Antibiotic Smart Use in Hospital-acquired infection

Romanee Chaiwarith, MD, MHS.
Hospital-acquired infection

• A localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent (s) or its toxin (s)

• “No” evidence that the infection was present or incubating at the time of admission
Hospital-acquired infection

• For most bacterial HAIs, the infection usually evident 48 hours or more after admission

• However, incubation period varies with type of pathogen, each infection must be assessed individually

• The infection acquired in the hospital but does not become evidence until after hospital discharge is also counted as HAI.
Hospital-acquired infection

- The following conditions are **NOT** infections
  - **Colonization**: the presence of microorganisms on skin, mucous membranes, in open wounds, or in excretions or secretions but are not causing adverse clinical signs or symptoms
  - **Inflammation**: that results from tissue response to injury or stimulation by noninfectious agents, such as chemicals
Healthcare-associated infection

• Hospitalized in an acute care hospital for ≥ 2 days within 90 days
• Resided in a nursing home or long-term care facility
• Received recent IV antibiotic therapy, chemotherapy, or wound care within the past 30 days
• Attended a hospital or hemodialysis clinic
Prevalence of HAIs

• **WHO:** 8.7% of hospitalized patients, at any time > 1.4 million people worldwide suffer from HAIs. (1987)

• **Thailand (2006):** 4.9% for regional hospital, 6.0% for provincial hospital, 7.6% for university hospital

• **Maharaj Nakorn Chiang Mai Hospital:** 10.8% (2006), 12.2%(2007), 14.27%(2008)

[http://www.who.int/emc](http://www.who.int/emc)
Surveillance data on HAIs, Maharaj Nakorn Chiang Mai Hospital
<table>
<thead>
<tr>
<th>Sites of Infections</th>
<th>Target</th>
<th>2550</th>
<th>2551</th>
<th>2552</th>
<th>2553</th>
<th>UHOSNET (mean range)</th>
<th>NHSN</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>VAP</em> /1000 ventilator-day</td>
<td>≤ 9</td>
<td>9.64</td>
<td>8.13</td>
<td>6.28</td>
<td>4.99</td>
<td>10-13.4</td>
<td>3.13</td>
</tr>
<tr>
<td><em>CAUTI</em> /1000 catheter-day</td>
<td>≤ 7</td>
<td>9.52</td>
<td>8.16</td>
<td>8.92</td>
<td>7.12</td>
<td>4.4-5.8</td>
<td>4.77</td>
</tr>
<tr>
<td><em>CRBSI</em> /1000 central line-day</td>
<td>≤ 1</td>
<td>3.68</td>
<td>2.41</td>
<td>2.03</td>
<td>1.64</td>
<td>2.9-3.8</td>
<td>2.2</td>
</tr>
<tr>
<td><em>SSI</em> (Clean wound) /100 clean procedure</td>
<td>≤ 1</td>
<td>0.52</td>
<td>0.41</td>
<td>0.37</td>
<td>0.37</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**UHOSNET**: University Hospital Network  
**NHSN**: National health Safety Network
Prevalence of HAIs

Sites of HAIs


http://www.who.int/emc

Sites of HAIs in Medicine

- Pneumonia: 43.45%
- UTI: 35.65%
- Skin and soft tissue: 11.98%
- BSI: 5.57%
- SWI: 2.22%
- Other: 1.11%

Surveillance data on HAIs, Maharaj Nakorn Chiang Mai Hospital
Site specific for hospital-acquired pathogens in 2010

<table>
<thead>
<tr>
<th>Rank</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAP</td>
<td><em>A. baumannii</em></td>
<td><em>P. aeruginosa</em></td>
<td><em>K. pneumoniae</em></td>
<td><em>MRSA</em></td>
<td><em>S. aureus</em></td>
</tr>
<tr>
<td>CAUTI</td>
<td><em>E. coli</em></td>
<td><em>E. Faecalis</em></td>
<td><em>K. pneumoniae</em></td>
<td><em>P. aeruginosa</em></td>
<td><em>E. faecium</em></td>
</tr>
<tr>
<td>CRBSI</td>
<td><em>S. epidermidis</em></td>
<td><em>MRSA</em></td>
<td><em>A. baumannii</em></td>
<td><em>Coag neg. staph</em></td>
<td><em>C. albican</em></td>
</tr>
<tr>
<td>SSI</td>
<td><em>P. aeruginosa</em></td>
<td><em>E. coli</em></td>
<td><em>A. baumannii</em></td>
<td><em>MRSA</em></td>
<td><em>K. pneumoniae</em></td>
</tr>
</tbody>
</table>
Risk factors for MDR-pathogens

- Antimicrobial therapy in the preceding 90 days
- Current hospitalization for 5 days or more
- High frequency of antibiotic resistance in the specific hospital unit
- Immunosuppressive disease and/or therapy
Case 1

• A 70 year-old female was admitted to the hospital due to right intertrochanteric fracture. Urinary catheter was inserted for unknown reasons. She developed fever 3 days after admission. She had rhinorrhea and running nose for 2 days.

• Physical examination revealed BT 38.3°C, nasal voice, others were in normal. Laboratory revealed WBC 7,600 cells/mm³ and differential count was PMN 52%, L 45%, M 2%, E 1%.
Case 1

- Catheterized urine examination showed WBC 0-1/HPF, RBC 0-1/HPF, Epithelial cell 0-1/HPF.
- Urine culture grew *Pseudomonas aeruginosa* > 10^5 cfu/ml. This pathogen was sensitive to ceftazidime, piperacillin/tazobactam, amikacin, imipenem, meropenem.
Case 1

- What would you order?
  - NO antibiotic prescription
  - Ceftazidime
  - Piperacillin/tazobactam
  - Imipenem
  - Meropenem
Case 1

• The absence of pyuria in a symptomatic patient suggests a diagnosis other than CA-UTI (AIII)
CLUE 1:

Treat “infection” NOT “colonization”
Sequel of unnecessary antibiotics

• Drug allergy including Stevens Johnson Syndrome, bone marrow suppression, etc

• Unnecessary expenses

• Antimicrobial resistance develop especially in the setting of inappropriate doses and duration
How can bacterial drug resistance developed?

• Inherent or natural resistance
  – Enterococci resist to cephalosporins
  – Gram negative pathogens resist to vancomycin

• Acquired resistance
  – Spontaneous mutation
  – Acquisition of new genetic material
Acquired resistance

- Spontaneous mutation
  - The spontaneous mutation frequency for antibiotic resistance is on the order of about $10^{-8}$ to $10^{-9}$
  - In the selective environment of the antibiotic, the wild type (non-mutants) are killed and the resistant mutant is allowed to grow and flourish
  - Once the resistance genes have developed, they are transferred directly to all the bacteria's progeny during DNA replication. This is known as vertical gene transfer or vertical evolution.
Figure 1. Response of *Pseudomonas aeruginosa* at various garenoxacin exposures (AUC$_{90}$/MIC)

Acquired resistance

- Acquisition of new genetic material
  - Three possible mechanisms
    - Conjugation
    - Transformation
    - Transduction
  - Resistance genetic materials can be transferred between individual bacteria of the same species or even between different species and called horizontal gene transfer (HGT)
Environments that lead to bacterial resistance

- **Medical practices**
  - Antibiotics in non-bacterial infections
    - This gives the opportunity for indigenous bacteria (normal flora) to acquire resistance that can be passed on to pathogens (horizontal gene transfer)
  - Unfinished antibiotic prescription
    - Lead to selective pressure -> acquired resistance
Sequel of unnecessary antibiotics

<table>
<thead>
<tr>
<th>#</th>
<th>Qty</th>
<th>Code</th>
<th>Organism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>ECRCL</td>
<td>Escherichia coli</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Code</th>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ST</td>
<td>Sulfamethoxazole/Trimethoprim</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>G</td>
<td>Gentamicin</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>AN</td>
<td>Amikacin</td>
<td>S</td>
</tr>
<tr>
<td>4</td>
<td>AU</td>
<td>Amoxicillin/Clavulanic Acid</td>
<td>S</td>
</tr>
<tr>
<td>5</td>
<td>TZ</td>
<td>Piperacillin/Tazobactam</td>
<td>S</td>
</tr>
<tr>
<td>6</td>
<td>CX</td>
<td>Cefotaxime</td>
<td>S</td>
</tr>
<tr>
<td>7</td>
<td>CZ</td>
<td>Ceftazidime</td>
<td>S</td>
</tr>
<tr>
<td>8</td>
<td>FE</td>
<td>Cefepime</td>
<td>S</td>
</tr>
<tr>
<td>9</td>
<td>IP</td>
<td>Imipenem</td>
<td>S</td>
</tr>
<tr>
<td>10</td>
<td>ME</td>
<td>Meropenem</td>
<td>S</td>
</tr>
<tr>
<td>11</td>
<td>ETP</td>
<td>Ertapenem</td>
<td>S</td>
</tr>
<tr>
<td>12</td>
<td>OF</td>
<td>Ofloxacin</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Code</th>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ST</td>
<td>Sulfamethoxazole/Trimethoprim</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>AN</td>
<td>Amikacin</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>AU</td>
<td>Amoxicillin/Clavulanic Acid</td>
<td>I</td>
</tr>
<tr>
<td>4</td>
<td>TZ</td>
<td>Piperacillin/Tazobactam</td>
<td>S</td>
</tr>
<tr>
<td>5</td>
<td>CX</td>
<td>Cefotaxime</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CZ</td>
<td>Ceftazidime</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>IP</td>
<td>Imipenem</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>ME</td>
<td>Meropenem</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ETP</td>
<td>Ertapenem</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>OF</td>
<td>Ofloxacin</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CI</td>
<td>Ciprofloxacin</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>LX</td>
<td>Levofloxacin</td>
<td></td>
</tr>
</tbody>
</table>
CLUE II:

Treat “Patient” NOT “Physician”
Treat “Patient” NOT “Physician”
• Although infections are the most common cause of fever, the conditions below can also cause fever
  • Autoimmune disease
  • Inflammation process
  • Malignancy
  • Drugs and chemical irritation
  • Stroke

• Fever DOES NOT mean that you need to prescribe antibiotics, but it’s the beginning process to seek for the cause of fever and plan of treatment
Case II

• A 25 year-old male was admitted to the hospital due to abdominal trauma. Abdominal surgery was performed. He had fever on postoperative day 1, and dissappeared. On day 8 postoperative, he developed high grade fever with chill.

• Physical examinations: he was still intubated, rhonchi both lungs, yellowish sputum from suctioning, abdominal distension. The urinary catheter was still in place since post-operative.
• What would you do next?
CLUE III:

Specimen collection is “NOT” optional
Case II

- CBC
- Hemocultures
- CXR
- Sputum examination, sputum culture
- U/A, urine Gram stain, U/C
Case II

- CBC: WBC 7,600 cells/mm$^3$ and differential count was PMN 52%, L 45%, M 2%, E 1%.
- Hemocultures: pending
- CXR: no definite pulmonary infiltration
- Sputum examination: many Gram-negative bacilli,
- Sputum cultures: pending
- U/A: pyuria, many Gram-negative bacilli,
- U/C: pending
What is your empirically treatment?

- Ceftazidime
- Cefoperazone/sulbactam
- Cefepime
- Imipenem
- Meropenem
- Doripenem
- Colistin
CLUE IV:

You need to know your “OWN” local data
Percentages of various antimicrobial resistance for
*P. aeruginosa*

![Graph showing the percentages of various antimicrobial resistance for *P. aeruginosa* from 2006 to 2009 for different antibiotics: Meropenem, Imipenem, Piperacillin/tazobactam, Cefoperazone/sulbactam, Ceftazidime, Ciprofloxacin, and Amikacin. The graph illustrates the decline in resistance over the years for each antibiotic.]
Percentages of various antimicrobial resistance for A. baumannii

- Meropenem
- Imipenem
- Piperacillin/tazobactam
- Cefoperazone/sulbactam
- Ceftazidime
- Ciprofloxacin
- Amikacin
ESBL-producing enterobacteriaceae

<table>
<thead>
<tr>
<th>Year</th>
<th>E.coli</th>
<th>K.pneumoniae</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>56.7</td>
<td>52.2</td>
</tr>
<tr>
<td>2007</td>
<td>62.4</td>
<td>54.1</td>
</tr>
<tr>
<td>2008</td>
<td>61.6</td>
<td>55.5</td>
</tr>
<tr>
<td>2009</td>
<td>56.5</td>
<td>53.3</td>
</tr>
</tbody>
</table>
CLUE V:

You need to know Pk/Pd of antibiotics
Pharmacokinetics/ Pharmacodynamics

- Cmax/MIC
- AUC/MIC
- MIC
- Time > MIC

Antibiotic concentration vs. Time
Target Attainment

- β-lactams (T>MIC)
  - Penicillins:
    - Penicillin > 40%
    - Piperacillin/tazobactam > 50%
  - Cephalosporins > 50%
  - Carbapenems > 40%
Target Attainment

- **Macrolides (AUC/MIC)**
  - Azithromycin > 25
  - Clarithromycin > 125

- **Quinolones**
  - Gram-negative bacilli
    AUC/MIC > 100-125
  - *P. aeruginosa* 125
  - *S. pneumoniae* 30-40

- **Vancomycin**
  - AUC/MIC > 400

- **Aminoglycosides**
  - Cmax/MIC > 8-10
Pharmacokinetics/Pharmacodynamics

- Pk/Pd parameter changes as MIC change
Conc-time curve of cefoperazone following 2 g every 12 hr

Ambrose et al
Plasma concentration (ug/mL) vs. Day

Conc-time curve of cefoperazone following 2 g every 12 hr

Ambrose et al

MIC<sub>90</sub>

*P.aeruginosa*
Conc-time curve of cefoperazone following 2 g every 12 hr
Continuous v.s. Intermittent Administration of β-lactams

- Bolus dose
- Continuous infusion
- Concentration
- Once dosing interval
- MIC
Comparison of the Pharmacodynamics of Meropenem in Patients with Ventilator-Associated Pneumonia following Administration by 3-Hour Infusion or Bolus Injection

Sutep Jaruratanasirikul,* Somchai Sriwiriyajan, and Jarurat Punyo

Department of Medicine, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkla, Thailand

3 Hours Infusion of Meropenem

- The study was conducted with 9 patients with VAP
- Each subject received meropenem in three regimens consecutively

- Bolus injection of 1 g q8h for 24 h
- 3-h infusion of 1 g q8 h for 24 h
- 3-h infusion of 2 g q8 h for 24 h.
Figure 1. Mean serum meropenem concentration-time data for 9 VAP patients following administration of 1 g bolus (filled squares); 2 g 3 h infusion (filled triangles); and 1 g 3 h infusion (open circles).
### 3 Hours Infusion of Meropenem

- Pharmacokinetic parameters for meropenem administered by 3-h infusion and bolus injection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bolus injection</th>
<th>3 h infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 g</td>
</tr>
<tr>
<td>%T &gt; 4 MIC of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (µg/L)</td>
<td>28.33±11.67</td>
<td>37.78±20.57</td>
</tr>
<tr>
<td>2 (µg/L)</td>
<td>45.89±22.90</td>
<td>58.11±24.38</td>
</tr>
<tr>
<td>1 (µg/L)</td>
<td>57.00±24.82</td>
<td>72.67±21.97</td>
</tr>
</tbody>
</table>

Jaruratanasirikul S. *et al.*, AAC 2005
CLUE VI:

You need to know when to “COMBINE” antibiotics
## Combination therapy

### Advantages

1. Synergism
2. Prevention of emergence of resistance
3. Broad spectrum

### Disadvantages

1. Antagonism
2. Adverse events
3. Resistance development

Role of combination therapy in *P. aeruginosa* septicemia

Figure 6. Analysis of studies comparing combination anti-infective therapy with monotherapy for reducing mortality of *Pseudomonas spp* bacteraemia. The size of the squares is proportional to the reciprocal of the variance of the studies. The summary odds ratio is 0.50 (95% CI 0.32–0.79), indicating a mortality benefit with combination antimicrobial therapy.
Enterococcal septicemia

- β-lactam plus Gentamicin v.s. β-lactam monotherapy

<table>
<thead>
<tr>
<th>#</th>
<th>Qty</th>
<th>Code</th>
<th>Organism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>ETCFL</td>
<td>Enterococcus faecalis</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>STPAC</td>
<td>Staphylococcus sanguis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Code</th>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G(120)</td>
<td>Gentamicin (120 mcg)</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>P</td>
<td>Penicillin</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>AM</td>
<td>Ampicillin</td>
<td>S</td>
</tr>
<tr>
<td>4</td>
<td>VA</td>
<td>Vancomycin</td>
<td>S</td>
</tr>
<tr>
<td>5</td>
<td>LX</td>
<td>Levofloxacin</td>
<td>S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Code</th>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G(120)</td>
<td>Gentamicin (120 mcg)</td>
<td>R</td>
</tr>
<tr>
<td>2</td>
<td>P</td>
<td>Penicillin</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>AM</td>
<td>Ampicillin</td>
<td>S</td>
</tr>
<tr>
<td>4</td>
<td>VA</td>
<td>Vancomycin</td>
<td>S</td>
</tr>
<tr>
<td>5</td>
<td>LX</td>
<td>Levofloxacin</td>
<td>R</td>
</tr>
</tbody>
</table>
# Multidrug-resistant bacteria

## TABLE 8. Studies that primarily assessed combination therapy with colistin for the treatment of *Acinetobacter baumannii* infection

<table>
<thead>
<tr>
<th>Reference and study type</th>
<th>Study design</th>
<th>Combination therapy</th>
<th>Synergy or greater efficacy with combination therapy&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studies with animal models</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montero et al. (373)</td>
<td>Mouse pneumonia model</td>
<td>Colistin + rifampin against one carbapenem- and rifampin-resistant <em>A. baumannii</em> isolate</td>
<td>No difference to rifampin alone but &gt; 2 log reduction compared to colistin alone</td>
</tr>
<tr>
<td>Pantopoulou et al. (415)</td>
<td>Neutropenic rat thigh infection model</td>
<td>Colistin + rifampin against one carbapenem- and rifampin-resistant <em>A. baumannii</em> isolate</td>
<td>Improvement in 6-day survival with combination, tissue bacterial eradication similar to rifampin</td>
</tr>
<tr>
<td>Human studies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falagas et al. (161)</td>
<td>Retrospective cohort study</td>
<td>Colistin (&lt;i&gt;n&lt;/i&gt; = 14) vs colistin-meropenem (&lt;i&gt;n&lt;/i&gt; = 57)</td>
<td>No synergy observed</td>
</tr>
<tr>
<td>Motaouakkil et al. (374)</td>
<td>Retrospective case series (noncomparative)</td>
<td>Colistin + i.v. rifampin (&lt;i&gt;n&lt;/i&gt; = 26) (16 received nebulized colistin, 9 received i.v. colistin, and 1 received intrathecal colistin)</td>
<td>NA (favorable response in all patients)</td>
</tr>
<tr>
<td>Petrosillo et al. (432)</td>
<td>Retrospective case series (noncomparative)</td>
<td>i.v. colistin + i.v. rifampin (&lt;i&gt;n&lt;/i&gt; = 14) (five patients also received ampicillin-sulbactam)</td>
<td>NA (mortality rate of 50%)</td>
</tr>
</tbody>
</table>

<sup>a</sup> NA, not assessed.
CLUE VII:

You need to know when to “DE-ESCALATE” antibiotics
Case II

- CBC: WBC 7,600 cells/mm$^3$ and differential count was PMN 52%, L 45%, M 2%, E 1%.
- Hemocultures: pending
- CXR: no definite pulmonary infiltration
- Sputum examination: many Gram-negative bacilli,
- Sputum cultures: pending
- U/A: pyuria, many Gram-negative bacilli,
- U/C: pending
Case II

- Meropenem 1 gm infusion in 3 hours IV q 8 hour was prescribed

- Fever subsided on Day 4 of antibiotics
Case II

- CBC: WBC 7,600 cells/mm³ and differential count was PMN 52%, L 45%, M 2%, E 1%.
- Hemocultures: *Klebsiella pneumoniae*
- Sputum examination: many Gram-negative bacilli,
- Sputum cultures: *K. pneumoniae*
- U/A: pyuria, many Gram-negative bacilli,
- U/C: *K. pneumoniae*
Sensitivity results

Klebsiella pneumoniae ESBL-producing

### Micro Report

<table>
<thead>
<tr>
<th>#</th>
<th>Code</th>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ST</td>
<td>Sulfamethoxazole/Trimethoprim</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>AN</td>
<td>Amikacin</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>AU</td>
<td>Amoxicillin/Clavulanic Acid</td>
<td>S</td>
</tr>
<tr>
<td>4</td>
<td>TZ</td>
<td>Piperacillin/Tazobactam</td>
<td>S</td>
</tr>
<tr>
<td>5</td>
<td>CX</td>
<td>Cefotaxime</td>
<td>R</td>
</tr>
<tr>
<td>6</td>
<td>CZ</td>
<td>Ceftazidime</td>
<td>R</td>
</tr>
<tr>
<td>7</td>
<td>IP</td>
<td>Imipenem</td>
<td>S</td>
</tr>
<tr>
<td>8</td>
<td>ME</td>
<td>Meropenem</td>
<td>S</td>
</tr>
<tr>
<td>9</td>
<td>ETP</td>
<td>Ertapenem</td>
<td>S</td>
</tr>
<tr>
<td>10</td>
<td>OF</td>
<td>Ofloxacin</td>
<td>R</td>
</tr>
<tr>
<td>11</td>
<td>CI</td>
<td>Ciprofloxacin</td>
<td>R</td>
</tr>
<tr>
<td>12</td>
<td>LX</td>
<td>Levofloxacin</td>
<td>R</td>
</tr>
</tbody>
</table>
What would you prescribe?

- Amoxicillin/clavulanate
- Cefoperazone/ sulbactam
- Piperacillin/ tazobactam
- Ertapenem
- Meropenem
- Doripenem
Klebsiella pneumoniae
What would you prescribe?

- Amoxicillin/clavulanate
- Ceftriaxone
- Cefoperazone/ sulbactam
- Piperacillin/ tazobactam
- Ciprofloxacin
- Meropenem
- Doripenem
De-escalation therapy

• As soon as you get the identified pathogen and susceptibility testing results
Collateral Damage from Antibiotics

CLUE VIII:

You need to know when to “SWITCH THERAPY”
Antibiotic Switch Therapy

• Misconception
  – Infectious diseases need intravenousous treatment
  – The same agent must be used both ways

• Parenteral therapy is usually continued until the patient has clinically improved and is afebrile for 24-48 hours
Candidate for switch therapy

- Site of infection: should have no barrier e.g. endocardium, meninges
- Patients able to take oral medication
- Oral antimicrobial available
- Antimicrobial coverage identical to the intravenous agent or coverage identified pathogen
- Good oral bioavailability and good tissue penetration
- Adequate therapeutic ratio (AUC/MIC, T>MIC)
- Once or twice daily
CLUE VIII:

You need to know the “DURATION” of therapy
Antibiotic Smart Use in Hospital-acquired Infections

- Treat “infection” NOT “colonization”
- Treat “Patient” NOT “Physician”
- Specimen collection is “NOT” optional
- You need to know your “OWN” local data
- You need to know “Pk/Pd” of antibiotics
- You need to know when to “COMBINE” antibiotics
- You need to know when to “DE-ESCALATE” antibiotics
- You need to know when to “SWITCH” therapy
- You need to know the “DURATION” of therapy
Thank you for your attention