“Only Skin Deep?”
A Guided Tour of Skin & Soft Tissue Infections

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Objectives

- Understand differential diagnosis of SSTI’s and use this to optimize diagnosis and management
- Learn the latest guideline recommendations for SSTI treatment
- Will understand the approach and management of the most serious SSTI’s
Clinical Case to Ponder

- 58 y/o WF with DM & CHF on insulin in clinic complains of redness & pain of the right leg. Exam – she is afebrile, has uniform redness and warmth over anterior thigh. The appropriate treatment is:

- A. Oral cephalexin for 5 days
- B. Admit for 7-14 days of IV vancomycin
- C. admit to the ICU for pip-tazo + vancomycin
- D. send emergently to surgery for debridement
What is needed for a tour?

Map
Know the language
Know the rules
Identify danger
Know the terrain

Know the Language

Identify danger:
Ireland *not* part of Britain; don’t wear Union Jack clothes
The Skin/Soft Tissue Map

**VIRAL PATHOGENS**
- Herpes simplex
- Papillomavirus
- Molluscum
- Orf
- Varicella

**BACTERIA**
- *S. aureus*
- *S. pyogenes*
- *C. diphtheriae*
- *M. tuberculosis*
- *M. marinum*
- *M. ulcerans*
- *C. minutissimum*
- *Pseudomonas aeruginosa*
- *Erysipelothrix rhinosphaerica*

**FUNGAL PATHOGENS**
- *Epidermophyton*
- *Microsporum*
- *Trichophyton*
- *Candida*
- *Malassezia furfur*

**INFECTIOUS/INFECTIOUS**
- **S. aureus**
  - Impetigo, furunculosis, boils, toxic epidermal necrolysis, acute paronychia
  - Cellulitis, erysipelas, impetigo
  - Cutaneous diphtheria
  - Lupus vulgaris
  - Chronic ulcerative disease (Buruli ulcer)
  - Erythrasma
  - Colonization of burns

- **S. pyogenes**
  - Necrotizing fasciitis (S. pyogenes or mixed anaerobic and aerobic organisms)

- **TOXIN-MEDIATED**
  - Scalded skin
  - Toxic shock
  - S. pyogenes
  - Scarlet fever

**DERMAL LEVELS**
- Epidermis
- Dermis
- Hair follicle
- Subcutaneous fat
- Fascia
- Muscle

- Folliculitis (S. aureus)
- Impetigo (S. aureus, S. pyogenes)
- Erysipelas (S. pyogenes)
- Cellulitis (S. pyogenes)
- Necrotizing fasciitis (S. pyogenes or mixed anaerobic and aerobic organisms)
Primary infections –
   - Impetigo → → necrotizing fasciitis
Secondary infections complicating pre-existing skin lesions
   - Post-surgical infections
   - Traumatic SSTI
   - Bite infections
   - Diabetic foot / vascular insufficiency infections
Know the Language

- Impetigo
- Ecthyma
- Furuncle, carbuncle
- Cellulitis – erysipelas, necrotizing, synergistic, gangrenous
- Abscess – primary vs post-operative infections

Abbreviations
- SSTI = skin & soft tissue infections
- Group A strep = GAS  Psa = pseudomonas
- GPC = Gram positive cocci  GNR = gram negative rods
Impetigo:

- vesicular, crusted lesions – GA Strep, staph
- GAS colonizes skin about 10 d before infection
- Differential dx: herpetic lesion
Bullous Impetigo

Usually in newborns

Etiology:  Staph aureus phage type II
Exfoliative exotoxins

Most isolates - MSSA
Ecchyma

- Starts like impetigo but goes into subq tissue; GAS
- Punched-out ulcer covered by greenish-yellow crust
- Diff dx: insect bite, M marinum, sporotrichosis, leishmania
- Rare – cutaneous anthrax (exposure to animal hide)
Impetigo & Ecthyma (know the Rules)

- Target Staph but expect Strep
- Oral antibiotics usually 7 days
  - Cephalexin
  - Erythromycin
  - Augmentin
  - Dicloxacillin
- Mupriocin or Retapmulin – mild cases, 5 days
- Gram stain and culture pus
- Admit if systemic sx’s – compromised host (GNR, Psa)
Folliculitis

Pyoderma of hair follicles
Etiology: Staph aureus (Pseudomonas: hot tubs, natatoria)
Different stages occur simultaneously

Candida intertrigo

Eosinophilic folliculitis (HIV)
Furuncle and Carbuncle

**Furuncle**: deep inflammatory nodule around hair follicle

**Carbuncle**: coalescent furuncles usually areas of friction

Staph aureus
Furuncle, Carbuncle, Abscess
(the rules)

- I&D may be sufficient
- Gram stain and culture - do they have MRSA?
- Anti-staphylococcal antibiotics
- Admit if systemically ill (SIRS)
- Recurrent abscesses:
  - R/O foreign body, local problem (hidradenitis)
  - Culture again, then 5-10 d course antibiotics
  - Consider decolonization regimen
  - If since early childhood, r/o neutrophil disorder
Can recurrent staph infections be stopped?

- Decolonization strategies – pre-MRSA:
  - BID intranasal mupriocin, chlorhexidine washes
  - Clindamycin 150mg daily x 3 months

- MRSA era – no successful strategies
  - CID 2014;58:1540-8
  - 3 personal hygiene strategies in 30,000 military trainees - none worked
**Erysipelas**: superficial cellulitis
prominent lymphatic involvement
GAS
recurrence rate 30%
5% develop bullae
**Cellulitis**: acute infection of subq tissue

: *non-purulent* unless injury

: GAS, staph aureus
Stages & consequences of cellulitis
Cellulitis: Differential Diagnosis

- Erysipelothrix
- Insect bite
- Fixed drug reaction
  - Necrotizing fasciitis
- Kawasaki’s disease
- Sweets syndrome

- Weil’s Disease
- Carcinoma
  - Erysipeloides
- Acute gout
- DVT
- Calciphylaxis
Typical Cellulitis – (rules)

- No cultures unless immunocompromised
  - chemo, neutropenic, transplant, immersion injury

- Immunocompetent patient:
  - Mild – moderate – target *streptococci*
  - Erysipelas – vast majority caused by strep

- 5 days antibiotics then re-evaluate
What about MRSA?

- MRSA is an unusual cause of typical cellulitis
- Prospective study in area with high rates of MRSA
  - Typical cellulitis treated with beta-lactams
  - Cure in 96% of patients
  - Medicine (Baltimore) 2010;89:217-26

- Why is this important?
  - Sulfa drugs & doxycycline have poor Group A strep activity
If need IV antibiotics
  ▪ Many target Staph in addition to Strep, but evidence for the need for this is weak
  ▪ Outpatient IV antibiotics may be appropriate

Anti-inflammatory agents speed recovery
  ▪ NSAIDS TID x 1 week
  ▪ Prednisone taper – esp erysipelas

Leg cellulitis – look for tinea pedis
Cellulitis: Immunocompromised Hosts

- Chemotherapy, XRT
- Neutropenic
- Transplant (graft vs host)
- Indwelling lines, catheters, procedures

- Bacteria – broaden coverage – GNR’s, Psa
- Mycobacteria
- Fungi
**Immunocompromised Patients:** (rules)

- **Review** all previous antibiotic therapy
- **Aggressively determine etiology**
  - Skin biopsy, cultures, imaging
- **Risk-stratify patients** with febrile neutropenia
  - Is it profound? Will it be prolonged?
- **Initially target GPC and GNR’s**
- Prolonged cases – add fungal coverage
  - 30-40% GPC
  - 10-15% GNR
  - 50% yeast or molds
Recurrent Cellulitis

- 3-4 episodes a year
- Identify and modify pre-disposing factors:
  - Obesity
  - Eczema
  - Tinea pedis
  - Edema

- Prophylactic antibiotics in selected patients
  - Oral PCN or erythromycin BID
  - IM benzathine PCN q 2-4 weeks
  - Clindamycin po
Prevention of recurrent cellulitis, especially with lymphedema:

- **Penicillin** V 500mg PO twice daily
- **Amoxicillin** 250-500mg PO twice daily
- **Clindamycin** 150-300mg PO daily
- **Erythromycin** 250mg PO once or twice daily

**Prophylactic Regimens**
Know when you (or your patient) may be in danger

Necrotizing fasciitis

Gangrenous fasciitis / infections

Post-trauma or post-operative infections

Immunocompromised hosts
Necrotizing Fasciitis

- Two types:
  - Type I: Polymicrobial: anaerobes + GPC + GNR
  - Type II: Streptococcal
- Precipitating trauma (may be minor)

- Think fasciitis when:
  - Pain out of proportion to visible abnormalities
  - Failure to respond to initial therapy
  - Hard woody subq tissue extending beyond erythema borders, crepitus, skin necrosis
Necrotizing Fasciitis

- Cellulitis, but *exquisitely tender*
- Rapid progression to dusky, necrotic skin – *anesthesia*
- √ for subq gas, compartment syndrome
Necrotizing fasciitis

- **Surgical intervention** – emergently
- **Broad-spectrum antibiotics** to target
  - MRSA, streptococci, GNR’s, Anaerobes
  - Pip-tazo, vancomycin/linezolid, carbapenem
  - Consider clindamycin – suppresses GAS toxin and cytokine production

- If proven Group A strep necrotizing fasciitis
  - *PCN + clindamycin drugs of choice (need both)*)
Clostridial Gas Gangrene

- Clostridium perfringens – seen in trauma
- *Clostridium septicum* – seen in spontaneous cases
  - Neutropenic or colonic malignancy patients
  - Develops in normal soft tissue
- Fulminant infection = surgery, ICU care
- Broad-spectrum antibiotics
- Hyperbarics – not recommended
  - Not proven beneficial
Clinical Case - revisited

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SSTI’s Post-Trauma &/or Surgery

- Penetrating trauma – expands etiology
- Surgery = controlled trauma
  - Staph / strep from skin
  - Mucosal surfaces – GNR’s and anaerobes
- Compromised hosts –
  - Inpatients may colonize with GNR’s
  - Cancer / transplant units, ICU’s – resistant bacteria
  - Neutropenia – add fungal pathogens
- Trauma – add environmental organisms
Surgical Site Infections

- Rarely occur in first 48-72 hours post-op
  - Fever in this time frame – look for another cause
- Exception – clostridium and Group S strep
  - Occur in 24-48 hours
  - Start subtly – not much pus but patient septic
Post-op Infections: Management

- Suture removal: may be sufficient

- Antibiotics:
  - Erythema/induration > 5cm from wound edges
  - > 38.5 fever  HR > 110  WBC > 12,000

- If clean operation – trunk, head/neck extremities
  - Short-course antibiotics – target staph

- Other – GI, GYN, GU, axilla
  - Target staph, GNR’s +/- anaerobes
SSTI’s following trauma

Determine exposure
water? If yes, what kind?

Type of injury
penetrating? crush?
hollow organ involvement?

Image and culture — need to cover AFB?
Tailor antibiotics

Vibrio infections – doxycycline + ceftazidime
Bite Infections

- Determine animal – most common dog / cat
- Pre-emptive early antibiotics for 3-5 days
  - Immunocompromised including asplenic
  - Advanced liver disease
  - Moderate to severe injuries – esp hand and face
  - Penetrating injury to joint capsule
- Meta-analysis of 8 studies dog bites –
  - cumulative infection risk 16%
  - Antibiotics only helped high-risk wounds
Animal bites: antibiotics

Aerobic and anaerobic coverage
Amoxicillin-clavulanate (covers Pasteurella)
Alternatives: (avoid macrolides)
- cephalosporin + clindamycin
- moxifloxacin or doxycycline
- TMSU or levofloxacin + clindamycin or metronidazole
Human Bites

- Mixed GPC /anaerobes, *Eikenella corrodens*
  - Resistant to 1\textsuperscript{st} cephalosporin, macrolides, clindamycin, AG’s
- Amoxicillin-clavulanate or IV equivalent
- Alternatives
  - cephalosporin, clindamycin + quinolone

- All bites: tetanus if due, rabies if needed
- Primary closure only cautiously to face
  - Others may be approximated
Diabetic Foot Infections

- Due to trauma + vascular insufficiency + microbial inoculation

- Polymicrobial – aerobes / anaerobes
- Wide spectrum of presentations
  - Uninfected ulcer to infected gangrene

- Guidelines:
  - CID 2012;54:132-173
Diabetic Foot Infections

- Assessment
  - Severity of wound and infection (probe to bone)
  - R/O arterial insufficiency, osteomyelitis (Xray, MRI)
- Target antibiotics (post-debridement culture)
- Treatment ‘rules’:
  - Mild-moderate infection (no prior Abxic) – target GPC; IV / po
  - Severe – broad-spectrum
  - Address vascular insufficiency, bone debridement
  - Treat until infection resolved (not until wound closed)
### Management: Non-Purulent SSTI’s

#### Erysipelas, cellulitis, necrotizing cellulitis

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<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
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<td>Emergent surgery</td>
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<td>IV antibiotics</td>
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<td>Empiric Antibiotics</td>
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<td>PCN</td>
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<td>vanco + pip-tazo</td>
<td>vanco + pip-tazo</td>
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<td>If Strep – PCN + clinda</td>
<td>If immunocompromised</td>
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<td>Tailor antibiotics</td>
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<td>cover Gram (-), MRSA</td>
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- **Severe**: Requires emergent surgery.
- **Moderate**: IV antibiotics (e.g., PCN, Ceftriaxone).
- **Mild**: Oral antibiotics (e.g., PCN VK, Cefazolin, Clindamycin).
# Management: Purulent SSTI’s

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*Empiric Rx*  
Vancomycin  
Daptomycin  
Linezolid  
Televancin  

* If MSSA – nafcillin, cephalosporins, dicloxacillin