Infectious Diseases
Family Medicine
Board Review

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UCSF, Division of Infectious Diseases
Overview

• Lecture Outline
  – Cases with questions (90%)
  – High yield information (10%)
Case 1

32 y/o M with 3 days of an enlarging, painful lesion on his L thigh that he attributes to a “spider bite”

T 36.9 BP 118/70 P 82
How would you manage this patient?

A. Incision and drainage alone

B. Incision and drainage plus cephalexin

C. Incision and drainage plus TMP-SMX
Abscesses: Do antibiotics provide benefit over I&D alone?

<table>
<thead>
<tr>
<th>Study</th>
<th>Antibiotics</th>
<th>Placebo</th>
<th>% Patients Cured</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rajendran '07</td>
<td>Cephalexin</td>
<td>Placebo</td>
<td>60%</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>TMP-SMX</td>
<td>Placebo</td>
<td>80%</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>TMP-SMX</td>
<td>Placebo</td>
<td>80%</td>
<td>0.52</td>
</tr>
</tbody>
</table>

TMP-SMX vs. placebo for skin abscesses

- Multi-center randomized control trial
- 5 US Emergency Departments
- All got I&D plus TMP-SMX vs. placebo
- Cure (per-protocol); p<0.001
  - TMP-SMX: 487/524 (93%)
  - Placebo: 457/533 (86%)

Talan D. NEJM. 2016
Antibiotic therapy is recommended for abscesses associated with:

- Severe disease, rapidly progressive with associated cellulitis or septic phlebitis
- Signs or symptoms of systemic illness
- Associated comorbidities, immunosuppressed
- Extremes of age
- Difficult to drain area (face, hand, genitalia)
- Failure of prior I&D

Liu C. *Clin Infect Dis*. 2011
Microbiology of Purulent SSTIs

- MRSA: 59%
- MSSA: 17%
- B-hemolytic strep: 3%
- non-B hemolytic strep: 4%
- other: 8%
- unknown: 9%

Moran NEJM 2006
# Empiric PO Antibiotics for Purulent SSTIs

<table>
<thead>
<tr>
<th>PO agents</th>
<th>Strep active</th>
<th>Dosing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TMP-SMX</strong></td>
<td>+/-</td>
<td>Q12h</td>
<td>HyperK+</td>
</tr>
<tr>
<td><strong>Doxy/mino</strong></td>
<td>+/-</td>
<td>Q12h</td>
<td>GI; Photosensitivity</td>
</tr>
<tr>
<td><strong>Clindamycin</strong></td>
<td>++</td>
<td>Q8h</td>
<td>Susceptible: Adults 50%; Peds 75%</td>
</tr>
<tr>
<td><strong>Linezolid</strong></td>
<td>++</td>
<td>Q12h</td>
<td>$$;$ Tox - heme, SSRI</td>
</tr>
</tbody>
</table>
## Empiric IV Antibiotics for Purulent SSTIs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin</td>
<td>Q12h</td>
<td>OK for bacteremia, PNA</td>
</tr>
<tr>
<td>Daptomycin</td>
<td>Q24h</td>
<td>OK for bacteremia, <strong>not</strong> PNA</td>
</tr>
<tr>
<td>Televancin</td>
<td>Q24h</td>
<td>Approved for PNA, renal tox</td>
</tr>
<tr>
<td>Ceftaroline</td>
<td>Q12h</td>
<td>Active vs. Gram - (not pseudo)</td>
</tr>
<tr>
<td>Dalbavancin</td>
<td>Q7d x 2</td>
<td></td>
</tr>
<tr>
<td>Oritavancin</td>
<td>x1</td>
<td>VRE activity</td>
</tr>
</tbody>
</table>

*Linezolid and tedizolid come in IV formulation as well*
How would you manage this patient?

A. Incision and drainage alone

A. Incision and drainage plus cephalexin

B. Incision and drainage plus TMP-SMX
Case 2

28 y/o woman presents with erythema of her left foot over past 48 hrs

No purulent drainage, exudate, or fluctuance.

T 37.0 BP 132/70 P 78

Eels SJ et al Epidemiology and Infection 2010
How would you manage this patient?

A. Clindamycin 300 mg TID

B. Cephalexin 500 mg QID, monitor clinically with addition of TMP/SMX if no response

C. Cephalexin 500 mg QID + TMP/SMX 1 DS BID
Cephalexin vs. Cephalexin + TMP-SMX in patients with Uncomplicated Cellulitis

- **Cure**: 82.0% for Cephalexin, 85.0% for Cephalexin + TMP-SMX (N=146)
- **Progression to abscess**: 6.8% for both groups
- **Adverse Events**: 53.0% for Cephalexin, 49.0% for Cephalexin + TMP-SMX

Pallin CID 2013; 56: 1754-1762
# Empiric Antibiotics for Non-purulent SSTIs

<table>
<thead>
<tr>
<th></th>
<th>MSSA active</th>
<th>MRSA active</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penicillin</td>
<td>-</td>
<td></td>
<td>Q6h</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>+</td>
<td></td>
<td>Q6h</td>
</tr>
<tr>
<td>Dicloxacillin</td>
<td>+</td>
<td></td>
<td>Q6h</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>++</td>
<td>+</td>
<td>Q8h</td>
</tr>
<tr>
<td><strong>IV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penicillin</td>
<td>-</td>
<td></td>
<td>Q6h</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>+</td>
<td></td>
<td>Q8h</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How would you manage this patient?

A. Clindamycin 300 mg TID

B. Cephalexin 500 mg QID, monitor clinically with addition of TMP/SMX if no response

C. Cephalexin 500 mg QID + TMP/SMX 1 DS BID
Case 3: A slight alteration…

- 34 y/o comes in with the similar symptoms
- Temp 38.9, HR 105, SBP 100, RR 20
- Appears ill and in more pain than what you would expect for cellulitis
Necrotizing soft tissue infection
Early diagnosis and intervention!

Mortality rate: > 30%

Wong CH. Jour of Bone and Joint Surg. 2003
Necrotizing soft tissue infections: clinical clues

- Tenderness
- Erythema
- Warmth
- Bullae
- Induration
- Fluctuance
- Crepitus
- Necrosis
- Sensory/motor
- Hypotension
- Fever
- Tachycardia

Late findings

Wong CH. Jour of Bone and Joint Surg. 2003
Necrotizing soft tissue infections: radiographic techniques

- Plain films
  - Low sensitivity
  - Helpful if gas present

- CT and ultrasound
  - May identify other Dx (abscess)

- MRI
  - Enhanced sensitivity, low specificity
# Necrotizing Skin and Soft Tissue Infection: Pathogens

<table>
<thead>
<tr>
<th>Monomicrobial</th>
<th>Polymicrobial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A strep</td>
<td>Aerobic Gram +/Gram -</td>
</tr>
<tr>
<td>CA-MRSA</td>
<td>PLUS</td>
</tr>
<tr>
<td>Clostridia sp</td>
<td>Anaerobes</td>
</tr>
<tr>
<td>Gram negatives</td>
<td></td>
</tr>
<tr>
<td>Vibrio vulnificus</td>
<td></td>
</tr>
</tbody>
</table>

Empiric treatment of necrotizing soft tissue infections

• Early surgical intervention! (be annoying)

• Antimicrobial therapy
  – **Pip/tazo** (*Gram neg/anaerobes*)
    - plus
  – **Vancomycin** (*MRSA*)
    - plus
  – **Clindamycin** (*group A strep*)
## Toxic shock syndromes

<table>
<thead>
<tr>
<th></th>
<th>Pathophys</th>
<th>Site</th>
<th>Clinical</th>
<th>Rx</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strep (GAS)</strong></td>
<td>Pyrogenic exotoxin</td>
<td>Sterile (blood, tissue)</td>
<td>Shock</td>
<td>Prot synth inhibitor</td>
</tr>
<tr>
<td></td>
<td>(superantigen)</td>
<td></td>
<td></td>
<td>IVIg</td>
</tr>
<tr>
<td><strong>Staph</strong></td>
<td>TSST-1</td>
<td>Non-sterile site often (tampon, nasal packing)</td>
<td>Shock + Eythroderma (desquamation (1-2 weeks later)</td>
<td>Prot synth inhibitor</td>
</tr>
</tbody>
</table>
Erythroderma
Case

- 61 y/o diabetic presents to ED with fever, stiff neck, and new onset seizure.
- Febrile to 39°C with stable vital signs.
- Lethargic but able to answer questions.
- Nuchal rigidity and photophobia seen but no focal neurological abnormalities.
Question: Does he need a CT scan before getting an LP?

A. Yes

B. No
Who needs a head CT before LP?

Who is at high risk for herniation from LP?

- Patients at high risk for mass lesions or increased intracranial pressure can be identified clinically and should then undergo CT scan

- Who are high risk patients?
  - New-onset seizure
  - Immunocompromised
  - Focal neurological finding
  - Papilledema
  - Moderate-severe impairment of consciousness

Question 4a: Does he need a CT scan before getting an LP?

A. Yes
B. No
Question: Which is the preferred antibiotic regimen for this patient? (61 y/o male)

A. Ceftriaxone
B. Ceftriaxone and Vancomycin
C. Ceftriaxone and Ampicillin
D. Vancomycin and Ceftriaxone and Ampicillin
<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Pathogens</th>
<th>Antimicrobials</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 month</td>
<td>GBS, E. coli, L. monocytogenes</td>
<td>Ampicillin + cefotaxime</td>
</tr>
<tr>
<td>1-23 months</td>
<td>S. pneumoniae, N. meningitidis, H. influenzae</td>
<td>Vancomycin + 3rd gen ceph</td>
</tr>
<tr>
<td>2-50 yrs</td>
<td>N. meningitidis, S. pneumoniae</td>
<td>Vancomycin + 3rd gen ceph</td>
</tr>
<tr>
<td>&gt; 50 yrs</td>
<td>S. pneumoniae, N. meningitidis, L. monocytogenes</td>
<td>Vancomycin+ 3rd gen ceph + ampicillin</td>
</tr>
</tbody>
</table>

Adapted from Tunkel AR. CID 2004; GBS=group B strep (Strep agalactiae), 3rd gen ceph=ceftriaxone or cefotaxime
IDSA algorithm for management of bacterial meningitis

**Indication for head CT**

- **NO**
  - Blood cx + Lumbar puncture
    - Steroids and empiric antimicrobials
      - CSF suggestive of bacterial meningitis
      - Refine therapy

- **YES**
  - Blood cx
    - Steroids and empiric antimicrobials
    - Head CT w/o mass lesion or herniation
      - Lumbar puncture

Tunkel AR. *CID* 2004
Question: Which is the preferred antibiotic regimen for this patient? (61 y/o male)

A. Ceftriaxone
B. Ceftriaxone and Vancomycin
C. Ceftriaxone and Ampicillin
D. Vancomycin and Ceftriaxone and Ampicillin
Antibiotic prophylaxis for contacts?

- Only those with close contact to case of Neisseria or Haemophilus
- Prophylaxis options
  - Ciprofloxacin
  - Rifampin
  - Ceftriaxone
HSV infections of CNS

• Aseptic meningitis (HSV-2)
  – Benign course
  – Treatment of unclear benefit, IV->PO acyclovir
  – May recur (Mollaret's syndrome)

• Encephalitis (HSV-1)
  – Severe neurologic impairment
  – Classical MRI changes (temporal lobes)
  – Start treatment when you suspect diagnosis
  – Treatment - IV acyclovir (10 mg/kg IV q8)
West Nile virus

< 1% NEUROINVASIVE DISEASE
• Encephalitis (55-60%)
• Meningitis (35-40%)
• Poliomyelitis (5-10%)

20% WEST NILE FEVER

WNV Fever
• Fever and HA
• Malaise/Fatigue
• Anorexia

Diagnosis: WNV IgM and IgG from serum and CSF

Peterson LR. JAMA. 2004
Case

- 65 y/o diabetic woman presents to clinic for routine evaluation. She has been feeling well. A urinalysis and culture are sent.
- UA: WBC->100, RBC-0, Protein-300
- The next day you are called because the urine culture has >100,000 *Klebsiella pneumoniae*
Question 5: What do you recommend?

A. No antibiotics

B. Empiric ciprofloxacin and await susceptibilities

C. Repeat culture in 1 week and if bacteria still present then treat
Definition: Asymptomatic bacteriuria

- Bacteriuria without symptoms
  - Midstream: $\geq 10^5$ CFU/ml
  - Cath: $\geq 10^2$ CFU/ml

- Pyuria is present $> 50\%$ of patients
Asymptomatic bacteriuria in diabetic women

- Asymp bacteriuria ~ 25% of diabetic women (pyuria > 50%)
- RCT, placebo controlled of 105 diabetic women
- 14 days of antibiotic vs. placebo
- 1° endpoint: symptomatic UTI
  - 42% antibiotic group vs. 40% placebo
  - RR 1.19 (0.28–1.81), p=0.42

Harding GKM. NEJM 2003
Treatment of asymptomatic bacteriuria?

- **Clear benefit**
  - Pregnant women
  - Pre traumatic urologic interventions with mucosal bleeding

- **Likely benefit**
  - Neutropenic

- **No benefit**
  - Postmenopausal ambulatory women
  - Institutionalized
  - Spinal cord injuries
  - Patients with urinary catheters
  - Diabetics
Question 5: What do you recommend?

A. No antibiotics

B. Empiric ciprofloxacin and await susceptibilities

C. Repeat culture in 1 week and if bacteria still present then treat
Case 6

• A 21 year-old college student, calls to say that she has “a urinary tract infection, again”

• You have treated her for uncomplicated cystitis 2 times in the past year

• You obtain a UA:
  – Leukocyte esterase 3+, RBC 1+
Question 6: According to the IDSA Guidelines, what is the 1st line treatment for an uncomplicated UTI?

A. Ciprofloxacin 250mg BID x 3d
B. Nitrofurantoin 100mg BID x 5d
C. TMP-SMX DS BID x 7d
D. Cephalexin 500 mg QID x 7d
IDSA guidelines for uncomplicated UTI treatment

Goal: Low resistance and low “collateral damage”

• Nitrofurantoin 100 mg PO BID x 5 days
• TMP-SMX DS PO BID x 3 days
  – avoid if resistance >20%, recent usage
• Fosfomycin 3 gm PO x 1

Gupta K. CID 2011
Question: According to the IDSA Guidelines - what is the 1st line treatment for an uncomplicated UTI?

A. Ciprofloxacin 250mg BID x 3d
B. Nitrofurantoin 100mg BID x 5d
C. TMP-SMX DS BID x 7d
D. Cephalexin 500 mg QID x 7d
What would make the UTI “complicated”?

- Anatomic abnormality
- Indwelling catheter
- Recent instrumentation
- Men
- Healthcare-associated
- Recent antimicrobial use
- Symptoms > 7 days
- Diabetes or immunosuppression
- History of childhood UTI

How would you treat?

- Fluoroquinolones for empiric therapy
- Obtain cultures
- Duration 7-14 days
Prevention of recurrent UTIs

- Prevent vaginal colonization w/ uropathogens
  - Avoid spermicide
  - Intra-vaginal estrogen (post-menopausal)

- Prevent growth of uropathogens in bladder
  - Methenamine hippurate
  - Increase in daily fluid (1.5L+)
  - Postcoital or daily antibiotics

- Correct anatomic/neurologic problems
  - Select cases consider urology evaluation (elevated Cr, hematuria, recurrent Proteus infection)

Note that Cranberry is not on this list!
Question: If this same patient presented with pyelonephritis what would be the best regimen?

A. Ceftriaxone 1 gm IV q24
B. Moxifloxacin 400 mg IV/PO q24
C. Nitrofurantoin 100 mg PO q12
D. Cefpodoxime 200 mg PO q12
Empiric treatment of pyelonephritis

- **Recommended**
  - Ciprofloxacin 500 mg q12 (7 days if uncomplicated)
    - Levofloxacin OK but **not** Moxifloxacin
  - Ceftriaxone 1 gm IV q24 (14 days)

- **Not recommended**
  - TMP-SMX (high resistance rate so not good empiric)
  - Nitrofurantoin (does not get into kidney parenchyma)

- **Health-care associated pyelonephritis**
  - Use antipseudomonal agent other than fluoroquinolone
Question: If this same patient presented with pyelonephritis what would be the best regimen?

A. Ceftriaxone 1 gm IV q24
B. Moxifloxacin 400 mg IV/PO q24
C. Nitrofurantoin 100 mg PO q12
D. Cefpodoxime 200 mg PO q12
Case

• 60 y/o woman with HTN presents with 3 days of cough with green sputum, dyspnea on exertion, fever, pleuritic chest pain. She otherwise has no past medical history.

• Exam: 38.5°, 145/90, 100, 18, 95% RA

• Chest: crackles at left base

• WBC: 15.5  CXR: LLL infiltrate
Question: How would you manage this patient?

A. Oral antibiotics at home
B. Hospitalize for IV antibiotics; when afebrile, switch to PO antibiotics and discharge home
C. Hospitalize for IV antibiotics; when afebrile, switch to PO antibiotics and discharge after 24 hours observation
D. Hospitalize for minimum of 7 days of IV antibiotics
Pneumonia Severity Index

Demographic
Age (+1 point/yr, -10 if woman)
Nursing home (+10)

Comorbidities
Cancer (+30)
Liver disease (+20)
CHF (+10)
Cerebrovascular dz (+10)
Renal disease (+10)

Examination
Mental status (+20)
Pulse > 125 (+20)
Resp rate > 30 (+20)
SBP < 90 (+15)
Temp < 35 or > 40 (+10)

Labs
pH < 7.35 (+30)
BUN > 30 (+20)
Na < 130 (+20)
Glucose > 250 (+10)
pO2 < 60 (+10)
Hct < 30 (+10)
Pleural effusion (+10)

*Don’t memorize this!*
Pneumonia Severity Index

http://pda.ahrq.gov/clinic/psi/psicalc.asp

<table>
<thead>
<tr>
<th>Class</th>
<th>PSI score</th>
<th>Mortality</th>
<th>Triage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Age &lt; 50, no comorbidity, stable vital signs</td>
<td>0.1%</td>
<td>outpatient</td>
</tr>
<tr>
<td>II</td>
<td>≤ 70</td>
<td>0.7%</td>
<td>outpatient</td>
</tr>
<tr>
<td>III</td>
<td>71-90</td>
<td>3%</td>
<td>consider admission</td>
</tr>
<tr>
<td>IV</td>
<td>91-130</td>
<td>8%</td>
<td>admission</td>
</tr>
<tr>
<td>V</td>
<td>&gt; 130</td>
<td>29%</td>
<td>? ICU</td>
</tr>
</tbody>
</table>
**CAP: When to Admit**

**Outpatient:**
- Younger
- No cancer or end-organ disease
- No severe vital sign abnormalities
- No severe laboratory abnormalities

**Inpatient:**
- Doesn’t meet outpt criteria
- Hypoxia
- Active coexisting condition
- Unable to take oral meds
- Psychosocial issues
  - Homeless, drug abuse, risk of non-adherence
CAP: When to Discharge

• Afebrile, hemodynamically stable, not hypoxic, and tolerating POs
• No minimum duration of IV therapy needed
• No need to watch on oral antibiotics
• Most patients with CAP, 5 days of antibiotic treatment is adequate
Question: How would you manage this patient?

A. Oral antibiotics at home
B. Hospitalize for IV antibiotics; when afebrile, switch to PO antibiotics and discharge home
C. Hospitalize for IV antibiotics; when afebrile, switch to PO antibiotics and discharge after 24 hours observation
D. Hospitalize for minimum of 7 days of IV antibiotics
Case:

- 82 y/o with h/o CHF presents with 5 days of productive cough and dyspnea. Denies recent travel or hospitalization.
- 39° 110/90 110 24 85% RA
- Chest: crackles at right base
- CXR: Right lower & middle lobe infiltrates
- Labs: WBC 12, BUN=38, otherwise normal
Question: What is the most appropriate treatment?

A. Cefuroxime IV
B. Levofloxacin IV
C. Piperacillin-tazobactam IV
D. Azithromycin IV
E. Cefepime IV + vancomycin IV
Etiology of CAP

- Clinical and CXR not predictive of organism
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae*
  - *Mycoplasma pneumoniae*
  - *Chlamydia pneumoniae*
  - *Legionella*
  - (Enteric Gram negative rods)
  - Viruses
  - *Staphylococcus aureus*
# Empirical Treatment for Outpatients

<table>
<thead>
<tr>
<th>No comorbidity or recent antibiotics</th>
<th>Macrolide or Doxycycline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comorbid condition(s)</td>
<td>β-lactam (e.g. amox) + either macrolide or doxycycline or Respiratory FQ*</td>
</tr>
<tr>
<td>age &gt; 65, EtOH, CHF, severe liver or renal disease, cancer</td>
<td></td>
</tr>
<tr>
<td>or Antibiotics in last 3 months</td>
<td></td>
</tr>
</tbody>
</table>

B-lactam= High-dose amoxicillin [e.g., 1 g 3 times daily] or amoxicillin-clavulanate [2 g 2 times daily] is preferred; alternatives include ceftriaxone, cefpodoxime, and cefuroxime [500 mg 2 times daily];

* Respiratory FQ = Levofloxacin or Moxifloxacin
## Empirical Treatment for Inpatients

<table>
<thead>
<tr>
<th>Inpatient non-ICU</th>
<th>β-lactam + macrolide or doxycycline or • Respiratory FQ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inpatient ICU</strong></td>
<td>β-lactam + azithromycin or resp FQ (Penicillin allergy: fluoroquinolone + aztreonam)</td>
</tr>
<tr>
<td><strong>MRSA concern</strong></td>
<td>• Add vancomycin or linezolid to above</td>
</tr>
</tbody>
</table>

*B-lactam* = cefotaxime, ceftriaxone, and ampicillin-sulbactam; ertapenem for selected patients

*Resp FQ = Levofloxacin or Moxifloxacin*
Question: What is the most appropriate treatment?

A. Cefuroxime IV
B. Levofloxacin IV
C. Piperacillin-tazobactam IV
D. Azithromycin IV
E. Cefepime IV + vancomycin IV
Diagnostic Testing in CAP

• Chest radiography:
  – Indicated for all patients with suspected pneumonia

• Blood culture:
  – Recommended for inpatients (do before antibiotics)

• Sputum exam:
  – Controversial but recommended for inpatients

• Other:
  – Legionella urinary Ag, pneuemo urinary Ag, resp virus testing
Case

- 60 y/o intubated 17 days ago following MVA. Received ciprofloxacin for a UTI 8 days ago.
- Now she has new fever, WBC 15, and increased oxygen requirements.
- Chest X-ray was done
Question: Which antibiotics would you start after obtaining blood and sputum cultures?

A. Vancomycin
B. Vancomycin + ceftriaxone
C. Ceftriaxone + azithromycin
D. Vancomycin + meropenem
E. Moxifloxacin
Ventilator associated pneumonia (VAP)

- Clinical diagnosis!
  - Increased oxygen requirement
  - Fever
  - Increased WBC count
  - New infiltrate on CXR
  - Increased secretions

- Use respiratory culture to tailor therapy
<table>
<thead>
<tr>
<th>HAP/VAP pathogens</th>
<th>Empiric Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gram negatives</strong></td>
<td></td>
</tr>
<tr>
<td>-Pseudomonas</td>
<td>Anti-pseudomonal cephalosporin (ceftaz or cefepime)</td>
</tr>
<tr>
<td>-Acinetobacter</td>
<td>or</td>
</tr>
<tr>
<td>-Enterics</td>
<td>Anti-pseudomonal penicillin (piperacillin-tazobactam)</td>
</tr>
<tr>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>Anti-pseudomonal carbapenem (imi-, mero-, doripenem)</td>
</tr>
<tr>
<td></td>
<td><strong>PLUS</strong></td>
</tr>
<tr>
<td></td>
<td>Anti-pseudomonal aminoglycoside (gent, tobra, amikacin)</td>
</tr>
<tr>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>Anti-pseudomonal fluoroquinolone (cipro, levo)</td>
</tr>
<tr>
<td></td>
<td><strong>PLUS</strong></td>
</tr>
<tr>
<td><strong>S. aureus (MRSA)</strong></td>
<td>Vancomycin or linezolid</td>
</tr>
</tbody>
</table>
When do we need to cover for *pseudomonas*?

- Not cause of community acquired pneumonia but if any below present can consider…
  - Recent or current hospitalization
  - Recent antibiotics
  - Structural lung disease (CF)
What antibiotics cover pseudomonas?

• **B-lactams**
  – Piperacillin and ticaricillin
  – Ceftazidime, cefepime
  – Aztreonam
  – Imipenem, meropenem, doriopenem (*not* ertapenem)

• **Fluoroquinolones**
  – Ciprofloxacin and levofloxacin (*not* moxifloxacin)

• **Aminoglycosides**
  – Gentamicin, tobramycin, amikacin
Question: Which antibiotics would you start after obtaining blood and sputum cultures?

A. Vancomycin
B. Vancomycin + ceftriaxone
C. Ceftriaxone + azithromycin
D. Vancomycin + meropenem
E. Moxifloxacin
Case:

- 70 y/o M is hospitalized for diverticulitis. HD#9 he develops a new fever. Purulent drainage is noted from a central venous catheter, and it is removed.
- Fever persists for several days. Exam reveals new systolic murmur. Echo shows a small vegetation on the mitral valve.
- Which organism MOST LIKELY grew from his blood cultures?
Question:

A. *Staphylococcus aureus*
B. *Streptococcus bovis*
C. *Enterococcus spp.*
D. Candida
Endocarditis

• Most common organisms
  – *Staphylococcus aureus*
  – Streptococci, viridans group; also *S. bovis*
  – Coagulase-negative staph (prosthetic valve)
  – Candida
  – Culture negative
  – HACEK
Question:

A. *Staphylococcus aureus*

B. *Streptococcus bovis*

C. *Enterococcus spp.*

D. Candida
Endocarditis: Modified Duke Criteria

• Diagnosis: Clinical Criteria
  – Major
    • Blood culture criteria
    • Endocardial involvement (Echo veg, new regurgi)
  – Minor
    • Predisposition
    • Fever
    • Other microbiologic
    • Vascular phenomena
    • Immunologic phenomena
Osler nodes

Janeway lesions

Roth spots
(white-centered retinal hemorrhages - arrow heads)

Splinter hemorrhages
Endocarditis

• Duke criteria continued…
  – Definite endocarditis:
    • 2 major OR 1 major + 3 minor OR 5 minor
  – Indications for surgery?
    • CHF, continued emboli, uncontrolled sepsis, perivalvular abscess
    • Difficult to treat organisms (fungi, Gram- negatives, resistant organisms)
    • Large vegetations (> 1 cm?)
Endocarditis - Treatment

*Use recommended regimens!*

- **Penicillin-susceptible streptococcus**
  - Penicillin G or ceftriaxone x 4 wk
  - Penicillin G or ceftriaxone + gentamicin x 2 wk
- **Streptococcus MIC >0.1 to 0.5 mg/mL**
  - Penicillin G or ceftriaxone x 4 wk + gentamicin x 2 wk
- **Streptococcus MIC >0.5 mg/mL or enterococccus**
  - Ampicillin or penicillin G + gentamicin x 4-6 wk
Endocarditis - Treatment

- Aortic or mitral valve MSSA
  - Nafcillin or cefazolin x 6 wk
- MRSA
  - Vancomycin x 6 wk
- HACEK
  - Ceftriaxone x 4 wk
Endocarditis - Prophylaxis

• Prophylaxis only for highest risk patients
  – Prosthetic valve, previous endocarditis, cardiac transplantation with valvulopathy, certain congenital heart disease

• Procedures requiring prophylaxis for above:
  – Dental with manipulation of gingiva or periapical region of teeth or perforation of oral mucosa
  – No prophylaxis for GI or GU procedures
### Recommended antibiotics when endocarditis prophylaxis is needed

<table>
<thead>
<tr>
<th>Oral</th>
<th>Amoxicillin</th>
<th>2 g 1 hour pre-procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clindamycin</td>
<td>600 mg 1 hour pre-procedure</td>
</tr>
<tr>
<td>Penicillin allergy</td>
<td>Cephalexin</td>
<td>2 g 1 hour pre-procedure</td>
</tr>
<tr>
<td></td>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Penicillin allergy</td>
<td>Azithromycin or clarithromycin</td>
<td>500 mg 1 hour pre-procedure</td>
</tr>
<tr>
<td>Parenteral</td>
<td>Ampicillin</td>
<td>2 g IM or IV 30 min pre-procedure</td>
</tr>
<tr>
<td>Penicillin allergy</td>
<td>Clindamycin</td>
<td>600 mg IV 1 hour pre-procedure</td>
</tr>
<tr>
<td></td>
<td>or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cefazolin</td>
<td>1 g IM or IV 30 min pre-procedure</td>
</tr>
</tbody>
</table>
Case

• 67 year-old male with COPD/asthma, presents to clinic with 3 days of fever, cough, wheezing, and achiness. You do a rapid flu test which is positive.

• How should you treat this patient?
Question

A. Start amantadine
B. Start oseltamivir
C. Start zanamivir
D. No treatment because symptoms > 48h
Influenza

- Two important types: A and B

- Influenza A
  - Typed by glycoproteins: hemagglutinin/neuraminidase
  - Treatments:
    - Adamantanes (amantadine, ramantidine)
    - Neuraminidase inhibitors (oseltamivir, zanamivir)

- Influenza B: not susceptible to adamantanes
Influenza

• Diagnosis (sensitivity):
  – PCR >> DFA (immunofluorescence) >> Rapid test

• Treatment:
  – Who
    • Hospitalized or severe illness: anytime
    • Outpt high-risk for complications: anytime
    • Non-high-risk outpatients: < 48h of symptoms
  – What
    • Oseltamivir or Zanamivir
Question

A. Start amantadine
B. Start oseltamivir
C. Start zanamivir
D. No treatment because symptoms > 48h
Influenza Vaccine

- Recommended for everyone > 6 mo.
- Options
  - Inactivated vaccines: > 6 months
  - Live-attenuated: 2-49 years
## Infection Control

<table>
<thead>
<tr>
<th>Type of Precaution</th>
<th>Conditions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Diarrhea, Wounds, Vesicular rashes, Some resp infections</td>
<td>C. difficile, chickenpox, smallpox, scabies, lice, viral conjunctivitis, drug resistant organisms</td>
</tr>
<tr>
<td>Droplet</td>
<td>Meningitis, seasonal resp viruses</td>
<td>Meningococcus, Pertussis, influenza</td>
</tr>
<tr>
<td>Airborne</td>
<td>Some resp infections</td>
<td>TB, chickenpox, measles, smallpox, SARS</td>
</tr>
</tbody>
</table>
High yield

- Device (and line) related infections
  - Answer usually “pull the line” plus antibiotics
- Endocarditis
  - Acute: *S. aureus* (MRSA) #1
  - Subacute: Viridans group streptococci #1
  - Prosthetic valve endocarditis: *S. aureus* or *S. epidermidis*
- Doxycycline is usually the answer for...
  - Lyme disease (also amoxicillin, ceftriaxone)
  - Rocky mountain spotted fever (*even in children*)
  - Ehrlichiosis and Anaplasmosis (“spotless fevers”)
  - Syphilis (when penicillin is not an option but not neuro dz)
High yield

• Fungal infections
  – Candidemia
    • Empiric treatment for critically ill is an echinocandin
    • Always remove central venous catheters
    • Always get an eye exam to rule-out ocular involvement
  – Histoplasmosis – itraconazole or ampho
  – Coccidiomycosis – fluconazole or ampho
  – Aspergillosis – voriconazole > ampho
  – Cryptococcal meningitis – treatment of choice is amphotericin B plus 5-FC followed by fluconazole
High yield

• Latent TB diagnostics
  – Prior BCG should not influence how you read PPD
  – Interferon gamma release assays (IGRAs)– no false positives with prior BCG
  – If + PPD or +IGRA, check chest X-ray and history to evaluate for active TB

• Active TB
  – Treatment of active TB in HIV often use rifabutin not rifampin due to interactions with ARVs
High yield

- Severe infection in asplenic patients
  - Encapsulated organisms (Streptococcus pneumoniae, Neisseria meningitidis, Haemophilus influenzae)
    - Vaccinate 2 weeks before if possible
  - Babesiosis – ticks in New England
  - Capnocytophaga – dog bites
  - Anaplasmosis/Erlichiosis