</td>
<td>0%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Amp/amox IV PO</td>
<td>8%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Amp-sulbactam/amox-clav IV PO</td>
<td>275%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Fluoroquinolone IV PO</td>
<td>33%</td>
<td>No</td>
</tr>
<tr>
<td>Cardiac Critical Care</td>
<td>Trach Culture Orders (Tracheal Aspirate Culture)</td>
<td>-2%</td>
<td>No</td>
</tr>
</tbody>
</table>
General Surgery & NICU
Biliary atresia, Surgical NEC and Spontaneous intestinal perforation guidelines

Treatment Guideline for Surgical Necrotizing Enterocolitis (NEC)

The goals of Surgical NEC treatment guideline are to:
1. Standardize approach to treatment (antibiotics and duration of bowel rest) for suspected or confirmed surgical NEC
2. Standardize the approach to feeding following suspected or confirmed surgical NEC

Through standardization, we aim to:
1. Minimize the duration of NPO
2. Optimize feeding potential
3. Reduce TPN associated cholestasis/hepatitis
4. Reduce Central lines, risk of CLABSI, and antibiotics exposure
This guideline will promote intestinal health and reduce dysbiosis.

Treatment:
1. Upon concern of surgical NEC, order a surgical consult, make the patient NPO with replege to low intermittent suction, order appropriate labs, and begin antibiotic therapy after appropriate cultures are obtained
2. Choice of Antibiotics - see SCH Formulary for dosing, considering chronologic and gestational age:
   a. Ampicillin and Gentamicin (first week of life)
   b. Piperacillin/Tazobactam (Zosyn)
Outpatient Parenteral Antimicrobial Therapy (OPAT)

“...serves as a resource to assist the primary medical team in developing a plan for discharge and follow up of patients deemed appropriate for OPAT.”

Follow-up appointments, monitoring of toxicity, non-response to therapy, adequate lab follow-up, contact providers for issues, imaging, PICC line issues, etc.
MRSA is a critical value at SCH.

MSSA was not a critical value until March 2017

ASP sought out to reduce vancomycin usage since a critical value of MSSA would communicate to the providers that the patient no longer needs vancomycin.
No difference between pre- and post-intervention cohorts in proportion of patients with vancomycin discontinuation time <6 hours, 19/39 (48.7%) versus 11/23 (47.8%).

Among non-ICU patients, we observed a non-significant increase in median time to vancomycin discontinuation during the post-intervention phase (5.2 hours vs. 9.8 hours, \( P = 0.16 \)).

A “hands-off” model of notification did not achieve goal of reducing time to optimization.
Nursing-ASP Engagements

- Synagis® (Palivizumab) Season
  - RSV community infection rate >10%
  - Prior authorization paperwork
  - Start date November 16, 2020

- Nitrofurantoin suspension price hike
  - $475 per bottle vs $2200 per bottle
  - $2-3 per capsule

Formalized ASP and Nursing Engagements

Let’s Get to Work!
Nursing-ASP Engagements

➢ How to incorporate ASP activities into their daily activities

➢ How nurses can take leadership role in defining robust stewardship program
Nursing-ASP Engagements

- 2019 Magnet Application Manual added Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridiodes difficile* (*C. diff*) infection to list of nurse-sensitive clinical indicator data.

- Beta-Lactam De-labeling Project
  
  **Penicillin Allergy**
  
  “Both parents allergic; were told by pediatrician to not give it to her; patient hasn’t actually had medication.”
Discussing Antibiotics with Families

- Why are we starting / not starting antibiotics?
- Why are you poking my child for labs again?
- What side effects should I expect from these antibiotics?
- Why are you changing antibiotics?
- Why can’t we use an oral antibiotic instead?
- Why do we need a central line?
- OPAT!
AN ANTIBIOTIC IS THE WRONG TOOL TO TREAT A VIRUS.

Make sure you use the right tool for the job.

Antibiotics save lives by treating certain infections caused by bacteria, not viruses like colds or flu. When they’re not needed, antibiotics won’t help you, and the side effects could still hurt you. Ask your doctor when an antibiotic is the right tool for your illness and when it’s not.

To learn more about antibiotic prescribing and use, visit www.cdc.gov/antibiotic-use.