

Microbiology - Skin and Soft-Tissue Infections

Team 437

Red : Important!

Black: Doctors slides

Grey : Extra Info

Green: Notes

Please check our editing file
frequently.

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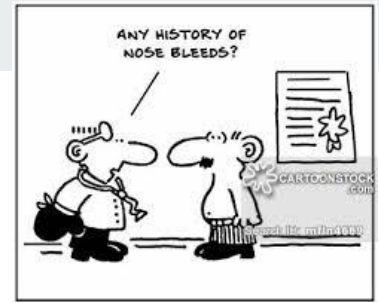
Revised by

Objectives



1. Describe the anatomical structure of skin and soft tissues.
2. Differentiate the various types of skin and soft tissue infections and their clinical presentation.
3. Name bacteria commonly involved in skin and soft tissue infections
4. Describe the pathogenesis of various types of skin and soft tissue infections
5. Recognize specimens that are acceptable and unacceptable for different types of skin and soft tissue infections
6. Describe the microscopic and colony morphology and the results of differentiating bacteria isolates in addition to other non-microbiological investigation
7. Discuss antimicrobial susceptibility testing of anaerobes including methods and antimicrobial agents to be tested.
8. 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,
- animal exposure or bites

Physical examination:

- To determine the severity of infection

Investigation:

- CBCs, Chemistry
- Swab, biopsy or aspiration (**Aspirate :For pus or exudate**)
- Radiographic procedures (X-rays, CT, MRI) (**primary to determine if there is bone infection or if there is gas.**)
- Level of infection and the presence of gas or abscess.

Diagnostic and therapeutic:

- Surgical exploration or debridement "**diagnostic (very important to determine the infection and whether it is deep or superficial) and therapeutic (if it's severe it might need amputating"**)
- Antibiotics treatment

Introduction:

- Soft tissue definition: anything other than bones.
- Soft tissue infections : It is a Common disease.
- Can be mild to moderate or severe. Muscle or bone and lungs or heart valves infection.
- Most **common Cause** are: **Staphylococcus aureus and streptococcus.**
- Emerging **antibiotic resistance** among:
 - -**Staphylococcus aureus (methicillin resistance).**
 - -**Methicillin drug is the laboratory name for cloxicillin drug**
 - -**Streptococcus pyogenes (erythromycin resistance).**
- You should differentiate between epidermis, dermis, subcutaneous infections and is it invading other tissues like muscles or bones to choose the right management.
- The more the organism has powerful toxins and enzyme the more it spread deeply, and he may devolve gas gangrene. For example : clostridium perfringase

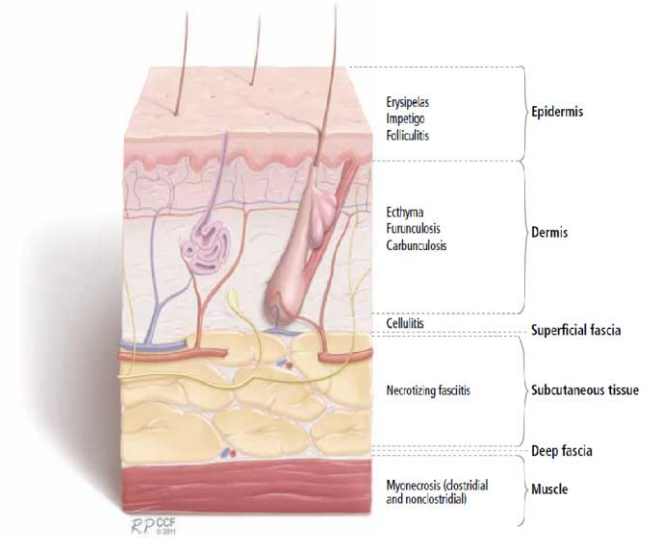


FIGURE 1. Depth of involvement in skin and soft-tissue infections.

Important to know the:

- 1- Name of the **syndrome.**
- 2- **Organisms** causing it.
- 3- **Clinical presentation.**
- 4- **Antibiotics.**

Impetigo - (pyoderma)

- It's a **common** skin infection, in **Children 2–5 years** in tropical or subtropical regions. **Very superficial in epidermis**
- Always caused by **β -hemolytic streptococci** ((Nonbullous) and, or staphylococcus aureus “bullus”(rarely alone)



Characteristics:

- **Systemic symptoms** are usually **absent**.
- Consists of discrete purulent lesions
Blister if it rupture, it's produce fluid (honey cust
- Exposed areas of the body(**face and extremities**)
- Skin colonization- Inoculation by **abrasions, minor trauma, or insect bites**
- Poststreptococcal glomerulonephritis*.
- (anti-DNAse B) : (antideoxyribonuclease B) ; if there is a lot of AntiDNAse in the test then it means he have impetigo .

Treatment:

- Cefazolin: covers Both Staphylococcus and streptococcus.
- Cloxacillin: covers Staphylococcus only
- Erythromycin: covers streptococcus only
- Mupirocin : It may lead to immune complication in some cases.

If patient has cellulitis,
1st drug you think of
= Cefazolin

*Group A streptococci are sensitive to penicillin
Pyoderma : skin disease that is pyogenic (has pus).
Bullous: Involves the formation of bullae (blisters).

Cutaneous abscesses.

- Collections of pus within the dermis and deeper skin tissues.
- Typically **polymicrobial** (caused by several types of microorganisms) **S. aureus** alone in ~ 25 %



Characteristics:

- Painful, tender, and fluctuant
- **Multiple lesions:**
- cutaneous gangrene.
- severely impaired host defenses.
- extensive surrounding cellulitis.
- high fever.

Diagnosis:

- Gram stain, culture and systemic antibiotics

Treatment:

- Incision and evacuation of the pus. (فتح الخراج واستخراج الصديد منه)
- **Antibody: Cloxacillin (S.Aureus only)**

Furuncles and carbuncles



- **Furuncles** (or “boils”) are infections of the hair follicle (folliculitis), usually caused by *S. aureus*, in which suppuration extends through the dermis into the subcutaneous tissue. One or separated hair follicles.
- **Carbuncle:** extension to involve several adjacent follicles with coalescent inflammatory mass. Present in back of the neck, especially in diabetics.
- usually caused by *S. aureus*

Characteristics:

- extends through the dermis into the **subcutaneous tissue** (so it is Deeper than **Cutaneous abscesses.**)
- Carbuncle present in the **back of neck** especially diabetes patients

Treatment:

- Larger furuncles and all carbuncles **require incision and drainage.**
- **Mupirocin ointment:** eradicate staphylococcal carriage and nasal colonization.
- **Systemic** antibiotics are usually **unnecessary**

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 nares- 20-40%

إذا فيه إصابة في العائلة راح تاخذهم
كلهم وتاخذ منهم
Nose swap
وتشوف مين يحمل البكتيريا وتسوي له
Decolonization
وتعطيه معقمات ، للاستحمام مثلا
+ topical antibiotics

Erysipelas and 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

- Affects the upper dermis (raised-clear line of demarcation)
- Red, tender, painful plaque
- Infants, young children-

❑ Caused by:

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

❑ Treated by:

- Penicillin-IV or oral.



- Well Demarcated
- Swelling
- Edema
- Redness

- Erysipelas: in the whole epidermis and dermis and it is caused mainly by group A streptococci

Cellulitis

Acute spreading infection involves the deeper **dermis** and **subcutaneous** tissues.

Caused by:

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



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

CA-MRSA (Community Associated MRSA):

- Carry Panton-Valentine leukocidin gene
- More sensitive to antibiotics
- Can lead to severe skin and soft tissue infection or septic shock



Cellulitis



Clinical diagnosis Symptoms and Signs:

- 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:

- cover streptococcus and staphylococcus
- Penicillin, cloxacillin, **cefazolin (cephalexin)**, clindamycin
- Vancomycin or linezolid in case of MRSA
- Clindamycin, TMP-SMZ for CaMRSA

Summary

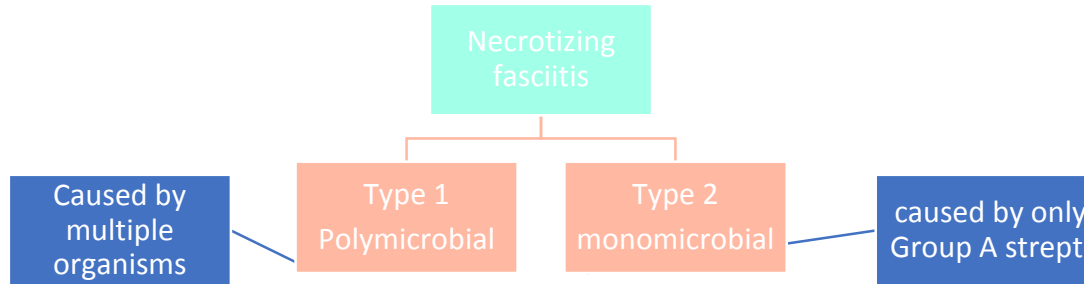
	Erysipelas	Cellulitis (Acute spreading)
Affects	The Upper Dermis (Epidermis) (Raised-clear Line Of Demarcation)	The Deeper Dermis And Subcutaneous Tissues
Caused by	<ul style="list-style-type: none"> - B-hemolytic Streptococci (Group A) - S. Pyogenes 	<ul style="list-style-type: none"> - B-hemolytic Streptococci (A&b-diabetics) - S. Aureus : Commonly Causes Cellulitis - Haemophilus Influenzae in Children
	Well Demarcated, Edematous.	Not Demarcated
Affects	Infants, Young Children	All Ages
Clinical presentation	<u>VERY RED, Tender, Painful Plaque</u>	Tenderness And Redness That Spreads To Adjacent Sk
Treatment	Penicillin: IV Or Oral	Penicillin, Cloxacillin, Cefazolin (cephalexin)

Basically, the most important things you must know so far is that:

- 1- Impetigo and the rest of diseases are caused by both staphylococcus aureus and streptococcus.
- 2- Folliculitis is caused by staphylococcus aureus.
- 3- Erysipelas is caused by Group A streptococci. (This group could cause sore throat and pharyngitis).

Necrotizing fasciitis (Flesh-eating disease)

- It is a rare deep skin and subcutaneous tissues infection



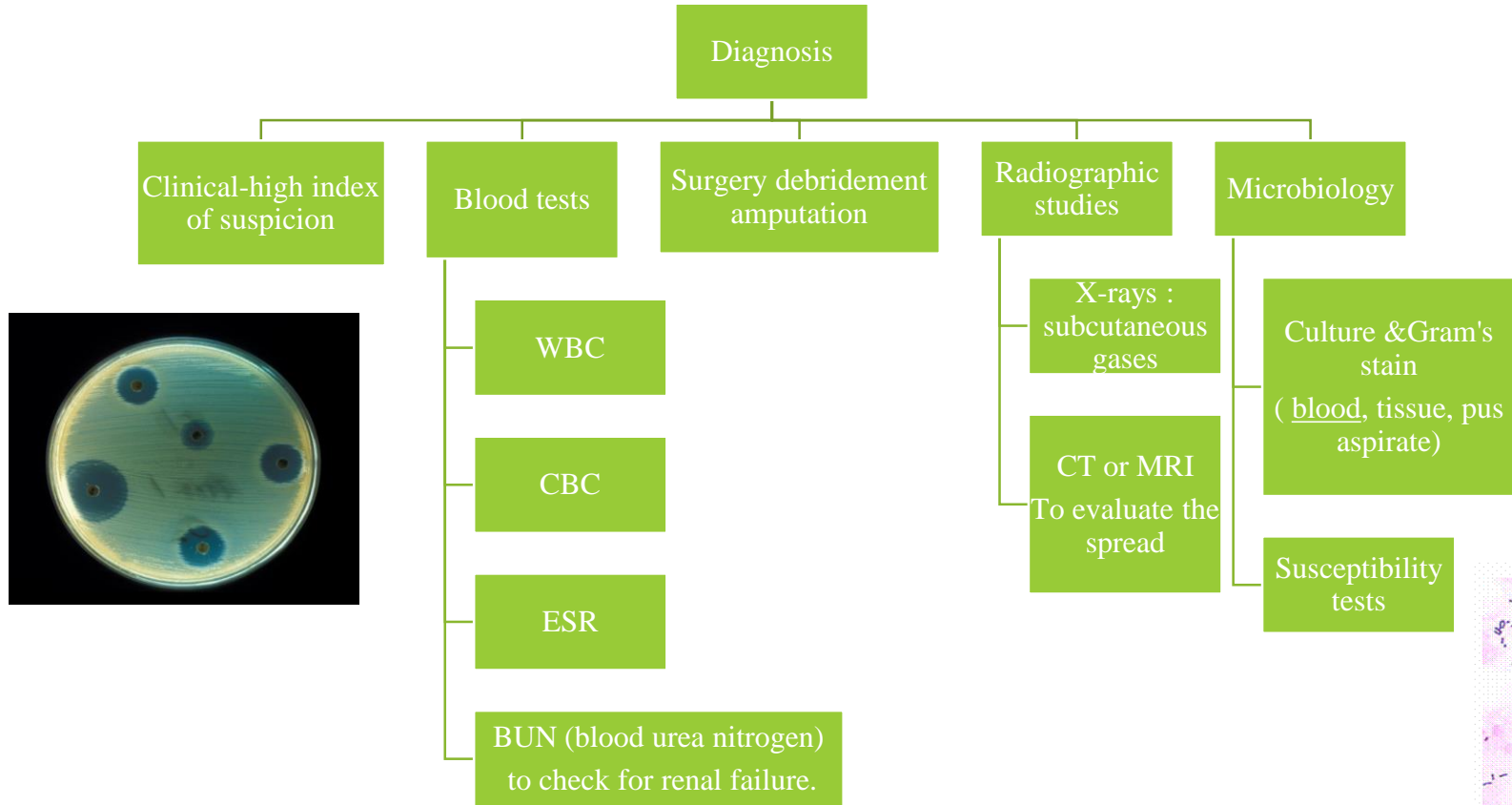
- Most common in the arms, legs, and abdominal wall and is fatal in 30%-40% of cases.
- Fournier's gangrene (testicular), Necrotizing cellulitis
- Mortality as high as 73 % if untreated



Causing microbes:	Risk factors	Pathophysiology	Signs and symptoms
<ul style="list-style-type: none"> Group A streptococcus <p>It produces toxins that causes a septic shock</p> <ul style="list-style-type: none"> Clostridium perfringens (gas in tissues) <p>It's a normal flora of the GI</p> <p>-A wound can causes the Clostridium perfringens to spread in other tissues</p> <p>-It has a high virulent factor we call it {Phospholipase} which causes a necrosis of the fascia of the muscle ,it can lead to Death due to hypotension.</p> <ul style="list-style-type: none"> Staphylococcus aureus or CA-MRSA (Streptococcus pyogenes) Bacteroides fragilis Vibrio vulnificus (liver function) Gram-negative bacteria (synergy). <ul style="list-style-type: none"> E. coli, Klebsiella, Pseudomonas Fungi 	<ul style="list-style-type: none"> -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 	<p>Destruction of skin and muscle by releasing toxins</p> <ul style="list-style-type: none"> Streptococcal pyogenic exotoxins Superantigen <ul style="list-style-type: none"> Non-specific activation of T-cells Overproduction of cytokines Severe systemic illness (Toxic shock syndrome) <p>كلام د الصميلي:</p> <p>Edema will press on the nerves (causing a severe pain) and blood vessels which will lead to necrosis and death of the supplied tissue</p>	<ul style="list-style-type: none"> 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) Mortality as high as 73% if left untreated Shock organ failure Hypotension

Diagnosis of Necrotizing fasciitis

➤ A delay in diagnosis is associated with a grave prognosis and increased mortality to check for renal failure



Treatment of Necrotizing fasciitis

If clinically suspected patient needs to be hospitalized OR require admission to ICU.

Start intravenous antibiotics immediately.

Antibiotic selection based on bacteria suspected

broad spectrum antibiotic combinations against:

- methicillin-resistant *Staphylococcus aureus* .(A)
- anaerobic bacteria.
- Gram-negative and gram-positive bacilli.

1. Antibiotics combinations:

- **Penicillin-clindamycin**-gentamicin.

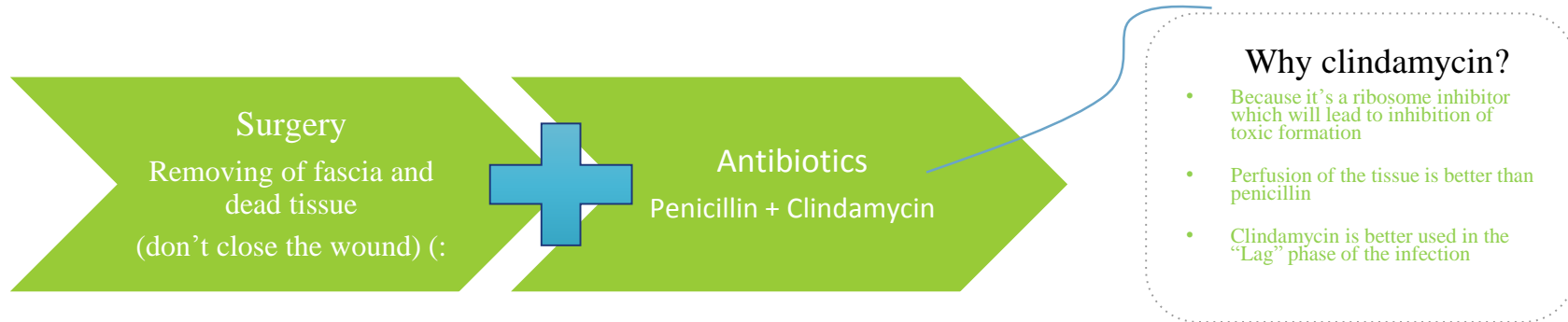
(Given together, and they're the most important)

- Ampicillin/sulbactam.
- Cefazolin plus metronidazole.
- Piperacillin/tazobactam.
- *Clostridium perfringens* - penicillin G.

2. Hyperbaric oxygen therapy (HBO) treatment.

Surgeon consultation:

- Extensive Debridement of necrotic tissue and collection of tissue samples.
- Can reduce morbidity and mortality.



Pyomyositis:

Definition: Acute bacterial infection of **skeletal muscle**, usually caused by **Staph. Aureus**.

- No predisposing penetrating wound, vascular insufficiency or contiguous infection.
- Most cases occur in the **tropics** (الدول الاستوائية).
- 60% of cases outside of tropics have predisposing risk factors (RF):

Diabetes mellitus, ethyl alcohol, liver disease, steroid prescriptions, HIV, hematologic malignancy.

History:

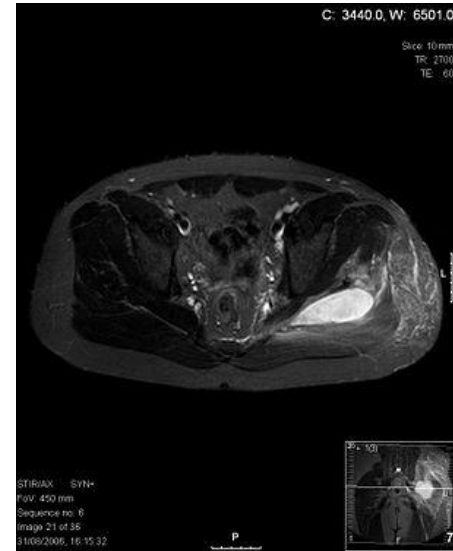
- Blunt trauma or vigorous exercise (50%), then period of **swelling without pain**.
- 10-21 days later : pain, tenderness, swelling and fever.
- Pus can be aspirated from muscle.
- 3rd stage: sepsis, later metastatic abscesses if untreated.

Diagnosis:

X-ray, US, MRI or CT.

Treatment:

Surgical drainage and antibiotics.



Other Specific Skin Infections

Epidemiology	Common Pathgen(s)	Therapy
Cat/Dog Bites	<i>Pasturella 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
Fresh water 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

- 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 of the infections are mild and can be managed on an outpatient basis. In case
- 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.

Quiz



Please take a look at
team 436 SAQ

1- Which of the following organisms cause gas in tissue ?

A- s.aureus B- c.perfringens C- group A streptococcus D- E.coli

2- Which of the following diseases are treated with penicillin?

A-Erysipelas B-cellulitis C-Necrotizing fasciitis D-impetigo

3- Known as flesh eating disease?

A-Erysipelas B-cellulitis C-Necrotizing fasciitis D-impetigo

4- Which of the following is the best treatment for necrotizing fasciitis?

A-penicillin with clindamycin B-surgery C-ampicillin D-metronidazole

5- Which of the following diseases are localized in the epidermis ?

A-Erysipelas B-cellulitis C-Necrotizing fasciitis D-impetigo

6- Which of the following diseases cause infection to the skeletal muscle?

A-Erysipelas B-pyomyositis C-Necrotizing fasciitis D-impetigo

1- B, 2- A, 3-C, 4-B, 5-A, 6-B

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Some videos for understanding the lecture:

- 1- Impetigo <https://www.youtube.com/watch?v=hQ9xv2cTAyw>
- 2- abscesses <https://www.youtube.com/watch?v=pL6rP8C1e7w>
- 3- MRSA https://www.youtube.com/watch?v=tI7aXjgy_Vk