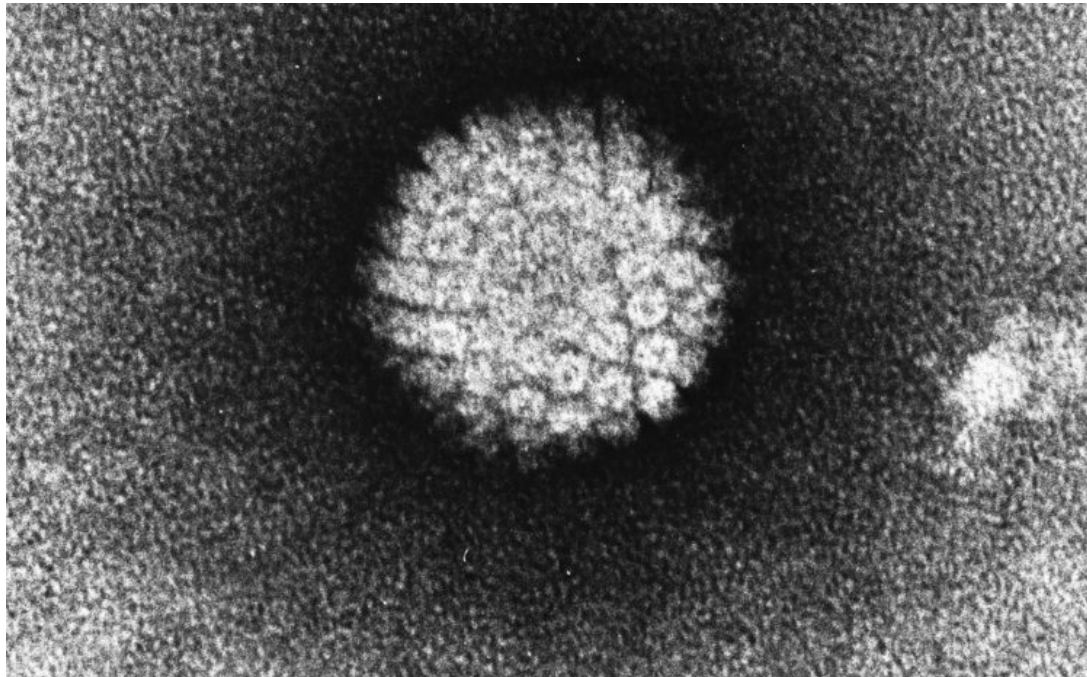


## Skin and Soft Tissue Infections in Children

[See online here](#)

**Skin and soft tissue infections include impetigo, skin abscesses, acne, carbuncles, and staph-scalded skin syndrome. Necrotizing fasciitis is a more severe form of soft tissue infections that are usually caused by *Streptococcus pyogenes*, but can also be polymicrobial. *Staphylococcus aureus* is more commonly associated with abscesses and purulent skin infections. Genital and non-genital warts caused by the human papillomavirus are becoming more commonly seen in children. *Molluscum contagiosum* is a common viral skin infection of young children. Antibiotic therapy is indicated for bacterial soft tissue infections, while cryotherapy and other lesional destructive therapy are usually used for viral skin and soft tissue infections.**

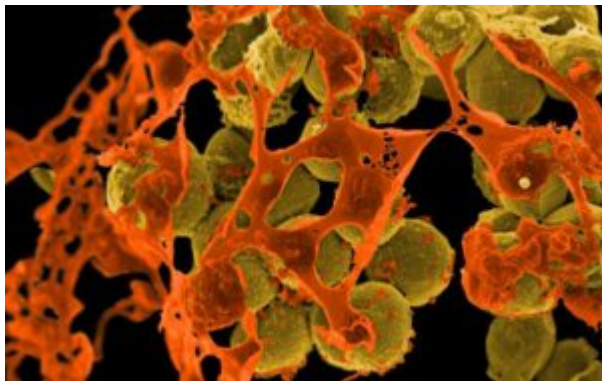


## Definition of Skin and Soft Tissue Infections in Children

Bacterial skin and soft tissue infections are defined as acute illnesses. They are characterized by **localized or diffuse skin and subcutaneous infection**. This definition includes **impetigo, folliculitis**, and **deep subcutaneous infections**. Viral causes of skin infections might be implicated in **warts** or other superficial skin lesions related to **molluscum contagiosum**.

# Epidemiology of Skin and Soft Tissue Infections in Children

Skin and soft tissue infections (SSTIs) are becoming more commonly recognized and diagnosed in children. Some studies link this increase in the incidence of SSTIs to a concomitant increase in the incidence of **methicillin-resistant *Staphylococcus aureus*** in the community.



**Image:** "Scanning electron micrograph of methicillin-resistant *Staphylococcus aureus* (MRSA, brown) surrounded by cellular debris. MRSA resists treatment with many antibiotics." by NIAID/NIH. License: Public Domain

The incidence of SSTIs related to *Staphylococcus aureus* alone has doubled in the last decade. Therefore, the costs of treating these infections nowadays are estimated to be around 4.22 billion dollars, signifying a serious burden on the health care system.

Another possible cause for the recent increase in the risk of SSTIs could be the increased prevalence of **human immunodeficiency virus** among children. Children with **impaired immune systems** are living longer due to recent advances in medicine.

## Etiology of Skin and Soft Tissue Infections in Children

1. ***Staphylococcus aureus***: The most common causes of **impetigo** are *Staphylococcus aureus* and streptococcus infections. *Staphylococcus aureus* acquired from the community is becoming **resistant to methicillin**.
2. ***Streptococcus pyogenes*: Group A streptococcus** is responsible for more invasive SSTIs than might be associated with **monomicrobial necrotizing fasciitis** (type I). One commonly identified organism of this group is *Streptococcus pyogenes*.
3. **Polymicrobial Infection**: Due to mixed infection of Staphylococci, *Peptostreptococcus*, *Bacteroides*, or *Clostridium*, **polymicrobial** necrotizing fasciitis (type I) occurs in children.
4. **Viral etiologies** implicated with SSTIs include **molluscum contagiosum and human papillomaviruses**. Molluscum contagiosum infections are more common among children aged 1 to 4 years. Warts caused by the human papillomavirus are common in older children and adolescents.

**Cellulitis** and **erysipelas** are also common non-purulent SSTIs caused by *Staphylococcus* infections. Purulent SSTIs

include **furuncles**, **carbuncles**, and **abscesses**. These conditions are also related to *Staphylococcus aureus* infection. **Staph-scalded skin syndrome** (SSSS) is a condition that is caused by toxin-producing *Staphylococcus aureus* strains.



- Group A Strep
- **Staph aureus**
- Pseudomonas (rare)
  - Adults with insulin-dependent diabetes mellitus (uncommon in children)
  - Hot tub folliculitis
  - **Nail through sneaker rubber into the foot**
  - Children with vasculitis of the extremities (very rare)

## Clinical Presentation of Skin and Soft Tissue Infections in Children

### 1) Impetigo

Simple(non-bullous) impetigo presents with localized single or multiple **skin lesions** that are crusted and brown or honey-colored, usually on the face or extremities. It is common in children with 2 to 5 years of age. More complicated cases (bullous impetigo) present with deeper skin involvement, possibly with a purulent discharge, and sometimes vesicles may enlarge (bullae). Bullous impetigo is exclusively caused by *staph aureus* due to the release of epidermolytic toxin into the local tissues.

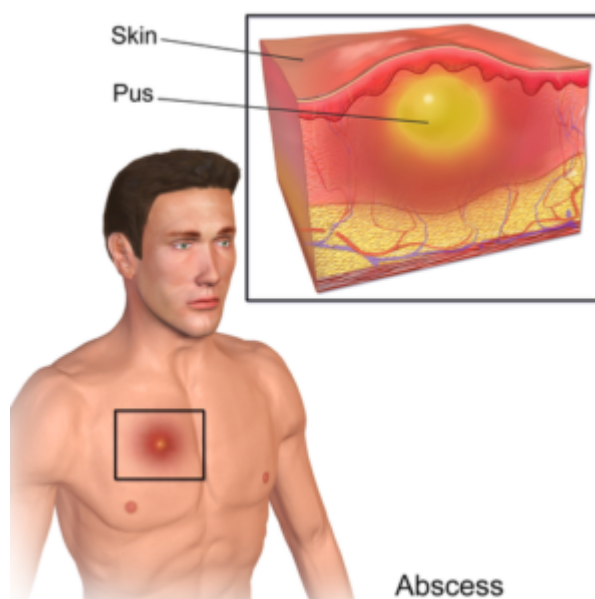


Image: "Abscess" by Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014". Wikijournal of Medicine 1 (2). DOI:10.15347/wjm/2014.010. ISSN 2002-4436. - Own work. License: [CC BY 3.0](https://creativecommons.org/licenses/by/3.0/)

## 2) Cellulitis

Cellulitis presents with localized swelling, warmth, redness, and pain in an area. It involves the dermis and subcutaneous fat and may form abscesses. *Haemophilus influenzae* was initially considered the major reason for facial cellulitis in children 3-24 months of age. Recent studies have reported other flora, including *Escherichia coli*, *Peptostreptococcus* species, and *Bacteroides fragilis* apart from *S. aureus* in infected tissue.

## 3) Abscesses

Abscesses usually present with localized swelling or a lump in an inflamed area. They can occur in the subcutaneous tissue of an upper or lower limb. Patients with a purulent disease are more likely to have a fever because of toxins.

## 4) SSSS (Staphylococcal Scalded Skin Syndrome)

It presents with a **painful desquamative skin rash**, especially around the nose, mouth, and anus. The rash can also be seen around flexures. It is caused by exfoliating toxins produced by *staph aureus*. These toxins are expressed at the infection site, causing bullous impetigo and acting systemically to cause SSSS. Patients with SSSS might be feverish, develop **hypotension**, have **multisystemic dysfunction**, or develop **sepsis**. Therefore, SSSS is considered a **pediatric emergency**, requiring urgent treatment, and adequate fluid replacement therapy.

## 5) Acne

**Acne** is another common presentation of **Propionibacterium infection** or Streptococcus superficial skin infection.

## 5) Molluscum Contagiosum

Patients with molluscum contagiosum may have self-limited skin lesions that are round and umbilicated. The lesions resemble skin warts.

## 6) Skin Warts

**Skin warts** caused by the human papillomavirus can occur in the hands or feet, in the genital tract, or in the mouth and nasopharynx. Patients presenting with anal or genital warts who are too young to be sexually active should be screened for **possible sexual abuse**.

## 6) Folliculitis

This condition is caused by inflamed hair follicles due to *Pseudomonas aeruginosa*, *S. aureus*. It is associated with acne.

# Diagnostic Workup for Skin and Soft Tissue Infections in Children

The first and most important step in evaluating the patient with SSTIs is to determine whether the child has a deep abscess. **Abscesses** must be incised and drained for optimum treatment. After careful examination, most SSTIs require no further diagnostic workup.

A **complete blood count** might be indicated to evaluate patients presenting with severe

SSTIs, such as SSSS. **Leukocytosis** might be seen in that case. **Electrolyte imbalances** are also common with severe SSTIs, such as SSSS.

**Culture and sensitivity testing** of the infected sites might be indicated if the patient does not respond to typical [antibiotic therapy](#). Methicillin-resistant *Staphylococcus aureus* is becoming more commonly identified in community-acquired cases of impetigo and other SSTIs.

Skin warts or lesions caused by *Molluscum contagiosum* rarely need further diagnostic workup. Cases of extensive genital warts might warrant determining the type of human papillomavirus to assess the risk of **dysplasia** or **malignant transformation**.



- Clinical diagnosis
- Ultrasound may help distinguish between “drainable abscess” and “non-drainable phlegmon”
- **Blood tests are not indicated**
- If an abscess is drained, obtain a culture

## Treatment of Skin and Soft Tissue Infections in Children

### 1) Superficial infection: erysipelas, cellulitis, bullous impetigo, bite infections, and periorbital cellulitis

- a. **Nonpurulent SSTIs**, such as non-bullous or bullous impetigo, can be treated with **topical antibiotics**, such as **mupirocin**, **retapamulin**, and **fusidic acid**. Fusidic acid is not available in the United States, but it is active against *Propionibacterium acnes*.

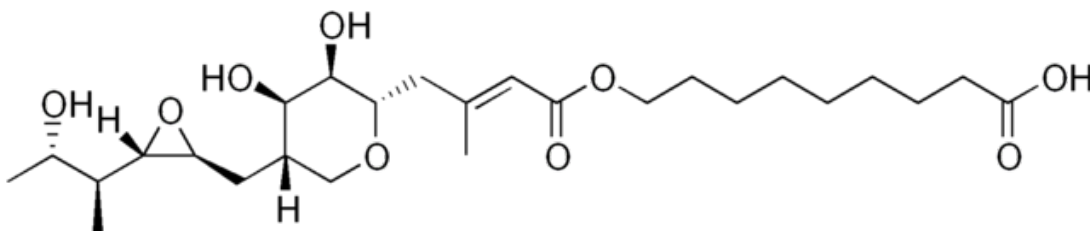


Image: “Chemical structure of mupirocin.” by Edgar181 - Own work. License: Public Domain

### 2) Deeper infections: orbital cellulitis, necrotizing fasciitis, and pyomyositis

- a. **Without abscesses**: Patients presenting with moderate **SSTIs that affect deeper tissues** but **have no abscesses** should be treated with **oral or intravenous antibiotics**, such as **ceftriaxone** and **clindamycin**. **Clindamycin**

is more likely to be effective against methicillin-resistant *Staphylococcus aureus* but might be associated with an increased risk of **pseudomembranous colitis**.

- b. **Necrotizing fasciitis:** Patients with severe nonpurulent necrotizing fasciitis or SSSS might need **surgical intervention** and **debridement of necrotic tissues**. This group of patients should receive **intravenous vancomycin plus piperacillin** to cover *Pseudomonas* species. This group of patients should undergo culture and sensitivity testing of the infected regions to identify the causative organism and switch to **narrow-spectrum** antibiotics.
- c. **Surgery:** Patients with purulent SSTIs, such as **abscesses or carbuncles**, should first undergo **surgical intervention**. **Incision** and **drainage** relieve symptoms, provide material for culture and sensitivity testing, and might be curative. Once a sample is collected for culture and sensitivity testing, **empirical antibiotic therapy** is indicated for this group of patients. **Vancomycin** or **Linezolid** are first-line empirical therapies for purulent SSTIs after incision and drainage. Linezolid and quinupristin/dalfopristin are good antibacterial agents for treating highly resistant organisms like methicillin-resistant *S. aureus*, vancomycin-resistant *S. aureus*, and vancomycin-resistant enterococci.

### Sensitivity tests:

Once the results of the culture and sensitivity tests are available, the main question would be whether the patient has **methicillin-resistant or sensitive *Staphylococcus aureus***. Patients with purulent SSTIs caused by methicillin-sensitive *Staphylococcus aureus* should be switched to **nafcillin**. Those who are confirmed to have community-acquired methicillin-resistant *Staphylococcus aureus* should continue receiving **vancomycin or linezolid** or be switched to **clindamycin**.

Patients who are confirmed to have *Streptococcus pyogenes* SSTI should be switched from **vancomycin plus piperacillin to penicillin plus clindamycin**. A similar protocol should be followed in cases of clostridial necrotizing fasciitis. Necrotizing fasciitis might also be polymicrobial; in that case, the patient should continue **vancomycin plus piperacillin**.

## Abscess management



- Incision and drainage with an appropriate technique
- Packing is unlikely to help and is painful
- Do not drain with a needle
- Antibiotics are unnecessary unless the patient has associated cellulitis (consider MRSA)

## Viral SSTIs

Managing molluscum contagiosum and viral SSTIs is more complicated. The prognosis is usually worse than bacterial SSTIs. **Cryotherapy** and **cantharidin** are destructive therapy for molluscum contagiosum, with good clinical response. **Potassium hydroxide** has also been used as destructive therapy for skin lesions caused by

molluscum contagiosum.

- **Cryotherapy, paring, excision,** and administration of **cantharidin** are also possible options for warts caused by human papillomavirus.
- **Imiquimod** has been used as an **immune-modulator therapy** to treat warts, but should not be used in cases of molluscum contagiosum.
- Finally, the **human papillomavirus vaccine** has been found to be effective against genital and, more recently, non-genital warts; therefore, the vaccine is



recommended for all children.

## Special considerations

<b>Cellulitis from bite</b>	Broad coverage with amoxicillin/clavulanate
<b>Cellulitis of hand</b>	Admit for IV antibiotics
<b>A pilonidal or perirectal abscess</b>	Consider IBD, consult the surgeon for evaluation for tract
<b>MRSA colonization</b>	Difficult to manage, good hygiene encouraged

## References

Rush J, Dinulos JG. Childhood skin and soft tissue infections: new discoveries and guidelines regarding the management of bacterial soft tissue infections, molluscum contagiosum, and warts. *Curr Opin Pediatr.* 2016 Apr;28(2):250-7. doi: 10.1097/MOP.0000000000000334. Review. PubMed PMID: 26900921.

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