This CPM was created by the ED Development Team within the Intensive Medicine Clinical Program and the antibiotic stewardship service at Intermountain Healthcare. It guides the assessment and treatment of adult patients with purulent (i.e., abscess) and non-purulent cellulitis presenting to emergency departments, urgent care, or primary care clinics.

**Why Focus ON SSTI?**

- **SSTI are common and diverse.** Skin and soft tissue infections (SSTI) are infections of the skin and/or subcutaneous space. They are diverse in nature and can impact any body part. SSTI are the fifth most common diagnosis in Intermountain Emergency Departments.

- **SSTI are costly.** Hospitalization costs for SSTI average at least $8,000 per patient, which is two to four times more than outpatient care. In addition, Intermountain data on antibiotic prescribing in the ED show significant use of several high-cost intravenous (IV) antibiotics—daptomycin and ertapenem—for the treatment of SSTI.

- **There is excessive variability in antibiotic prescribing.** A recent retrospective review of 1,500 patients presenting to Intermountain EDs showed 95 different treatment regimens prescribed to treat patients with SSTI. This is more than what would be expected under consistent processes.

There is a need to standardize antibiotic prescribing for SSTI. Doing so will improve the rate of pathogen susceptibility to targeted treatment such that patients experience less treatment failure and fewer repeat visits to the ED. In parallel with improved patient outcomes, reducing the use of expensive medications will lower the overall cost of SSTI to Intermountain Healthcare.

**What’s new in this update?**

- For patients with non-purulent cellulitis, the addition of an MRSA active agent (e.g., Bactrim) is not necessary. Monotherapy with cephalexin is recommended.

- Patients presenting with abscess do benefit from oral antibiotics to prevent recurrence of infection in addition to incision and drainage, based on two large randomized controlled trials.

- Clindamycin and trimethoprim-sulfamethoxazole appear to be equally effective when treating wound infection, abscess, and cellulitis.

- Linezolid and vancomycin have similar cure rates for SSTI. Historically, linezolid was cost prohibitive for most patients. Linezolid has recently become generic and is now covered by most insurance carriers and is relatively affordable.

Intermountain will track which antibiotics are prescribed for the most common SSTI as well as the proportion of patients who are admitted to the hospital vs. discharged for outpatient follow up. These data will support the following system goals to reduce:

- Daptomycin and ertapenem use in patients with SSTI by 75%
- Combination therapy (trimethoprim-sulfamethoxazole AND cephalexin) by 50%
- SSTI treatment failure (ED visits 72 hours after index visit) by ensuring appropriate follow up and standardized antibiotic therapy

*Indicates an Intermountain measure*
DIAGNOSTIC CONSIDERATIONS

Although clinically common, SSTI are often difficult to diagnose and treat because of the high incidence of mimicking conditions and rising antibiotic resistance rates. No accurate or reliable diagnostic studies for cellulitis are currently available, so providers (typically in the ED or clinic) rely on a history and physical examination for these signs and symptoms in order to diagnose SSTI. The clinical features of SSTI include patchy redness, swelling, warmth, and tenderness. Non-purulent vs. purulent cellulitis (including cutaneous abscess, furuncles, boils, carbuncles, and superficial surgical site or other wound infections) can be distinguished primarily by the presence or absence of purulent drainage.

Due in part to the non-specificity of SSTI signs, the accuracy of SSTI diagnoses is not reliable among providers. More than 30% of patients given a diagnosis of cellulitis actually have an alternative condition that mimics SSTI (see sidebar).

Misdiagnosis of other conditions as SSTI results in delay of effective care, unnecessary exposure to antibiotics, and inappropriate hospitalization. This CPM suggests when it is appropriate to consider the most common conditions that mimic SSTI (see sidebar).

CLINICAL PRESENTATION

Clinical characteristics and common pathogens typically associated with SSTI:

- **Non-purulent cellulitis**
  - Acute, spreading area of patchy redness (erythema)
  - Poorly demarcated
  - Lack of pus/drainage
  - Warm, tender skin
  - Lymphadenopathy and/or lymphangitis
  - Systemic signs and symptoms
  - Common pathogen: Group A *Streptococcus*

- **Purulent cellulitis**
  - Localized infection
  - Tenderness
  - Redness (erythema)
  - Pus within the dermis or subcutaneous space
  - Common pathogen: *Staphylococcus aureus*
ALGORITHM 1: INITIAL SSTI ASSESSMENT

Patient presents with suspected SSTI

[Flowchart]

REASSESS per Algorithm 4: SSTI
Reassessment on page 9

Evaluate patient condition

Decide if patient is most likely going to be treated as an inpatient
or an outpatient (see table 1 below) based on:

- Vital signs / SIRS criteria met (a)
- Existing comorbidities
- Infection severity as observed in the clinical exam
- Social factors

If uncertain and the clinician determines that IV antibiotics in the
ED are warranted, choose the inpatient treatment pathway.

INPATIENT

OUTPATIENT

TREAT per INPATIENT
pathway detailed in
algorithm 3 on page 7

TREAT per OUTPATIENT
pathway detailed in
algorithm 2 on page 5

ALGORITHM NOTE

(a) SIRS criteria

- Temperature: > 38.3 °C or < 36 °C
- Heart rate: > 90 bpm
- Respiratory rate: > 20
- WBC: > 12,000 / mm³ or < 4,000 / mm³
- WBC: > 10 % band forms

TABLE 1. Hospital Admission Guidelines for SSTI

<table>
<thead>
<tr>
<th>ABSOLUTE CRITERIA (ADMIT IF PATIENT HAS ANY):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hemodynamic instability (hypotension)</td>
</tr>
<tr>
<td>• Possible necrotizing infection and rapid disease progression</td>
</tr>
<tr>
<td>• Unstable comorbidities (e.g., decompensated heart failure, acute or chronic kidney injury) with ≥ 2 SIRS criteria</td>
</tr>
<tr>
<td>• Neutropenia or severe immunosuppression** with ≥ 2 SIRS criteria (a)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE CRITERIA (CONSIDER ADMISSION* IF PATIENT HAS ANY):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Failed outpatient therapy</td>
</tr>
<tr>
<td>• Neutropenia or severe immunosuppression with a mild/localized infection</td>
</tr>
<tr>
<td>• Extensive cellulitis and/or large abscess</td>
</tr>
<tr>
<td>• Lymphedema with extensive cellulitis</td>
</tr>
<tr>
<td>• Morbid obesity and extensive panniculitis</td>
</tr>
<tr>
<td>• Infection in high risk locations that often require surgery (i.e., orbital cellulitis, hand infections, and perineal infections)</td>
</tr>
<tr>
<td>• Abscess in difficult-to-drain location (groin, face)</td>
</tr>
<tr>
<td>• ≥ 2 SIRS criteria (a) unresolved with ED management</td>
</tr>
<tr>
<td>• Social and personal factors that interfere with outpatient care</td>
</tr>
<tr>
<td>• Mild-to-moderate immunosuppression*** with ≥ 2 SIRS criteria (a)</td>
</tr>
</tbody>
</table>

* The decision to admit to the hospital is best approached as an opportunity for shared decision making between the patient, the ED/clinic provider, and the inpatient attending. Inform the patient about clinical recommendations, but also encourage the patient to weigh his or her own unique needs and preferences prior to making a treatment decision.

** Severe immunosuppression includes any of the following in the last year: Organ transplant, daily prednisone ≥ 20 mg, HIV infection with CD4 count < 200, or untreated HIV infection.

*** Mild-to-moderate immunosuppression includes end-stage organ dysfunction, diabetes, TNF inhibitor therapy, recent chemotherapy without neutropenia, daily prednisone ≤ 20 mg
TREATMENT CONSIDERATIONS

Treatment of SSTI varies based on clinical severity, patient comorbidities, allergies, admission status, and diagnosis. Despite existing panel recommendations and treatment guidelines, there are no specific risk stratification criteria for grading SSTI severity. This leads to a considerable variation in treatment approach.

Admission

A crucial point in the SSTI care pathway occurs on initial presentation when deciding whether a patient should be admitted to the hospital for intravenous (IV) antibiotic therapy or be treated as an outpatient. This CPM provides guidelines for making this decision, which is in part based on whether or not the patient has systemic inflammatory response syndrome (SIRS). In general, outpatients undergo more conservative treatment (algorithm 2 on page 5), while admitted patients undergo more aggressive treatment (algorithm 3 on page 7).

Antibiotics

Antibiotic treatment for SSTI presents a challenge with variation in antibiotic prescribing and hospital admission patterns. There is a lack of evidence-based agreement on antibiotic SSTI therapy in patients with more severe infections but whose condition does not necessarily warrant inpatient admission. A review of SSTI management across six Intermountain Healthcare emergency departments identified 95 different antibiotic regimens given to patients with SSTI in the ED.

This variation in antibiotic prescribing and hospital admission patterns has been seen elsewhere as well; a Cochrane review of 25 randomized controlled studies on the management of cellulitis found no cross-study agreement on recommendations for treatment regimen.

This CPM outlines specific guidelines on preferred and alternative antibiotic regimens for patients based on the risks presented in algorithm 1 (page 3). Table 5 on page 13 provides recommended adjustments for compromised renal function.
ALGORITHM 2: OUTPATIENT SSTI TREATMENT PATHWAY

Patient presents with SSTI not requiring inpatient admission

CLASSIFY infection type and SIRS criteria (a)
- RULE OUT mimicking conditions (see sidebar on page 2)
- DETERMINE if patient has:
  - Purulent or non-purulent infection
  - SIRS criteria (a)

IDENTIFY and PERFORM appropriate treatment plan
- IDENTIFY the appropriate regimen based on the above classification (see table 2 on page 6)
- If possible, GIVE initial antibiotic dose in the clinic or ED
- PRESCRIBE the same antibiotic and reinforce compliance
- COMPLETE all other treatment actions as indicated in table 2 on page 6

ASSESS risk for treatment failure
- DESIGNATE patient as high risk if ANY of the following:
  - Fever on presentation
  - ≥ 2 SIRS criteria (a)
  - Recurrent cellulitis in the same location
  - Infections due to chronic wounds/ulcers
  - Any of the relative criteria for hospital admission (see table 1 on page 3)

Is patient at high risk?

no
- INSTRUCT PATIENT to follow up with a primary care provider as needed

yes
- FLAG PATIENT for phone follow-up protocol (see algorithm 5 on page 10)

ALGORITHM NOTE

(a) SIRS criteria
- Temperature: > 38.3 °C or < 36 °C
- Heart rate: > 90 bpm
- Respiratory rate: > 20
- WBC: > 12,000/mm³ or < 4,000/mm³
- WBC: > 10% band forms
### TABLE 2. Outpatient SSTI Treatment Regimens

<table>
<thead>
<tr>
<th>Infection type</th>
<th>Treatment actions</th>
<th>Antibiotic and dose (preferred in <strong>bold type</strong>*)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>0 – 1 SIRS criteria met</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Purulent cellulitis, abscess, or wound infection | • Incision and drainage, if applicable  
• If surgical site infection, suture removal at the discretion of the surgeon  
• Obtain routine culture of pus  
• Elevate affected body part  
Cure rates with incision and drainage alone are 70–85% in most studies. Incision and drainage alone is reasonable in patient at high risk for antibiotic-related adverse events (e.g., *C. difficile* infection). | • Trimethoprim-sulfamethoxazole 1 DS PO BID x 7 d (2 DS if > 80 kg)  
OR  
• Doxycycline/minocycline 100 mg PO BO BID x 7 d  
OR  
• Clindamycin* 300 mg PO QID x 7 d |
| Non-purulent cellulitis | • Consider soft tissue ultrasound to rule out occult abscesses  
• Elevate affected body part  
• Prescribe ibuprofen 400 mg PO Q6 hours x 5 days if no exclusions: Active GI ulcer or high risk for bleeding, decreased renal function, concomitant nephrotoxic agents | • Cephalexin 500 mg PO QID x 7 d  
OR  
• Dicloxacillin 500 mg PO QID x 7 d  
OR  
• Clindamycin 300 mg PO QID x 7 d |
| **≥ 2 SIRS criteria met** | | |
| Purulent cellulitis, abscess, or wound infection | • Incision and drainage, if applicable  
• If surgical site infection, suture removal at the discretion of the surgeon  
• Obtain routine culture of pus  
• Elevate affected body part  
• Trimethoprim-sulfamethoxazole 1 DS PO BID x 7 d (2 DS if > 80 kg)  
OR  
• Linezolid** 600 mg PO BID x 7 d  
OR  
• Clindamycin* 450 mg PO QID x 7 d | |
| Non-purulent cellulitis | • Consider soft tissue ultrasound to rule out occult abscesses  
• Elevate affected body part  
• Prescribe ibuprofen 400 mg PO Q6 hours x 5 days if no exclusions: Active GI ulcer or high risk for bleeding, decreased renal function, concomitant nephrotoxic agents | • Cephalexin 1 g PO QID x 7 d  
OR  
• Linezolid** 600 mg PO BID x 7 d  
OR  
• Clindamycin 450 mg PO QID x 7 d |

* Approximately 30% MRSA resistance to clindamycin
** Administering linezolid concomitantly with other proserotonergic drugs may cause serotonin syndrome (incidence 0.24% – 4%). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myoclonus, shivering, and tachycardia, which typically resolve in 1–5 days after discontinuation. Avoid use in patients taking other pro-serotonergic medications unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions. Linezolid therapy is reserved for patients with ≥ 2 SIRS criteria that would have otherwise been treated with IV antibiotics as an outpatient.
ALGORITHM 3: INPATIENT SSTI TREATMENT PATHWAY

Patient presents with SSTI requiring possible hospital admission

CLASSIFY infection type and SIRS criteria (a)
- RULE OUT mimicking conditions (see page 2)
- DETERMINE if patient has:
  - Purulent or non-purulent infection
  - SIRS criteria (a)
  - Severe sepsis (b)

IDENTIFY and FOLLOW appropriate treatment plan for patients WITHOUT severe sepsis
- IDENTIFY the appropriate regimen (see table 3 on page 8)
- If possible, GIVE initial antibiotic dose
- COMPLETE all other treatment actions as indicated in table 3 on page 8.

IDENTIFY and FOLLOW appropriate treatment plan for patients WITH severe sepsis
- IDENTIFY appropriate antibiotic regimen (see table 3 on page 8)
- If in ED, GIVE initial antibiotic doses within 3 HOURS of severe sepsis determination
- If in urgent care or clinic, GIVE initial IV antibiotic and REFER to ED
- COMPLETE all other treatment actions as indicated in table 3 on page 8.

RE-EVALUATE patient condition
DETERMINE if hospital admission is warranted. See admission criteria (table 1 on page 3). Also consider:
- Changes in vital signs while under observation
- Clinical progression of infection while in the ED/clinic

PRESCRIBE antibiotic
- PRESCRIBE based on recommendations in table 2 on page 6
- ENCOURAGE compliance

ASSESS risk for treatment failure
DESIGNATE patient as high risk if ANY of the following:
- Fever on presentation
- ≥ 2 SIRS criteria (a)
- Recurrent cellulitis in the same location
- Infections due to chronic wounds/ulcers
- Any of the relative criteria for hospital admission (see table 1 on page 3)

Patient at high risk for treatment failure?
- yes
  - FLAG PATIENT for phone follow-up protocol (see algorithm 5 on page 10)
- no

Patient being admitted?
- yes
  - ADMIT PATIENT, and CONTINUE antibiotic treatment as indicated in table 3 on page 8
- no

Does patient have severe sepsis?
- yes
- no

See page 8 for algorithm notes.
### TABLE 3. Inpatient SSTI Treatment Regimens

<table>
<thead>
<tr>
<th>Infection type</th>
<th>Treatment actions</th>
<th>Antibiotic and dose (preferred in <strong>bold type</strong>)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO SEVERE SEPSIS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purulent cellulitis, abscess, or wound infection</td>
<td>Incision and drainage/surgical debridement, if applicable</td>
<td><strong>Vancomycin</strong> (pharmacy to manage; goal trough concentration 10–15mg / L) OR Linezolid** 600mg PO or IV BID</td>
<td>Change to targeted therapy after culture results are available (see below)***</td>
</tr>
<tr>
<td></td>
<td>If surgical site infection, suture removal at the discretion of the surgeon</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obtain routine culture of pus*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-purulent cellulitis</td>
<td>Empiric antibiotic therapy (see right)</td>
<td>Cefazolin 2g IV Q8 hours OR Clindamycin 600mg IV Q8 hours OR Vancomycin (pharmacy to manage; goal trough concentration 10–15mg / L)</td>
<td>If suspicious of necrotizing infection, treat as if patient has severe sepsis</td>
</tr>
<tr>
<td></td>
<td>Consider soft tissue ultrasound to rule out occult abscesses</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SEVERE SEPSIS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purulent cellulitis, abscess, or wound infection</td>
<td>Incision and drainage/surgical debridement, if applicable</td>
<td><strong>Vancomycin</strong> (pharmacy to manage; goal trough concentration 10-15 mg / L) AND Ceftriaxone 2g IV daily</td>
<td>Change to targeted therapy after culture results are available (see below)***</td>
</tr>
<tr>
<td></td>
<td>If surgical site infection, suture removal at the discretion of the surgeon</td>
<td>Linezolid** 600mg PO or IV BID may be substituted for vancomycin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obtain routine culture of pus*</td>
<td>Aztreonam 2g IV Q8 hours may be substituted for ceftriaxone in patients with severe allergy</td>
<td></td>
</tr>
<tr>
<td>Non-purulent cellulitis</td>
<td>Empiric antibiotic therapy (see right)</td>
<td><strong>Vancomycin</strong> (pharmacy to manage; goal trough concentration 15-20 mg / L) AND Cefepime 2g IV Q8 hours</td>
<td>If suspicious of necrotizing infection, add clindamycin 900mg IV Q8 hours x 3 days</td>
</tr>
<tr>
<td></td>
<td>Consider soft tissue ultrasound to rule out occult abscesses</td>
<td>Linezolid** 600mg IV may be substituted for vancomycin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meropenem 500mg IV Q6 hours may substitute for cefepime in patients with severe allergy</td>
<td></td>
</tr>
</tbody>
</table>

* Send pus in sterile container if possible. If not, send sample on a swab.

** Administering linezolid concomitantly with other proserotoninergic drugs may cause serotonin syndrome (incidence 0.24% – 4 %). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myoclonus, shivering, and tachycardia, which typically resolve in 1 – 5 days after discontinuation. Avoid use in patients taking other pro-serotoninergic medications unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions.**<sup>*<sup>** Linezolid therapy is reserved for patients with ≥ 2 SIRS criteria that would have otherwise been treated with IV antibiotics as an outpatient.

*** Targeted therapy: If MRSA grows, continue vancomycin or linezolid. If MSSA grows, change to cefazolin 2g IV Q8 hours (alternatives are vancomycin or clindamycin).
ALGORITHM 4: SSTI REASSESSMENT

Patient presents with SSTI treatment failure or for SSTI follow up

PERFORM clinical exam
Assess erythema, presence of SIRS criteria (a), and pain
Note: The erythema from group A Streptococcal infections may take weeks to improve. Persistent erythema is not always indicative of treatment failure.

Is patient improving?
yes → CONTINUE treatment as directed in CPM
no → ASSESS for cellulitis mimics (see page 2)

Mimicking condition likely?
no → TREAT underlying condition
yes → PERFORM soft tissue ultrasound

ASSESS potential causes of treatment failure with prescribed antibiotic (IF ANY)
• Inappropriate for the infecting organism
• Patient non-compliant due to inability to obtain
• Patient non-compliant due to intolerance or allergy

YES to ANY of the above?
no → PERFORM incision and drainage
• OBTAIN specimen for routine culture
• CONTINUE antibiotic as directed in CPM
yes → PRESCRIBE alternate antibiotic; ENSURE new treatment addresses likely cause(s) of treatment failure

Occult abscess present?
no → CHANGE antibiotic
PRESERVE linezolid (600 mg PO BID x 7 days)

yes → FLAG PATIENT for phone follow-up protocol (see algorithm 5 on page 10)

ALGORITHM NOTE

(a) SIRS criteria
- Temperature: > 38.3 °C or < 36 °C
- Heart rate: > 90 bpm
- Respiratory rate: > 20
- WBC: > 12,000 / mm² or < 4,000 / mm²
- WBC: > 10 % band forms
**SSTI FOLLOW UP**

Patients with SSTI typically respond to therapy within 72 hours when treated appropriately. However, some patients can worsen, and erythema can spread in the first 48 hours even with appropriate antibiotic therapy. (Patients presenting with fever, recurrent cellulitis, infection of chronic wounds or ulcers, and immunosuppression are known to be at a high risk of treatment failure.) Based on these considerations, this CPM defines specific guidelines for identifying patients who should be flagged (in either the outpatient or inpatient treatment pathway) as “high risk for treatment failure.” These patients will enter a follow-up protocol defined in algorithm 5 below).

At a minimum, patients at high risk of failure should receive a phone call from a healthcare provider within 72 hours of being diagnosed and treated for an SSTI. If patients are not responding to therapy within 72 hours, they should be seen by a medical provider for reassessment (see algorithm 4 on page 9). In addition to CPM-concordant antibiotics, providers should:

- Assess the patient for SSTI-mimicking conditions
- Consider ibuprofen as an adjunctive therapy to decrease inflammation
- Promote elevation of the affected limb to decrease the risk of treatment failure

### ALGORITHM 5: SSTI PHONE FOLLOW-UP PROTOCOL

**Patient at high risk for treatment failure**

CONTACT patient at 48 – 72 hours post visit

SCREEN for following signs of improvement (usually by phone): (a)
1. Is your pain improving?
2. Has the redness stopped progressing?
3. If you had a fever, has your fever resolved?

All signs of improvement met?

yes

INSTRUCT patient to follow up with primary care provider as needed

no

INSTRUCT patient to see a medical provider as soon as possible based on local follow-up plans. Options include:
- PCP appointment within 24 hours
- ED follow up
- Infectious diseases appointment within 24 hours

### ALGORITHM NOTE

**(a) Site-specific, follow-up protocols**

Follow-up protocols are expected to differ by treatment facility according to staff and other resources available on site. The physician or other caregiver should arrange contact according to the patient’s preferred contact method and make recommendations based on the patient’s ability to obtain follow up for urgent care.
SPECIAL POPULATIONS

A number of SSTI are unique and require special attention as treatment can be especially challenging. See table 4 (below and continued on page 12) for clinical diagnostic guidelines and treatment recommendations for these types of infections.

<table>
<thead>
<tr>
<th>Infection type</th>
<th>Clinical features and diagnosis</th>
<th>Pathogens</th>
<th>Treatment and antibiotics (if preferred antibiotics, shown in bold type)</th>
<th>Key considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orbital infections</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preseptal cellulitis (infection anterior to the septum of the eyelid)</td>
<td>Unilateral ocular pain, eyelid swelling, erythema, NO PAIN with eye movement</td>
<td>S. aureus, S. pneumoniae, other streptococci</td>
<td><strong>Trimethoprim-sulfamethoxazole</strong> 1 DS PO BID (2 DS PO BID if &gt; 80 kg) <strong>AND</strong> <strong>Cephalexin</strong> 500 mg PO QID OR <strong>Clindamycin</strong> 300 mg PO QID (monotherapy)</td>
<td>Recommend telephone follow up at 72 hours (see page 12)</td>
</tr>
<tr>
<td>Orbital cellulitis (infection of the contents of the fat and ocular muscles of the orbit).</td>
<td>Unilateral ocular pain, eyelid swelling, erythema, pain with eye movement, proptosis, ophthalmoplegia with diplopia</td>
<td>S. aureus, beta-hemolytic S. pyogenes, S. viridans</td>
<td>Consult ENT and/or ophthalmology. Hospital admission with IV antibiotics (see below)</td>
<td>Severe infection: May cause permanent disability</td>
</tr>
</tbody>
</table>

| **Bite infections**                                                                                                           |
| Animal (dog/cat) bites | Fever, erythema, swelling, tenderness, purulent drainage, and lymphangitis | Most polymicrobial. *Pasteurella* is present in cat bites more than dog bites; *Capnocytophaga canimorsus* is common in patients without a spleen | 1. Consider x-ray to evaluate bony structures 2. Aggressive wound care 3. Evaluate for tetanus and rabies vaccinations 4. Antibiotic therapy as follows: **ORAL antibiotics:** **Amoxicillin/clavulanate** 875 mg PO BID OR **Doxycycline** 100 mg PO BID OR **Trimethoprim-sulfamethoxazole** 1 DS BID AND Metronidazole 500 mg PO TID **IV antibiotics (deep or severe infections):** **Ampicillin-sulbactam** 3 g IV Q6 hours OR **Ceftriaxone** 2 g IV daily PLUS metronidazole 500 mg IV/PO Q8 hours | Prophylactic antibiotics x 3 – 5 days recommended in patients who are immunocompromised or asplenic or who have: – Advanced liver disease – Pre-existing or resultant edema of the affected area – Moderate-to-severe injuries (especially of hand/face) including wounds that: – Are deep – Require surgical repair – Are close to a bone or joint – Injuries that may have penetrated the periosteum or joint capsule |
| Human bites and clenched fist injuries | Fever, erythema, swelling, tenderness, purulent drainage, and lymphangitis | See above (same treatment as for animal bite infections). | Prophylactic antibiotics x 3 – 5 days should be given for all bites or injuries where the dermis is compromised |

* Administering linezolid concomitantly with other serotonergic drugs may cause serotonin syndrome (incidence 0.24% – 4 %). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myclonus, shivering, and tachycardia, which typically resolve in 1 – 5 days after discontinuation. Avoid use in such patients unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions.*
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</thead>
<tbody>
<tr>
<td>Mastitis</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
| Lactational mastitis| Breast is painful, swollen, firm, and red, often with fever > 38.3°C, decreased milk secretion, and systemic complaints | S. aureus and beta-hemolytic streptococci; *E. coli* and *bacteroides* species are less common | 1. Culture breast milk  
2. Nonsteroidal anti-inflammatories and cold compresses  
3. Complete emptying of the breast via ongoing breastfeeding or pumping  
4. Antibiotic therapy (see below)  
5. Consider ultrasound to evaluate for abscess if infection does not respond to 48–72 hours of antibiotic therapy | Lactational mastitis is most common during the first 3 months of breast feeding |
| Necrotizing fasciitis | • Severe, constant pain  
• Bullae related to occlusion of deep blood vessels that traverse the fascia or muscle compartments  
• Skin necrosis  
• Gas in the soft tissue  
• Edema that extends beyond the margin of erythema  
• Systemic toxicity  
• Rapid spread while on antibiotic therapy  
• Cutaneous anesthesia  
• Wooden-hard feel of subcutaneous tissue | Beta-hemolytic streptococci and polymicrobial infections  
Also consider anaerobic streptococcal myositis, pyomyositis, *Fournier’s gangrene*, clostridial myonecrosis | 1. Urgent surgical consultation  
2. Obtain blood cultures before starting IV antibiotics  
3. Antibiotic therapy (see below) | CT or MRI can be performed to demonstrate gas and necrosis only if patient is stable |
| Diabetic foot infection (DFI) | Redness, warmth, swelling, pain, or purulent secretions; atypical signs of infection include non-purulent secretions, discolored/frail granulation tissue, undermining, or foul odor  
Plain radiograph and/or MRI may be performed to evaluate for osteomyelitis  
Ankle brachial index may be performed to evaluate vascular supply | Most are polymicrobial; *staphylococci* and *streptococci* are the most common causative organisms  
Gram-negative bacilli are frequently co-pathogens in infections that are chronic or follow antibiotic treatment  
Anaerobes may be co-pathogens in ischemic or necrotic wounds | 1. Most DFIs require some surgical intervention, ranging from minor debridement to major resection or amputation  
2. For infected wounds, obtain a post-debridement specimen (preferably of deep tissue) for aerobic and anaerobic culture. **Superficial wound swabs are NOT recommended.**  
3. For mild-to-moderate infections in patients who have not recently received antibiotic treatment, therapy targeting *staphylococci* and *streptococci* is sufficient. Options include: dicloxacillin, clindamycin, cephalexin, doxycycline, and sulframethoxazole/trimethoprim.  
4. For all other infections, consult with podiatry or infectious diseases. | Infections are classified as:  
1. Mild (superficial and limited in size and depth)  
2. Moderate (deeper / more extensive)  
3. Severe (accompanied by systemic signs of infection).  
Note that wounds without evidence of soft tissue or bone infection **DO NOT require** antibiotic therapy |

* Administering linezolid concomitantly with other pro-serotonergic drugs may cause serotonin syndrome (incidence 0.24%–4%). Symptoms of serotonin syndrome include agitation, confusion, hallucinations, hyper-reflexia, myclonus, shivering, and tachycardia, which typically resolve in 1–5 days after discontinuation. Avoid use in patients taking other pro-serotonergic medications unless clinically appropriate and under close monitoring for signs/symptoms of serotonin syndrome like reactions. Linezolid therapy is reserved for patients with ≥ 2 SIRS criteria that would have otherwise been treated with IV antibiotics as an outpatient.
<table>
<thead>
<tr>
<th>Medication</th>
<th>If CrCL is:</th>
<th>Recommended adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aztreonam</td>
<td>10–30 mL/min</td>
<td>2,000 mg load IV, then 1,000 mg IV Q8 hours</td>
</tr>
<tr>
<td></td>
<td>&lt;10 mL/min or hemodialysis</td>
<td>2,000 mg load IV, then 500 mg IV Q8 hours</td>
</tr>
<tr>
<td>Cefepime</td>
<td>30–60 mL/min</td>
<td>2,000 mg load, then 1,000 mg IV Q8 hours</td>
</tr>
<tr>
<td></td>
<td>11–29 mL/min</td>
<td>2,000 mg load, then 1,000 mg IV Q12 hours</td>
</tr>
<tr>
<td></td>
<td>≤10 mL/min or hemodialysis</td>
<td>2,000 mg load, then 1,000 mg IV Q24 hours</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>11–34 mL/min</td>
<td>2,000 mg IV load, then 1,000 mg IV Q12 hours</td>
</tr>
<tr>
<td></td>
<td>&lt;11 mL/min or hemodialysis</td>
<td>2,000 mg IV load, then 1,000 mg IV Q24 hours</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>10–50 mL/min</td>
<td>500 mg PO Q8 hours</td>
</tr>
<tr>
<td></td>
<td>&lt;10 mL/min or hemodialysis</td>
<td>500 mg PO Q12 hours</td>
</tr>
<tr>
<td>Meropenem</td>
<td>26–50 mL/min</td>
<td>500 mg IV Q8 hours</td>
</tr>
<tr>
<td></td>
<td>10–25 mL/min</td>
<td>500 mg IV Q12 hours</td>
</tr>
<tr>
<td></td>
<td>&lt;10 mL/min or hemodialysis</td>
<td>500 mg IV Q24 hours</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>10–30 mL/min</td>
<td>1 DS PO BID if weight &gt; 80 kg; 1 SS PO BID if weight &lt; 80 kg</td>
</tr>
<tr>
<td></td>
<td>&lt;10 mL/min or hemodialysis</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Adjust IV interval; consult clinical pharmacist</td>
<td></td>
</tr>
<tr>
<td>Clindamycin, dicloxacillin, doxycycline, minocycline, linezolid, ceftriaxone</td>
<td>No adjustments required</td>
<td></td>
</tr>
</tbody>
</table>
ANTIBIOGRAMS

Antibiograms for each Intermountain hospital are available within Intermountain.net. If you’re logged in and within the Intermountain firewall, you can access the antibiogram tool with up-to-date information by typing “antibiogram” in the address bar of your browser. The tool provides custom antibiogram reports for pathogen, patient type, infection type, facility, and/or service for any given time period.

Printable antibiograms can be found on GermWatch: https://phy.intermountain.net/germWatch/Pages/Home.aspx/

RESOURCES

Patient resources

Clinicians can order Intermountain patient education booklets and fact sheets for distribution to their patients from Intermountain’s Online Library and Print Store, iprintstore.org.

Fact Sheets related to skin and soft tissue infection include:
- Skin Abscess
- Lymphedema
- Antibiotics: What you need to know and do

Provider resources

To find this CPM, clinicians can go to intermountainphysician.org/clinicalprograms and click on “Clinical Topics A - Z” on the left side of the screen. Then, select “Skin and Wound Problems” under “S.”

OR

Go to intermountain.net, click on the “Clinical” banner on the top. Select “Care Processes Models” under Clinical Programs. Open the “Intensive Medicine CPMs and Related Tools” menu, and select “Skin and Soft Tissue Infections in Adults.”
REFERENCES


This CPM presents a model of best care based on the best available scientific evidence at the time of publication. It is not a prescription for every physician or every patient, nor does it replace clinical judgment. All statements, protocols, and recommendations herein are viewed as transitory and iterative. Although physicians are encouraged to follow the CPM to help focus on and measure quality, deviations are a means for discovering improvements in patient care and expanding the knowledge base. Send feedback to Eddie Stenehjem, MD, Intermountain Healthcare, Antibiotic Stewardship Medical Director (Eddie.Stenehjem@imail.org).