Question #1
A 25 year old female suffers a cat bite on the forearm. She presents one hour later for care. If no antibacterial is administered, the percentage of such patients that get infected is:

A. 0-10 %
B. 10-30 %
C. 30-70 %
D. 70-100 %

Management of Animal Bites
• Wound care: irrigate, debridement
• Image for Fracture or as baseline for osteo or to detect foreign body?
• Wound closure: NO
• Anticipatory (prophylactic) antibiotics
• Vaccines (tetanus and rabies)

Cat Bites
• Most cat bites become infected with bacteria
• Wound types: puncture
• Microbiology: 63% polymicrobial
• Infection type:
  — nonpurulent wound with cellulitis, lymphangitis, or both (42%)
  — purulent wound without abscess (39%)
  — abscesses (19%)

Pasturella multocida
• In saliva of > 90% of cats and over 80% of wounds get infected
• Different species, *Pasturella canis*, in saliva of 50% of dogs and only 2-10% get infected
• Small aerobic Gram-Negative bacillus
• Hard to remember antibiotic susceptibility profile, but amoxicillin sensitive; alternatives can be tricky
Can you name 6 pathogens that can cause infection after cat bites?

1. Pasteurella species
2. Anaerobic bacteria: e.g., Fusobacteria
3. Bartonella henselae (Cat Scratch dis.)
4. Rabies virus
5. S. aureus
6. Streptococcal species

Question #2

A 50 year old female alcoholic suffered a provoked dog bite. It was cleansed, tetanus toxoid given, and the dog placed under observation.

The patient is post-elective splenectomy for ITP. She received pneumococcal vaccine one year ago.

One day later, the patient is admitted to the ICU in septic shock with severe DIC and peripheral symmetric gangrene of the tips of her fingers/ toes.

Question #2 Continued

Which one of the following is the most likely etiologic bacteria?

A. Pasteurella canis
B. Capnocytophaga canimorsus
C. Fusobacterium sp.
D. Bartonella henselae

Dog Bites and Splenectomy

- Only 2-10% get infected
- Potential pathogens from
  - Dog’s mouth: Pasteurella canis, Capnocytophaga canimorsus
  - Human skin: S. aureus, S. pyogenes
- Capnocytophaga is an important cause of overwhelming sepsis in splenectomized patients
- Capnocytophaga
  - Susceptible to: AM/CL, PIP/Tazo, Penicillin G, and clindamycin
  - Resistant to: TMP/SMX and maybe vancomycin

Question #3

A 45 year old USA homeless male presents with fever and severe polymyalgia. On physical exam, animal bite marks found around his left ankle. A faint rash is visible on his extremities. Within 24 hours, blood cultures are positive for pleomorphic gram-negative bacilli.

Which one of the following is the most likely diagnosis?

A. Pasteurella multocida?
B. Haemophilus parainfluenza?
C. Spirillum minus?
D. Streptobacillus moniliformis?

Rat bite fever

- USA: Streptobacillus moniliformis
- Asia: Spirillum minus
- Bites or contaminated food/water
- S. moniliformis:
  - Fever, extremity rash
    - Macular/papular, pustular, petechial, purpuric
  - Symmetrical polyarthralgia
- Treatment: Penicillin or doxycycline
Question #4
A 35 year old male suffers a clenched fist injury in a barroom brawl. He presents 18 hours later with fever and a tender, red, warm fist wound. Gram stain of bloody exudate shows a small gram-negative rod with some coccobacillary forms. The aerobic culture is positive for viridans streptococci.

Which one of the following organisms is the likely etiologic agent?
A. Viridans streptococci?
B. Eikenella corrodens?
C. Peptostreptococcus?
D. Fusobacterium species?

Eikenella corrodens
- Anaerobic small gram-negative bacillus
- Susceptible to: penicillins, FQs, TMP/SMX, Doxy, and ESCs.
- Resistant to: Cephalaxin, clinda, erythro, and metronidazole

Question #5 (Extra Credit)
Medicinal leeches are applied to a non-healing leg ulcer. Which one of the following pathogens is found in the "mouth" of the leech?
A. Alcaligenes xylosoxidans
B. Aeromonas hydrophila
C. Acinetobacter baumannii
D. Arcanobacterium haemolyticum

The Skin: Local Invasion by Structure

Skin Infections: Predisposing Factors
- Trauma to normal skin
- Immune deficiency
- Disrupted venous or lymphatic drainage
- Local inflammatory disorder
- Presence of foreign body
- Vascular insufficiency
- Obesity; poor hygiene
**Purulence (sometimes mixed with blood) where hair follicles exit skin**

- **Diagnosis:** Superficial Folliculitis
- **Etiology:**
  1. *S. aureus*
  2. *P. aeruginosa* (hot tub)
  3. *C. albicans* *(esp. in obese patient)*
  4. *Malassezia furfur* - lipophilic yeast *(former Pityrosporum sp)*
  5. Idiopathic eosinophilic pustular folliculitis in AIDS patients

**Folliculitis under the swim trunks is?**

- **Microbial etiology?**
  - Infection of outer layers of epidermis with production of “honey-crust” scales
  - Prevalent in warm, humid environments – esp. in children
  - Microbial etiology?

- **Streptococcal**
  - Infection of outer layers of epidermis with production of “honey-crust” scales
  - Prevalent in warm, humid environments – esp. in children
  - Microbial etiology?
  - *Streptococci: Groups A, B, C, G*
Name of clinical syndrome?

Infection of outer layers of epidermis with production of “honey-crust” scales
Prevalent in warm, humid environments – esp. in children

Microbial etiology?
- Streptococci: Grps A, B, C, G

Name?

Streptococcal Infection of the Epidermis

Infection of outer layers of epidermis with production of “honey-crust” scales.
Prevalent in warm, humid environments – esp. in children.

Microbial etiology?
- Streptococci: Grps A, B, C, G

Name?
- Streptococcal impetigo

Fragile Bullae in Epidermis

Diagnosis?
- Bullous impetigo

Etiology?
Fragile Bullae in Epidermis

Diagnosis?
- Bullous impetigo

Etiology?
- S. aureus

Impetigo ("to attack")

- Bullous impetigo: S. aureus
- Non-bullous impetigo: S. pyogenes, group A
- So, empiric therapy aimed at S. aureus as could be MRSA
- Topical: topical antibiotic ointment (TAO), mupirocin, retapamulin
- Oral rarely needed — e.g., Clindamycin, doxycycline

Complications of S. pyogenes, S. dysgalactiae (Gps C&G) impetigo

- Post-streptococcal glomerulonephritis due to nephritogenic strains
- Rheumatic fever has “never” occurred after streptococcal impetigo

Acute onset of painful, rapidly spreading red plaque of inflammation involving epidermis, dermis, and subcutaneous fat

NO PURULENCE

Diagnosis?
Acute onset of painful, rapidly spreading red plaque of inflammation involving epidermis, dermis, and subcutaneous fat
NO PURULENCE
Diagnosis?
- **Erysipelas**: Non-purulent cellulitis

Etiology?
- **Hemolytic Streptococci**: Grp A now less common than groups C and G
- If on the face, could be **S. aureus**

### Erysipelas (“Red Skin”)

- Acute onset of painful skin, rapid progression +/- lymphangitis
- Inflamed skin elevated, red, and demarcated
- Predisposition:
  - Lymphatic disruption, venous stasis

### Erysipelas and Cultures

- Usually no culture necessary
- Can isolate **S. pyogenes** from fungal-infected skin between toes
- Low density of organisms. Punch biopsy positive in only 20-30%
- Blood cultures positive in <= 5%
- Confused with stasis dermatitis
Stasis Dermatitis

- Looks like erysipelas; Patient often obese
- No fever
- Chronic, often bilateral, dependent edema
- Goes away with elevation
- Does not respond to antimicrobials
- Cadexomer iodine (IODOSORB) response rate 21% vs 5% for usual care

Treatment of Erysipelas (Non-purulent “cellulitis”)

- Elevation
- Topical antifungals between toes if tinea pedis present
- Penicillin, cephalosporins, clindamycin
- Avoid macrolides and TMP/SMX due to frequency of resistance

Cellulitis

- Without localization or preceding micro or macro trauma: usually Beta strep. (usually GAS), extremities > face, elsewhere
- With localization (cut, pustule, etc) or preceding trauma: S. aureus

Severe Cellulitis

Microbiology: Streptococci (grp A,B,C,G); less often S. aureus; rarely GNR

Recurrent Cellulitis

- Frequently non-group A streptococci (esp. B,G)
- Relapse > recurrence
- Prophylaxis:
  - benzathine penicillin IM
  - oral penicillin; other systemic antibiotics
  - decolonization (nasal, elsewhere)
Risk factors for recurrent Cellulitis

- **Lower Extremity**
  - Post-bypass venectomy
  - Chronic lymphedema
  - Pelvic surgery
  - Lymphadenectomy
  - Pelvic irradiation
  - Chronic dermatophytosis

- **Upper Extremity**
  - Post-mastectomy/node dissection

- **Breast**
  - Post-breast conservation surgery, biopsy

Erysipelothrix (Gram + rod)

- On finger after cut/abrasion exposure to infected animal (swine) or fish
- Subacute erysipelas (erysipeloid)
- Severe throbbing pain
- Diagnosis: Culture of deep dermis (aspirate or biopsy)
- Treatment: Penicillin, cephalosporins, clindamycin, fluoroquinolone

Erysipelothrix rhusiopathiae Infection

- Gram stain of the organism identified on culture

Erysipelothrix rhusiopathiae Infection

- Resolving cellulitis caused by Erysipelothrix rhusiopathiae

Question #6

A 53 year old male construction worker has sudden onset of pain in his left calf. Within hours the skin and subcutaneous tissue of the calf are red, edematous and tender. Red “streaks” are seen spreading proximally. A short time later, patient is brought to the ER

- Confused, vomiting, and hypotensive.
  - Temp is 40°C with diffuse erythema of the skin. Oxygen sat. 88% on room air
  - WBC 3000 with 25% polys and 50% band forms. Platelet count is 60,000

(Continued)

Question #6 Continued

Which one of the following is the most likely complication of the erysipelas?

A. Bacteremic shock due to *S. pyogenes*?
B. Toxic shock due to *S. pyogenes*?
C. Bacteremic shock due to *S. aureus*?
D. Toxic shock due to *S. aureus*?

Toxic Shock Syn. (TSS): Staph vs Strep

<table>
<thead>
<tr>
<th>Feature</th>
<th>Staphylococcal</th>
<th>Streptococcal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predisposition</td>
<td>Tampon, surgery; colonization</td>
<td>Cuts, Burns, Vacciella, erysipelae</td>
</tr>
<tr>
<td>Focal Pain</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Tissue necrosis/inflammation</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>N/V, renal failure/DIC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Erythroderma</td>
<td>Very common</td>
<td>Less Common</td>
</tr>
<tr>
<td>Bacteremia</td>
<td>Very rare</td>
<td>60%</td>
</tr>
<tr>
<td>Mortality</td>
<td>&lt;3%</td>
<td>30-70%</td>
</tr>
</tbody>
</table>
Sore throat and skin rash

- 20 year old man with 3 days of sore throat, fever, chills, and skin rash
- Rash is nonpruritic and involves abdomen, chest, back, arms, and legs
- Exam: Exudative tonsillitis, strawberry tongue, rash, and tender cervical lymph nodes

The most likely diagnosis?

- Infectious mononucleosis
- Coxsackie hand, foot and mouth disease
- Scarlet fever
- Arcanobacterium hemolyticum

Question #7

Which one of the following is the likely etiology of the skin bullae?

A. \textit{S. aureus} scalded skin syndrome?
B. Bullous pemphigus?
C. Drug-induced Toxic epidermal necrolysis (TEN)?
D. \textit{S. pyogenes} necrotizing fasciitis?
The Skin and Toxins of S. aureus and S. pyogenes

<table>
<thead>
<tr>
<th>Organism</th>
<th>Toxin</th>
<th>Clinical Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. aureus colonization</td>
<td>TSST</td>
<td>TSS &amp; Erythroderma</td>
</tr>
<tr>
<td>S. aureus colonization</td>
<td>Exfoliative toxin</td>
<td>Impetigo; scalded skin syndrome</td>
</tr>
<tr>
<td>Strept. pyogenes invasion</td>
<td>TSST</td>
<td>TSS; Erythroderma (not always)</td>
</tr>
<tr>
<td>Strept. pyogenes</td>
<td>Pyrogenic  exotoxin</td>
<td>Pharyngitis; Scarlet Fever (sandpaper rash)</td>
</tr>
</tbody>
</table>

Erysipelas with loss of pain, hemorrhagic bullae, rapid progression...

Necrotizing fasciitis due to which one?
- a. Streptococcal fasciitis
- b. Staphylococcal fasciitis
- c. Clostridial infection
- d. Synergy between aerobe (S. aureus, E.coli) plus anaerobe (anaerobic strep, Bacteroides sp) equals Melenev’s, Fournier’s.

Necrotizing Fasciitis: at the bedside

Sudden onset excruciating pain & systemic toxicity
Note swelling of leg & 2 small purple bullae on anterior shin
Pressures in the anterior/lateral compartments (blood at needle entry) elevated; surgical exploration performed
Treatment of necrotizing fasciitis

- Think of it
- Surgical debridement: sometimes several times so as to achieve source control
- Appropriate antimicrobial therapy

Anatomy Syndrome

<table>
<thead>
<tr>
<th>Structure</th>
<th>Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidermis</td>
<td>Erythema</td>
</tr>
<tr>
<td>Skin</td>
<td>Impetigo</td>
</tr>
<tr>
<td>Dermis</td>
<td>Folliculitis</td>
</tr>
<tr>
<td>Superficial fascia</td>
<td>Ecthyma</td>
</tr>
<tr>
<td>Subcutaneous tissue</td>
<td>Furunculosis</td>
</tr>
<tr>
<td>Subcutaneous fat</td>
<td>Carbunculosis</td>
</tr>
<tr>
<td>Nerves, arteries, veins</td>
<td></td>
</tr>
<tr>
<td>Deep fascia</td>
<td>Muscle (necrotizing fasciitis)</td>
</tr>
</tbody>
</table>

Question #8

A 50-year-old male African American fisherman with known alcoholic cirrhosis suffers an abrasion of his leg while harvesting oysters. Within hours, the skin is red, painful, and hemorrhagic bullae appear.

Which one of the following conditions predisposes to this infection?

A. G6PD Deficiency
B. Hemochromatosis
C. Sickle cell disease
D. Achlorhydria

Vibrio vulnificus

- Leading cause of shellfish (e.g., oysters)- associated deaths in USA
- Portal of entry: skin abasions or GI
- Liver disease, hemochromatosis, and exposure to estuaries are major risk factors
- Infected wounds manifest as bullae in 75%; primary bacteremia also occurs.
- Treatment (look up): doxy plus ceftriaxone (alternative is an FQ)

Organisms Whose Growth is Stimulated by Excess Iron

- *Vibrio vulnificus* V
- *Escherichia coli* E
- *Listeria monocytogenes* L
- *Aeromonas hydrophilia* A
- *Rhizopus species (Mucor)* R
- *Yersinia enterocolitica* Y

Definition: “The sails of a ship”
Thank You!
• David Gilbert

Our patients and their families

Common Masqueraders of Cellulitis
• Vascular Disorders
  - Superficial thrombophlebitis
  - Deep venous thrombophlebitis
• Primary Dermatologic Disorders
  - Contact dermatitis
  - Insect stings or bites and other envenomations
  - Drug reactions
    - Eosinophilic cellulitis (Wells syndrome)
    - Sweet syndrome
• Rheumatic disorders
  - Gouty arthritis

Skin Abscesses
• Predisposing factors
  - S. aureus colonization
  - IV/SQ drug injection
  - Underlying diseases
    - DM, immunodeficiencies, etc
• Microbiology
  - S. aureus: the vast majority
    - Treatment: Drainage, antibiotics
  - Always cover S. aureus. Broad spectrum in special cases (septic IVDU)

CA-MRSA & CA-MRSA-Like Skin Lesions
Cutaneous lesions
Bite of Loxosceles
Ecthyma gangrenosum