Disclosures

• Research Grant: Astellas Pharmaceuticals

• I will not discuss off-label use and/or investigational use in my presentation
Learning Objectives

• Review principles of recognition and management of a selection of commonly encountered infectious disease emergencies in the primary care setting

• Identify strategies to diagnose, treat, and prevent life threatening infectious diseases commonly encountered by primary care providers

• Discuss effective management strategies when working with infectious disease consultants/specialists
“I Have a Bad Headache”

- A 55 year old healthy woman complains of severe headache for 3 days which is associated with fever, nausea, and vomiting

- She self-diagnosed herself with a migraine headache

- 24 hours later she experienced photophobia and neck stiffness

- The following day her family called emergency services when she became disoriented
What is the most likely cause of her headache?

A. Meningitis  
B. Sinusitis  
C. Mastoiditis  
D. Spinal Epidural Abscess  
E. Lemierre’s Syndrome
Meningoencephalitis
A Continuum of Syndromes

• Meningitis
  • Acute: Fever, headache, +/- altered mental status
  • Chronic: Gradual and indolent onset of symptoms
    • Infection of central nervous system (CNS) for at least 4 weeks

• Encephalitis

  • Fever, headache, and altered mental status is common
  • Mental status changes occur early and progress to obtundation or coma
  • The most common focal neurological signs include:
    • Hemiparesis,
    • Aphasia, ataxia, cranial nerve palsies, myoclonus
    • Seizures

Mandell, Douglas, and Bennett’s Principles and Practice of Infectious Diseases, 8th Edition, 2015
# Characteristic Features of Common Causes of Meningitis

<table>
<thead>
<tr>
<th>Organism</th>
<th>Site of Entry</th>
<th>Age Range</th>
<th>Predisposing Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Neisseria meningitidis</em></td>
<td>Nasopharynx</td>
<td>All ages</td>
<td>Complement deficiency</td>
</tr>
<tr>
<td><em>S. pneumoniae</em></td>
<td>Nasopharynx, skull fracture, contiguous or distant foci of infection</td>
<td>All ages</td>
<td>Bacteremia, cribriform plate fracture, cochlear implants, cerebrospinal fluid otorrhea, defects of the ear ossicle</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>Gastrointestinal tract, placenta</td>
<td>Elderly, Neonates</td>
<td>Defects in cell-mediated immunity, pregnancy, liver disease, alcoholism</td>
</tr>
<tr>
<td>CoN staphylococci <em>S. aureus</em></td>
<td>Foreign body, Skin, Bacteremia</td>
<td>All ages</td>
<td>Surgery and foreign body, especially ventricular drains, endocarditis, skin</td>
</tr>
<tr>
<td>Gram-negative bacilli</td>
<td>Various</td>
<td>Elderly, Neonates</td>
<td>Advanced medical illness, neurosurgery, ventricular drains, strongyloidiasis</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em></td>
<td>Nasopharynx, contiguous spread from local infection</td>
<td>Adults; infants and children if not vaccinated</td>
<td>Diminished humoral immunity</td>
</tr>
</tbody>
</table>

Tunkel AR, UpToDate, 2018
Analyzing the Cerebrospinal Fluid (CSF)

The CSF formula

- Opening pressure
- Cell count and differential
- Protein
- Glucose
- Gram stain and culture

Normal Values

- Pressure 9 – 18 cm H₂O
- WBC/mm³ 0 – 5
- Protein mg/dL 15 – 40
- Glucose mg/dL 50 – 75
- Appearance - Clear

Do not “waste” CSF on unnecessary tests; it is difficult to get more!

Mandell, Douglas, and Bennett’s Principles and Practice of Infectious Diseases, 8th Edition, 2015
## Differential Diagnosis: CSF Examination

<table>
<thead>
<tr>
<th>50-100 WBC, 90% mononuclear</th>
<th>Viral or “Aseptic” Neurosyphilis</th>
<th>Enteroviral PCR</th>
<th>West Nile IgM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal glucose</td>
<td></td>
<td>HSV PCR</td>
<td>VDRL</td>
</tr>
<tr>
<td>Mildly elevated protein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal opening pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1000 – 5000 WBC, 80% neutrophils</th>
<th>Bacterial</th>
<th>Gram stain and culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose &lt; 10</td>
<td></td>
<td>Blood cultures</td>
</tr>
<tr>
<td>Elevated protein</td>
<td></td>
<td>Multiplex PCR assays</td>
</tr>
<tr>
<td>60 -90% positive gram statin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 -80% positive culture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated opening pressure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>20-200 WBC, 90% mononuclear</th>
<th>Fungal Tuberculosis</th>
<th>Fungal culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose &lt; 40</td>
<td></td>
<td>Cryptococcal Antigen</td>
</tr>
<tr>
<td>Very elevated protein</td>
<td></td>
<td>Coccidioides</td>
</tr>
<tr>
<td>Elevated opening pressure</td>
<td></td>
<td>Antibody/antigen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AFB smear/culture</td>
</tr>
</tbody>
</table>
Suspicion for bacterial meningitis

Yes

Immunocompromise,* history of CNS disease,† new-onset seizure, papilledema, altered consciousness, or focal neurologic deficit; or delay in performance of diagnostic lumbar puncture

No

Blood cultures and lumbar puncture STAT

Dexamethasone‡ + empirical antimicrobial therapy§

CSF findings c/w bacterial meningitis

Positive CSF Gram stain

Dexamethasone‡ + empirical antimicrobial therapy§

No

Yes

Blood cultures STAT

Dexamethasone‡ + empirical antimicrobial therapy§

Negative CT scan of the head

Perform lumbar puncture

Dexamethasone‡ + targeted antimicrobial therapy¶

IDSA Guidelines, CID, 2004
• Penicillin resistance is increasing and antibiotic levels in CSF reach only 2-10% of serum levels

• PCN CSF breakpoints for *S. pneumoniae*:
  • <0.1 ug/ml
  • 0.1 – 1.0 ug/ml
  • ≥ 2.0 ug/ml

(IDSA Guidelines, CID, 2004)
“My Father is Acting Strange”

• A 82 year old man presented to the clinic with fever, fatigue, urinary incontinence, confusion, and had been walking naked in the house.

• Urinalysis showed bacteriuria and pyuria and he was diagnosed with an urinary tract infection (UTI); he was prescribed Levofloxacin.

• The following day he continued to have fever and worsening confusion.

• He was admitted that evening after developing aphasia, ataxia, and seizures.
What is his working diagnosis?

A. Cystitis  
B. Prostatitis  
C. Influenza  
D. Herpes Encephalitis  
E. Community acquired pneumonia
Herpes Simplex Virus (HSV) Encephalitis

- Reactivation in cranial nerve ganglia and retrograde spread along axons
- Involvement of temporal lobe with personality changes, seizures, and focal neurologic findings
- Diagnosis: HSV 1/2 CSF PCR
- Intravenous Acyclovir is the recommended therapy
Herpes Simplex Virus (HSV) Encephalitis

**Meningitis**
- HSV 2 >> 1
- Associated with primary infection
- Normal mental status
- Can be recurrent (Mollaret)
- Benign

**Encephalitis**
- HSV 1 >> 2
- Usually not primary in adults
- Abnormal mental status
- Usually no oral lesions
- Acyclovir decreases mortality

Whitley et al JAMA 1982:247:317
“My Foot is Killing Me”

• A 50 year old woman presented to the clinic because of severe pain and swelling of her left foot

• She had been well until 2 days earlier when she noticed a lesion on her foot, thought to be an insect bite

• The next day, her foot became swollen and painful, she felt ill and febrile, and on the way to the ED she became confused and hypotensive

• Her skin appeared cyanotic and cool. The foot was mottled with a black eschar; the swelling extended up the thigh
What is the most likely diagnosis?

A. Cellulitis
B. Deep venous thrombosis
C. Heart failure with lower extremity edema
D. Necrotizing Fasciitis
E. Erysipelas
Necrotizing Fasciitis
Necrotizing Fasciitis

• Necrotizing soft tissue infections include necrotizing forms of cellulitis, myositis, and fasciitis

• Type I necrotizing fasciitis, at least one anaerobic species is isolated in combination with one or more facultative anaerobic species such as streptococci (other than group A) and members of the Enterobacteriaceae

• Type II, group A streptococci are isolated alone or in combination with other species, most commonly *S. aureus*
Clinical Presentation

• Necrotizing fasciitis can affect any part of the body but is most common on the extremities.

• Other sites of predilection are the abdominal wall, perianal and groin areas, and postoperative wounds.

• The portal of entry is usually a site of trauma, post-surgical procedure, perirectal abscess, decubitus ulcer, or intestinal perforation.
Clinical Features

• Severe, constant pain
• Bullae (occlusion of deep blood vessels that traverse the fascia)
• Skin necrosis or ecchymosis that precedes skin necrosis
• Gas in the soft tissues, detected by palpation or imaging
• Edema that extends beyond the margin of erythema
• Cutaneous anesthesia
• Systemic toxicity (fever, leukocytosis, delirium, and renal failure)
• Rapid spread, especially during antibiotic therapy
Diagnosis

• Prompt diagnosis is crucial because of the rapidity with which the process can progress and a mortality rate of 24% to 34%

• The most expeditious route to diagnosis is through surgical exploration without delay for imaging studies

• CT scanning and magnetic resonance imaging (MRI) can demonstrate subcutaneous and fascial edema and tissue gas

• Frozen section examination of biopsy specimens is helpful for early diagnosis
<table>
<thead>
<tr>
<th>Predisposing Factor</th>
<th>Clinical Syndrome</th>
<th>Etiologic Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major penetrating trauma: crush or deeply penetrating wound</td>
<td>Gas gangrene</td>
<td>Clostridium perfringens, C. histolyticum, or C. novyi</td>
</tr>
<tr>
<td>Minor penetrating trauma</td>
<td>NF type II</td>
<td>Aeromonas hydrophila, Vibrio vulnificus</td>
</tr>
<tr>
<td>Freshwater laceration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saltwater laceration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor nonpenetrating trauma: muscle strain, sprain, or contusion</td>
<td>NF type II or streptococcal myonecrosis</td>
<td>Streptococcus pyogenes</td>
</tr>
<tr>
<td>Mucosal breach: mucosal tear (rectal, vaginal, urethral); gastrointestinal, genitourinary or gynecologic surgery</td>
<td>NF type I</td>
<td>Mixed aerobic and anaerobic organisms</td>
</tr>
<tr>
<td>Skin breach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varicella lesions</td>
<td>NF type II or streptococcal myonecrosis</td>
<td>S. pyogenes</td>
</tr>
<tr>
<td>Insect bites</td>
<td>NF type II or streptococcal myonecrosis</td>
<td>S. pyogenes</td>
</tr>
<tr>
<td>Injection drugs</td>
<td>Gas gangrene</td>
<td>C. perfringens, C. histolyticum, C. novyi, or C. sordellii</td>
</tr>
<tr>
<td>Immune-compromised state</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes with peripheral vascular disease</td>
<td>NF type I</td>
<td>Mixed aerobic and anaerobic organisms</td>
</tr>
<tr>
<td>Cirrhosis and ingestion of raw oysters</td>
<td>NF type II</td>
<td>V. vulnificus</td>
</tr>
<tr>
<td>Neutropenia</td>
<td>Gas gangrene</td>
<td>C. septicum</td>
</tr>
<tr>
<td>In women: pregnancy, childbirth, abortion (spontaneous or medically induced), gynecologic procedures or surgery</td>
<td>NF type II, streptococcal myonecrosis, or clostridial myonecrosis</td>
<td>S. pyogenes, C. perfringens, or C. sordellii</td>
</tr>
<tr>
<td>Occult factors: colonic lesions, including carcinoma</td>
<td>Spontaneous gas gangrene</td>
<td>C. septicum</td>
</tr>
</tbody>
</table>

* Gas gangrene is also known as clostridial myonecrosis.
Treatment

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>First-line Antimicrobial Agent</th>
<th>Adult Dosage</th>
<th>Pediatric Dosage Beyond the Neonatal Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed infections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piperacillin-tazobactam plus vancomycin</td>
<td>3.37 g every 6–8 h IV</td>
<td>60–75 mg/kg/dose of the piperacillin component every 6 h IV</td>
<td></td>
</tr>
<tr>
<td>Imipenem-cilastatin</td>
<td>1 g every 6–8 h IV</td>
<td>10–13 mg/kg/dose every 8 h IV</td>
<td></td>
</tr>
<tr>
<td>Meropenem</td>
<td>1 g every 8 h IV</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Ertapenem</td>
<td>1 g daily IV</td>
<td>20 mg/kg/dose every 8 h IV</td>
<td></td>
</tr>
<tr>
<td>Cefotaxime plus metronidazole or clindamycin</td>
<td>2 g every 6 h IV</td>
<td>50 mg/kg/dose every 6 h IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 mg every 6 h IV</td>
<td>7.5 mg/kg/dose every 6 h IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>600–900 mg every 8 h IV</td>
<td>10–13 mg/kg/dose every 8 h IV</td>
<td></td>
</tr>
<tr>
<td>Streptococcus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penicillin plus clindamycin</td>
<td>2–4 million units every 4–6 h IV (adult)</td>
<td>60 000–100 000 units/kg/dose every 6 h IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>600–900 mg every 8 h IV</td>
<td>10–13 mg/kg/dose every 8 h IV</td>
<td></td>
</tr>
</tbody>
</table>

IDSA Guidelines 2014
Treatment

<table>
<thead>
<tr>
<th>Staphylococcus aureus</th>
<th>Nafcillin</th>
<th>1–2 g every 4 h IV</th>
<th>50 mg/kg/dose every 6 h IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oxacillin</td>
<td>1–2 g every 4 h IV</td>
<td>50 mg/kg/dose every 6 h IV</td>
</tr>
<tr>
<td></td>
<td>Cefazolin</td>
<td>1 g every 8 h IV</td>
<td>33 mg/kg/dose every 8 h IV</td>
</tr>
<tr>
<td></td>
<td>Vancomycin (for resistant strains)</td>
<td>30 mg/kg/d in 2 divided doses IV</td>
<td>15 mg/kg/dose every 6 h IV</td>
</tr>
<tr>
<td></td>
<td>Clindamycin</td>
<td>600–900 mg every 8 h IV</td>
<td>10–13 mg/kg/dose every 8 h IV</td>
</tr>
</tbody>
</table>

| Clostridium species           | Clindamycin plus penicillin | 600–900 mg every 8 h IV | 10–13 mg/kg/dose every 8 h IV |
|                              |                          | 2–4 million units every 4–6 h IV (adult) | 60 000–100 000 units/kg/dose every 6 h IV |

| Aeromonas hydrophila         | Doxycycline plus ciprofloxacin or ceftriaxone | 100 mg every 12 h IV | Not recommended for children but may need to use in life-threatening situations |
|                             |                                                  | 500 mg every 12 h IV |                                         |
|                             |                                                  | 1 to 2 g every 24 h IV |                                         |

| Vibrio vulnificus            | Doxycycline plus ceftriaxone or cefotaxime      | 100 mg every 12 h IV | Not recommended for children but may need to use in life-threatening situations |
|                             |                                                  | 1 g qid IV |                                         |
|                             |                                                  | 2 g tid IV |                                         |
“My back is killing me”

- A 24 year old woman presents to the clinic with complains of fever, severe back pain described as "shooting" and stabbing in nature for 48 hours

- She was prescribed analgesics and heating pads

- The following day she developed lower extremity weakness with decreased sensation, difficulty walking, and bladder dysfunction

- That evening she was admitted to the ICU with sepsis
What is the most likely diagnosis?

A. Disc with degenerative bone disease
B. Metastatic tumor
C. Vertebral discitis with osteomyelitis
D. Spinal epidural abscess
E. Herpes zoster, prior to the appearance of rash
Imaging

- Epidural abscess extending from the L4-S1 levels causing severe thecal sac stenosis with cauda equina impingement

- 2 out 2 blood cultures grew Methicillin-resistant Staphylococcus aureus (MRSA)
Microbiology

- *S. aureus* (Over 60% of cases)
- Gram-negative bacilli
- Streptococci
- Coagulase-negative staphylococci
- Anaerobes
- Others (fungi, tuberculosis, parasites)
Pathogenesis

- Abscesses are more likely to develop in larger epidural spaces that contain infection-prone fat
Management of Spinal Epidural Abscess

Suspected spinal epidural abscess

Do any of these conditions exist?
Patient refuses surgery
Patient with high operative risk
Paralysis for more than 24–36 hr
Panspinal infection

No

Emergency decompressive laminectomy plus antibiotic therapy

Yes

Have blood cultures identified the infecting pathogen?

No

Culture abscess by CT-guided needle aspiration to navigate definitive antibiotic therapy

Yes

Antibiotic therapy guided by blood cultures
“I feel like I am going to die”

• A 23 year old Native American man presents to the clinic with complains of fever, chills, headaches, malaise, myalgia, nausea, and vomiting for 48 hours

• He reported visiting family on the reservation three days prior to his presentation

• His Labs revealed hyponatremia, thrombocytopenia, and elevated liver enzymes

• His family owns three outdoor dogs, two cats, and several horses
What is his likely diagnosis?

A. Acute HIV infection
B. Disseminated Coccidioidomycosis
C. Influenza
D. Rocky Mountain Spotted Fever
E. Dengue Fever
Rocky Mountain spotted fever (RMSF)

• RMSF is a zoonotic disease that causes illness in both dogs and humans

• *Rickettsia rickettsii*, a small gram-negative obligate intracellular parasite from the family Rickettsiaceae

• RMSF was not recognized in dogs until the 1970’s and *Rhipicephalus sanguineous* is the most common vector in Arizona

• The incubation period is 2-14 days followed by invasion of endothelial cells of the venules and capillaries resulting in vasculitis
RMSF in Arizona

- Between 2003 and 2012, over 250 cases and 19 fatalities occurred.

- Most cases occurred in areas with large amounts of free-roaming dogs and severe tick infestations, including six Tribal Lands.

- During 2010-2011, RMSF in Arizona occurred at a rate of 200 times the national average.
The Primary Arizona Tick Vector of RMSF

*Rhipicephalus sanguineus* (Brown dog tick)
Clinical Manifestations

• Early (first 4 days): Fever, headache, myalgia, abdominal pain, nausea, vomiting, and light rash may be present

• Thrombocytopenia, hyponatremia, elevated liver enzymes may occur

• Late (day 5 or later): Definitive petechial rash, altered mental status, seizures, cough, dyspnea, arrhythmias, hypotension, and severe abdominal pain
RMSF: The Rash

• Generally not apparent until day 2-5 of symptoms (only seen in 68% of AZ patients)

• Begins as 1 to 5 mm macules progressing to maculopapular

• May begin on ankles, wrists, and forearms, spreads to trunk

• Petechial rash is a late finding, occurs on or after day 6

• Rash may be asymmetric, localized, or absent
Rashes of RMSF
Antimicrobial Therapy of RMSF

Pregnant adult or tetracycline allergic

Chloramphenicol
500 mg qid, less likely to prevent death

Non-pregnant adult or child ≥45 kg

Doxycycline
100 mg bid

Child <45 kg

Doxycycline
4.4 mg/kg/day in 2 divided doses

Therapy should be continued at least 72 h after defervescence AND until evidence of clinical improvement
Confirmation of *R. rickettsii*

- **Serology (RMSF titer)**
  - Indirect immunofluorescence assay (IFA)
  - Requires paired sera (acute and convalescent)
  - Look for a change (4-fold) in antibody titers for confirmed infections
  - Positive single titers or titers that do not rise are considered probable cases

- **PCR**
  - Available at CDC. Can give a rapid result (48 hours)
  - Skin biopsy (2-4mm)
  - Whole blood of severely ill/fatal cases
  - NOTE: Negative PCR does not rule-out RMSF
The Red Herring

• A 75 year old man was seen in the clinic for having had fever, fatigue, night sweats, and weight loss

• Urinalysis indicated pyuria and cultures grew >100,000 CFU/mL of *E. Coli*

• One out of 4 blood cultures grew *Viridans streptococci*, regarded as a contaminant
The Red Herring

• He was prescribed with a course of Ciprofloxacin, but his symptoms persisted for another two months

• He was prescribed several courses of antibiotics for reoccurring UTIs

• He presented three months after the initial visit with worsening mental status, shortness of breath, lower extremity edema, and painful lesions involving his fingers and feet

• He complained of back pain, lower extremity weakness with decreased sensation, difficulty walking, and bladder dysfunction
Why is the most likely diagnosis?

A. Pyelonephritis
B. Subacute Bacterial Endocarditis
C. Meningitis
D. Coccidioidomycosis
E. Tuberculosis
Endocarditis due to Viridans streptococci
Infective Endocarditis (IE)

- Infection of the endocardium that involves the cardiac valves and adjacent structures
- Bacterial (most common), fungal, rickettsia
- Acute and subacute course
Microbiology

- *S. aureus* — 31 percent
- *Viridans* group streptococci — 17 percent
- *Enterococci* — 11 percent
- *Coagulase-negative staphylococci* — 11 percent
- *Streptococcus bovis* — 7 percent
- Non-HACEK gram-negative bacteria — 2 percent
- Fungi — 2 percent
- HACEK — 2 percent

*Haemophilus spp*
*Aggregatibacter* [formerly *Actinobacillus* spp.]
*Cardiobacterium hominis*
*Eikenella corrodens*
*Kingella kingae*
Consequences of Septic Emboli

- Mitral or aortic valve
- Left ventricle
- Aorta

Large vessel

Small vessel (Janeway lesions)
Which of the following would be the mostly likely pathogen in this rapidly expanding skin lesion in a febrile neutropenic patient?

A) *Fusarium solani*
B) *Streptococcus pyogenes*
C) *Borrelia burgdoferi*
D) *Pseudomonas aeruginosa*
Neutropenic Fever

• Hospitalization for febrile neutropenia (FN) is associated with considerable morbidity, mortality, and cost

• In-hospital mortality associated with FN was 9.5% between 1995 and 2000 across 115 US medical centers (total of 41,779 patients)

• Hospital mortality of 50% has been reported in neutropenic patients with severe sepsis

• Bacteremia occurs in 10%–25% of patients, with most occurring in the setting of prolonged or profound neutropenia (ANC <100 neutrophils/mm$^3$)

• Fever: A single oral temperature of ≥38.3°C (101°F) or a temperature of ≥38.0°C (100.4°F) sustained over 1 hour

• Neutropenia: ANC <500 cells/mm³ or ANC that is expected to decrease to <500 cells/mm³ during the next 48 hours

• The term “profound” is used to describe neutropenia in which the ANC is <100 cells/mm³ and prolonged >7 days

• Functional neutropenia refers to qualitative defects of circulating neutrophils
Etiology of Bacteremia

REVIEW OF LITERATURE FROM YEARS 2005-2011

- **S. aureus**, 6% (0%-20%)
- Coagulase-negative staphylococci, 25% (5%-60%)
- Viridans streptococci, 5% (0%-16%)
- Enterococci, 5% (0%-38%)
- Other gram positives, 6% (0%-21%)
- Enterobacteriaceae, 24% (6%-54%)
- *P. aeruginosa*, 10% (0%-30%)
- *Acinetobacter*, 2% (0%-12%)
- Other gram negatives, 3% (0%-11%)

Mandell GL, Principals and Practice of Infectious Diseases, 8th edition, 2016
Initial in-Hospital Treatment (A-II)

- Anticipated prolonged (>7 days duration) and profound neutropenia (ANC <100 cells/mm³)
- Co-morbid conditions, hypotension, pneumonia, new-onset abdominal pain, or neurologic changes
- High-risk patients require intravenous empirical antibiotics with an antipseudomonal b-lactam agent
- Low-risk patients with anticipated brief (<7 days duration) neutropenic period or few co-morbidities, are candidates for oral empirical therapy

Freifeld AG, CID. 2011
Initial Empiric Therapy

• In high-risk patients requiring hospitalization for empirical antibiotic therapy, monotherapy with an anti-pseudomonal β-lactam agent is recommended
  • Cefepime
  • Carbapenem (meropenem or imipenem-cilastatin)
  • Piperacillin-tazobactam

• Other antimicrobials may be added to the initial regimen for management of complications or if antimicrobial resistance is suspected or proven
  • Aminoglycosides
  • Fluoroquinolones
  • Vancomycin

Freifeld AG, CID. 2011
Cutaneous Presentations in Neutropenic Fever

Skin Lesions

- **Candidiasis**
  - Small, tender papules
- **Herpes**
  - Vesicular
- **Aspergillus**
  - Ulcerative, necrotic
- **Other filamentous fungi** (*Fusarium, P. boydii*)
  - Multiple, erythematous, different stages
- **P. aeruginosa**
  - Ecthyma gangrenosum
Working with your ID consultants

- Call your consultant early in the case of an ID emergency
- Obtain cultures before administering antibiotics when indicated
- Do not treat asymptomatic bacteruria (there are a few exceptions)
- Be familiar with local diseases and at risk hosts
- Dose adjust antimicrobials and monitor for drug interactions
- Talk to your consultant if you don’t agree with the management plan
- Avoid using superficial swab cultures
- Narrow the antibiotic spectrum and duration when appropriate
- Test your patients for HIV at least once
- Avoid testing for a *Clostridium difficile* in the absence of diarrhea
Social History is Key in ID!!!
Other ID Emergencies

• Sepsis
• Severe Malaria
• Disseminated Coccidioidomycosis
• Brain Abscess
• Invasive Fungal Sinusitis
• Meningococcemia
• Toxic Shock Syndrome
• Severe Clostridium difficile colitis
• Agents of Bioterrorism (Anthrax, Plague, Small Pox, Tularemia, Botulism)
• Viral Hemorrhagic Fevers
YOUR CONSULT IS APPRECIATED...

Is there something you're not telling me, Doctor?