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Skin and Soft Tissue Infections

Developed by Roy Khalaf and Dr. Korah for PedsCases.com.
March 24th, 2024

Introduction:

Hello everyone, welcome to Peds Cases, my name is Roy Khalaf, I am a third year medical student at McGill University. In this podcast, we will discuss how we can formulate an approach to skin infections. This podcast was developed in collaboration with Dr Korah, a Hospitalist Pediatrician at Montreal Children's Hospital at the McGill University Health Center.

Learning objectives:
After listening to this podcast, the learner will be able to:

- Recognize the clinical manifestations of various skin and soft tissue infections
- Classify bacterial pathogens based on the clinical presentations of skin and soft tissue infections
- Identify red flags of skin and soft tissue infections
- Discuss the approach to management of skin and soft tissue infections

Case presentation:

Now, let's begin with the case.

You are on your paediatric rotation and are asked to assess a patient in the emergency department. The patient is Sara, a 7-year-old previously healthy female who presented to the ED with her mother because of a skin rash on her right lower leg for the past three days. The lesion started as a small red bump but has since enlarged and become painful. Her mother tells you there is some yellow discharge coming from the lesion today and she is concerned. Sarah does not have any significant contributing medical, developmental or family history. She is currently attending Grade 2 and involved in several extra-curricular activities including Girl Guides and swimming lessons. As you review her symptoms, you note that she does not have any fever, chills or night sweats. Sarah has not recently traveled or been exposed to sick individuals. She does not have a history of recent trauma or insect bites and has no known allergies.

On physical examination, Sarah appears well nourished, non-toxic and in no acute distress. Her vitals are stable. However, as you examine her right lower leg, you find a 5 cm erythematous, warm, and exquisitely tender area with central pustulation with surrounding edema. There are no palpable lymph nodes in the groin and the remainder of the physical examination is unremarkable.

This case is a common presentation of cellulitis, an infection of the deep dermis and subcutaneous fat. The most common symptoms include erythema, edema and warmth of the affected area. If

the patient were to have presented with a painful and fluctuant mass to her right leg, the diagnosis would likely be cellulitis complicated with an abscess.

In cases of a child with an acutely erythematous rash it is sometimes difficult to distinguish a local allergic reaction (such as an insect bite) from a bacterial infection. Typically, an acute local allergic reaction is erythematous sometimes accompanied by edema, warm to touch, and very itchy, but is not tender on palpation. This is a conundrum often encountered in the summer months when a child has been bitten by a clandestine insect. Many insect bites around the eye are difficult to differentiate from peri-orbital cellulitis.

Common organisms in skin infections:

The most causal organisms of a skin and soft tissue infection vary depending on the features of the presenting history and physical examination.

- Cellulitis is usually caused by Group A Streptococcus (GAS) but may also be caused by Staphylococcus aureus. In our case, the risk factors for the patient only include school attendance and extracurricular activities as she does not have history of skin trauma, a history of MRSA infection or contact with a sick individual.
- Abscesses or other purulent skin and soft tissue infection are usually caused by Staphylococcus aureus.
- Finally, impetigo and folliculitis are common skin infections usually caused by Staph aureus or GAS. Impetigo is a superficial bacterial infection with lesions progressing from papules to vesicles, pustules and crusts. The appearance of honey yellow crusts is the hallmark of impetigo.

Risk factors for infections other than GAS or Staph Aureus:

When completing the history of a patient presenting with a skin and soft tissue infection it is important to rule out any risk factors for infections organisms other than GAS or Staph aureus.

For example, if the patient traveled to an endemic region, there may be a risk of Corynebacterium diphtheriae infection. In this example, it will be important to look for symptoms of that infection such as a thick gray exudate in the throat with fever and enlarged lymph nodes in the neck.

If a patient has not been immunized, it is important to suspect other pathogens such as Haemophilus influenzae type b (Hib). Prior to the inclusion of Hib vaccine in routine childhood immunizations we encountered not infrequently a spectrum of diseases caused by this organism including cellulitis, epiglottitis, pneumonia and meningitis.

Traumatic lesions, such as puncture wounds increase the likelihood of polymicrobial infections and fungal infections. Finally, if the patient was a victim of an animal bite, then other pathogens ahouls be considered such as Bartonella (cat scratch disease) or Pasteurella or Capnocytophaga canimorsus if the bite was from a dog. Immunocompromised and unimmunized patients are also susceptible to other organisms and these considerations will affect which antibiotics you choose for initial and ongoing coverage.

The physical examination of the patient will be an important aspect to determine the priorities of your interventions and antimicrobial approach. Your first step will be to determine whether your patient seems hemodynamically stable. Review your vital signs and look for systemic signs such

as fever, hypotension or tachycardia. Assessing your ABCs is always the initial step in any assessment followed by a determination of whether the patient "looks sick" or "not sick".

Presentations of skin infections:

Cellulitis can present as mild, moderate or severe. Some presentations that require urgent intervention include:

- Necrotizing skin infections in which case you will note significant systemic signs of toxicity such as fever, tachycardia, rapid spread of erythema and tissue destruction, and a significant amount of pain ("pain out of proportion" to the appearance of the rash).
- Toxic shock syndrome is usually caused by Staphylococcus aureus or Group A streptococcus. In these cases, your patients will present with a rapid onset of fever, rash, hypotension and multiorgan involvement.

The next step to consider is relevant and appropriate investigations. Your priority will be to obtain a culture of the lesion if possible, knowing that not all lesions will demonstrate exudate. A blood culture should also be drawn for moderate to severe presentations along with a CBCD, CRP, and other relevant labs if there is multisystem involvement such as renal and liver function. Culture results along with sensitivity testing will guide your ultimate antibiotic choice. In cases of purulent infections, incision and drainage may be required.

Treatment and antibiotics:

Tailoring treatment for pediatric skin infections depends on the severity of the patient's presentation, whether the patient is immunized for Haemophilus influenzae type b, and any pertinent aspects of the history such as a history of a dog or cat bite/scratch.

In general, when dealing with typical skin and soft tissue infections, the most common organisms are GAS and Staphylococcus aureus hence antibiotics should target these organisms. In pediatrics we also need to consider which antibiotics will support compliance. For instance, oral cephalexin and Amox/Clav are palatable in liquid form while clindamycin and cloxacillin are often reserved for kids who can swallow pills as the taste often thwarts compliance.

The following treatment guidelines are given as per the Montreal Children's Hospital guidelines as well as the Michigan Medicine Hospital guidelines, encompassing a standardized form of treatment for common infections. However, other healthcare centers may have varied antibiotic treatment protocols. Please refer to local resources and consult with your Pediatric Infectious Diseases colleagues for patients with atypical, severe, or multi-system involvement. In cases of necrotizing fasciitis Pediatric Infectious Diseases and Plastic surgery should be involved early in the management plan.

In this next part, we will go over the most common infections such as cellulitis and their treatment plan as well as some less common infections.

In cases of mild non-purulent infections, topical mupirocin 2% can be given BID - QID x 5 days or oral Cephalexin 25mg/kg/dose PO TID x 5 days.

In the case of our patient, the first line treatment for mild to moderate cellulitis will be a first generation cephalosporine such as Cephalexin 50-100mg/kg/day PO divided q8H (max 4.5g/Day). In cases of penicillin allergy, you would consider a second generation cephalosporin

such as Cefuroxime 15mg/kg/dose PO q 12h due to a risk of cross reactivity in pen allergic patients and first gen cephalosporins. You may also consider TMP-SMX for a dose of 6mg of TMP/kg/dose PO BID (max 320mg TMP/dose) in cases of suspected MRSA as S.aureus resistance rates are lower for TMP-Smx and Doxycycline. If the patient was inpatient and not pen allergic, then a first generation cephalosporin such as cefazolin (ancef) 33mg/kg/dose IV can be given q8H for a maximum of 2g/dose. Treatment length will be 5-10 days depending on clinical resolution and signs and symptoms of inflammation. It will be important to re-assess the patient and step down to PO antibiotics once the patient's infection starts to resolve and the patient is able to tolerate oral antibiotic.

If a patient presents with severe cellulitis, then they will require hospitalization for intravenous antibiotic treatment and management. The first line treatment will be Cefazolin, a first-generation cephalosporin 50-100mg/kg/day IV (or intravenous) divided q8H X 5-10 days with a maximum of 1g/dose. The same treatment is to be given if the patient presents with a penicillin allergy**. As first generation cephalosporin treats more effectively Gram-positive organisms, in cases of severe infection despite penicillin allergy, the physician may continue using a first-generation rather than a second-generation cephalosporin. However, it will be up to the physician.** You may also consider TMP-SMX for a dose of 6mg of TMP/kg/dose PO BID (max 320mg TMP/dose) in cases of suspected MRSA as S.aureus resistance rates are lower for TMP-Smx and Doxycycline. This is also given inpatient in patients presenting with a severe purulent skin and soft tissue infection caused by S.aureus or GAS.

If a patient presents with a mild-moderate animal/human bite related wound infection, it will first be important to verify the tetanus immunization status and assess whether rabies post-exposure prophylaxis is warranted. First line treatment will be Amoxicillin-Clavulanate 45-60mg/kg/day PO divided q8h (maximum 1500 mg/day) X 7-10 days depending on clinical resolution of signs and symptoms of inflammation. In cases of penicillin allergy, the first-line treatment will be TMP-SMX 8-12mg TMP/kg/day PO divided q12h (max 160mg TMP/dose) x 7-10 days. In the cases of a human bite, Clindamycin 30-40mg/kg/day PO divided q8h (maximum 600mg/dose) x 7-10 days will be indicated.

In cases of severe animal/human bite related wound infection, the treatment will be Amoxicillin-clavulanate 25mg/kg/dose IV q8h (max 1000mg/dose) x 7-10 days. If patient presents with penicillin allergy, then give Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) or Metronidazole 10mg/kg/dose PO q 8H x 7-10 days. If the patient is suspected to have Haemophilus influenzae type B, giving parenteral third-generation cephalosporin is indicated.

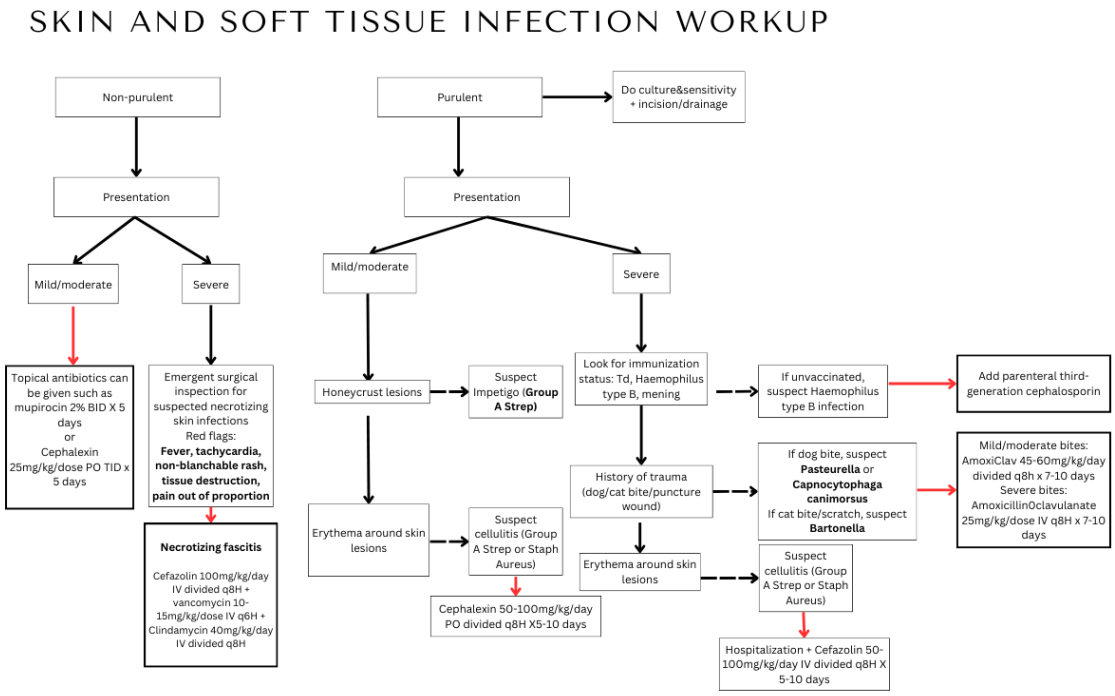
If the patient presents with necrotizing fasciitis, the treatment will be more interventional. First line treatment will be Cefazolin 100mg/kg/day IV divided q8H (max 2g/dose) + Vancomycin 10-15mg/kg/dose IV q6h + Clindamycin 40mg/kg/day IV divided q8H (max 900mg/dose). The same treatment is to be given in the case of penicillin allergy. Only if you suspect polymicrobial or water-borne infection should you replace the piptazo with Meropenem 20mg/kg/dose IV q8h (max 1g/dose). Surgical consult will be mandatory for consideration of deriding the tissue, which is an important part of the treatment plan. IVIG should be considered as adjunctive therapy if the patient is severely ill as there is an increased mortality rate (~up to 25%) for these patients. Treatment should be maintained until further debridement is no longer necessary and clinical symptoms and fever are resolved X 48-72 hours.

Conclusion:

In conclusion, in this episode, we have navigated through the nuanced landscape of pediatric skin infections. From Sarah's case, we've learned to discern key symptoms and signs of cellulitis and its differentiation from other infections such as impetigo. I hope you now recognize how crucial it is always to complete a comprehensive history and physical exam on every patient to determine the most likely diagnosis, the severity, and special consideration related to immune status and the etiology of the rash. Remember that neonates have nuanced treatment strategies that differ from patients over 28 days.

Thank you for tuning into Peds Cases. I hope you enjoyed this episode on skin and soft tissue infections.

Figure 1. Skin and soft tissue infection workup



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2. MUHC (McGill University Healthcare Centre) guidelines for skin and soft tissue infections in children > 28 days old.
3. Michigan Medicine Guidelines "Empiric Antibiotic Guidelines for Skin and Soft Tissue Infections In Patients on Pediatric Services" , applied to the C.S. Mott Children's Hospital.

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