Establishing Antimicrobial Stewardship Practices in the Emergency Department

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Conflict of Interest

• The presenter has no real or potential conflicts of interest to report

Objectives

• Discuss the importance of antimicrobial stewardship with a focus on the emergency department
• Discuss literature supporting antimicrobial stewardship practices in the emergency department
• Discuss the role of pharmacists in assisting with antimicrobial stewardship in the emergency department
• Discuss the role that pharmacy technicians might play in an antimicrobial stewardship program in the emergency department

How Many People Work At A Site With An Antimicrobial Stewardship Program?

How Many People Work At A Site With A Clinical Pharmacist In The Emergency Department?
How Many People Work At A Site Where The Emergency Department Pharmacist And The Antimicrobial Stewardship Program Work Closely Together For Unified Goals?

Antimicrobial Resistance

• Widely recognized as a looming threat in American healthcare
• The emergency department is one of the biggest contributors to inappropriate antimicrobial usage
• Antimicrobials are the most used medicine in the world

Antimicrobial Resistance Statistics

• 2 million people acquire an antimicrobial resistant bacteria every year
• 23,000 people die from antimicrobial resistant bacteria every year
• 250,000 people every year are hospitalized with C. difficile
• Antimicrobial resistance may add 20 billion dollars in additional direct healthcare costs every year

Antimicrobial Stewardship

• “To optimize clinical outcomes while minimizing the unintended consequences of antimicrobial use including toxicity, selection of pathogenic organisms, and emergence of antimicrobial resistance”

Antimicrobial Stewardship Strategies

• Policies
• Guidelines
• Surveillance
• Education
• Intervention
Antimicrobial Usage

• Anywhere from 30-50% of antimicrobials used in the hospital are either inappropriate or unnecessary
• Recent study showed that majority of antimicrobials used for respiratory infections in adults in the emergency department are inappropriate


Antimicrobial Usage in the ED

• Greater than 50% of ED visits for upper respiratory infections resulted in the use of antimicrobials
• 40% of ED visits for urinary tract infections involve the use of broad spectrum fluoroquinolones


Antimicrobial Usage in the ED

• Of 320 patients with cultured cellulitis, abscess, or SSTI with complication
• 97% cultured S. aureus or streptococci
• 60-80% were on broad GN coverage
• 73-83% were on anaerobic coverage
• Duration of therapy was 13-14 days


Antimicrobial Safety in the ED

• 1 out of 5 ED visits for an adverse drug event is because of an antimicrobial
• Allergic reactions, drug interactions, side effects, and C. difficile infection are adverse effects associated with antimicrobials

Antibiotic Resistance Threats 2013. CDC.

Why Is The Emergency Department Important?

• Bridge between community and hospital (best and worst of both worlds)
• Overuse for common infections (URI)
• Overuse of broad agents (SSTI / UTI)
• Guidelines adherence starts in ED

Challenges Facing Stewardship in the Emergency Department

• High patient turnover
• High physician turnover
• Low levels of accountability
• Diagnostic uncertainty
• Concern for poor outcomes
• Patient satisfaction
• Auto-verification
Specific Interventions

Interventions In The Emergency Department

• Incorporate ED leadership and hospital administration into an existing antimicrobial stewardship program
• Education and guidelines
• Audit and feedback
• Rapid diagnostics
• Clinical decision support


Get Leadership Buy In

• Support from the top down is key
• Allocation of resources
• Incorporate into performance reviews
• Access for education and audit initiatives
• Engage thought leaders


Education

• Multidisciplinary education initiatives (i.e. grand rounds and nursing inservices)
• Do what is effective for your institution (academic vs community)
• Have goals in mind for educational objectives
• Education can’t be only intervention


Use of Emergency Department Specific Guidelines

• Allows ability to individualize treatments to facility based on local conditions
• Encourages and promotes uniform treatment regardless of provider
• Allows venue for provider feedback upfront and on back end

Clinical Decision Support

- The “Holy Grail” of computerized physician order entry and electronic medical record
- Ideal is incorporating “real time” data at time of prescribing to optimize antimicrobial use while not being cumbersome


Emergency Department Pharmacist

- Widely recognized as an important component of any comprehensive antimicrobial stewardship program
- Facilitates appropriate antibiotic selection and dose


Post-Prescription Review

- More of an inpatient strategy versus an ED strategy
- Requires routine follow-up
- Idea is shortening duration versus optimizing initial ordering


Rapid Diagnostic Tests

- Coordination between Stewardship, Pharmacy, Emergency Department, and Lab
- Results vary from POC to < 4 hours
- Tests exist for a variety of organisms (i.e. MSSA vs MRSA)


Disease Specific Pathways

Cystitis and Pyelonephritis

- Study Conducted at MetroHealth in Cleveland, OH
- Targeted guideline adherence to cystitis/pyelonephritis in ED
- Interventions included an electronic orderset, financial incentive and audit & feedback

Cystitis and Pyelonephritis

- After order set implemented audit and feedback was started
- Pharmacist and ID physician
- Feedback provided via EMR messaging regarding: diagnosis, culture order, drug, and duration

Skin and Soft Tissue Infections

- Recent study looking at ED visits from 2007-2010
- 3.2% of all ED visits were for skin infections
- 22% of skin infections were associated with an incision and drainage procedure
Skin and Soft Tissue Infections

- 83% of visits had antibiotics prescribed
- 68% of antibiotic regimens included an antibiotic active against MRSA (56% of all visits)
- 28% of antibiotic regimens were sulfamethoxazole/trimethoprim monotherapy


Antibiotics For Discharged Abscess Patients

- Efficiency measure assessing potential overuse
- Guidelines recommend that systemic antibiotics are rarely needed
- Exceptions: immunosuppressed, difficult to drain, large area and cellulitis
- Only 13% of eligible visits met criteria


CA-MRSA Active Agents For Abscess

- Effectiveness criteria assessing potential underuse
- 84% of abscess visits were prescribed an antibiotic active against CA-MRSA
- Though antibiotics are not typically recommended for abscesses, regimens should always cover CA-MRSA


CA-MRSA Active Agents For Cellulitis

- Efficiency criteria assessing potential overuse
- IDSA guidelines recommend only covering *streptococcus* for non-purulent cellulitis
- 63% of regimens for cellulitis contained an agent active against CA-MRSA


TMP/SMX Monotherapy For Cellulitis

- Effectiveness criteria assessing potential misuse
- Traditionally TMP/SMX isn’t considered active against *streptococcus*
- 23% of cellulitis visits (29% of antibiotic regimens)

Rapid Diagnostic Tests

- Diagnosing infections typically based on clinical suspicion and basic lab values
- ED physicians often operating and prescribing on limited data
- Limited use in ED but can provide rapid results soon after admission


GeneXpert MRSA/MSSA PCR

- PCR based, rapid test performed on wound swabs
- 3 Phase Study
  - Phase 1: Baseline data collection
  - Phase 2: Introduction of test and MD education
  - Phase 3: Active Pharmacist direction

Talan DA, Abstract Presented at IDSA Annual Meeting 2011

<table>
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<tr>
<th></th>
<th>Phase I n/total (%)</th>
<th>Phase II n/total (%)</th>
<th>Phase III n/total (%)</th>
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<tr>
<td>All Patients</td>
<td>31/53 (58)</td>
<td>31/50 (62)</td>
<td>28/62 (45)</td>
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<tr>
<td>MRSA</td>
<td>1/15 (7)</td>
<td>2/13 (15)</td>
<td>0/19 (0)</td>
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<tr>
<td>Non-MRSA**</td>
<td>30/38 (79)</td>
<td>29/37 (78)</td>
<td>28/43 (65)</td>
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</tbody>
</table>

*Treatment with vancomycin, linezolid, daptomycin and TMP/SMX were considered inappropriate for Non-MRSA
** Non-MRSA includes those with no growth and contaminants
1 Chi-square and Fishers exact p-value comparing Phase I and Phase III patients

Figure 2. Days of inappropriate antibiotics* among non-MRSA patients by study phase

p=0.04 **
Ongoing Study

• “Antimicrobial Stewardship Through MRSA Diagnosis in Emergency Department (ED) Patients With Abscesses”
• NCT01523899, 030927
• Prospective, randomized trial
• Results expected later in 2014

MALDI – TOF

• Matrix Assisted Laser Desorption/Ionization Time of Flight
• Organisms identified directly from samples
• Sample is converted to charged particles
• Each organism has a unique molecular signature

MALDI – TOF in Practice

• MALDI – TOF implemented for gram negative isolates from blood cultures
• ID pharmacist contacted 24/7 who then made subsequent appropriate recommendation


MALDI – TOF in Practice

• Decreased LoS (11.9 vs 9.3 days; p=0.01)
• Decreased ICU LoS (7.3 vs 6.3 days; p=0.05)
• Decreased hospital costs ($45,709 ± $61,806 vs $26,162 ± $28,996; p=0.009)


Benefits of Rapid Diagnostic Tests

• Improved diagnostic and management capabilities
• Simple tests to perform
• Equal or better performance compared to cultures
• Direct specimen testing

Limitations of Rapid Diagnostic Tests

• False positives and false negatives
• Clinician buy-in and interpretation
• Turn-around-time
• Training of personnel
• Cost
• Limited susceptibility information
• Need for manual tests (24 hour services)
### Procalcitonin

- Precursor of calcitonin
- Biomarker that is indicative of systemic infection
- Rapid turn around time
- Has been studied extensively as a prognostic and diagnostic indicator for numerous disease states

### Procalcitonin in COPD Exacerbations

- 208 hospitalized patients randomized to PCT guided therapy or standard of care
- 40% rate of antibiotic use in PCT group vs 72% in the standard of care group
- No difference in length of stay, exacerbation rate, time to next hospitalization, and time to next exacerbation


### Procalcitonin in Acute Respiratory Tract Infections

- Performed in primary care offices
- Patients were felt to need antibiotics before enrollment
- Randomized to standard care or PCT algorithm
- 85% adherence to PCT algorithm
- Antibiotics prescribed for 25% of PCT group and 97% of standard of care group


### Procalcitonin in Lower Respiratory Infections

- RCT of patients with LRTIs
- PCT algorithm vs evidence based guidelines
- 1359 patients enrolled at 6 EDs
- 68% CAP, 17% COPD, 11% bronchitis, 4% other
- 92.5% hospitalized; median LoS was 8 days


### Procalcitonin in Lower Respiratory Infections

- Primary endpoint and mortality were similar between the two groups at 30 days
- Antibiotic exposure less in PCT group (5.7 days vs 8.7 days)
- 75.4% of patients prescribed antibiotics in PCT group vs 87.7% in standard of care
- IV antibiotic duration decreased from 3.8 to 3.2 days and oral antibiotic duration decreased from 4.9 to 2.5 days

Procalcitonin in Sepsis

- Meta-analysis of 7 trials totaling 1075 patients
- No difference in hospital mortality and 28-day mortality between PCT groups and controls
- LoS in hospital and in ICU did not differ between groups
- Statistically significant reduction in antibiotic duration in PCT group compared to control (6 days vs 8 days)

Pharmacy Technicians

- Medication histories
  - Tracking down outpatient antibiotic therapies
  - Contacting pharmacies, doctor’s offices, and nursing homes for complete histories
  - Vaccination history

Role of Pharmacy Technicians

- Allergy history
  - Clarifying that “PCN-rash” allergy!
  - Looking through history for previous received antibiotics

Role of Pharmacy Technicians

- Other potential roles
  - Data collection
  - Safety and quality reporting
  - DUE/MUE (daily, monthly, quarterly, or annual)
  - Medication preparation
  - Med safety roles
  - Facilitating medication assistance program enrollment
Questions

Why is antimicrobial stewardship important?
A. Reducing hospital costs
B. Improving outcomes
C. Reducing antimicrobial resistance
D. All of the above

Which of the following are important for antimicrobial stewardship in the ED?
A. Administrative Buy-in
B. Pharmacy and laboratory involvement
C. Change in prescriber culture
D. Optimal utilization of IT resources
E. All of the Above

Which of the following is not a potential limitation of rapid diagnostic tests?
A. Often requires positive culture
B. Equal or better performance compared to cultures
C. Limited or no susceptibility information
D. Cost

Which of the following are ways pharmacists contribute to antimicrobial stewardship?
A. Correct drug selection
B. Optimizing antibiotic dosing
C. Following up on diagnostic studies
D. De-escalating on admission
E. All of the above

Which of the following are ways pharmacy technicians can be involved in an antimicrobial stewardship program?
A. Collecting allergy histories
B. Collecting vaccine histories
C. Running antibiotic usage reports
D. All of the above
Conclusions

• Antimicrobial stewardship is critically important from economic, humanistic, and clinical perspectives
• The emergency department is an underserved area for antimicrobial stewardship

Conclusions

• Establishing antimicrobial stewardship practices in the emergency department can be difficult for numerous reasons
• Utilizing all available resources from technology, microbiology, laboratory, pharmacy residents, students, and technicians is important to maximize results

Thank You.