

# GUIDE TO INFECTION CONTROL IN THE HOSPITAL

## CHAPTER 28:

# Skin and Soft Tissue Infections

### **Author**

Antoni Trilla, MD, PhD, MSc

### **Chapter Editor**

Ziad A. Memish, MD, FRCPC, FACP

### **Topic Outline**

#### Known Facts

##### Staphylococcal Skin Infections

Key Issue

Known Facts

Controversial Issues

Suggested Practice in All Settings

##### Staphylococcal Scalded-Skin Syndrome (SSSS)

Key Issue

Known Facts

Controversial Issues

Suggested Practice in All Settings

##### Skin and Soft Tissue Severe Infections

Key Issue

- Known Facts
- Controversial Issues
- Suggested Practice in All Settings
- Burn Wound Infections
  - Key Issue
  - Known Facts
  - Suggested Practice in All Settings
- Pressure Sores (Decubitus Ulcers)
  - Key Issue
  - Known Facts
  - Controversial Issues
  - Suggested Practice in All Settings
- Nosocomial Bacteremia Due to SST Infection
  - Key Issue
  - Known Facts
  - Suggested Practice in All Settings

Summary

References

*Chapter last updated: March, 2018*

## KNOWN FACTS

- The most common agent of SST infections is *Staphylococcus aureus*, followed by *Streptococcus pyogenes* and anaerobic gram-negative bacilli. Amongst special populations (diabetic patients, patients with burn wounds), aerobic Gram-negative bacilli, including *Pseudomonas aeruginosa*, should be considered. *S. aureus* is found in the normal skin as a transient colonizing organism, often linked to nasal carriage (anterior nares). Pre-existing conditions, such as tissue injury (surgical wounds, trauma, pressure sores) or skin inflammation (dermatitis), as well as other diseases (insulin-dependent diabetes, cancer, chronic renal failure on hemodialysis, intravenous drug abuse, and HIV infection) are risk factors for skin colonization and/or secondary infection by *S. aureus*.
- SST infections attended most frequently in inpatients are cellulitis and erysipelas, most of them being community-acquired. Methicillin-resistant *S. aureus* (MRSA) infections are mainly healthcare related, but community-acquired MRSA strains are being recognized increasingly.

## STAPHYLOCOCCAL SKIN INFECTIONS

### Key Issue

Impetigo is the most common skin infection. It is a superficial primary skin infection, often caused by *S. pyogenes* (90%) or *S. aureus* (10%) infection. Impetigo may appear as a complication of other skin disorders, like eczema, varicella, or scabies. Gram stain and culture of the pus or exudates from skin lesions of impetigo and ecthyma are recommended.

### Known Facts

Often seen in children, impetigo is readily transmitted in households and hospitals. The increasing frequency of skin disorders in HIV-infected patients should also be noted, and the diagnosis of impetigo considered.

## Controversial Issues

The use of several antibiotics (mupirocin, retapamulin, fusidic acid, erythromycin, tetracycline) as topical treatment for impetigo has been shown to have a ~90% efficacy in clinical trials. The use of topical antibiotics decreases bacterial colonization and infection, and promotes faster wound healing. Oral antibiotic treatment (erythromycin, an anti-staphylococcal penicillin or amoxicillin + clavulanic acid) has been used with a similar success rate. The emergence of multidrug-resistant *S. aureus* strains, including MRSA mupirocin-resistant strains, is a matter of concern. The introduction of these strains (from the community setting) should be monitored in hospitals as well as if topical treatments with agents, like mupirocin, are widely used for long periods of time.

## Suggested Practice in All Settings

Standard hygienic measures and contact isolation procedures should be used in patients with impetigo. This practice must be encouraged, especially in neonatal and pediatric intensive care units, as well as for patients with HIV infection and a rash. Bullous and non-bullous impetigo can be treated with oral antimicrobials (oral penicillin, dicloxacillin, or cephalexin, 7 days) or topical antimicrobials (mupirocin or retapamulin, 5 days). Oral therapy is recommended for patients with numerous lesions or in outbreaks affecting several people to help decrease transmission of infection. When MRSA is suspected or confirmed, doxycycline, clindamycin, or sulfamethoxazole-trimethoprim are recommended.

# STAPHYLOCOCCAL SCALDED-SKIN SYNDROME (SSSS)

## Key Issue

Staphylococcal scalded-skin syndrome (SSSS) is a severe *S. aureus* infection with extensive bullae and exfoliation.

## Known Facts

It occurs in children, but rarely in adults. Several epidemics have been reported in nurseries and neonatal intensive care units (NICU). Its clinical picture is related to the production of a powerful exotoxin by the *S. aureus* strains. Most cases develop acute fever and a scarlatiniform skin rash. Large bullae soon appear, followed by exfoliation. Also known as *toxic epidermal necrolysis*, this disease can be due to other infections or drug reactions.

## Controversial Issue

The use of corticosteroids alone is not recommended for SSSS.

## Suggested Practice in All Settings

The use of an antistaphylococcal penicillin is the antibiotic treatment of choice. Topical treatment includes cool saline compresses.

# SKIN AND SOFT TISSUE SEVERE INFECTIONS

## Key Issue

The most severe condition is the *acute dermal gangrene syndrome*. This syndrome, related to a deep tissue infection and dermal necrosis, is often associated with prior trauma or surgery. It includes different conditions. Diabetic patients are at higher risk for developing severe skin and soft tissue *S. aureus* infections.

## Known Facts

### ***Necrotizing Fasciitis***

Necrotizing fasciitis is a severe SST infection, involving the fascial and/or muscle compartments and is potentially devastating due to major tissue destruction. It is often associated with high fever, sepsis, and septic shock. The mortality rate is high (30%-70%). *Necrotizing fasciitis* usually develops from an initial break in the skin related to trauma or surgery. It can be due to a single microorganism, usually streptococci or less commonly community-acquired MRSA, *Aeromonas hydrophila*, or *Vibrio vulnificus*, or due to more than one microorganism, involving a mixed aerobe–anaerobe bacterial flora. Polymicrobial infection is often associated with the following clinical settings: (a) perianal abscesses, penetrating abdominal trauma, or surgical procedures of the bowel; (b) decubitus ulcers; (c) injection sites in intravenous drug abusers (IVDA); and (d) spread from a genital infection such as Bartholin abscess or an episiotomy wound.

### ***Progressive bacterial gangrene***

Progressive bacterial gangrene is a more slowly progressive infection, related to surgical wounds, ileostomy sites, and exit site of drains (intra-

abdominal or thoracic), which affects the hypodermis. The patient has a low-grade fever or no fever at all. Local signs of infection are prominent.

### ***Fournier gangrene***

Fournier gangrene is a necrotizing soft tissue infection that involves the scrotum and penis or vulva. Fournier gangrene usually occurs from a perianal or retroperitoneal infection that has spread along fascial planes to the genitalia; a urinary tract infection that involves the periurethral glands and extends into the penis and scrotum; or previous trauma to the genital area. The average age at onset is 50-60 years. 80% of patients have significant underlying diseases, particularly diabetes mellitus. Most cases are caused by mixed aerobic and anaerobic flora. *S. aureus* and *Pseudomonas* species are sometimes present, usually in mixed culture. *S. aureus* is known to cause this infection as the sole pathogen.

### ***Clostridial Gas Gangrene or Myonecrosis***

Clostridial gas gangrene or myonecrosis is a severe SST infection commonly caused by *Clostridium perfringens*, although other *Clostridium* spp. can be also its cause. Severe pain beginning within 24 hours at the injury site is the first reliable clinical symptom. The infected region becomes tense and tender and bullae appear. Gas in the tissue is usually present by this stage. Signs of toxicity, including tachycardia, fever, and diaphoresis, develop rapidly, followed by shock and multiple organ failure. Urgent surgical exploration of the suspected gas gangrene site and surgical debridement of involved tissue should be performed. Broad-spectrum treatment with vancomycin plus either piperacillin-tazobactam, ampicillin-sulbactam, or a carbapenem antimicrobial is recommended. Antimicrobial therapy with penicillin and clindamycin is recommended for treatment of clostridial myonecrosis. Hyperbaric oxygen therapy is not recommended because it has not been proven as a benefit to the patient and may delay surgical debridement.

## **Other**

Other severe SST syndromes include *Meleney gangrene*, where the clinical picture is slowly progressive and without deep fascial involvement; *streptococcal gangrene*, if *S. pyogenes* is the causative agent, or *non-clostridial anaerobic synergistic myonecrosis* if the muscles are also involved. These SST disorders are nearly always due to polymicrobial infections, with *S. pyogenes* and *S. aureus* being the most commonly isolated microorganisms.

## Suggested Practice in All Settings

Prompt surgical consultation is recommended for patients with aggressive infections associated with signs of systemic toxicity or suspicion of necrotizing fasciitis or gas gangrene. Empiric antibiotic treatment should be broad (vancomycin or linezolid plus piperacillin-tazobactam or plus a carbapenem, or plus ceftriaxone and metronidazole). Penicillin plus clindamycin is recommended for treatment of documented group A streptococcal necrotizing fasciitis.

## BURN WOUND INFECTIONS

### Key Issue

Burn wound patients and burn wound units are potential portals of entry for nosocomial outbreaks due to MRSA and *P. aeruginosa* infections. *S. aureus* is responsible for 25% of all burn wound infections, followed by *P. aeruginosa*.

## Known Facts

The most likely reservoirs for these infections are the hands and nares of healthcare workers (*S. aureus*, MRSA), the burn wound itself and the GI tract of burn patients (*S. aureus*, *P. aeruginosa*), and the inanimate environment of the burn unit, including the surfaces and/or the equipment (*S. aureus*, MRSA, *P. aeruginosa*).

## Suggested Practice in All Settings

Common standard isolation precautions, together with contact isolation precautions are important to prevent nosocomial infections in burn units. Topical treatment using mafenide acetate, silver sulfadiazine, bacitracin/neomycin/polymyxin, 2% mupirocin, together with systemic, antistaphylococcal and anti-*Pseudomonas* antibiotics should be reserved for documented or clinical infections.

## PRESSURE SORES (DECUBITUS ULCERS)

### Key Issue

Pressure sores appear in 6% of patients admitted to healthcare institutions (range 3 to 17%), and are the leading cause of infection in long-term care facilities.

## Known Facts

The prevention of pressure sores includes the control of local factors such as unrelieved pressure, friction, moisture, or systemic factors such as low serum albumin, fecal incontinence, and poor hygienic measures. The

infection is polymicrobial, and includes Gram-negative bacilli, *S. aureus*, *Enterococcus* spp. and anaerobes. The average number of isolates in infected pressure sores is four, including three aerobic and one anaerobic bacteria. Pressure sores are sometimes associated with severe systemic complications, including bacteremia, septic thrombophlebitis, cellulitis, deep tissue and fascial necrosis, and osteomyelitis. The development of clinical tetanus is unlikely, although still possible. In patients with bacteremia and pressure sores, the sores were considered to be the source of the bacteremia in half the cases. Overall mortality was 55%, with approximately 25% of deaths attributable to the infection. Therefore, pressure sores must be considered a potential source for nosocomial bacteremia.

## Controversial issues

- A Cochrane review concluded that honey dressings do not increase rates of healing significantly in venous leg ulcers when used as an adjuvant to compression. Honey might be superior to some conventional dressing materials, but there is considerable uncertainty about the replicability and applicability of this evidence. There is insufficient evidence to guide clinical practice in other types of wounds.
- Iodine is often used in the treatment of wounds. A systematic review concludes that iodine did not lead to a reduction or prolongation of wound-healing time compared with other (antiseptic) wound dressings or agents. In individual trials, iodine was significantly superior to other antiseptic agents (such as silver sulfadiazine cream). Based on the available evidence from clinical trials, iodine is an effective antiseptic agent and does not impair wound healing.

## Suggested Practice in All Settings

Antibiotic treatment, together with surgical care and debridement of the sores, is needed. Taking into account the most likely microorganisms, a second-generation cephalosporin is one of the drugs of choice. The combination of a beta-lactam antibiotic with an aminoglycoside, or clindamycin plus an aminoglycoside, or a cephalosporin plus metronidazole are other therapeutic options, but one must be especially cautious in using aminoglycosides in diabetic patients.

## NOSOCOMIA BACTEREMIA DUE TO SST INFECTION

### Key Issue

Nosocomial bacteremia secondary to SST infections has a low frequency rate. According to National Nosocomial Infections Surveillance (NNIS) data, only 5 to 8% of all bacteremic episodes were secondary to SST infections.

### Known Facts

- Patients with poorly controlled diabetes and cancer are a high-risk group for developing this infection. In one large series from the US National Cancer Institute, 12% of all bacteremic episodes in cancer patients were secondary to SST infection. However, only 6% of those cases were associated with severe neutropenia. In neutropenic patients, *Ecthyma gangrenosum* due to *P. aeruginosa* SST infection must be considered.
- Intravenous drug abuse (IVDA) is a worldwide problem. SST infections are common among IVDA, and *S. aureus* is the most common microorganism (30% of cases). The common clinical presentations are subcutaneous abscesses, cellulitis, and lymphangitis, most often (60%)

located in upper extremities. Bacteremia is one of the most severe and common complications among IVDA, with 40% of all episodes due to *S. aureus*.

## Suggested Practice in All Settings

If bacteremia develops in an IVDA, septic thrombophlebitis or endocarditis should be considered, and IV antibiotic treatment started as soon as possible.

## SUMMARY

Skin and soft tissue (SST) infections are not uncommon in the hospital setting. SST infections result from microbial invasion of the skin and its supporting structures. SST infection management is based on the severity and location of the infection as well as by the patient's situation and prior illnesses. SST infections can be easily classified as simple or complicated (see *Table 28.1*). Simple infections are usually due to a single microorganism and present with localized clinical findings. Complicated infections can be due to a single or to more than one microorganism and may present with a sepsis syndrome or even with a life-threatening bacteremia. The diagnosis is based on clinical evaluation. Laboratory testing may be required in some instances. Initial antimicrobial choice is commonly empiric. In simple infections, it should cover *Staphylococci* and *Streptococci*. Patients with complicated infections, including necrotizing fasciitis and gangrene, require wide spectrum antibiotic coverage and often surgical debridement.

## REFERENCES

1. Caravaggi C, Sganzaroli A, Galenda P, et al. The Management of the Infected Diabetic Foot. *Curr Diabetes Rev* 2013; 9(1):7–24.
2. Eron LJ, Lipsky BA, Low DE, et al. Managing Skin and Soft Tissue Infections: Expert Panel Recommendations on Key Decision Points. *J Antimicrob Chemother* 2003; 52 (suppl 1):i3–i17.
3. Jull AB, Walker N, Deshpande S. Honey as a Topical Treatment for Wounds. *Cochrane Database Syst Rev*. 2013; Issue 2. Art. No.: CD005083. doi: 10.1002/14651858.CD005083.pub3.
4. May AK. Skin and Soft Tissue Infections: the New Surgical Infection Society Guidelines. *Surg Infect (Larchmt)*. 2011; 12(3):179–84. doi: 10.1089/sur.2011.034.
5. Park H, Copeland C, Henry S, Barbul A. Complex Wounds and Their Management. *Surg Clin North Am* 2010; 90(6):1181–94. doi: 10.1016/j.suc.2010.08.001.
6. Ramakrishnan K, Salinas RC, Agudelo Higuera NA. Skin and Soft Tissue Infections. *Am Fam Physician* 2015; 92(6):474–83.
7. Roberts AD, Simon GL. Diabetic Foot Infections: the Role of Microbiology and Antibiotic Treatment. *Semin Vasc Surg* 2012; 25(2):75–81. doi: 10.1053/j.semvascsurg.2012.04.010.
8. Stevens DL, Bisno AL, Chambers HF, et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014; 59(2):e10–52. doi: 10.1093/cid/ciu444.

9. Vermeulen H, Westerbos SJ, Ubbink DT. Benefit and Harm of Iodine in Wound Care: a Systematic Review. *J Hosp Infect* 2010; 76(3):191–9. doi: 10.1016/j.jhin.2010.04.026.
10. Yue J, Dong BR, Yang M, et al. Linezolid versus Vancomycin for Skin and Soft Tissue Infections. *Cochrane Database Syst Rev.* 2013; Issue 7. Art. No.: CD008056. doi: 10.1002/14651858.CD008056.pub2.