Acute Bacterial Skin Infections

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Disclosures

- These are my personal recommendations and are not the official views of the Office of Medical Services or the Department of State
- I have no financial relationship to disclose
- There are non FDA approved recs for use of antibiotics
Goals for this lecture

- Define and describe the different types of acute bacterial skin infections that commonly present to health units
- Review the management options for skin infections:
  - Evaluation
  - Antibiotic choices in a world of MRSA
  - Surgical drainage/debridement
Skin Infections

- Can be classified as:
  - either superficial or deep
  - caused by pathogens that penetrate through the skin or thru hematogenous spread
  - Purulent vs non purulent

- Overall *Strep pyogenes* (Group A β hemolytic strep) and *Staph aureus* are the most common causes
  - Other Strep groups, some anaerobes (eg. *Clostridium*), gram negative rods (eg *Vibrio vulnificus, Pasteurella* spp.) and fungi (mucor, *Aspergillus*) may also cause serious infections
  - Immunocompromised are far more likely to have infections with unusual organisms
## Acute Bacterial Skin and Skin Structure Infections (ABSSSI)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Cellulitis/erysipelas:** | • Diffuse skin infection characterized by spreading of edema, redness, and heat  
|                       | • May accompany lymphangitis and regional lymph node inflammation  
|                       | • Erysipelas may be differentiated with raised skin lesions and clear demarcation line of affected and unaffected areas  |
| **Wound infection:**  | • Purulent drainage with edema, redness, and/or induration of the surrounding wound  |
| **Cutaneous abscess:** | • Involves the dermis and deeper skin tissues in the presence of pus collections  
|                       | • Includes furuncles and carbuncles  |
Definitions of commonly used (and misused) terms
Misclassification can lead to incorrect management

Non purulent infections

- **Cellulitis**: diffuse, superficial spreading skin infection
  - Erythema around a furuncle or septic bursitis should not be called cellulitis, inflammation is more accurate.
  - *Strep >> Staph*

- **Erysipelas**: regional differences in definition:
  - Infection limited to the upper dermis with clearly delineated borders (whereas cellulitis involved deeper dermis and subcut fat)
  - Some define this as cellulitis of the face only
  - Especially in Europe, synonymous with cellulitis

Pics and schematics from: www.medicinenet.com/boils_pictures_slideshow/article.htm
Non purulent infections

Necrotizing fasciitis: a rapidly progressive infection of the fascia, with secondary necrosis of the subcutaneous tissues.

- AKA hemolytic streptococcal gangrene, Meleney ulcer, synergistic necrotizing cellulitis
- Fournier’s gangrene is necrotizing fasciitis of the perineum and scrotum
- The speed of spread is directly proportional to the thickness of the subcutaneous layer.
- Necrotizing fasciitis moves along the fascial plane.
- Combination of bacteria most commonly Group A Strep often with *Klebsiella, Clostridium, E.coli, Staph aureus, Aeromonas hydrophila*
Purulent Infections

**Folliculitis**

- Superficial infection of the hair follicles with purulence confined to the epidermis
- Multiple erythematous, pruritic papules that may become pustular
- Commonly *S. aureus* and *P. aeruginosa*. *Candida, Aeromonas, Klebsiella, Acinetobacter, nontuberculous mycobacteria* are less common causes
- Usually self-resolving with no need for treatment, may use mupiricon for *Staph*
- Hot tub folliculitis is usually *Pseudomonas* and associated with inadequately chlorinated hot tubs and whirlpools
**Purulent Infections**

**Furuncles**: (aka boils) deep skin abscesses preceding from a folliculitis and involved surrounding tissue

- When associated with an eyelash it is a **sty**.
- **Staph >>Strep**

**Carbuncles**: clusters of furuncles connected subcutaneously associated with deeper suppuration and scarring
Purulent Infections

- **Impetigo**: a superficial skin infection with crusting or bullae:
  - Non bullous: *Staph* > *Strep* (reversed in the last 20 years)
  - Bullous: Nearly always Staph (up to 20% MRSA recently)

- **Ecthyma**: an ulcerative pyoderma that extends into the dermis. Often considered deep impetigo
  - Mainly Group A *Strep*
  - Ecthyma gangrenosum start like ecthyma but caused by *P. aeruginosa*

- **Hidradenitis suppurativa**: chronic, suppurative cicatricial infections of the apocrine glands of the axilla, genital and perianal areas
  - Mainly Staph
Clang Associations
Some criteria should always make you think of a particular skin infection

- Streaking, non purulent cellulitis: *Streptococcus* (Group A and others)
- “Spider bite” → purulence and erythema: *Staph*; community acquired MRSA
- Pain “out of proportion to the exam”, esp in DM: necrotizing fasciitis
- Cat bites with significant induration within hours: *Pasteurella multocida*
- Wound or surgical site with crepitant tissue: *Clostridial myonecrosis*
- Rapid onset cellulitis in water associated trauma: *Aeromonas hydrophila*
- Liver disease or alcoholic with bullous skin lesions: *Vibrio vulnificus*
- Black eschar with minimal or no pain: *Bacillus anthracis* (anthrax)
Management of Skin Infections in the Health Unit

- Increasing recognition:
  - Determining if the infection is suppurative or non-suppurative is important for determining treatment
  - Surgical management (maybe as simple as a needle or scalpel puncture I&D) is more important for many suppurative infections than antibiotics
  - MRSA in the community is increasingly common in suppurative infections but not in cellulitis
  - Choice of antibiotics should be made considering local resistance patterns and prior exposures in the patient
Outpatient† management of skin and soft tissue infections in the era of community-associated MRSA‡

**Patient presents with signs/symptoms of skin infection:**
- Redness
- Swelling
- Warmth
- Pain/tenderness
- Complaint of “spider bite”

**Is the lesion purulent (i.e., are any of the following signs present)?**
- Fluctuance—palpable fluid-filled cavity, movable, compressible
- Yellow or white center
- Central point or “head”
- Draining pus
- Possible to aspirate pus with needle and syringe

**Possible cellulitis without abscess:**
- Provide antimicrobial therapy with coverage for *Streptococcus* spp. and/or other suspected pathogens
- Maintain close follow-up
- Consider adding coverage for MRSA (if not provided initially), if patient does not respond

**YES**

1. Drain the lesion
2. Send wound drainage for culture and susceptibility testing
3. Advise patient on wound care and hygiene
4. Discuss follow-up plan with patient

**YES**

† For severe infections requiring inpatient management, consider consulting an infectious disease specialist.
‡ Visit [www.cdc.gov/mrsa](http://www.cdc.gov/mrsa) for more information.

**Abbreviations:**
- I&D—incision and drainage
- MRSA—methicillin-resistant *S. aureus*
- SSTI—skin and soft tissue infection

If systemic symptoms, severe local symptoms, immunosuppression, or failure to respond to I&D, consider antimicrobial therapy with coverage for MRSA in addition to I&D. (See below for options)

MANAGEMENT OF SSTIs

NONPURULENT
Necrotizing Infection /Cellulitis /Erysipelas

Severe
- EMERGENT SURGICAL INSPECTION / DEBRIDEMENT
  - Rule out necrotizing process
- EMPIRIC Rx
  - Vancomycin PLUS Piperacillin/Tazobactam

Moderate
- INTRAVENOUS Rx
  - Penicillin or Ceftriaxone or Cefazolin or Clindamycin
- Defined Rx (Necrotizing Infections)
  - Monomicrobial
    - Streptococcus pyogenes
      - Penicillin PLUS Clindamycin
    - Clostridial sp.
      - Penicillin PLUS Clindamycin
    - Vibrio vulnificus
      - Doxycycline PLUS Ceftazidime
    - Aeromonas hydrophila
      - Doxycycline PLUS Ciprofloxacin
  - Polymicrobial
    - Vancomycin PLUS Piperacillin/Tazobactam

Mild
- ORAL Rx
  - Penicillin VK or Cephalexin or Clindamycin
- Defined Rx
  - MRSA
    - See Empiric
  - MSSA
    - Nafcillin or Cefazolin or Clindamycin

PURULENT
Furuncle / Carbuncle / Abscess

Severe
- I & D C & S

Moderate
- I & D C & S

Mild
- I & D

1 Since daptomycin and televancin are not approved for use in children, vancomycin is recommended; clindamycin may be used if clindamycin resistance is <10-15% at the institution.
Drugs used to treat MRSA infections

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
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</thead>
<tbody>
<tr>
<td>Beta-lactam</td>
<td>Ceftaroline $$</td>
<td></td>
</tr>
<tr>
<td>Folate antagonist</td>
<td>Trimethoprim-sulfamethoxazole **</td>
<td></td>
</tr>
<tr>
<td>Glycolipopeptide</td>
<td>Telavancin $$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oritavancin $$$</td>
<td></td>
</tr>
<tr>
<td>Glycopeptide</td>
<td>Vancomycin *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dalbavancin $$$</td>
<td></td>
</tr>
<tr>
<td>Lincosamide</td>
<td>Clindamycin **</td>
<td></td>
</tr>
<tr>
<td>Lipopeptide</td>
<td>Daptomycin $$</td>
<td></td>
</tr>
<tr>
<td>Oxazolidinone</td>
<td>Linezolid $$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oxazolidinone $$$</td>
<td></td>
</tr>
<tr>
<td>Streptogramin</td>
<td>Quinupristin-dalfopristin</td>
<td></td>
</tr>
<tr>
<td>Tetracycline</td>
<td>Doxycycline *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minocycline *$</td>
<td></td>
</tr>
</tbody>
</table>

* - good choice
$ - expensive
- toxicity & side effects
So what do I do for cellulitis?

- Most cellulitis is caused by *Strep* spp and a minority by *Staph* spp.
  - typically NOT resistant *Staph*, this should guide antibx coverage.

- Concern about MRSA increases with:
  - penetrating trauma, MRSA colonization or infection at other sites, IVDU, SIRS, poor response to initial antibx

- Severe necrotizing infections are often polymicrobial and require surgical management in conjunction with broad spectrum IV antibiotics

- Specific exposures may suggest other drugs be used:
  - i.e. water exposure, shellfish, recent surgery
Cellulitis treatment

- **Mild Cellulitis** (without systemic symptoms):
  - Start with an oral penicillin as most will be covered:
    - Dicloxacillin, Pen VK, cephalexin, use clinda in Pen allergic

- **Moderate cellulitis** (i.e. with systemic symptoms):
  - Start with IV therapy, at least initially:
    - nafcillin, oxacillin, cefazolin, ceftriaxone or clinda
  - If associated with penetrating injury, IVDU, MRSA elsewhere or SIRS:
    - Vancomycin or combination with Strep and Staph coverage is important

- **Severe cases**, especially in immunocompromised:
  - Consider surgical consult for necrotizing infection
  - Blood cultures should be obtained as they may help guide therapy
  - Vancomycin plus piperacillin/tazobactam

Any role for steroids in cellulitis?

- Nondiabetic patients, in conjunction with antibiotics:
  - use of a short course prednisone leads to more rapid resolution of inflammation
  - may be associated with fewer post inflammatory changes and sequelae
- Prednisone 40 mg po qd for 5 days
- Probably most important to consider in orbital cellulitis where inflammation may lead to compromise of critical structures

What about recurrent cellulitis?

- Patients with recurrent episodes of cellulitis:
  - Obesity, chronic edema, eczema, venous insufficiency and toe web abnormalities all increase risk
  - Attempt to optimize these conditions first
    - Tinea pedis and any chronic condition which causes skin breaks markedly increases cellulitis risk
    - Control DM and attempt to minimize leg edema
  - Despite attempts to control other conditions if 3-4 cases of cellulitis per year occur then prophylactic antibx can be considered
  - Oral Pen VK or erythromycin bid, IM benzathine Pen q 2-4 weeks

How should I treat impetigo/ecthyma?

- Gram stain and cultures of pus or exudates to identify *Staph* vs *Strep* is ideal
  - In typical mild cases empiric therapy is reasonable
  - In recurrent cases or in school or family clusters is best to get cultures

- Oral or topical therapy can be used for impetigo but large or numerous lesions are best treated with oral therapy to ↓ transmission
  - Mupiricon (*Bactroban*) $ or retapamulin (*Altabax*) $$ bid
  - Most Staph in these lesions is NOT MRSA
    - 7 days Dicloxacillin or cephelexin (unless Strep alone in cx then use Pen VK)

- Ecthymas should be treated with oral antibiotics and usually are not MRSA
How should I treat purulent skin infections?

Furuncles, carbuncles, skin abscesses

- Gram stain and cultures of pus or exudates is ideal
  - In typical mild cases empiric therapy is reasonable
  - Gram stain and cultures are not recommended from inflamed epidermal cysts (often called epidermal inclusion cysts)

- Incision and drainage is the recommended treatment for most

- After surgical intervention, decision to add coverage for *S. aureus* reserved for those with systemic symptoms of infection (fever, leukocytosis) or with numerous lesions or large abscesses (>5 cm)
  - Need to cover for MRSA is recommended for patients who have failed initial therapy or are markedly immunosuppressed or in those with SIRS and hypotension or in areas with high rates of MRSA or in the midst of an “outbreak” of MRSA
  - 5-7 day therapy is usually sufficient, longer duration in severe dz.
What about recurrent furunculosis?

- Incision and drainage with culture and sensitivities
- 5-10 day course of antibiotics (guided by culture results)
- Consider nasal cultures 5 day regimen for Staph decolonization with bid intranasal mupiricon, daily chlorhexidine washes and daily changing of clothing and bedsheets
  - Dilute bleach baths also work and are cheaper (¼ cup bleach in 13 gals water)
  - For recalcitrant cases consider working up family and nasal decolonization
- If recurrent abscesses start in early childhood should be worked up for neutrophil disorders
- High dose vitamin C (1 g/day for 4-6 weeks) may correct neutrophil dysfunction especially in those with negative nasal cultures for Staph.
- If frequent recurrences consider suppression with minocycline or doxy plus rifampin or clindamycin

What about chronic hidradenitis suppuritiva?

- Avoid follicular trauma and maceration by wearing loose light clothing that avoids excess heat and friction.

- Avoid adhesive tape on dressings as it may cause more skin trauma. Elastic fishnet dressings or petrolatum

- Smoking cessation. Long term remission in those who continue to smoke is rarely seen.

- Weight and diet control may play some role

- Topical clindamycin 1% solution bid

- Intrallesional triamcinolone (.1 to .5 mL of 10mg/mL)

- Systemic antibx: 7-10 days of doxy or minocycline or clindamycin

- Severe cases may need chronic suppression with longer courses or combination with clinda and rifampin. Dapsone, moxifloxacin, other antibx
  - TNF-α inhibitors or isotretinoin
Antibiotics for purulent skin infections

- Drainage is most important
- Even with MRSA as the etiology the role of antibiotics is secondary and coverage for MRSA does not appear to be as important for mild to moderate infections as would be expected if antibx were crucial.

### Options for oral treatment of methicillin-resistant Staphylococcus aureus (MRSA)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Adult dose</th>
<th>Pediatric dose (children &gt;28 days)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clindamycin</td>
<td>300 to 450 mg orally three times daily</td>
<td>40 mg/kg per day orally divided in three or four doses</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>1 DS tab orally twice daily</td>
<td>8 to 12 mg trimethoprim component/kg per day orally divided in two doses</td>
</tr>
<tr>
<td>Doxycycline*</td>
<td>100 mg orally twice daily</td>
<td>≤45 kg: 4 mg/kg per day orally divided in two doses &gt;45 kg: 100 mg orally twice daily</td>
</tr>
<tr>
<td>Minocycline*</td>
<td>200 mg orally once, then 100 mg orally twice daily</td>
<td>≤45 kg: 4 mg/kg per day orally divided in two doses &gt;45 kg: 100 mg orally twice daily</td>
</tr>
<tr>
<td>Linezolid</td>
<td>600 mg orally twice daily</td>
<td>&lt;12 years: 30 mg/kg per day orally divided in three doses ≥12 years: 600 mg orally twice daily</td>
</tr>
<tr>
<td>Tedizolid</td>
<td>200 mg orally once daily</td>
<td></td>
</tr>
</tbody>
</table>

DS: double strength.

* Dosing for neonates is provided separately. (Please refer to the UpToDate table “Treatment of cellulitis in neonates”.)
* Not recommended for children <8 years of age.

The new kids on the block

The US FDA approved 3 new drugs for ABSSSI in 2014 but convenience comes at a great cost!

- **Oritavancin** (*Orbactiv*): lipoglycopeptide with $T_{1/2}$ of 245 hours
  - 1200 mg IV x 1
  - $1026 per 400 mg vial = $3078 for full course

- **Dalbavancin** (*Dalavance*): glycopeptide with $T_{1/2}$ of 346 hours
  - Dosage is 1000 mg IV x 1 then 1 week later 500 mg IV x 1
  - $1513 per 500 mg vial = $4539 for full course

- **Tedizolid** (*Sivextro*): oxazolidinone with $T_{1/2}$ of 12 hours
  - Dosage is 200mg po/IV x 6 days
  - $1821 for six 200mg tabs = $1821 for full course


Options for empiric outpatient antimicrobial treatment of SSTIs when MRSA is a consideration*

<table>
<thead>
<tr>
<th>Drug name</th>
<th>Considerations</th>
<th>Precautions**</th>
</tr>
</thead>
</table>
| Clindamycin        | - FDA-approved to treat serious infections due to *S. aureus*<ref> S. aureus</ref>  
- D-zone test should be performed to identify inducible clindamycin resistance in erythromycin-resistant isolates | *Clostridium difficile*-associated disease, while uncommon, may occur more frequently in association with clindamycin compared to other agents. |
| Tetracyclines      |  
- Doxycycline is FDA-approved to treat *S. aureus* skin infections.                                                                                                                                              |  
- Not recommended during pregnancy.  
- Not recommended for children under the age of 8.  
- Activity against group A streptococcus, a common cause of cellulitis, unknown. |
| Trimethoprim-     | Not FDA-approved to treat any staphylococcal infection                                                                                                                                                    |  
- May not provide coverage for group A streptococcus, a common cause of cellulitis  
- Not recommended for women in the third trimester of pregnancy.  
- Not recommended for infants less than 2 months. |
| Sulfamethoxazole   |                                                                                                                                                                                                           |                                                                                                     |
| Rifampin           | - Use only in combination with other agents.                                                                                                                                                               | Drug-drug interactions are common.                                                                      |
| Linezolid          | - Consultation with an infectious disease specialist is suggested.  
- FDA-approved to treat complicated skin infections, including those caused by MRSA.                                                                 | Has been associated with myelosuppression, neuropathy and lactic acidosis during prolonged therapy. |

- MRSA is resistant to all currently available beta-lactam agents (penicillins and cephalosporins)
- Fluoroquinolones (e.g., ciprofloxacin, levofloxacin) and macrolides (erythromycin, clarithromycin, azithromycin) are not optimal for treatment of MRSA SSTIs because resistance is common or may develop rapidly.

* Data from controlled clinical trials are needed to establish the comparative efficacy of these agents in treating MRSA SSTIs. Patients with signs and symptoms of severe illness should be treated as inpatients.
** Consult product labeling for a complete list of potential adverse effects associated with each agent.

Role of decolonization

Regimens intended to eliminate MRSA colonization should not be used in patients with active infections. Decolonization regimens may have a role in preventing recurrent infections, but more data are needed to establish their efficacy and to identify optimal regimens for use in community settings. *After treating active infections and reinforcing hygiene and appropriate wound care, consider consultation with an infectious disease specialist regarding use of decolonization when there are recurrent infections in an individual patient or members of a household.*
What about animal bites?
When is antibiotic prophylaxis appropriate?

Routine antibiotic prophylaxis is not recommended

- Prophylactic antibiotics reduce infections due to some bites, especially cat bites (80% cat bites vs 5% dogs).
- Antibx for 3-5 days are warranted in certain high-risk wounds:
  - Deep puncture wounds (especially due to cat bites)
  - Moderate to severe wounds with associated crush injury
  - Wounds in areas of underlying venous and/or lymphatic compromise
  - Wounds on the hand, genitalia, face, or in close proximity to a bone or joint (particularly the hand and prosthetic joints)
  - Wounds requiring closure
  - Bite wounds in compromised hosts (eg, immunocompromised, absent spleen or splenic dysfunction or DM)
## Recommended antibiotics after an animal bite

<table>
<thead>
<tr>
<th>Antimicrobial Agent by Type of Bite</th>
<th>Oral</th>
<th>Intravenous</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Animal bite</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amoxicillin-clavulanate</td>
<td>875/125 mg bid</td>
<td>...</td>
<td>Some gram-negative rods are resistant; misses MRSA</td>
</tr>
<tr>
<td>Ampicillin-sulbactam</td>
<td>...</td>
<td>1.5–3.0 g every 6–8 h</td>
<td>Some gram-negative rods are resistant; misses MRSA</td>
</tr>
<tr>
<td>Piperacillin-tazobactam</td>
<td>...</td>
<td>3.37 g every 6–8 h</td>
<td>Misses MRSA</td>
</tr>
<tr>
<td>Carbenems</td>
<td>See individual info.</td>
<td></td>
<td>Misses MRSA</td>
</tr>
<tr>
<td><strong>Doxycycline</strong></td>
<td>100 mg bid</td>
<td>100 mg every 12 h</td>
<td>Excellent activity against <em>Pasteurella multocida</em>; some streptococci are resistant</td>
</tr>
<tr>
<td><strong>Penicillin plus dicloxacillin</strong></td>
<td>500 mg qid/500 mg qid</td>
<td>...</td>
<td></td>
</tr>
<tr>
<td>SMX-TMP</td>
<td>160–800 mg bid</td>
<td>5–10 mg/kg/day of TMP component</td>
<td>Good activity against aerobes; poor activity against anaerobes</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>250–500 mg tid</td>
<td>500 mg every 6–8 h</td>
<td>Good activity against anaerobes; no activity against aerobes</td>
</tr>
<tr>
<td><strong>Clindamycin</strong></td>
<td>300 mg tid</td>
<td>600 mg every 6–8 h</td>
<td>Good activity against staphylococci, streptococci, and anaerobes; misses <em>P. multocida</em></td>
</tr>
<tr>
<td><strong>Second-generation cephalosporin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cefuroxime</strong></td>
<td>500 mg bid</td>
<td>1 g every 12 h</td>
<td>Good activity against <em>P. multocida</em>; misses anaerobes</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>...</td>
<td>1 g every 6–8 h</td>
<td></td>
</tr>
<tr>
<td><strong>Third-generation cephalosporin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>...</td>
<td>1 g every 12 h</td>
<td></td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>...</td>
<td>1–2 g every 6–8 h</td>
<td></td>
</tr>
<tr>
<td><strong>Fluoroquinolones</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>500–750 mg bid</td>
<td>400 mg every 12 h</td>
<td>Good activity against <em>P. multocida</em>; misses MRSA and some anaerobes</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>750 mg daily</td>
<td>750 mg daily</td>
<td></td>
</tr>
<tr>
<td>Moxifloxacin</td>
<td>400 mg daily</td>
<td>400 mg daily</td>
<td>Monotherapy; good for anaerobes also</td>
</tr>
<tr>
<td><strong>Human bite</strong></td>
<td></td>
<td></td>
<td></td>
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<td><strong>Doxycycline</strong></td>
<td>100 mg bid</td>
<td>...</td>
<td>Good activity against <em>Eikenella</em> species, staphylococci, and anaerobes; some streptococci are resistant</td>
</tr>
</tbody>
</table>

Abbreviations: bid, twice daily; MRSA, methicillin-resistant *Staphylococcus aureus*; qid, 4 times daily; SMX-TMP, sulfamethoxazole-trimethoprim; tid, 3 times daily.

Thanks for your attention

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