Becker’s Hospital Review

Oct 2, 2014

Top 10 Best Practices for Antimicrobial Stewardship & Hospital Infection Prevention

Presented in Cooperation with
Today’s Panelists:

- Stacy Pur, RN (Moderator)
  Vice President Clinical Decision Support, VigiLanz
  www.vigilanzcorp.com

- John Russillo, RPh
  Clinical Pharmacy Manager at John Muir Health – Concord, CA

- Brian Koll, MD, FACP, FIDSA
  Executive Director, Infection Prevention Mount Ainai Health System

- Josh David Courter, Pharm.D.
  Antimicrobial Stewardship Clinical Pharmacist at Cincinnati Children’s Hospital Medical Center – Cincinnati, OH
TOPICS

What you will learn:

- Leading edge approaches to effective antimicrobial stewardship
- Recommendations for implementing best practice HAI prevention
- Outcomes and results that improve patient care and drive better hospital performance
- Insights from peer clinicians through discussion and Q&A following brief formal presentations
Antibiotics have revolutionized modern healthcare

- Improved Sepsis Survival
- Immunosuppressant therapy
  - Organ transplant and Bone Marrow transplant
  - Lupus, Crohn’s, Rheumatoid arthritis, MS
- Chemotherapy survival improvements
- Extreme low-birth-weight infants
- Complex extended surgeries
- Admission Prevention
Impact of Antibiotic Misuse

20-50% Hospital Antibiotics Unnecessary/Inappropriate

- Adverse Drug Reactions
  - Allergic
  - Renal toxicity
- Increased Length of Stay
- Clostridium Difficile
- Increased Costs
- Secondary Infections related to central lines
- Environmental Contamination

Antibiotic Resistance

"Antimicrobial resistance: no action today, no cure tomorrow"
WHO April, 2011

### Development of Resistance to Newly Introduced Antimicrobials

<table>
<thead>
<tr>
<th>Agent</th>
<th>Year of FDA Approval</th>
<th>First Reported Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>1943</td>
<td>1940</td>
</tr>
<tr>
<td>Streptomycin</td>
<td>1947</td>
<td>1947</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>1952</td>
<td>1956</td>
</tr>
<tr>
<td>Methicillin</td>
<td>1960</td>
<td>1961</td>
</tr>
<tr>
<td>Nalidixic Acid</td>
<td>1964</td>
<td>1966</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>1967</td>
<td>1969</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>1972</td>
<td>1987</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>1981</td>
<td>1981 (AmpC ß-lactamase)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1983 (ESBL)</td>
</tr>
<tr>
<td>Linezolid</td>
<td>2000</td>
<td>1999</td>
</tr>
</tbody>
</table>
Hospital Acquired Infections

“1 in 25 patients Impacted”
CDC Prevalence Survey NEJM 2014

### Surgical Site Infections: Colon Surgery and Abdominal Hysterectomy Surgery

When germs get into an area where surgery is or was performed, patients can get a surgical site infection. Sometimes these infections involve the skin only. Other SSIs can involve tissues under the skin, organs, or implanted material.

- 3% of Illinois hospitals have a colon surgery SIR worse than the national SIR of 0.80.

### Estimates of Healthcare-Associated Infections Occurring in Acute Care Hospitals in the United States, 2011

<table>
<thead>
<tr>
<th>Major Site of Infection</th>
<th>Estimated No.</th>
</tr>
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<tbody>
<tr>
<td>Pneumonia</td>
<td>157,500</td>
</tr>
<tr>
<td>Gastrointestinal Illness</td>
<td>123,100</td>
</tr>
<tr>
<td>Urinary Tract Infections</td>
<td>93,300</td>
</tr>
<tr>
<td>Primary Bloodstream Infections</td>
<td>71,900</td>
</tr>
<tr>
<td>Surgical site infections from any inpatient surgery</td>
<td>157,500</td>
</tr>
<tr>
<td>Other types of infections</td>
<td>118,500</td>
</tr>
<tr>
<td>Estimated total number of infections in hospitals</td>
<td>721,800</td>
</tr>
</tbody>
</table>

This report is based on 2011 data, published March 2014.
The role of real time clinical surveillance software in an Antimicrobial Stewardship Program

John Russillo
Clinical Pharmacy Manager
John Muir Health
John Muir Health

- Walnut Creek Campus ~400 beds
- Concord Campus ~200 beds
- Unit-based pharmacist model – ED, Critical Care, Med-Surg pharmacists
- VigiLanz real-time clinical surveillance software – 10 years
- P+T ID subcommittee – antibiotic specific guidelines, protocols, order-sets (EPIC)
ASP Goals

- Reduce inappropriate antimicrobial use
- Ensure guideline directed use
- Minimize duration of antimicrobials
- Ensure optimal antimicrobial dosing to prevent ADE’s and/or treatment failure
- Track collateral damage of antibiotics
- Educate medical staff on proper use of antimicrobials
ASP – Optimal Antibiotic dosing

- Kinetics service
- Pharmacy directed renal dosing protocols
- Automated dosing rules
- Antimicrobial DI's
- Toxicity - peaks, troughs, AKI, nephrotoxicity
- Collateral damage - abic induced C. diff
- IV to PO
Vancomycin > 10 mg/kg/day (DBW) and CrCl 10-30 ml/min (>130% IBW)
- Alerts to the need to change vancomycin dosing to approx 15 mg/kg (DBW) q48h if CrCl 10-30 ml/min

Vancomycin > 10 mg/kg/day (TBW) and CrCl 10-30 ml/min (<130% IBW)
- Alerts to the need to change vancomycin dosing to approx 15 mg/kg (TBW) q48h if CrCl 10-30 ml/min

Vancomycin <30 mg/kg/day (DBW) and CrCl >60 ml/min (>130% IBW)
- Alerts to the need to increase the dosing to approx 30 mg/kg/day (DBW) if CrCl >60. Pt is >130% IBW.

Cefepime >1g/day and CrCl <15 ml/min

Cefepime <4g/day and CrCl >50 ml/min

Cefepime <6g/day and CrCl >50 ml/min and ANC<1000

Cefepime NOT on 1g q12hr and CrCl=15-30 ml/min

Cefepime NOT 1g q8hr and CrCl=30-50 ml/min

Tobramycin trough level >2 alert (no active order)

Tobramycin and tobramycin trough level >2 alert (active order)

Tobramycin timed random level result (no active order)

Tobramycin and tobramycin timed random level result (active order)

Tobramycin IV and no level drawn in 5 days
• ID MD/RX collaboration – referral based changed to salaried ID consultants
• Drug/bug mismatch
• DC, de-escalation opportunities
• Optimal Tx – based on positive culture results
• Duration alerts - sequential 3,5,7,10 (EPIC 10d)
• Culture results – positive or negative
• Combination therapy
• Multiple antibiotics
VigiLanz ASP Rules Examples

- **Organism-Antibiotic Mismatch** (based on antibiotic panel sensitivities testing)
- Vancomycin IV and MRSA with vancomycin MIC \( \geq 2 \)
- Vancomycin IV and MSSA
- MSSA and NOT on cefazolin
- Vancomycin Day #3 and no MRSA positive culture
- De-escalation Opportunity - E. coli on anti-pseudomonal agent
- De-escalation Opportunity - Antibiotics for 7 days and negative cultures
- Levofloxacin IV and PO Med Orders
- Levofloxacin IV and PO Med Orders + WBC < 10K
- *C. difficile positive (GDH+, toxin+) and ciprofloxacin use*
- C. difficile positive and PPI use
- Duplicate anaerobic coverage
- Duplicate beta-lactam use
- Duplicate anti-pseudomonal use
- Antibiotics 3 or more
- Antibiotic duration Day 3, 5, 7, 10 + negative culture
ASP – Utilization Data

- DOT analysis
- NHSN AU – JMH submits
- Antibiogram – real-time data collection
- Abic MUE – unit locations, physician orders
- Restricted antibiotic use analysis
ASP Intervention data

- ASP alerts ~600/monthly
- ASP Pharmacist action taken ~30%
- ASP related cost savings ~$60,000/month
Antimicrobial Stewardship

Brian Koll, MD, FACP, FIDSA
Executive Director, Infection Prevention
Mount Sinai Health System

Medical Director and Chief
Infection Prevention and Control
Mount Sinai Beth Israel

Professor of Medicine
Icahn School of Medicine at Mount Sinai
Antibiotic Stewardship and CAP

- Community acquired pneumonia
  - moxifloxacin vs ceftriaxone-based therapy
  - colonization and infection with multidrug-resistant organisms higher in moxifloxacin group
  - restriction policies to diminish moxifloxacin use

Goldstein RC, Lalite S, Mildvan D, Perlman DC, Jodlowski T, Ruhe J. IDSA Poster Presentation 205. Boston, October 2011
Antibiotic Stewardship and CAP

Number of Orders

Moxifloxacin Use

Feb
Mar
Antimicrobial Stewardship and *C. difficile*

- San Francisco General
- Jun 2005 – Dec 2010
- historical cohort study
- development of CDI within 30 days of ceftriaxone therapy
- 3,730 patients

**Does Doxycycline Protect Against Development of Clostridium difficile Infection?**

Sarah B. Dornberg, Lisa G. Winston, Daniel H. Deck, and Henry F. Chambers

**Background.** Doxycycline has been associated with a lower risk for *Clostridium difficile* infection (CDI) than other antibiotics. We investigated whether doxycycline protected against development of CDI in hospitalized patients receiving ceftriaxone, a high-risk antibiotic for CDI.

**Methods.** We studied adults admitted to an academic county hospital between June 2005 and December 2010 who received ceftriaxone to determine whether the additional receipt of doxycycline decreased the risk of CDI. Patients were followed from first administration of ceftriaxone to occurrence of CDI or administrative closure 30 days later.

**Results.** Two thousand three hundred five unique patients comprising 2734 hospitalizations were studied. Overall, 43 patients developed CDI within 30 days of ceftriaxone receipt, an incidence of 5.60 cases per 10,000 patient-days. The incidence of CDI was 3.67 cases per 10,000 patient-days in those receiving doxycycline, compared to 8.11 per 10,000 patient-days in those who did not receive doxycycline. In a multivariable model adjusted for age, gender, race, comorbidities, hospital duration, pneumonia diagnosis, surgical admission, and duration of ceftriaxone and other antibiotics, for each day of doxycycline receipt the rate of CDI was 27% lower than a patient who did not receive doxycycline (hazard ratio, 0.73; 95% confidence interval, 0.60–0.90).

**Conclusions.** In this cohort of patients receiving ceftriaxone, doxycycline was associated with lower risk of CDI. Guidelines recommend this combination as a second-line regimen for some patients with community-acquired pneumonia (CAP). Further clinical studies would help define whether doxycycline-containing regimens should be a preferred therapy for CAP.
Antimicrobial Stewardship and *C. difficile*

- Multivariate analysis
- Doxycycline associated with protection against development of CDI
- 27% lower rate
- Hazard ratios ctx + doxy
  - vs ctx + azith = 0.15
  - vs ctx + fluoroquinolone = 0.13
- Strongest predictor of CDI
- Length of stay

Does Doxycycline Protect Against Development of *Clostridium difficile* Infection?

Sarah B. Doernberg, Lisa G. Woronon, Daniel H. Deck, and Henry B. Aizper

Department of Internal Medicine, Division of Infectious Diseases, University of California, San Francisco, and Department of Pharmaceutical Sciences, San Francisco General Hospital, California

**Background.** Receipt of antibiotics is a major risk factor for *Clostridium difficile* infection (CDI). Doxycycline has been associated with a lower risk for CDI than other antibiotics. We investigated whether doxycycline protected against development of CDI in hospitalized patients receiving ceftiraxone, a high-risk antibiotic for CDI.

**Methods.** We studied adults admitted to an academic county hospital between 1 June 2003 and 31 December 2010 who received ceftiraxone to determine whether the additional receipt of doxycycline decreased the risk of CDI. Patients were followed from first administration of ceftiraxone to occurrence of CDI or administrative discharge 30 days later.

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Antimicrobial Stewardship and *C. difficile*

![Graph showing the number of orders for CTX + AZITH and CTX + DOXY from November to March.](image-url)
Proton Pump Inhibitors

- Elderly
- Underlying medical conditions
- Broad spectrum antibiotics
- PPI
- 28 observational studies
  - strength of association ranged from 1.4 to 2.8x higher
- Indications
  - erosive gastritis
  - symptomatic GERD
  - NSAID gastric ulcer risk reduction
  - *H. pylori* eradication
Proton Pump Inhibitors

![Graph showing the number of units of Nexium sold from December to March.](image_url)
HO CDI
Josh David Courter, PharmD
Antimicrobial Stewardship Clinical Pharmacist at Cincinnati Children’s Hospital Medical Center

- Cincinnati Children’s Hospital Medical Center has more than licensed 500 beds
- We are a full-service, nonprofit pediatric academic medical center, established in 1883
- Cincinnati Children’s Research Foundation is one of the largest pediatric research programs in the nation, and the third-highest recipient of National Institutes of Health grants for pediatric research.
- Ranked by US News and World Report #3 Pediatric Hospital in U.S.
- Our vision: to be the leader in improving child health.
Cincinnati Children’s Goals

- Prospectively tracking all antimicrobial use
- Reduce unnecessary broad-spectrum antibiotic use, and time to optimal antibiotic regimen
- Reduce untoward effects of antimicrobials
  - Resistance, C diff, and adverse effects
- Quickly identify opportunities with alerts
Actions to Meet Goals

• Educate staff on the perils of over-extensive antibiotic use

• Intervene earlier to prevent patient harm

• Implement VigiLanz’ Dynamic Monitoring Suite to work with hospital’s HER
  • Design weight and organ function-based dose alerts
Results to Date

- Significant decrease in antimicrobial expenditures
- Reduced use of linezolid and Carbapenems
- Less time to optimal antibiotic regimen
- Reduced staff hours compiling reports
Becker’s Hospital Review

Q & A
Thank you for joining us today!!

The slides from today’s program will be available on www.vigilanzcorp.com site and www.beckershospitalreview.com