Skin and soft tissue infections (SSTIs), are referred as skin and skin structure infections. These infections also represent a group of infections that are diverse in their clinical presentations and degrees of severity. Bacterial SSTIs are a common problem encountered in clinical practice. Although most SSTIs can be managed on an outpatient basis, physicians must remain alert for signs and symptoms indicative of a more serious infection requiring rapid evaluation and hospital admission.

Pathophysiology and Risk Factor

Intact skin provides protection from the external environment by serving as a physical barrier and maintaining a normal flora that is not conducive to the growth of pathogenic organisms. Most SSTIs occur de novo, or follow a breach in the protective skin barrier from trauma, surgery, or increased tissue tension secondary to fluid stasis. Primary SSTIs occur when microorganisms invade otherwise healthy skin, whereas secondary SSTIs occur when, because of underlying disease or trauma, microorganisms infect already damaged skin. Staphylococcus aureus and streptococci are responsible for most simple community-acquired SSTIs. Staphylococcus aureus, P. aeruginosa, enterococcus, and Escherichia coli are the predominant organisms isolated from hospitalized patients with SSTIs. Older age, cardiopulmonary or hepato-renal disease, diabetes mellitus, debility, immunosenescence or immunocompromised, obesity, peripheral arteriovenous or lymphatic insufficiency, and trauma are among the risk factors for SSTIs (Table 2.1). Community-acquired methicillin-resistant S. aureus (CA-MRSA) causes infection in a wide variety of hosts. Pseudomonas aeruginosa infections are often associated with intravenous drug abuse.

Classification

Skin and soft tissue infections represent a heterogeneous array of disorders. Several classifications have been proposed, but yet none is universally accepted. These are generally classified into two categories: purulent infections (e.g., furuncles, carbuncles, abscesses) and nonpurulent infections (e.g., erysipelas, cellulitis, necrotizing fasciitis). Again these are further classified into three subcategories:
mild, moderate, and severe. Mild infections present with local symptoms only, whereas moderate to severe infections are associated with systemic signs of infection such as temperature higher than 38ºC, heart rate higher than 90 beats/minute, respiratory rate higher than 24 breaths/minute, or white blood cell higher than 12x10³ cells/mm³. The Infectious Diseases Society of America (IDSA) classification has been the most useful and practical guidance to date by adopting three different distinctions:

- **Skin extension:**
  - Simple or uncomplicated typically superficial infections (uSSTI)- Common simple SSTIs include cellulitis, erysipelas, impetigo, folliculitis, furuncles, carbuncles, abscesses, and trauma related infections.
  - Complicated infections (cSSTI)- Complicated infections extending into and involving the underlying deep tissues.

- **Rate of progression:**
  - Acute and chronic wound infection.

- **Tissue necrosis:**
  - Necrotizing and non-necrotizing infections. Example- abscesses, decubitus ulcers, necrotizing fasciitis, Fournier gangrene, and infections from human or animal bites.

Recently, the US Food and Drug Administration (FDA) has introduced the new definition of acute bacterial skin and skin-structure infection (ABSSSI) to more closely define complicated soft-tissue infection for the purposes of registration trials.²,³

### Diagnosis

As we know diagnosis of most SSTIs are based on clinical impression. Laboratory investigations may help to confirm clinical diagnosis and elucidate characteristics of specific etiologies. The cardinal signs of SSTIs include erythema, edema, tenderness to palpation, and increased warmth. Signs such as fluctuance, crepitus, induration, blisters, or bullae may help the clinician determine the depth of infection or the presence of an abscess. Symptoms such as fever, chills, and hypotension may be present in deeper infections.⁴ The causative organism and clinical features of different SSTIs are given in Table 2.²

Investigations may include blood cultures, tissue swab with culture, needle aspiration, X-ray, ultrasound and computed tomography (CT) scan or magnetic resonance imaging (MRI) screen, depending on the clinical manifestations. In the presence of systemic symptoms, such as fever and hypotension, blood cultures help to assess for bacteremia.⁵ For common and simple SSTIs (cellulitis or small subcutaneous abscess) cultures are not necessary, on the contrary when complicated SSTIs are associated with exudates or with abscesses, specimens have to be collected and sent rapidly to microbiology laboratory with detailed information.

Among the imaging studies plain radiography may be useful to detect the presence of gas in the soft tissues. Computed tomography scans and MRI may show air in the tissues or enhancement with intravenous contrast. Ultrasonogram is a highly sensitive technique for SSTIs diagnosis, providing useful information to differentiate cellulitis from abscess.⁶ A complete blood count, C-reactive protein level, and liver and kidney function tests should be ordered for patients with severe infections, and for those with co-morbidities causing organ dysfunction.²

### Management of SSTIs

Management of SSTIs are determined primarily by their...
Table 2.2: Bacteriology and Clinical Features of Skin and Soft Tissue Infections

<table>
<thead>
<tr>
<th>Infection</th>
<th>Microbiology</th>
<th>Clinical features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscess</td>
<td><em>Staphylococcus aureus</em>, <em>Streptococcus</em>, anaerobes (often polymicrobial)</td>
<td>Collection of pus with surrounding granulation; painful swelling with induration and central fluctuance; possible overlying skin necrosis; signs or symptoms of infection; features attenuated in cold abscess; recurrent abscesses with sinus tracts and draining in axillae and groin occur in hidradenitis suppurativa</td>
</tr>
<tr>
<td>Bites (human, animal)</td>
<td>Polymicrobial (<em>Bacteroides</em>, <em>Bartonella henselae</em>, <em>Capnocytophaga canimorsus</em>, <em>Eikenella corrodens</em>, <em>Pasteurella multocida</em>, <em>Peptostreptococcus</em>, <em>S. aureus</em>, <em>Streptococcus faecalis</em>)</td>
<td>Cat bites become infected more often than dog or human bites (30% to 50%, up to 20%, and 10% to 50%, respectively); infection sets in 8 to 12 hours after animal bites; human bites may transmit herpes, hepatitis, or human immunodeficiency virus; may involve tendons, tendon sheaths, bone, and joints</td>
</tr>
<tr>
<td>Clostridial myonecrosis (gas gangrene)</td>
<td><em>Clostridium</em> (usually <em>C. perfringens</em>, <em>C. septicum</em>)</td>
<td>Traumatic or spontaneous; severe pain at injury site followed by skin changes (e.g., pale, bronze, purplish red), tenderness, induration, blistering, and tissue crepitation; diaphoresis, fever, hypotension, and tachycardia</td>
</tr>
<tr>
<td>Erysipelas, cellulitis</td>
<td><em>Beta-hemolytic streptococci</em>, <em>Haemophilus influenzae</em> (children), <em>S. aureus</em></td>
<td>Erysipelas: usually over face, ears, or lower legs; distinctly raised inflamed skin Cellulitis: over areas of skin breakdown Signs or symptoms of infection: lymphangitis or lymphadenitis, leukocytosis</td>
</tr>
<tr>
<td>Folliculitis</td>
<td><em>Candida</em>, <em>dermatophytes</em>, <em>Pseudomonas aeruginosa</em>, <em>S. aureus</em></td>
<td>Infection or inflammation of the hair follicles; tends to occur in areas with increased sweating; associated with acne or steroid use; painful or painless pustule with underlying swelling</td>
</tr>
<tr>
<td>Fournier gangrene</td>
<td>Polymicrobial</td>
<td>Genital, groin, or perineal involvement; cellulitis, and signs or symptoms of infection followed by suppurative and necrosis of overlying skin</td>
</tr>
<tr>
<td>Furuncle, carbuncle (deep folliculitis)</td>
<td><em>S. aureus</em></td>
<td>Walled-off collection of pus; painful, firm swelling; systemic features of infection; carbuncles are larger, deeper, and involve skin and subcutaneous tissue over thicker skin of neck, back, and lateral thighs, and drain through multiple pores</td>
</tr>
<tr>
<td>Impetigo (non bullous, bullous)</td>
<td><em>Beta-hemolytic streptococci</em>, <em>S. aureus</em></td>
<td>Common in infants and children: affects skin of nose, mouth, or limbs; mild soreness, redness, vesicles, and crusting; may cause glomerulonephritis; vesicles may enlarge (bullae); may spread to lymph nodes, bone, joints, or lung</td>
</tr>
</tbody>
</table>
| Necrotizing fasciitis               | Type 1: polymicrobial  
  Type 2: monomicrobial                                                              | Spreading infection of subcutaneous tissue; usually affects genitalia, perineum, or lower extremities; severe, constant pain; signs or symptoms of infection; overlying redness and cutaneous anesthesia; edema and induration of apparently uninvolved tissues; skin crepitation; progression despite antibiotics |

*—Signs and symptoms of infection include fever, tachycardia, diaphoresis, fatigue, anorexia, nausea, and vomiting. Mental status changes and hypotension suggest worsening sepsis and hemodynamic compromise*
severity and location, and by the patient's co-morbidities (Figure 2.1). According to guidelines from the IDSA, initial management is determined by the presence or absence of purulence, acuity, and type of infection.²

**Mild to Moderate Infections:**

In general, a combination of surgical debridement or drainage and antibiotic treatment is used to treat the infection. For non-necrotizing SSTIs, including those caused by methicillin-sensitive *S. aureus* (MSSA), commonly used antibiotics include penicillin G, cloxacillin, ceftriaxone and clindamycin.² Beta-lactams are effective in children with non-purulent SSTIs, such as uncomplicated cellulitis or impetigo. In adults, mild to moderate SSTIs respond well to β-lactams in the absence of suppuration. Antibiotic therapy is required for abscesses that are associated with extensive cellulitis, rapid progression, or poor response to initial drainage; that involve specific sites (e.g., face, hands, genitalia); and that occur in children and older adults or in those who have significant comorbid illness or immunosuppression.²

According to Bangabandhu Sheikh Mujib Medical University (BSMMU) antibiotic guideline 2015, flucloxacinil (500mg) 6 hourly is the preferred drug for SSTIs. On the other hand they recommended Co-amoxiclav (625mg) 8 hourly for 7-10 days for diabetic foot lesion. Detailed recommendation of BSMMU guideline related to SSTIs is given in Table 2.3.⁷

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*—Ultrasoundography, computed tomography, or magnetic resonance imaging.
(MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-sensitive *S. aureus.*
Severe Infections:

Inpatient treatment is necessary for patients who have uncontrolled infection despite adequate outpatient antimicrobial therapy or who cannot tolerate oral antibiotics. Broad-spectrum antibiotics with proven effectiveness against gram-positive and gram-negative organisms and anaerobes should be used until pathogen specific sensitivities are available. According to IDSA vancomycin plus either piperacillin-tazobactam or imipenem/meropenem is strongly recommended as a reasonable empiric regimen for severe infections.

Meropenem is a broad-spectrum carbapenem antibiotic that possesses excellent activity against both aerobic Gram positive and aerobic Gram-negative bacteria, and also covers common anaerobes.

Conclusion

Skin and soft tissue infections have a variety of presentations from localized, trivial infection to rapidly progressive infection with systemic toxicity and considerable mortality. It is important to be able to recognize and treat these infections in the community, and in cases of severe infection to refer the patient promptly for specialist care. It is important for physicians to have knowledge of the local antimicrobial susceptibilities to avoid treatment failures and to prevent inappropriate antibiotic usage.

References