Medicine Boards Certification Review
Infectious Diseases, Part 2
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Case #1:
An 85 year-old woman is admitted to the hospital with a CHF exacerbation. Other co-morbid conditions include diabetes, dementia, and chronic kidney disease (creatinine = 2.5 mg/dL). A urinalysis shows 10 – 20 WBC/HPF. A urine culture is sent and grows pan-sensitive E. coli > 100,000 cfu/mL. The patient denies urinary symptoms but is noted to be a poor historian.

Which is the best course of action?

A. Ciprofloxacin for 3 days
B. Ciprofloxacin for 10 days
C. Trimethoprim-sulfamethaxazole for 3 days
D. Fosfomycin for 1 day
E. Nitrofurantoin for 7 days
F. No antibiotics

Urinary Tract Infections

- Uncomplicated cystitis in women
  - *Escherichia coli* 70-90%
  - > 35% ampicillin resistance
  - > 20% trimethoprim/sulfamethoxazole resistance in many areas
  - Fluoroquinolones (3 days) and nitrofurantoin (7 days) are generally reliable – new guidelines recommend avoiding fluoroquinolones
  - *Staphylococcus saprophyticus* 5-20%
  - Urinalysis for pyuria
  - May not need culture (dipstick alone in younger, healthy women)
  - Consider positive > 10^3 cfu/mL if symptomatic

- Recurrent cystitis in women (> 3x/year)
  - Daily or 3x weekly prophylaxis
  - Post-coital prophylaxis
  - Self-treatment for symptoms
    - Self diagnosis accurate
  - Other measures
    - Discontinue diaphragm and/or spermicide
    - Topical estradiol in post-menopausal women
    - ? Cranberry juice

- Pyelonephritis
  - Obtain urine culture
  - Hospitalize
    - Inadequate p.o. intake
    - Severe disease/underlying illness
    - Pregnancy
  - Initial rx: fluoroquinolone or 3rd generation cephalosporin (+/- ampicillin)
  - May switch to trimethoprim/sulfamethoxazole if susceptible
Urinary Tract Infections

- Imaging (U.S. or CT)
- Not better in 72 hours
- Multiple episodes
- Lower threshold in men
- Tip: remember not to use moxifloxacin for UTIs

Case #2:

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
Data: WBC: 15,500  CXR: LLL infiltrate

- What is the most appropriate treatment?

Case #2:

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

Pneumonia Severity Index

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (+1 point/yr, -10 if woman)</td>
<td>Mental status (+20)</td>
</tr>
<tr>
<td>Nursing home (+10)</td>
<td>Pulse &gt; 125 (+20)</td>
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<tr>
<td>Comorbidities</td>
<td></td>
</tr>
<tr>
<td>Cancer (+30)</td>
<td>Resp rate &gt; 30 (+20)</td>
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<tr>
<td>Liver disease (+20)</td>
<td>SBP &lt; 90 (+15)</td>
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<tr>
<td>CHF (+10)</td>
<td>Temp &lt; 35 or &gt; 40 (+10)</td>
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<tr>
<td>Cerebrovascular dz (+10)</td>
<td>Labs</td>
</tr>
<tr>
<td>Renal disease (+10)</td>
<td>pH &lt; 7.35 (+30)</td>
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<tr>
<td>Don't memorize this!</td>
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<tr>
<td>BUN &gt; 30 (+20)</td>
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<tr>
<td>Na &lt; 130 (+20)</td>
<td></td>
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<tr>
<td>Glucose &gt; 250 (+10)</td>
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<tr>
<td>pO2 &lt; 60 (+10)</td>
<td></td>
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<tr>
<td>Hct &lt; 30 (+10)</td>
<td></td>
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<tr>
<td>Pleural effusion (+10)</td>
<td></td>
</tr>
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</table>

Pneumonia Severity Index

<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>
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<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>

When to Admit Community Acquired Pneumonia

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

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

- Safe to discharge when afebrile, hemodynamically stable, not hypoxic, and tolerating p.o.’s
- No minimum duration of IV therapy needed
- No need to watch in-hospital on oral antibiotics
- For most patients with CAP, 7 total days of antibiotic treatment is adequate

**Case #3:**

82 y.o. man presents with 5 days of productive cough and dyspnea. His past medical history is notable for COPD. Denies recent travel or hospitalization.

Exam:
- 39° 110/90 110 24 85% RA
- Chest: crackles at right base

Data:
- CXR: Right lower & middle lobe infiltrates
- Labs: WBC 12,000, BUN=38, otherwise normal

What is the most appropriate treatment?

**Case #3:**

A. Cefuroxime IV
B. Levofloxacin IV
C. Piperacillin / tazobactam (Zosyn) IV + vancomycin IV
D. Cefepime IV + tobramycin IV

**Etiology of CAP**

- Clinical syndrome and CXR not predictive of organism
  - **Streptococcus pneumoniae**
  - **Haemophilus influenzae**
  - **Mycoplasma pneumoniae**
  - **Chlamydophila pneumoniae**
  - **Legionella**
  - (Enteric Gram negative rods)
  - Viruses
  - **Staphylococcus aureus** (many)

Covered by usual regimes

Not covered by usual regimens

**Empirical Treatment for Outpatients**

| No comorbidity or recent antibiotics | • Macrolide or
| | • Doxycycline |
| Comorbid condition(s) (age > 65, EtOH, CHF, severe liver or renal disease, cancer, etc.) or Antibiotics in last 3 months | • β-lactam (e.g. amoxicillin) + either macrolide or doxycycline or
| | • Respiratory fluoroquinolone* |
| | * NOT Ciprofloxacin |

**Empirical Treatment for Inpatients**

| Inpatient non-ICU | • β-lactam + either macrolide or doxycycline or
| | • Respiratory fluoroquinolone |
| Inpatient ICU | • β-lactam + either azithromycin or respiratory fluoroquinolone (Penicillin allergy: fluoroquinolone + aztreonam) |
| Healthcare associated pneumonia | • Antipseudomonal β-lactam or carbapenem + either fluoroquinolone or aminoglycoside (Controversial and being revised) |
| MRSA concern | • Add vancomycin or linezolid to above |
Diagnostic Testing in CAP

- Chest radiography:
  - Indicated for all patients with suspected pneumonia
  - Cannot distinguish atypical vs. typical pathogen
- Blood culture:
  - Generally recommended for inpatients (do before antibiotics)
- Sputum exam:
  - Controversial but appropriate for inpatients
  - Most helpful if single organism in large numbers

Pneumonia: Other Diagnostics

- Consider Legionella testing in sicker patients using respiratory culture or urine antigen
- Consider influenza testing (rapid testing, DFA, culture, PCR) in appropriate scenario (season, sore throat, ? myalgias)
- Parapneumonic effusions:
  - Small, free-flowing effusions don’t need to be tapped
  - Tap if loculated or if patient not improving

Case #4

A 67-year-old man was brought to the ED by paramedics because of difficulty breathing and increased cough and confusion. The patient had complained of cough with yellow sputum in the past three days and increasing dyspnea.

CXR: Right lower lobar infiltrate and moderate pleural effusion.

Sputum: Many polymorphonuclear neutrophils and many gram-positive cocci in pairs and chains.

The patient was admitted and started on ceftriaxone and azithromycin. His temperature decreased to 38°C after 48 hours and he felt somewhat improved.

On hospital day #3, he developed an increased temperature to 39°C and was tachypneic at 35 breaths/minute with an oxygen saturation of 88% on room air. The patient became more confused and was transferred to the intensive care unit.

Which of the following should be done now?
A. Change antibiotics to levofloxacin
B. Change intravenous lines and add tobramycin
C. Perform a diagnostic thoracentesis
D. Administer stress doses of corticosteroids
Clinical Syndromes

Pneumonia gone bad

When pneumonia fails to respond to initial treatment or gets worse, consider
- Wrong bug
- Wrong drug
- Noninfectious etiology
- Complications of pneumonia, e.g. empyema
- Natural history of disease

Case #5:

- A 70 year-old man is hospitalized for diverticulitis. He is nearing discharge when he develops a new fever. Purulent drainage is noted from a central venous catheter, and it is removed. Despite removal of the catheter, fever persists for several days. Physical examination reveals a new systolic murmur. Echocardiogram shows a small vegetation on the mitral valve.

- Which organism MOST LIKELY grew from his blood cultures?

A. Staphylococcus aureus
B. Streptococcus bovis
C. Enterococcus
D. Candida

Endocarditis

- Most common organisms
  - Staphylococcus aureus (especially healthcare-associated, injection drug use)
  - Streptococci, viridans group; also S. bovis
  - Coagulase-negative staphylococci (especially prosthetic valve)
  - Candida
  - Culture negative
  - HACEK

- Diagnosis: Modified Duke Criteria
  - Major
    - Blood culture criteria
    - Evidence endocardial involvement
      - New valvular regurgitation
      - Specific echocardiographic findings
  - Minor
    - Predisposition
    - Vascular phenomena
    - Fever
    - Immunologic phenomena
    - Other microbiologic

Osler nodes
Janeway lesions
Roth spots (white-centered retinal hemorrhages - arrow heads)
Splinter hemorrhages
Endocarditis

• Duke criteria continued…
  – Definite endocarditis = 2 major; 1 major + 3 minor; 5 minor; or pathologically confirmed
  – Possible endocarditis = 1 major + 1 minor; 3 minor

• Surgery: CHF, continued systemic emboli, uncontrolled sepsis, abscess, fungal IE; often prosthetic valve, Gram negative aerobes and unusual organisms

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 >.1 to .5 μg/mL
  – Penicillin G or ceftriaxone x 4 wk + gentamicin x 2 wk

• Streptococcus MIC >.5 μg/mL or enterococcus
  – Ampicillin or penicillin G + gentamicin x 4-6 wk

Endocarditis - Treatment

• Aortic or mitral valve MSSA
  – Nafcillin or oxacillin x 6 wk, +/- gentamicin x 3-5 d

• Tricuspid valve MSSA
  – Nafcillin or oxacillin + gentamicin x 2 wk

• MRSA
  – Vancomycin x 6 wk

• HACEK
  – Ceftriaxone x 4 wk

Endocarditis - Prophylaxis

• New guidelines from American Heart Association spring 2007

• Very different from previous guidelines updated in 1997

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

Endocarditis - Prophylaxis

• For cardiac conditions on previous slide only, prophylaxis for dental procedures with manipulation of gingiva or periapical region of teeth or perforation of oral mucosa

• No prophylaxis GI or GU procedures for purpose of preventing endocarditis

Case #6:

• A 40 year-old woman who returned 2 days ago after a 3-week trip to east Africa presents with fever. She had been prescribed mefloquine (Lariam) for malaria prophylaxis but stopped taking it due to insomnia. She developed fever during the flight home. Other symptoms include chills, diaphoresis, myalgia, and headache. She has had no diarrhea. Activities included frequent hikes, and she swam in fresh water 1 week before her departure.

• You are concerned about all of the following EXCEPT
Case #6:

A. Malaria  
B. Typhoid  
C. Rickettsial infection  
D. Acute schistosomiasis (Katayama fever)

Travel Medicine

• Returned traveler with a fever  
  – Short incubation period (< 14 days): Big 3  
    • Malaria (especially falciparum)  
    • Dengue  
    • Typhoid fever  
      – Also, non-tropical diseases  
  – Incubation period > 14 days  
    • Malaria: falciparum (~ 1 month) and non-falciparum  
    • Typhoid fever (3 weeks; rarely up to 60 days)  
    • Hepatitis, especially A and E

Travel Medicine

• Work up for fever  
  – Right away  
    • Malaria smears  
    • Blood cultures (typhoid, meningococcus)  
    • Other, directed appropriate evaluation:  
      e.g. CXR for respiratory symptoms

Travel Medicine

• Other tests to consider  
  – Eosinophil count  
  – Stool studies (diarrhea or elevated eosinophils)  
  – Serologies (hepatitis, dengue, leptospirosis, helminthic infections)  
  – HIV  
  – Occasionally, blood smears and/or skin snips (microfilariae)

Travel Medicine

• Initial therapy  
  – Ideally, etiology directed  
  – Supportive  
  – If very ill, antibiotics (e.g. ceftriaxone, fluoroquinolone) pending diagnosis  
  – Consider empirical therapy if characteristic syndrome  
    • Rickettsial disease  
    • Leptospirosis

Travel Medicine

• Immunizations  
  – Hepatitis A, typhoid  
  – If not up-to-date: tetanus-diphtheria (+/- pertussis), measles, polio  
  – Consider hepatitis B, Japanese encephalitis, yellow fever, meningococcus, rabies  
• Diarrhea: okay to give 3 days fluoroquinolone if symptoms develop  
  – Can also consider azithromycin or rifaximin
Case #7:

- A 60 year-old man with a history of multiple myeloma is brought in by his family to the Emergency Department. His family reports 1 day of headache, fever, and confusion. The patient is lethargic and unable to answer questions. Lumbar puncture reveals a WBC count of 800 cells/μL, glucose 30 mg/dL, and protein 150 mg/dL. Gram stain shows many WBC, no organisms.

- Which one of the following initial regimens is appropriate?

Bacterial Meningitis

- Very serious disease
  - Morbidity and mortality remain high
  - Fatal without antibiotics – emphasis on rapid delivery
  - If antibiotics given 1-2 hours before LP, yield does not appear decreased

  - Steroids indicated in adults given benefit for *Streptococcus pneumoniae*; give before—or at least with—first dose antibiotics

- Organisms
  - Neonates: *S. agalactiae, E. coli, L. monocytogenes*
  - Children: *N. meningitidis, S. pneumoniae, (H. influenzae)*
  - Younger adults (healthy): *S. pneumoniae, N. meningitidis*
  - Older adults (underlying disease): *S. pneumoniae, L. monocytogenes*

- General indications for CT before LP when meningitis suspected
  - Age (> 60 years)
  - Immunocompromise
  - History of CNS disease (e.g. mass lesion)
  - Recent seizure
  - Neurologic abnormalities
    - Including focal deficit and abnormal level of consciousness
    - Papilledema

- Empirical antibiotic therapy
  - Younger adults: broad-spectrum cephalosporin (high dose), often plus vancomycin – when at least moderate suspicion pneumococcus
  - Older adults/underlying illness: as above + ampicillin or tmp/smx (penicillin allergy)

- Prophylaxis for close contacts only if *N. meningitidis* and some cases *H. influenzae*
Encephalitis

- Herpes simplex encephalitis
  - Most common treatable encephalitis
  - Low threshold to add acyclovir
- West Nile Virus: 3 forms neuroinvasive – age is biggest risk factor
  - Meningitis – favorable outcome
  - Encephalitis – altered level of consciousness and/or personality change + CNS inflammation
  - Acute flaccid paralysis – worst

Case #8

- An 85 year-old woman is admitted in January with fever and shortness of breath for 36 hours. She lives with her daughter and grandchildren. CXR shows a patchy lower lobe consolidation. She is intubated for respiratory distress and hypoxemia. Tracheal aspirate Gram stain shows PMNs but no organisms. A rapid antigen test is negative for influenza A and B.
  - Which medications would you start?

Case #8:

A. Levofloxacin + azithromycin
B. Metronidazole + azithromycin
C. Vancomycin + ceftriaxone + rimantidine
D. Vancomycin + piperacillin/tazobactam
E. Ceftriaxone + azithromycin + oseltamivir

Influenza

- Two types of clinical importance: A and B
- Influenza A
  - Infects animals; cause of pandemic influenza
  - Has been susceptible to adamantanes and neuraminidase inhibitors
  - Resistance to both classes now an issue
  - Typed by surface glycoproteins hemagglutinin and neuraminidase
- Influenza B – not susceptible to adamantanes

Influenza

- Adamantanes – inhibit influenza A virus uncoating
- Neuraminidase inhibitors - block cleavage from host cell surface
  - Oseltamivir – oral
  - Zanamivir - inhaled

Influenza

- In susceptible influenza, all drugs reduce clinical illness by about 1 day when started within 48 hrs. of symptoms
  - Also efficacious for prophylaxis
- Recent data suggest mortality benefit for hospitalized patients treated with oseltamivir, even outside 48 hr. window
Influenza

- Influenza vaccine now recommended for everyone > 6 months of age, unless there is a contraindication

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</td>
<td>C. difficile, chickenpox, smallpox, scabies, lice, viral conjunctivitis, drug resistant organisms</td>
</tr>
<tr>
<td></td>
<td>Wounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vesicular rashes</td>
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<tr>
<td></td>
<td>Some resp infections</td>
<td></td>
</tr>
<tr>
<td>Droplet</td>
<td>Meningitis</td>
<td>Meningococcus, pertussis</td>
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<tr>
<td></td>
<td>Some resp infections</td>
<td></td>
</tr>
<tr>
<td>Airborne</td>
<td>Some resp infections</td>
<td>TB, chickenpox, measles, smallpox, SARS</td>
</tr>
</tbody>
</table>

Case #9:

- A 35 year-old man who recently returned from Hawaii (the big island) complains of fever, myalgia, and headache. Conjunctival suffusion is noted. He reports that he swam in a freshwater pond, although there was a sign posted that swimming was not advisable. He wonders if this could have anything to do with his current illness.

- What therapy is now appropriate?

Case #9:

A. Cephalexin
B. Chloramphenicol
C. Penicillin
D. Gentamicin

Potpourri

- Leptospirosis
  - Biphasic illness (renal/hepatic involvement second phase)
  - Jarisch-Herxheimer reaction possible
- Lyme disease
  - *Borrelia burgdorferi* spread by deer tick (nymphal)
  - Prolonged attachment (48-72 hrs)
  - Clinical diagnosis: erythema migrans
  - PEP with doxycycline is effective but only indicated if substantial risk
  - Prolonged IV therapy for chronic sx ineffective

Potpourri

- Other Borrelia
  - Patient presents with relapsing fever – multiple episodes tick-borne
  - Outdoor exposure, including western U.S.
  - Examine blood smear during fever for spirochetes
  - Treat with doxycycline (Jarisch-Herxheimer rxn common)
**Potpourri**

- **Recognize Rocky Mountain spotted fever**
  - Transmitted by ticks (mostly *Dermacentor* – dog and wood ticks); late spring and summer
  - Especially South Atlantic and East South Central states
- **Agent is *Rickettsia rickettsii***
- Classic petechial rash not in all patients, not always on palms and soles
  - May not appear until 3-5 days after fever
- Treat with doxycycline – low threshold
- Diagnosis usually confirmed retrospectively with serology

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**Ehrlichiosis and Anaplasmosis- "Spotless Fever"**

- Human monocytic ehrlichiosis (south/southeast)
  - *Ehrlichia chaffeensis* transmitted by lone star tick
  - Rash more common
- Human granulocytic anaplasmosis (upper midwest, northeast, northern CA)
  - *Anaplasma phagocytophilum* transmitted by *Ixodes* (deer) tick
  - More likely to see morulae (inclusions)
- Fever, headache, myalgia; leukopenia, thrombocytopenia, elevated AST/ALT
- Treat with doxycycline

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**Differential diagnosis of nodular lymphangitis**

- *Sporothrix schenckii*
- *M. marinum*
- *Nocardiabrasiliensis*
- Other mycobacteria and other organisms
  - (rarely)
- Don’t forget: Group A streptococcus, especially if more acute; *S. aureus*

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**Erysipelothrix**

- Gram positive rod
- “Fish handler’s disease”
- Treat with penicillin (many other antibiotics)

**Vibrio vulnificus**

- Sepsis and cutaneous lesions in immunocompromised host (esp. cirrhosis) after eating oysters
- Cellulitis after exposure to seawater
- Antibiotics may include ceftazidime, doxycycline, ciprofloxacin

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**Anthrax**

- Severe illness
- Widened mediastinum, meningitis, early positive blood cultures
- Ulcer after animal contact or BT scenario

**Tularemia**

- Ticks/biting flies; animal contact (e.g. skinning); airborne transmission (Martha’s Vineyard)
- Presentation may depend on mode of transmission: e.g. ulceroglandular from tick bite, pneumatic from brush cutting, also typhoidal form
- Notify lab if suspected – can be transmitted from culture
- Rx: gentamicin, streptomycin, chloramphenicol for meningitis
Potpourri

• Babesia
  – Tick-borne, intraerythrocytic protozoa
  – Symptomatic with splenectomy, immune compromise, older age
  – Can be co-transmitted with Lyme
  – "Maltese cross" (tetrads)
  – Treatment with atovaquone + azithromycin or quinine + clindamycin

Potpourri

• Bioterrorism: Category A Agents
  – Anthrax (Bacillus anthracis)
  – Botulism (Clostridium botulinum toxin)
  – Plague (Yersinia pestis)
  – Smallpox (variola major)
  – Tularemia (Francisella tularensis)
  – Viral hemorrhagic fever (e.g. Ebola, Marburg, Lassa)

Miscellaneous Tips:

• ID doctors frequently want to remove lines/devices
• Doxycycline: often the answer
• Chloramphenicol: rarely the answer
• Review tick borne illnesses
• Review syphilis
• Little HIV
• Nothing controversial or brand new

Answers