Skin and Soft Tissue Infections

- Important
- Doctor Notes
- Extra

Editing File

Reviewed by Razan AlRabah & Khalid Alkhani

Musculoskeletal Block - Microbiology Team 438

Microbiology Team 438

Objectives:

- Describe the anatomical structure of skin and soft tissues.
- Differentiate the various types of skin and soft tissue infections and there 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.

Key to developing an adequate differential diagnosis requires:

History :

- Patient's immune status,
- the geographical locale,
- travel history,
- recent trauma or surgery,
- previous antimicrobial therapy,
- lifestyle, and animal exposure or bites

Physical Examination :

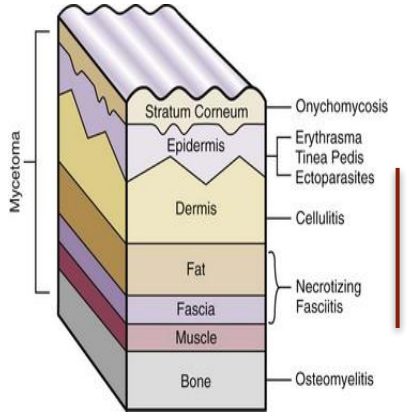
- To determine the severity of infection

Investigation :

- CBCs, Chemistry (Complete Blood Count)
- Swab, biopsy or aspiration (Aspirate for pus)
- Radiographic procedures (X-rays, CT, MRI) (to detect bone infection,or gas)
- Level of infection and the presence of gas or abscess.

Diagnostic & Therapeutic:

- Surgical exploration or debridement (To detect deepness of infection)
- Antibiotics treatment



Skin & Soft Tissue Infections,

IMPETIGO, Abscesses, Furuncles, Carbuncle, Erysipelas & Cellulitis:

What are the skin and Soft-Tissue Infections ?

- **Common** infections
- Can be **mild to moderate** or **severe** (rarely) muscle or bone and lungs or heart valves infection.
- Mostly cause by : **Staphylococcus aureus** & **Streptococcus.**
- Emerging antibiotic resistance :
  - 1) Staphylococcus aureus **(Methicillin resistance)**
  - 2) Streptococcus Pyogenes **(Erythromycin resistance).**

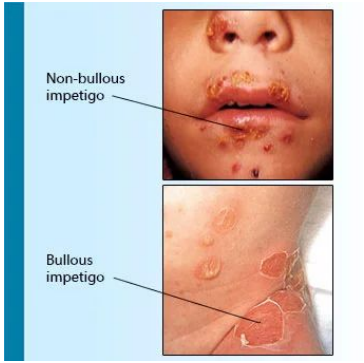
Skin and Soft-Tissue Infection,

Impetigo (Pyoderma)

*ASO: antistreptolysin O

DEFINITION

- A common and mild skin infection,
- Occurs mainly in children 2-5 years old, in tropical or subtropical regions,
  With Honey-crusted lesions.



CAUSED BY

- Nonbullous ⟶ (Streptococcus) or Bullous(pus) ⟶ (S. aureus)
- Nearly always caused by β-hemolytic streptococci (GAS) (= Group A Strepto).
- In some cases β-hemolytic streptococci (GAS) and S.aureus.
- Rarely by S. aureus only.

CHARSTRICTICS

- Consists of discrete purulent lesions
- Exposed areas of the body (face and extremities)
- Skin colonization- Inoculation by abrasions, minor trauma, or insect bites.
- Systemic symptoms are usually absent. ⟶ ما يجي معاها Fever.
- Poststreptococcal glomerulonephritis. ⟶ Group A Strepto can cause it.
  - (anti–DNAse B, ASO*) if there is a lot of AntiDNAse in the test then it means he have impetigo .

Honey-crusted lesions.

TREATMENT

- Cefazolin ⟶ First generation of Cephalosporins, covers all gram +ve (staph & strepto).
- Cloxacillin ⟶ Effective for Staph. Aureus, it's one of the penicillins.
- Erythromycin ⟶ used for patients allergic to penicillins & Cephalosporins, (Pyogenes is resistance).
- Mupirocin

Skin and Soft-Tissue Infection,
Cutaneous abscesses

DEFINITION

- Collection of pus within the dermis & deeper skin tissues.
- Staph. Aureus is important in Abscess.

CHARACTERISTIC

- Multiple lesions, cutaneous gangrene, severely impaired host defenses, extensive surrounding cellulitis or high fever & Tender.

CAUSES

- Typically polymicrobial (S. aureus and other microbes), (if it's near to the GIT),
- Or S. aureus alone in ∽25 % (if is the abscess in hand).
- Diagnosis :
  - Do Gram stain, culture, and systemic antibiotics.

TREATMENT

- Incision and evacuation of the pus (surgery if it's severe and deeper).
- Cloxacillin if caused by s.aureus only (non-severe).

Skin and Soft-Tissue Infection,

.Furuncles and carbuncles

DEFINITION

- Both is related to the Hair follicles and **not** severe..
- Furuncles (or “boils”) are infections of ONE hair follicle (folliculitis),
- -Carbuncle extension to involve several adjacent, Multi-Hair follicles together.

CHARACTERISTIC

In the next slide

CAUSES

follicle (folliculitis), usually caused by S.aureus, in which suppuration extends through the dermis into the subcutaneous tissue.

TREATMENT

- Larger furuncles and all carbuncles require incision and drainage. (Surgery).
- Systemic antibiotics are usually unnecessary

Skin and Soft-Tissue Infection,

.Furuncles and carbuncles

CHARACTERISTIC

- Furuncles : suppuration extends through the dermis into the subcutaneous tissue
- Carbuncles : with coalescent inflammatory mass - back of the neck especially in diabetics

MSSA & MRSA

Outbreaks of furunculosis caused by MSSA, and MRSA :

- Families-prisons-sports teams
- Inadequate personal hygiene
- Repeated attacks of furunculosis
- Presence of S. aureus in the anterior narse~ 20-40%
- Mupirocin ointment- eradicate staphylococcal carriage nasal colonization

- MSSA : Methicillin susceptible S.Aureus
- MRSA : Methicillin Resistance S.Aureus

Skin and Soft-Tissue Infection,
Erysipelas:

DEFINITION

Diffuse spreading skin infections, excluding infections associated with underlying suppurative foci

CHARACTERISTIC

- Affects the upper dermis (raised-clear line of demarcation) -deeper than impetigo- and upper than Cellulitis.
- Red (acute Erythema), tender, painful plaque, acute fever. → يعني لها فترة قصيرة من يومين او ثلاثة.
- Infants, young children- and older adults.

CAUSES

β-hemolytic streptococci (group A or S. pyogenes).

TREATMENT

- β-hemolytic streptococci sensitive to Penicillin-IV.
- or oral.

Skin and Soft-Tissue Infection,
Cellulitis

If it with abscess ⟶ usually β-hemolytic streptococci is the causes.
If it's clear and demarcated ⟶ usually S. aureus is the causses.

DEFINITION

- Acute spreading infection involves the deeper dermis and subcutaneous tissues.
- (deeper than Erysipelas)
- Because it's deep could be severe.
- Affect diff area, but usually we see it in legs.

CHARACTERISTIC

- Cellulitis doesn't occur in the face -Erysipelas usually occur in the face-, but usually in the leg.

- Risk factors ; Obesity, venous insufficiency, lymphatic obstruction (operations), preexisting skin infections -ulceration, or eczema.

CAUSES

- β-hemolytic streptococci, Group A streptococci, and group B streptococci-diabetics.
- S. aureus : commonly causes cellulitis- penetrating Trauma
- Haemophilus influenzae : periorbital cellulitis in children

TREATMENT

In Next slide

Skin and Soft-Tissue Infection,
Cellulitis

*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. taking from community.
There's another one (HA = hospital acquired).

DIAGNOSIS

- High WBCs, blood culture rarely needed.
- Aspiration and biopsy might be needed in diabetes mellitus, malignancy, animal bites, neutropenia (Pseudomonas aeruginosa), immunodeficiency, obesity and renal failure.
- Observe for progression to severe infection(increased in size with systemic manifestation ie . fever, leukocytosis)

TREATMENT

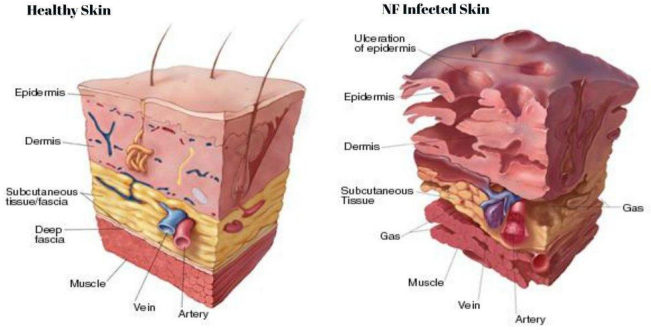
- Treatment should cover staphylococcus & streptococcus
E.g :
- Penicillin, ⟶ used if it's strept.
- cloxacillin,
- cefazolin(cephalexin), ⟶ First generation of Cephalosporins, covers all gram +ve (staph & strepto).
- clindamycin
- Vancomycin or linezolid in case of MRSA
- Clindamycin, TMP-SMZ** for Ca-MRSA

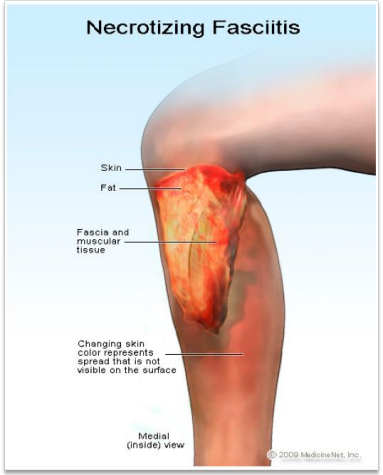
CA-MRSA* : -Community Acquired MRSA-
- Bacteria carry Panton-Valentine leukocidin gene
- More sensitive to antibiotics
- Can lead to severe skin and soft tissue infection or septic shock
- Any MRSA is resistance to all Beta lactam
- CA-MRSA has it own feature due to PVL gene and sensitive to Antibiotics other than Beta lacta

**TMP-SMZ = Trimethoprim / Sulfamethoxazole = antibiotics.

Necrotizing fasciitis,

Introduction :





- Also called : **Flesh-eating disease**
- **It's severe and life-threatening, need surgery and attention, it's systemic and very serious.**
- It is rare deep skin and subcutaneous tissues infection
- Two Types:
  - Type I: polymicrobial infection (Caused by Multimicrobial.)
  - Type II: Monomicrobial (Caused by one microbial Group A streptococcus)
- Most common in the arms, legs, (caused by mono) and *abdominal wall (caused by poly)* and is fatal in 30%-40% of cases.

Necrotizing fasciitis

Causing Microbes:

- **Monomicrobial** "Mediated toxin" ⟶ usually find in legs and arms cases,
  - ➔ Group A Streptococcus (Streptococcus Pyogenes).
  - ➔ 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.
  - ➔ Vibrio vulnificus (liver function) ⟶ not normal flora, but it's Salt water injury, لما شخص يسبح بالبحر ويجيه جرح
  - ➔ Clostridium perfringens**.
    - ◆ Gas in tissue (type III)
- **Polymicrobial** ⟶ usually find in abdominal wall cases, because it is rich of normal flora.
  - ➔ Caused by aerobic and anaerobic bacteria
    - ◆ Fournier's gangrene (perineum and genital area)
  - ➔ Bacteroides Fragilis.
  - ➔ Gram Negative Bacteria (synergy = التعاضد).
    - ◆ E.coli, Klebsiella, Pseudomonas.
  - ➔ Streptococcus (other than group A)
  - ➔ Uncommonly Fungi.

*there is more then two types and Cl. perfringens is the type 3 in some books (but don't bother yourself about it).

Necrotizing fasciitis

Flesh-eating disease

Risk factors:	Pathophysiology:
• 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.	• Destruction of skin and muscle by releasing toxins. • Streptococcal pyrogenic exotoxins. "Gram positive only" • Superantigen: ➔ Non-specific activation of T-cells ➔ Overproduction of cytokines ➔ Severe systemic illness (Toxic shock syndrome)

Necrotizing fasciitis

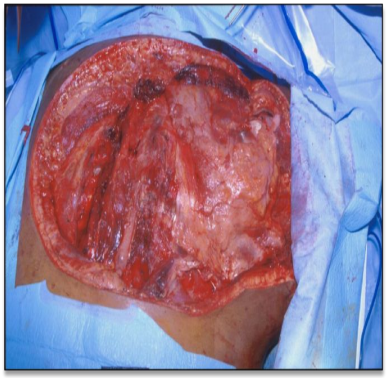
Signs and symptoms:

- Rapid progression of severe pain with fever , chills (typical)
- Swelling , redness, hotness, blister, gas formation, gangrene and necrosis
- Blisters with subsequent necrosis , necrotic eschars

Signs and symptoms

- Diarrhea and vomiting (very ill)
- Shock organ failure
- Mortality as high as 73 % if untreated

Visuals

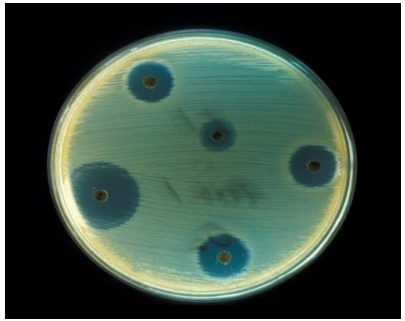


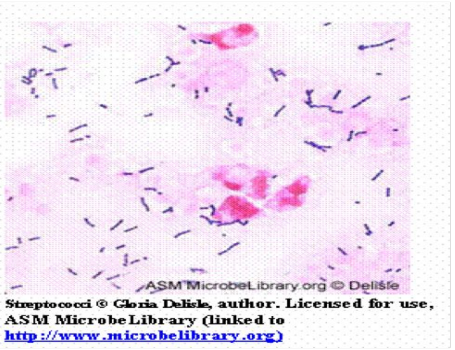
Necrotizing fasciitis

Diagnosis :

- A delay in diagnosis is associated with a grave prognosis and increased mortality

- **Clinical-high index of suspicion**
- **Blood tests**
  - ➔ CBC-WBC , differential,ESR
  - ➔ BUN (blood urea nitrogen)
- **Surgery debridement** "Debridement means cut away the infected tissue"
  - ➔ Amputation " if the infected area is very severe and cannot save it by surgery"
- **Radiographic studies**
  - ➔ X-rays : subcutaneous gases
  - ➔ Doppler CT or MRI
- **Microbiology**
  - ➔ Culture & Gram's stain (blood, tissue, pus aspirate)
  - ➔ Susceptibility tests





Streptococci © Gloria Delisle, author. Licensed for use, ASM MicrobeLibrary (linked to http://www.microbelibrary.org)

Necrotizing fasciitis

Treatment :

- If clinically suspected patient needs to be **hospitalized** OR require admission to **ICU** (**I**ntensive **C**are **U**nit)
- Start intravenous antibiotics immediately.
- Antibiotic selection based on bacteria suspected.

- **Broad spectrum antibiotic combinations against**
  - ➔ methicillin-resistant *Staphylococcus aureus* (MRSA)
  - ➔ anaerobic bacteria
  - ➔ Gram-negative and gram-positive bacilli
- **Surgeon consultation → most imp**
  - ➔ Extensive Debridement of necrotic tissue and collection of tissue samples
  - ➔ Can reduce morbidity and mortality

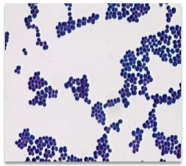
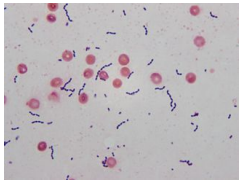
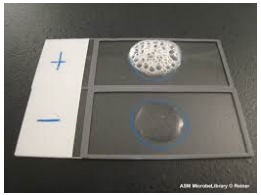
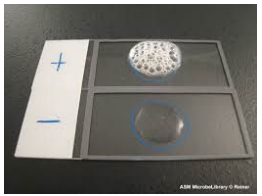
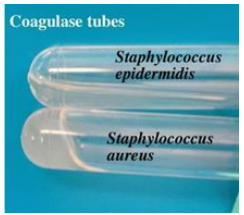
- **Antibiotics combinations**
  - ➔ Penicillin-clindamycin-gentamicin
  - ➔ Ampicillin/sulbactam
  - ➔ Cefazolin plus metronidazol
  - ➔ Piperacillin/tazobactam
  - ➔ *Clostridium perfringens*- penicillin G
- **Hyperbaric oxygen therapy (HBO) treatment**

Pyomyositis :

- **Definition**
  - ➔ Acute bacterial infection of skeletal muscle, usually caused by **Staphylococcus aureus**
- **Characteristic**
  - ➔ No predisposing penetrating wound, vascular insufficiency, or contiguous infection
  - ➔ Most cases occur in the tropics
  - ➔ 60% of cases outside of tropics have predisposing **R**isk **F**actors : Diabetes Mellitus, Ethyl alcohol liver disease, steroid, HIV, hematologic malignancy
- **History**
  - ➔ 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.
  - ➔ 3rdstage: sepsis, later metastatic abscesses if untreated
- **Diagnose**
  - ➔ X-ray, US, MRI or CT
- **Treatment**
  - ➔ surgical drainage +abx

Staphylococcus aureus & Streptococcus pyogenes

*The presumptive identification of group A**streptococci** (GAS) is usually done by testing for sensitivity to **bacitracin**. ... **Streptococcus** pyogenes (Group A **Streptococci**) is inhibited by the small amount of **bacitracin** in the disk; other **beta-hemolytic streptococci** usually are not.

Staphylococcus aureus ~~click here~~		Streptococcus pyogenes ~~click here~~	
Gram +ve cocci in clusters		Gram +ve cocci in chain	
Catalase positive		Catalase negative	
Coagulase positive		Beta hemolytic Group A (Bacitracin sensitive*)	 

Other Specific Skin Infections

NOT THAT IMPORTANT :)

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

Summary :

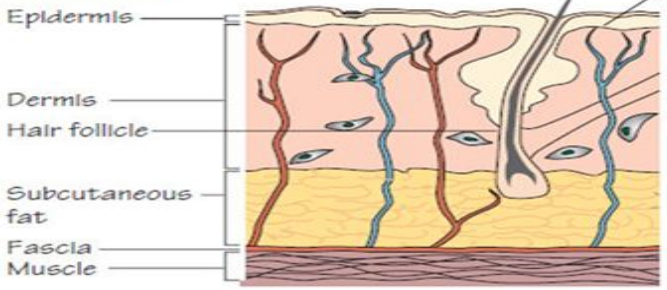
	Impetigo (pyoderma)	Coetaneous abscesses	Furuncles & Carbuncles	Erysipelas	cellulitis
Part affected	epidermis	dermis & deeper skin tissues.	In Hair follicles	Usually on cheek, upper dermis	usually legs deep dermis and subcutaneous tissue
Mainly causes	Group A Streptococcus (both)	Staph. Aureus or polymicrobial	Staph. Aureus	Group A Streptococcus	β-hemolytic streptococci Group A&B, Staph. Aureus
Imp symptoms /characteristics	Honey-crusted lesions	Collection of pus	Hair follicles infection	Red (acute Erythema), tender, painful plaque, acute fever. → الكيسات الي الهستوري فيها لها مدة قصيرة	Obesity, venous insufficiency, lymphatic obstruction (operations), preexisting skin infections -ulceration, or eczema.
Treatment	Cefazolin	(surgery if it's severe and deeper) Cloxacillin if caused by s.aureus only (non-severe).	• Surgery • Antibiotic are usualy unnecessary	Penicillin-IV	cefazolin(cephalexin)

VIRAL PATHOGENS

- Herpes simplex
- Papillomavirus
- Molluscum
- Orf
- Varicella

FUNGAL PATHOGENS

- *Epidermophyton*
- *Microsporum*
- *Trichophyton*
- *Candida*
- *Malassezia furfur*



Folliculitis (*S. aureus*)
Staphylococcal scalded skin syndrome
Impetigo (*S. aureus, S. pyogenes*)
Erysipelas (*S. pyogenes*)
Cellulitis (*S. pyogenes*)
Necrotizing fasciitis (*S. pyogenes* or mixed anaerobic and aerobic organisms)

TOXIN MEDIATED

S. aureus
- Scalded skin
- Toxic shock

S. pyogenes
- Scarlet fever

Bacteria	Infection/Syndrome
S. aureus	Impetigo, furunculosis, boils, toxic epidermal necrolysis, acute paronychia
S. pyogenes	Cellulitis, erysipelas, impetigo

Skin infections

Bacterial infections	
Impetigo	Very superficial skin infection. Usually from *S aureus* or *S pyogenes*. Highly contagious. Honey-colored crusting A. Bullous impetigo B has bullae and is usually caused by *S aureus*.
Erysipelas	Infection involving upper dermis and superficial lymphatics, usually from *S pyogenes*. Presents with well-defined, raised demarcation between infected and normal skin C.
Cellulitis	Acute, painful, spreading infection of deeper dermis and subcutaneous tissues. Usually from *S pyogenes* or *S aureus*. Often starts with a break in skin from trauma or another infection D.
Abscess	Collection of pus from a walled-off infection within deeper layers of skin E. Offending organism is almost always *S aureus*.
Necrotizing fasciitis	Deeper tissue injury, usually from anaerobic bacteria or *S pyogenes*. Pain may be out of proportion to exam findings. Results in crepitus from methane and CO_2 production. "Flesh-eating bacteria." Causes bullae and a purple color to the skin F. Surgical emergency.

Cases:

Q1/

1- 30 Yr old man went to the ER dept. With collection of pus on his left thigh large in size and physician did incision and drainage sample was sent to the lab, found Gram +ve cocci in cluster catalase +ve coagulase +ve, what the diagnosis and the most likely organism?

- Abscess & most likely organism is Staph. aureus

2- If it's MRSA what antibiotics you choose for?

- First choice is (Vancomycin) and second is Linezolid

Q2/

3-2 Yr old kid with a yellow lesion around his mouth and nose, what the diagnose and most likely organism ?

- impetigo , most likely is group A streptococcus (pyogenes)

Q3/

60 year old diabetic patients with chronic kidney disease seen presented to the ER dept. with 12 hour with rapidly progressing erythema on his leg very tender and high grade fever and need

and low BP that Needs additional support, What is the disease?

- Necrotizing fasciitis

Take Home Points

- 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.

MCQs

Q1/Which one is well demarcated?

a)Erysipelas b)Cellulitis c)Impetigo d)NF

Q2/what is the best antibiotic in case of Pyoderma with GAS and Staph aureus ?

a)Penicillin b)Cefazolin C)Cloxacillin d)Erythromycin

Q3/A 5 Yr old boy came to the ER with one day history of erythema around his face, what is the best treatment for him?

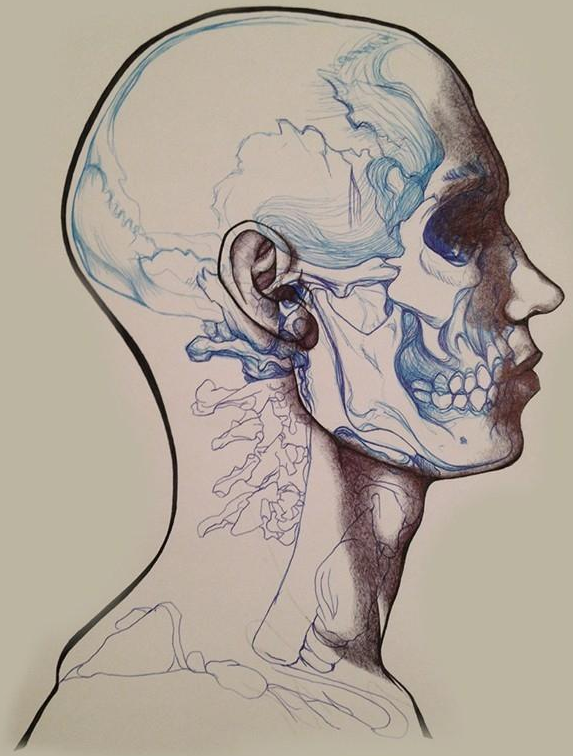
a)Vancomycin b) surgery c)Penicillin d)Linezolid

Q4/ cefazolin is the best choice for ?

a)impetigo b)severe Coetaneous abscesses C)cellulitis d) A&C

"Alway trust a microbiologist because they have the best chance of predicting when the world will END."

— Teddie O.Rahube



Thank You

Badr Al-Qarni

Haneen Somily

Faisal Al-Koblan

Faisal Al-Zahrani

Mohammed Alshoieer

Abdullah Othman

MicrobiologyTeam438@gmail.com