

Skin and Soft Tissue Infections

TEAM 439

MICROBIOLOGY



Objectives

- ❖ Describe the anatomical structure of skin and soft tissues.
- ❖ Differentiate the various types of skin and soft tissue infections and their clinical presentation.
- ❖ Name bacteria commonly involved in skin and soft tissue infections.
- ❖ Describe the pathogenesis of various types of skin and soft tissue infections.
- ❖ Recognize specimens that are acceptable for different types of skin and soft tissue infections.
- ❖ Describe the microscopic features and colony morphology of *Staphylococcus aureus* and group A *Streptococcus* and how to differentiate them from other bacteria.
- ❖ Discuss non-microbiological investigations.
- ❖ Describe the major approaches to treat of skin and soft tissue infections either medical or surgical.

Colour index:

Red: Important.

Grey: Extra info & explanation.

Purple: Only in girl's slides.

Green: Only in boy's slides.

Any future corrections will be in the editing file, so please check it

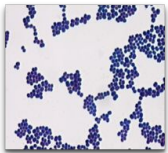
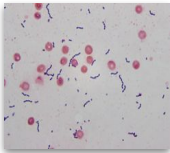
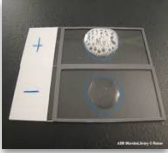



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Introduction

- ❖ Skin and soft tissue infections are common.
- ❖ Can be mild to moderate or severe
- ❖ Muscle or bone and lungs or heart valves might be infected.

Staphylococcus aureus	Most Common Cause	Streptococcus pyogenes β hemolytic - Group A
Methicillin resistance.	Emerging Antibiotic Resistance	Erythromycin resistance.
Gram + cocci in clusters 	Description *In the exam, these might be hints that will help you to identify the organism	Gram + cocci in chain 
Catalase + 		Catalase - 
Coagulase + 		Beta hemolytic Bacitracin* sensitive 

*The bacitracin susceptibility test is used to distinguish Group A streptococci, from other streptococci.

Key to developing an adequate differential diagnosis requires:

01

History

- Patient's immune status.
- The geographical locale.
- Travel history.
- Recent trauma
- Surgery.
- Previous antimicrobial therapy.
- Lifestyle.
- Animal exposure or bites.

03

Investigation

- CBCs, Chemistry.
- Swab, Biopsy or aspiration.
- Radiographic procedures (X-rays, CT, MRI).
- Level of infection.
- Presence of gas or abscess.

02

Physical examination

To determine the severity of infection.

04

Diagnostic & Therapeutic

- Surgical exploration or debridement.
- Antibiotics treatment

Impetigo (Pyoderma)

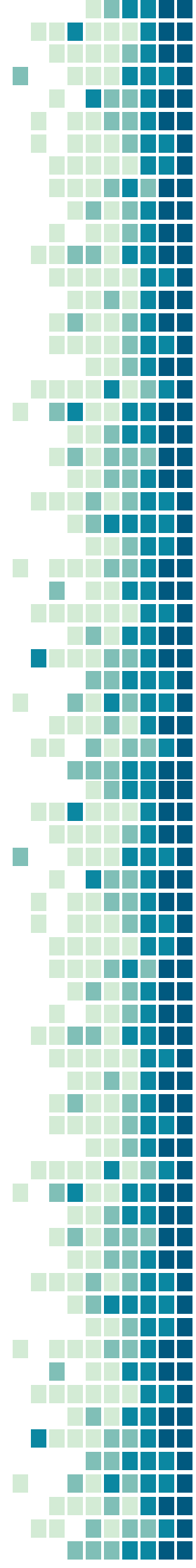
Note: Pyoderma means any skin disease that is pyogenic (has pus)

Overview	<ul style="list-style-type: none"> - A common skin infection, that usually appears as red sores on the face. - Usually infects children 2–5 years old in tropical or subtropical regions - Very Superficial skin infection 	
Cause	Nearly always	β -hemolytic streptococci (GAS) <u>only</u> . E.g. Nonbullous *GAS = Group A Streptococcal
	In some cases	β -hemolytic streptococci (GAS) <u>and</u> Staph. aureus
	Rarely	Staph. aureus <u>only</u> . E.g. Bullous..
Clinical Features	<ul style="list-style-type: none"> - Discrete purulent lesions. (Honey crusted lesions usually near mouth and nose) - Exposed areas of the body (face and extremities). - Skin colonization/ Inoculation (microbe enters) occurs from abrasions (wounds), minor trauma, or insect bites. - Systemic symptoms are usually absent. - Poststreptococcal glomerulonephritis. If the patient had a GAS infection (group A strep), he may develop Post-Streptococcal Glomerulonephritis in a few weeks, which is a rare kidney disease. Read more about it here. 	
Diagnosis	(Anti-DNAse B, ASO) To know if the patient has group A strep or not by looking for antigens.	
Treatment	<ul style="list-style-type: none"> - Cefazolin → First generation of Cephalosporins. - Cloxacillin → Effective for Staph. aureus, it's one of the penicillins. - Erythromycin → Used for patients allergic to penicillins & Cephalosporins. - Mupirocin 	

Note: remember that after skin & soft tissue infections caused by streptococcus, there will be a high chance of kidney inflammation (**PSGN**).



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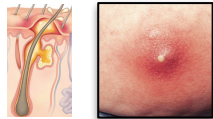

Cutaneous Abscesses



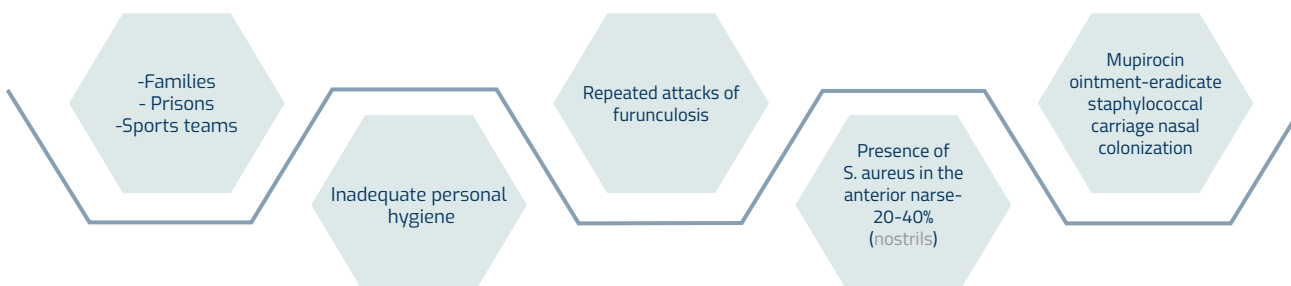
Definition	Collections of pus within the dermis and deeper skin tissues.
Cause	Typically: <i>Staph. aureus</i> with other organism (polymicrobial)
	25% of the cases: <i>Staph. aureus</i> alone (monomicrobial)
Clinical features	- Painful, tender, and fluctuant. In severe cases: Multiple lesions, cutaneous gangrene, severely impaired host defenses, extensive surrounding cellulitis or high fever.
Diagnosis	Do Gram stain, culture.
Treatment	<ul style="list-style-type: none"> - Incision and evacuation of the pus. (if the abscess is small drainage might not be necessary) - Systemic antibiotics especially if patient has fever & redness. So in general, treatment of abscess is drainage followed by antibiotics .

Note: the infection was on the fingers, most likely it will be monomicrobial. However, if the infection was around GIT for example, mostly it will be polymicrobial because there are many types of bacteria in there.

Furuncles & Carbuncles

	Furuncles (Boils) بصيلة شعر وحدة	Carbuncles بصيلات شعر متعددة
Definition	Infections of the hair follicle (folliculitis) 	Extension to involve <u>several adjacent</u> follicles 
Caused by	Mainly Staph. Aureus	
Characteristics of affected area	Suppuration extends through the dermis into the subcutaneous tissue	With coalescent inflammatory mass - back of the neck especially in diabetic patients.
	Note: regarding skin layers, impetigo is very superficial compared to furuncles & carbuncles.	
Treatment	<ul style="list-style-type: none"> • Large furuncles & all carbuncles require incision and drainage. • Systemic antibiotics are usually unnecessary. 	

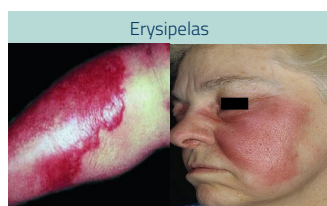
Outbreaks of furunculosis caused by MSSA, and MRSA:



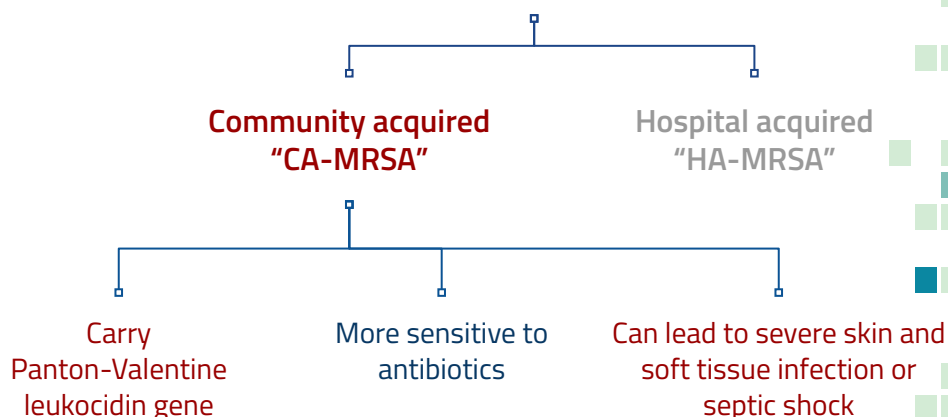
Erysipelas & Cellulitis

- Diffuse spreading skin infections, excluding infections associated with underlying suppurative foci.
- Most of the infections arise from streptococci, often group A, but also from other groups, such as B, C, or G.

	Erysipelas	Cellulitis
Skin and soft tissue involved	Upper layers (dermis). More superficial عشان كذا شكلها أوضح	Deeper dermis and subcutaneous tissue
Characteristics of affected area	Raised-clear line of demarcation , Red, tender, painful plaque. Raised regions, and classically affects the face. If you look at it's picture below, you can identify its borders and its shape,so it is well demarcated.	Acute & spreading Redness, warm, tender, inflamed. Usually affects the lower limb Poorly demarcated (you cannot identify its edges).
Causative Pathogen	Group A: β-hemolytic streptococci (GAS, strep.pyogenes) Streptococcus pyogenes is susceptible to penicillin so IV or Oral penicillin should be enough to treat erysipelas.	β-hemolytic streptococci group A, and group B (in diabetic patients). -Staph. aureus: commonly causes cellulitis (penetrating trauma) Bacteria penetrate due to injury, even if it's minor. +Usually associated with abscess. -Haemophilus influenzae: causes periorbital cellulitis in children. (affects anterior portion of skin around the eye without involving the eye itself)
Risk factors	Age group: infants, young children, and older adults (elders).	Obesity, venous insufficiency, lymphatic obstruction (operations), preexisting skin infections, ulceration, eczema, diabetes.
Clinical Diagnosis	<ul style="list-style-type: none"> - High WBCs. However, blood culture rarely needed. - Aspiration and biopsy might be needed in diabetes mellitus, malignancy, animal bites, neutropenia (<i>Pseudomonas aeruginosa</i>), immunodeficiency, obesity and renal failure -Observe for progression to severe infection (increased in size with systemic manifestation ie. fever, leukocytosis) 	
Treatment	<ul style="list-style-type: none"> - You have to cover both <i>Streptococcus</i> and <i>Staphylococcus</i> • Penicillin, cloxacillin, cefazolin (cephalexin) 1st generation of cephalosporins, clindamycin • Vancomycin or linezolid in case of MRSA • Clindamycin, TMP-SMZ (Trimethoprim-Sulfamethoxazole) for CA-MRSA 	



Methicillin Resistant Staphylococcus Aureus "MRSA"



Extra: PVL may be the key toxin and the factor responsible for enhanced virulence of CA-MRSA. It causes leukocyte destruction and tissue necrosis.

Necrotizing fasciitis (flesh-eating disease)

- ❖ It is a rare deep serious skin and **subcutaneous tissues** infection.
- ❖ Most common in the **arms, legs**, and abdominal wall and is fatal in 30%-40% of cases.
- ❖ Very severe, rapidly progressive خلال ساعات, causes necrosis, VERY painful.



01

Causing Microbes:

NF is classified according to its microbiology

Polymicrobial	Monomicrobial
Fournier's gangrene (perineum and genital area)	Group A streptococcus (<i>Streptococcus pyogenes</i>) (most common one)
Bacteroides fragilis	Staphylococcus aureus or CA-MRSA *When staph becomes resistant to commonly used antibiotics (meaning the antibiotics are no longer effective) it is called methicillin resistant staphylococcus aureus (MRSA), CA = community acquired
Streptococcus (other than group A)	Vibrio vulnificus (liver function)
Gram-negative bacteria (synergy). E. coli, Klebsiella, Pseudomonas	Clostridium perfringens (gas in tissues) (Type III)
Uncommonly fungi	

Necrotizing fasciitis, Contd..

02

Risk factors

- Immune-suppression
- **Chronic diseases:** (diabetes, liver and kidney diseases, malignancy)
- **Trauma:** (laceration, cut, abrasion, contusion, burn, bite, subcutaneous injection, operative incision)
- **Recent viral infection rash (chickenpox)**
- Steroids
- Alcoholism
- Malnutrition
- Idiopathic (unknown cause)

03

Pathophysiology

- Destruction of skin and muscle by releasing toxins:

Streptococcal pyrogenic exotoxin (Superantigen)

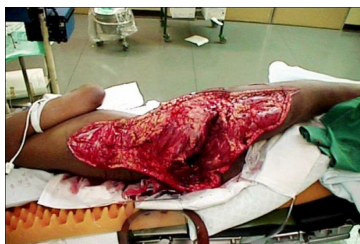
- Non-specific activation of T-cell.
- Overproduction of cytokines
- Severe systemic illness (**Toxic shock syndrome**)

(virulence factor) this superantigen acts non-specifically with the immune system and it interacts with any T-Cells, causing VERY severe immune response leading to toxic shock. + more severe illness.

04

Signs & Symptoms

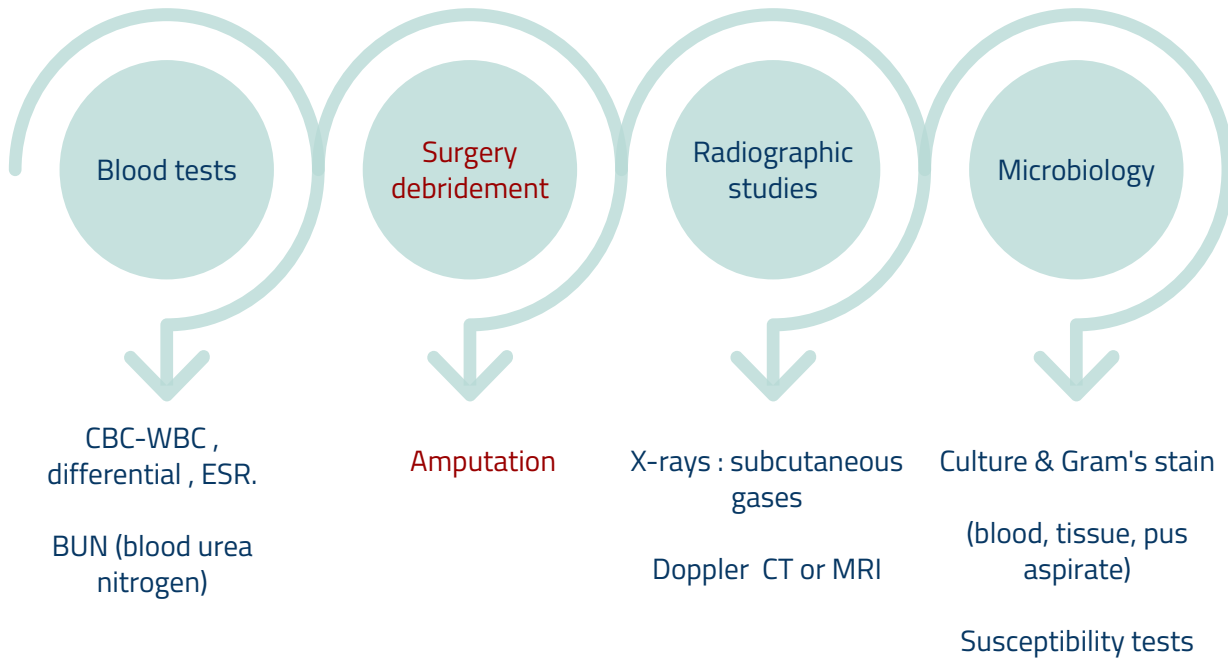
- ***RAPID progression of severe pain with fever , chills (typical).**
- Swelling , redness, hotness, blister, gas formation, gangrene and necrosis
- Blisters with subsequent necrosis , necrotic eschars Diarrhea and vomiting (very ill)
- Shock organ failure
- Mortality as high as 73 % if untreated



Necrotizing fasciitis, Contd..

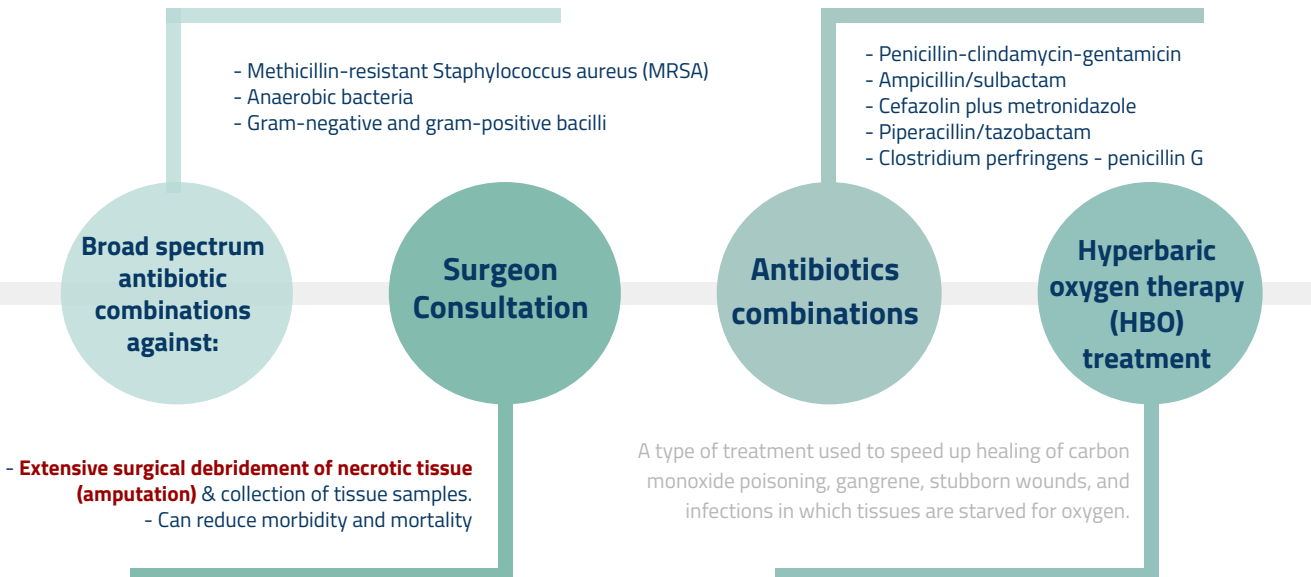
Diagnosis

- A delay in diagnosis is associated with a grave prognosis and increased mortality.
- Clinical-high index of suspicion



Treatment:

- If clinically suspected patient needs to be hospitalized OR require admission to ICU.
- Start intravenous antibiotics immediately
- Antibiotic selection based on bacteria suspected



Pyomyositis

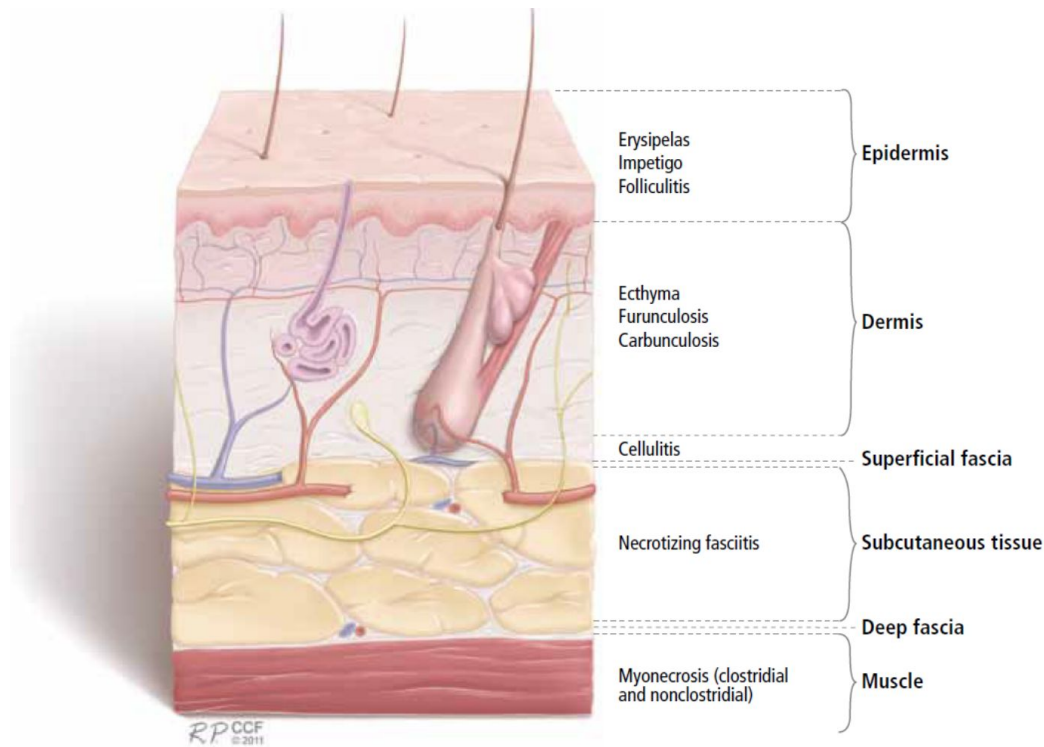
Definition	Acute bacterial infection of skeletal muscle, usually caused by <i>Staphylococcus aureus</i>
Characteristics	<ul style="list-style-type: none"> - No predisposing penetrating wound, vascular insufficiency, or contiguous infection. - Most cases occur in the tropics - 60% of cases outside of tropics have predisposing RF: DM, EtOH liver disease, steroid rx, HIV, hematologic malignancy.
History	<ul style="list-style-type: none"> ❖ Blunt trauma or vigorous exercise (50%), then period of swelling without pain. ❖ 10-21 days later, pain, tenderness, swelling and fever, Pus can be aspirated from muscle. ❖ 3rd stage: sepsis, later metastatic abscesses if untreated.
Diagnosis	X-ray, US, MRI or CT
Treatment	Surgical drainage + Antibiotics

Other Specific Skin Infections

Epidemiology	Common Pathogen (s)	Therapy
Cat/Dog Bites	<i>Pasteurella multocida</i> ; <i>Capnocytophaga</i>	Amox/clav (Doxy; FQ or SXT + Clinda)
Human bites	Mixed flora <i>eikenella corrodens</i>	Hand Surgeon; ATB as above
Freshwater injury	<i>Aeromonas</i>	FQ; Broad Spectrum Beta-lactam
Salt water injury (warm)	<i>Vibrio vulnificus</i>	FQ; Ceftazidime
Thorn , Moss	<i>sporothrix schenckii</i>	Potassium iodine
Meat-packing	<i>Erysipelothrix</i>	Penicillin
Cotton sorters	Anthrax	Penicillin
Cat scratch	<i>Bartonella</i>	Azithromycin

Take home points..

- ❖ Skin and soft tissue infections are most commonly caused by *Staphylococcus aureus* and *Streptococcus pyogenes*.
- ❖ Risk factors for developing SSTIs include breakdown of the epidermis, surgical procedures, crowding, comorbidities, venous stasis, lymphedema
- ❖ Most SSTIs can be managed on an outpatient basis, although patients with evidence of rapidly progressive infection, high fevers, or other signs of systemic inflammatory response should be monitored in the hospital setting
- ❖ Superficial SSTIs typically do not require systemic antibiotic treatment and can be managed with topical antibiotic agents, heat packs, or incision and drainage.
- ❖ Systemic antibiotic agents that provide coverage for both *Staphylococcus aureus* and *Streptococcus pyogenes* are most commonly used as empiric therapy for both uncomplicated and complicated deeper infections.



LAST BUT NOT LEAST

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Our Summary

CASES / SAQ + MCQs

CASE 1:

5 years old boy came to ER with crusty like lesions around his nose and with normal temperature (no fever). What is most likely the organism? Diagnosis? What is the complication that might result from this infection in a few weeks?

CASE 2:

A-Patient seen in ER with a collection on his thigh drained by emergency doctor and sent to microbiology lab, Gram stain showed Gram +ve cocci in clusters, and coagulase +ve, what is most likely his condition? What is the organism?

B-Swab was taken and sent to microbiology lab, which later on reported positive results of MRSA. What is your choice of treatment?

CASE 3:

A 5 years old with rapidly progressing inflammation and redness, erythema on his lower limb for the last few hours, high grade fever, seems really unwell. He was admitted and taken to the OR and surgically debrided the infected area. A sample was sent to the microbiology lab and Gram stain showed Gram +ve cocci in chains. What is the diagnosis?

CASE 4:

70 years old women came to ER with erythema on the right side of her face, painful, red and well demarcated raised region. What is the diagnosis? Most likely organism? And your choice of treatment?

Q1: Which of these organisms carries the PVL gene?

- A- Haemophilus influenzae
- B- Hospital acquired-methicillin resistant staphylococcus aureus
- C- Community acquired-methicillin resistant staphylococcus aureus
- D- Streptococcus pyogenes

Q2: Which skin layer would be most affected in a patient with Erysipelas?

- A- Lower dermis
- B- Upper dermis
- C- Epidermis
- D- Superficial fascia

Q3: A patient presented with cellulitis and the causative pathogen was discovered to be MRSA. Which antibiotic can be used for treatment?

- A- Vancomycin
- B- Clindamycin
- C- Penicillin
- D- Ampicillin

Q4: Poststreptococcal glomerulonephritis is a complication of.

- A- Group A Streptococcus pneumoniae
- B- Staphylococcus Aureus.
- C- Group B streptococcus pyogenes.
- D- Group A streptococcus pyogenes.

Q5: Which statement is incorrect about impetigo infection?

- A- Clinically shows purulent lesions.
- B- May develop Poststreptococcal glomerulonephritis.
- C- Fever is a clinical feature of it.
- D- Can be caused by both GAS & Staph. Aureus.

Q6: Most superficial infection is:

- A- Cutaneous abscess
- B- Furuncles & Carbuncles
- C- Impetigo
- D- Cellulitis

Q7: Virulence factor of necrotizing fasciitis is?

- A- PVL Gene
- B- Superantibody
- C- Streptococcal pyrogenic exotoxin
- D- Streptococcal pyrogenic endotoxin

Q8: Epidemiology of necrotizing fasciitis?

- A- Children
- B- Immunocompromised people
- C- Elderly people
- D- Female patients

Q9: Where can flesh eating disease usually begin to develop?

- A- Upper limbs
- B- Nose and mouth
- C- Back of the neck
- D- Site of trauma

Q10: Not a monomicrobial cause of flesh eating disease

- A- Group A streptococcus
- B- Staphylococcus aureus
- C- Fournier's gangrene
- D- Vibrio vulnificus



Scan or click on the code to test yourself on some quizlet flashcards that we made!

Answer Key

- 1: GAS - Streptococcus pyogenes, impetigo, poststreptococcal glomerulonephritis.
- 2A: Cutaneous abscess, Staphylococcus Aureus .
- 2B: Vancomycin
- 3- Necrotizing fasciitis
- 4- Erysipelas, streptococcus pyogenes, Oral or IV penicillin.

- 1-C
- 2-B
- 3-A
- 4-D
- 5-C
- 6-C
- 7-C
- 8-B
- 9-D
- 10-C

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