Antibiotic Update: A focus on special considerations in the elder

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Objectives

• Having completed the learning activities, the participant will be able to:
  – Identify factors influencing the choice of an antimicrobial.
  – Recognize the efficacy of standard and newer antibiotics for the treatment of infections commonly seen in the older adult.

Questions to Ask Prior to Choosing an Antimicrobial

• What is/are the most likely pathogen(s) causing this infection?
• What is the spectrum of a given antimicrobial’s activity?
• What is the likelihood of resistant pathogen?
• What is the danger if there is treatment failure?

Empiric Antimicrobial Therapy

• The decision-making process where the clinician chooses the agent based on patient characteristics and site of infection.

Global Initiative for Chronic Obstructive Lung Disease

National Heart, Lung, and Blood Institute
NIH
World Health Organization

Update available at http://www.goldcopd.org/Guidelines/guidelines-resources.html
COPD Defined

- COPD is a preventable and treatable disease with some significant extra pulmonary effects that may contribute to the severity in individual patients.
- Its pulmonary component is characterized by airflow limitation that is not fully reversible.

Per goldcopd.org

- The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases.

Exacerbation: Definition, Evaluation and Treatment

- An exacerbation of COPD is an event in the natural course of the disease characterized by a change in the patient’s baseline dyspnea, cough and/or sputum beyond day-to-day variability sufficient to warrant a change in management.

COPD Exacerbation: Treatment

- Use of bronchodilators
  - Short-acting β2-agonist and/or anticholinergic (ipratropium, tiotropium bromide) as needed
  - Consider adding long-acting bronchodilator (salmeterol, formoterol, tiotropium bromide) if patient currently not using one

COPD Exacerbation: Treatment (continued)

- If baseline FEV1 < 50% of predicted, add a systemic corticosteroid such as prednisone 40 mg daily for 5-10 days. Recent study supports shorter (5-day) course equally effective with less adverse effects than longer (10-day) course. Consider adding inhaled corticosteroid.
True or false?
• According to the most recent update of GOLDCOPD guidelines, the use of a daily dose of azithromycin to minimize COPD exacerbation risk does not have a favorable benefit vs risk ratio and is not recommended.

Antimicrobial Therapy in COPD Exacerbation
• Likely indicated in the presence of 3 cardinal symptoms: Increased dyspnea, increased sputum volume, and increased sputum purulence, though evidence varies.
• Recommended length of antimicrobial therapy per GOLDCOPD=5-10 d, per Sanford Guide=3-10 d

Sanford Guide Recommendation for Antimicrobial Therapy: COPD Flare

- Tobacco use, air pollution and viruses common contributing factors
- Causative pathogens (30-50%) include Haemophilus influenzae, Haemophilus parainfluenzae, Streptococcus pneumoniae, Moraxella catarrhalis.
- Less common pathogens include atypical pathogens, other gram positive and negative organisms.

Mild to moderate COPD exacerbation/acute exacerbation of chronic bronchitis
Antimicrobial therapy usually not indicated. If prescribed, consider using the following agents.
- Amoxicillin
- Doxycycline
  • Length of therapy=3-10 d

More severe COPD exacerbation/acute exacerbation of chronic bronchitis
Role of antimicrobial therapy debated even for severe disease. Consider severity of COPD and comorbidities in decision-making process.

Use one of the following agents.
- Amoxicillin-clavulanate
- 2d gen cephalosporin
- Azithromycin
- Clarithromycin
- Fluoroquinolone with activity against DRSP (Moxi-, levofloxacin)
Consider chest x-ray with fever and/or low SaO2 to help rule out a concomitant pneumonia.
Recurrent UTI Treatment Per Sanford Guide

### Type of infection | Usual pathogens | Regimens
--- | --- | ---
Recurrent UTI (=>3 culture-proven UTI per year in younger woman) | All of the aforementioned organisms | Treat any uncomplicated UTI, then trial of one of the following to prevent recurrences: TMP-SMX 80 mg/400 mg (single strength tab) PO q24h or 3x/week; OR TMP 100 mg once daily; OR cephalexin 250 mg once daily; OR fosfomycin 3 gm every 10 days administered for 6 months

### Repeated UTIs

Patient-initiated Therapy
- Patient has antimicrobial available
- Initiates therapy at 1st UTI sx
- Patient input
  - Clear understanding of length of UTI therapy
  - Signs and symptoms of treatment failure
  - When to seek provider assistance

Outcomes with Patient-initiated Therapy
- Study fails to demonstrate
  - Increase in rate of resistant pathogens
  - Poorer patient outcomes

Postmenopausal women: ≥3 culture + symptomatic UTIs in 1 year or 2 UTIs in 6 months
- All of the aforementioned organisms
- Treat as for uncomplicated UTI then consider one of the following:
  - Topical estrogen reduces risk by restoring normal vaginal flora
  - Nitrofurantoin more effective than vaginal estrogen but concern with pulmonary fibrosis with long-term use
  - Evaluate for potentially correctable urologic factors; cystocele, incontinence, increased residual urine volume (≥50 mL)
Extended-spectrum Beta Lactamase Producing Organisms

• AKA ESBL-producing organisms
  • Most often *K. pneumoniae*, *E. coli*, Acinetobacter
  • Organism that produce enzymes that confer resistance to most beta-lactam antibiotics
    – Penicillins
    – Cephalosporins
    – Monobactam aztreonam

ESBL-producing Organisms: Risk Factors for Acquisition

• Length of hospital/ICU stay
• Presence of central venous or arterial catheters
• Emergency abdominal surgery
• Presence of gastrostomy, jejunostomy tube
• Gut colonization with ESBL-producing organism

ESBL-producing Organisms: Risk Factors for Acquisition (continued)

• Prior administration of any antibiotic
• Prior residence in a long-term care facility (i.e., nursing home)
• Severity of illness
• Presence of a urinary catheter
• Ventilatory assistance
• Hemodialysis

Community-acquired Infection with ESBL-producing Organisms: Risk Factors

• Previous antibiotic therapy
• Use of systemic corticosteroids
• Presence of percutaneous gastrostomy or jejunostomy tube

UTI Caused by ESBL-producing Organisms: Treatment Options

• Usually effective antimicrobials
  – Nitrofurantoin
  – Fosfomycin
  – Amoxicillin-clavulanate plus cefdinir
  – Source: Sanfordguide.com

Length of Therapy in Select Populations

• DM
• Symptoms greater than 7 days
• Recently used antimicrobials
• =>age 65 yr
• Male

– Source: Gupta, K., Stamm, W. Best Dx/Best Tx, Urinary Tract Infection, available http://www.acpmedicine.com
Length of Therapy in Select Populations (continued)

- 7-day regimen
  - Oral TMP-SMX
  - Fluoroquinolone
  - Cefixime 400 mg daily
  - Cefpodoxime 100-200 mg daily
  - Other cephalosporin as appropriate

Source: Gupta, K., Stamm, W. Best Dx/Best Tx, Urinary Tract Infection, available http://www.acpmedicine.com

You see an older adult with a UTI.

- This person is being seen at a walk-in center and you do not have ready access to her record. She mentions that she has a “bit of kidney trouble” but is not sure of what nature. She has no allergies and is being treated for HTN, DM and dyslipidemia. Random glucose=110 mg/dL (6.1 mmol/L), BP=140/88, HR=80, RR=18, UA=Trace protein, +nitrates, +WBC

Antimicrobial Dose Adjustment in Renal Impairment: Nitrofurantoin

- If Cr Cl=>50 mL/min (0.835 mL/s)
  - Standard dosing according to indication
- If Cr Cl<50 mL/min (0.835 mL/s)
  - Avoid use as medication will likely have inadequate concentration in the urinary tract with subsequent risk of treatment failure

True or false?

- If the prescribing information about a given medication includes a warning about the need for dose adjustment in the presence of renal impairment, then that product is likely nephrotoxic.

Resources for Dosing

Source: http://www.globalrph.com/quicksearch_renal_dosing.htm
PI for Each Medication

You see an older adult with a UTI.

- As a result of this information, you consider prescribing:
  A. Nitrofurantoin.
  B. Ciprofloxacin.
  C. TMP-SMX.
  D. Amoxicillin.
Antimicrobial Dose Adjustment in Renal Impairment: Ciprofloxacin

- Ciprofloxacin
  - Cr Cl=>30 mL per minute (0.5 mL/s): No change with doses 250-750 mg BID
  - Cr Cl<30 mL per minute (0.5 mL/s): Required dose q24h

Mary

- 72-year-old woman
- HTN, T2DM, dyslipidemia
  - HgA1C=7.2% (0.072 proportion), BP=122/78
- Sustained non syncopal fall after tripping over grandchild's toy
- Evaluated in ED for hip pain
- No fracture revealed

Mary, UA in ED

- Protein=Negative
- Leukocyte esterase=Trace
- Nitrates=Negative
- RBC=1+
- U C&S=100K cfu E. coli
  - R=TMP/SMX, S=All others

Asymptomatic Bacteriuria: Epidemiology

- Epidemiology
  - Healthy premenopausal women=1-5%
  - Pregnant women=1.9-9.5%
  - Postmenopausal women=2.8-8.6%
  - Age 50-70 years
  - Women with diabetes=9-27%
  - Men with diabetes=0.7-1%

Asymptomatic Bacteriuria: Epidemiology (continued)

- In older adult
  - >15% community-dwelling women=>age 65 y
  - ~3-19% of community-dwelling men=>age 65 y

Asymptomatic Bacteriuria Defined per IDSA

- In absence of UTI sx
  - Clean-catch voided urine specimens with isolation of the same organism in quantitative counts of $\geq 10^5 \text{ cfu/mL}$
  - In men, X 1 specimen
  - In women, X 2 consecutive specimens

- In catheterized men or women
  - Single catheterized specimen with isolation of a single organism in quantitative counts of $\geq 10^2 \text{ cfu/mL}$

Asymptomatic Bacteriuria (continued)

- Epidemiology
  - Older long-term care residents
    - Women=25-50%
    - Men=14-40%
  - Patient with indwelling catheter
    - Short-term=9-23%
    - Long-term=100%
  - Source: http://www.aafp.org/afp/2006/0915/p985.html

- Hygienic issues
  - Fecal soiling, poor perineal hygiene

- Neurologic impairment
  - Impacting mobility, bladder emptying

- Postmenopausal hormonal changes

Asymptomatic Bacteriuria Risk Factors (Except in Pregnant Woman) (continued)

- Altered elimination
  - Fecal impaction
  - Medications that encourage constipation, urinary retention such as anticholinergic drugs

- Anatomic variations
  - Cystocele, BPH

- Hygienic issues
  - Fecal soiling, poor perineal hygiene

- Neurologic impairment
  - Impacting mobility, bladder emptying

- Postmenopausal hormonal changes

- Pregnant women
  - Bacteriuria associated with increased risk of preterm birth, low birth weight, perinatal mortality, pyelonephritis
  - Treat 3-7 days, dependent on antibiotic used
  - Antibiotic choice based on sensitivity of organism
Population to Screen, Treat for Asymptomatic Bacteriuria (continued)

- Treat?
  - If bladder instrumentation or surgery planned where risk of mucosal bleeding
  - Typically 1 week w/FQ
- Unneeded treatment can facilitate resistant organisms development

End of Presentation

Thank you for your time and attention.
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All websites listed active at the time of publication.
<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Cost (per dose)</th>
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</thead>
<tbody>
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<td>Penicillin</td>
<td>$25 0</td>
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<tr>
<td>Ampicillin</td>
<td>$25 0 93 6</td>
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<tr>
<td>Oxacillin</td>
<td>$100 0</td>
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<tr>
<td>Amoxicillin + clavulanate (Unexyn)</td>
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<td>Piperacillin + tazobactam (Zosyn)</td>
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<td>Cefazolin</td>
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<td>Cefuroxime</td>
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<td>Aztreonam</td>
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**Gram-Positive Organisms**

<table>
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<tr>
<th>Organism</th>
<th>Sensitivity</th>
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<tbody>
<tr>
<td>Staphylococcus aureus (a)</td>
<td>MRSA (a)</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>VRE</td>
</tr>
<tr>
<td>Streptococcus pneumoniae (d)</td>
<td>Streptococcus viridans</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>Enterococcus difficile</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa (b)</td>
<td>Klebsiella pneumoniae</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>Serratia marcescens</td>
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<tr>
<td>Enterobacter cloacae</td>
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<td>Hemophilus influenzae</td>
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<tr>
<td>Klebsiella oxytoca</td>
<td>Acinetobacter baumannii</td>
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<tr>
<td>Citrobacter freundii</td>
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**gram-Negative Organisms**

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</table>

(1) Resistance to vancomycin, linezolid, or quinoloxitone may be considered when using these agents. Please consult an antibiotic expert for guidance.

(2) Susceptibilities compiled from urinary tract isolates; should only be used for treatment of urinary tract infections (excluding enterococcus). See also the microbiology susceptibility panels and do not necessarily represent the hospital's antibiotic formulary.

*(a) Oxaclillin-resistant staphylococcus are also resistant to beta-lactamase inhibitor combinations, cephalosporins, and imipenem.

(b) The urinary tract tract two anti-Pseudomonas agents should be used for synergy and to reduce the risk of resistance.

(c) Susceptibilities compiled from urinary tract isolates; should only be used for treatment of urinary tract infections (i.e., should not be used for systemic infections).

(d) No S. pneumoniae isolates intermediate sensitivity to penicillin.

### All numbers have no duplicate patients, ED isolates not reported in antibiogram

The antibiotics listed on this antibiogram reflect those used on the microbiology susceptibility panels and do not necessarily represent the hospital's antibiotic formulary.

For teaching purposes only.