Surgical infections and antibiotics

Objectives:

1. Pathogenic potential of microbes.
2. Asepsis.
3. Surgical infection.
4. Anaerobic infection.
5. Hospital-acquired (nosocomial) infections.
6. Antimicrobial management of wound infections.
7. Principles governing the choice and use of antibiotics.
8. Management of immunosuppressed patients, including those who have had splenectomy.

Resources:

- Davidson's.
- 436 doctor's slides.
- 435' team work.
- surg wiki.
- wikipedia

Done by: Lujane Alzaid, Jawaher Abanumy, Mazyad Alotaibi, Lara Alsaleem

Leaders: Heba Alnasser, Rania Alessa, Mohammed Habib, Mohammad Almutlaq

Revised by: Maha AlGhamdi.

Color index:

Notes , Important , Extra , Davidson's

Editing file

Feedback

Introduction:

- Surgical infections occur because of a breakdown of the equilibrium that exists between organisms and the host. This may be due to a breach in a protective surface, changes in host resistance, or particular characteristics of the organism. The possible outcomes are resolution, abscess formation, extensive local spread with or without tissue death, and distant spread.

What is an infection?

- **Infection** is invasion of the body by pathogenic microorganisms and reaction of the host to organisms and their toxins.
- **Surgical infections**: Infections that require surgical intervention as a treatment or develop as a result of surgical procedure.
    - o A major challenge
    - o Account for 1/3 of surgical patients
    - o Morbidity and mortality (e.g. septicemia due to post-op infection), Increase cost of health care (longer hospital stays)

Principles Of Treatment:

1. **Drainage:** for abscess, or infected fluid
2. **Excision:** infection source (e.g. appendectomy)
3. **Debridement:** remove necrotic, injured tissue
4. Supportive measures:
    a. Antibiotics
    b. Immobilization (if in a limb)
    c. Limb elevation (to avoid fluid collection)

A case mentioned by the doctor at the beginning of the lecture

A woman, diagnosed with lung cancer with widespread metastasis received chemotherapy and became very fragile. She presented to the hospital with tachycardia (140) and subpleural effusion. Echo was normal, no cardiac issues. They drained the pleural effusion but she was still tachycardic. White cell count was normal. They thought maybe it's a side effect so they stopped medication, but she was still tachycardic. No clear source of the tachycardia. It turns out she was septic (she had a bad infection in her urine) but she was not showing off the regular signs of sepsis (fever or white count) because she was immunocompromised from the illness and chemotherapy. As soon as they started Meropenem her heart rate went down to 90 then 80.

Runners have a baseline of 50 so when they are tachycardic they will be 90.

An old man on 3 antihypertensive medications resting at home might have a baseline might be 120.

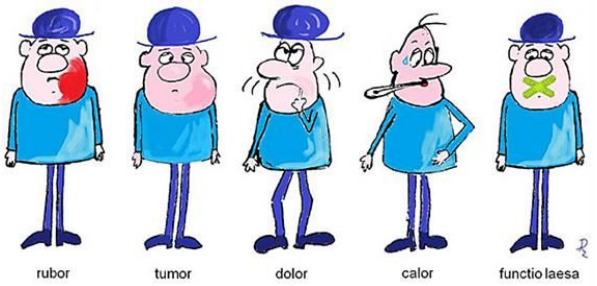
Surgical Infections[1]

Infection is defined by:

- Microorganisms in host tissue or the bloodstream
- Inflammatory response to their presence.

Types of Inflammatory Response:

- **Localized:** The four classical signs of inflammation:
  - Dolor (pain)
  - Calor (heat)
  - Rubor (redness)
  - Tumor (swelling)
  - Functio laesa (loss of function)



Sepsis …

infection> invasion > response > sepsis > septic shock

depending upon severity

يصير لما الانفيكشين يكون مره كبير هي تصير يا اما يكون المايكرو اورجانيزم مره قوي او ردة الفعل اكساجيريتيد بسبب ضعف في السيستم زي الديابيتك فوت او اميون كومبيتينت

:septic shock

(presence of organ damage (the name depends upon the cause

- **Systemic**: Systemic Inflammatory Response Syndrome (**SIRS**):

Defined as **Two** or more of the Following Criteria:

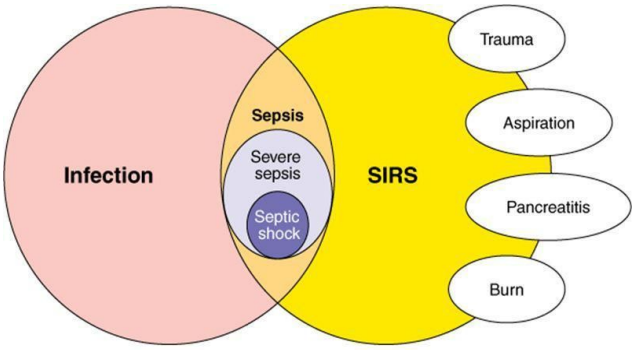
- Temperature: < 36.0 (hypothermia) or >38.0 (hyperthermia)
- Heart Rate : >90 (tachycardia can be the first early reliable sign of sepsis, BUT it can be masked by drugs such as beta blockers or CCB)
- Respiratory Rate: >20 (tachypnea)
- WBC: <4,000 (leukopenia) ,>12,000 (leukocytosis)

Clinical note for your information: When you check on a patient and view his white blood cells count you have to check the left shift first, because for example the patient's baseline is 9000 and the reading is 11000 it is still within the average normal range but for this patient it is considered elevated considering his normal baseline count. Keep in mind that the heart rate and blood pressure can also be different, so check the patient's baseline first.

clinical info.:

نقص او زيادة خلايا الدم البيضاء تعتبر مؤشر لوجود مشكلة لما يكون افريج الشخص الطبيعي 9 الاف ويسوي تحليل ويلاقيها 11 (على الرغم من كون الرقم في حدود الطبيعي) نبدأ نخاف لانه مو هذا الرقم الطبيعي لجسم الشخص

[1] it has two types: pt who undergone surgical procedure or pt with sepsis who require a surgery (management)

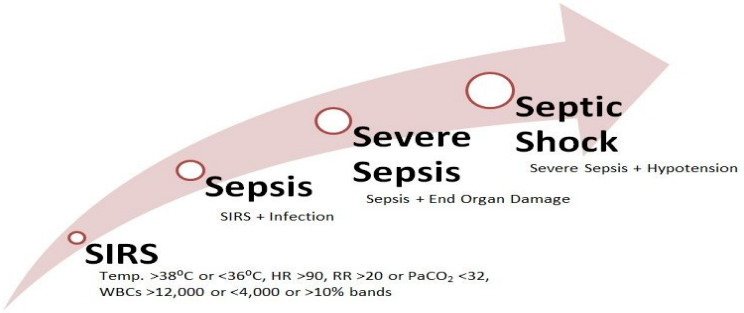


SIRS is not only due to infection. It is a reaction; an inflammatory cascade due to insult. The insult may be an infection or burn, or presence of a foreign body (example: aspiration: which is a presence of food in the bronchus causing chemical irritation.

Sepsis	SIRS + evidence of local or systemic infection
Septic Shock [2]	Sepsis + end organ **hypoperfusion** **(end organ damage)**. **Mortality of up to 40%.**

Spread Of Surgical Infections:

- direct:
  - necrotizing infection
  - abscesses
  - phlegmons[3] and superficial infections
- via the lymphatic system
- via blood stream



[2] **shock** means organ damage. depending upon the type of shock we give its name.
[3] **Phlegmon** is a spreading diffuse inflammatory process with formation of purulent exudate (the suppuration of pus).

Soft tissue infections

Cellulitis:

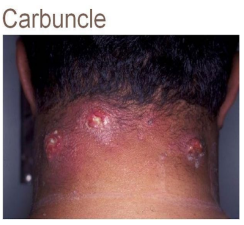
- **Diffuse** infection with severe inflammation of dermal and subcutaneous layers of the skin commonly in the limbs.
- Sx: Pain, Warmth, Hyperesthesia
- Treatment: Antibiotics. (oral or IV, depending on your judgement of how sick the patient is)
  - Rest, limb elevation
  - Penicillin, Erythromycin
  - Flucloxacillin (if staph. suspected)
- Common Pathogens: Skin Flora (Streptococcus/Staphylococcus)



  - Picture 1: Diffuse redness, shiny and swelling, painful and warm bilateral in the anterior surface of lower limbs. (Clear signs of inflammation).
  - Picture 3: Mark the edges of the swelling to monitor the response of antibiotics.
  - sometimes it can have a small localized abscess which should be drained.

Furuncles And Carbuncles:

- Furuncles and carbuncles are **localized** cutaneous abscesses that begin in skin glands and **hair follicles ,** respectively.
- If the pilosebaceous apparatus[4] becomes obstructed at the skin level, the development of a furuncle can be anticipated
- A carbuncle is a deep – seated mass of fistulous tracts between infected hair follicles. (**multiple**)
- Furuncles are the **most common** surgical infections, but carbuncles are **rare**
- Treatment:
  - The classic therapy of furuncle is incision & **drainage**.
  - Invasive carbuncles must be treated by excision and antibiotics.



Cellulitis + Furuncles And Carbuncles share the same causative normal flora, but in cellulitis the infection went deeper.

[4] The structure consisting of hair, hair follicle, arrector pili muscles, and sebaceous gland is an epidermal invagination known as a pilosebaceous unit.

Hidradenitis: التهاب الغدد العرقية


- Recurrent Serious skin infection/inflammation of the axillae or groin (in the body folds) Consisting of multiple abscesses of the **apocrine sweat glands.**
- The condition often becomes chronic.
- The cause is **unknown** but may involve a defect of terminal follicular epithelium.
- Infection > huge inflammatory response[5] > spontaneous scarring (Repeated infection and fistula formation)
- It happens in any folded hairy area, Scarring, irregular brownish vacuoles and patchy discoloration, forming scars which can affect movement of joint.
- We treat the infection and suppress the inflammation.

Abscess:


- Definition: Infectious accumulation of purulent material (Neutrophils) in a **closed cavity,**
- Sx: Fluctuant: Moveable and compressible
- Treatment: Drainage.
- An abscess is a good thing for the patient because it means the body is fighting the infection or injury and trying to keep it localized. So, we simply drain the abscess and the patient will be relieved.
- Localized collection of pus.
- Superficial on the trunk, head and neck > S. aureus, (less commonly streptococci)
- In the axillae > gram-negative
- On the perineum > mixed aerobic & anaerobic gram-ve
- Abscess may be mistaken for cellulitis when located deep

Diffuse Necrotizing Infection:

- Particularly dangerous.
- Risk factors: elderly, diabetic, immunosuppressed
- Difficult to diagnose, extremely toxic, spread rapidly, often leads to limb amputation
- Pathogenic factors
  - Anaerobic
  - wound Bacterial exotoxins
  - Bacterial synergy
  - Thrombosis of nutrient bridging vessels

- Starts as cellulitis > edema > systemic toxicity > shock
- Appears less extensive than actual necrosis
- Investigation: aspiration, Gram's stain, CT, MRI
- **Sites**:
  - o Limbs
  - o Perineum/genitalia (Fournier's gangrene).
  - o Abdominal wall (Meleny's)
  - o Trunk (in elderly, diabetics, immunosuppressed)

- The causative bacteria may be aerobic, anaerobic, or mixed flora.

A) NON-clostridial;
  - Type I, polymicrobial (synergistic bacterial gangrene)
  - Type II, single organism (group A streptococcal)

B) Clostridial
  - gas gangrene (aka clostridial myonecrosis)

[5] immunosuppressant is an option in treatment

Classification of Diffuse Necrotizing infections

Clostridial Infections	Non-clostridial Infections
➔ Necrotizing **cellulitis** ➔ Myositis ● They are fastidious anaerobes, ● gram+ve, large, rod-shaped bacteria, ● A broad spectrum of diseases is caused by clostridia	➔ Necrotizing **fasciitis** ➔ streptococcal gangrene ● Caused by multiple nonclostridial bacteria. ● Microaerophilic streptococci, staphyloccci, aerobic gram-negative bacteria, and anaerobes, especially peptostreptococci and bacteroides.

Clinical Findings

○ **Crepitant**[6] (subcutaneous gas) abscess or cellulitis. ○ Invasion is usually superficial to the deep fascia and may spread very quickly (very **virulent** pathogen), producing discoloration. ○ Delayed debridement of injured tissue after devascularization injury is the common setting. ○ Example: a 50 y/o diabetic patient steps on a fork and within an hour he has redness spreading from his foot until his thigh area, but no other signs of SIRS. This is gangrene NOT cellulitis! because it is very rapid. If he presents after 2 days or more then this is more likely cellulitis.	○ Usually begins in a localized area such as a puncture wound, leg ulcer, or surgical wound. ○ Externally, hemorrhagic bullae are usually the first sign of skin death. ○ The skin is anesthetic and crepitus is occasionally present. ○ The fascial necrosis is usually wider than the skin appearance indicates. ○ At operation, the finding of edematous, dull-gray, and necrotic fascia and subcutaneous tissue confirm the Dx.

Examples

❖ **Gas Gangrene (myositis)**	❖ **Streptococcal gangrene** (Uncommon)
● Severe pain suggests extension into muscle compartments (myositis) ● The disease progresses rapidly (within 20 min), with loss of blood supply to the infected tissue. ● Profound shock can appear early, rapidly leading to organ dysfunction. ● Air bubbles often visible on plain radiograph ● Crepitus may be present, but not reliable to differentiation.	● **Group A** streptococcus is a bacterium frequently found in in the skin and throat. ● The sudden onset of severe pain is the most common presenting symptom, usually in an extremity associated with a wound. ● Fever and other signs of systemic infection are frequently present at the time of presentation. ● Shock and renal dysfunction are usually present within 24 hours.

General Treatment for Necrotizing Fasciitis

○ **Complete debridement** and "depress tight fascial compartment[7]".
○ Adequate debridement is the first step in management of wounds to avoid infection.
○ Amputation in peripheral area (limb).
○ Broad-spectrum antibiotic therapy Penicillin, clindamycin,metronidazole (in case of clostridial infection)
○ Resuscitative therapy, IV fluids
○ Treat diabetes mellitus aggressively
○ Hyperbaric oxygenation, inhibit bacterial invasion but does not eliminate the focus of infection.
o IV antibiotics (broad spectrum: ampicillin, cephalosporins, clindamycin, metronidazole, aminoglycosides)
o Surgical: repeated debridement , dressings, skin grafting

[6] you can feel air below the wound
[7] "Nonadherent compressive dressings"

Necrotizing Soft Tissue Infection[8]



Diffuse discoloration in background of redness and patchy blue and black area, undemarcated edges with swelling and desquamation to skin

Fournier gangrene: a special form of necrotizing fasciitis in the **genital area**, we see it in diabetic patients. High mortality (60-70%) -**VERY IMPORTANT-**

Gas Gangrene

Description of the image: there is redness and swelling. But the redness here is more congested and there are areas of dark blue/black.

You have to differentiate between cellulitis and gangrene.
The cardinal sign for gangrene is the presence of bulla (arrow).
Bacteria is very virulent and produces gas which dissects the tissue **(gives crepitus)** and **spreads rapidly.**

Gangrene is worse than cellulitis, and cellulitis is worse than abscess.

[8] brown= dead/ischemic

Postoperative Infections

- Fever After Surgery (a fever is the result of cytokines, and they can be released for many reasons)
- What is the cause? look for The "**Five W's**"
    1. **W**ind: Atelectasis (partial or complete collapse of the lung) (SIRs) in the airways, due to endotracheal intubation (ventilator).
    2. **W**ater: UTI (infection) from catheters.
    3. **W**alking: DVT (SIRs)
    4. **W**onder Drug: Medication Induced (SIRs)
    5. **W**ound: Surgical Site Infection (infection): There was an injury to the tissue, even if it was a planned injury the patient may develop fever as part of SIRS.

  Example: A 20 y/o immunocompetent patient develops a fever (38 degrees) one day post-hemithyroidectomy. No redness or hotness around the surgical wound, normal HR and slight elevation in white cell count (13000). What do you do? We observe the patient for 24 hrs. If there are no other signs, then this is NOT a post-op infection.

  Example: A 50 y/o diabetic, hypertensive and obese patient with renal failure and is on renal dialysis. The surgery was complicated by injury to the trachea that was repaired. Patient started to develop high fever and has deep localized pain. White cell count is high and blood pressure is borderline. What is happening? Deep post-op infection, we need to do imaging. If there is an abscess we drain it and give antibiotics if needed.

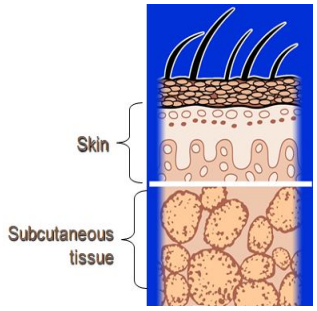
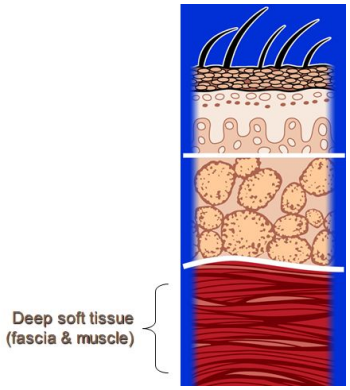
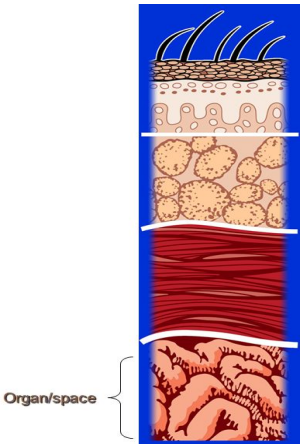
Surgical Site Infections[9] (SSI)

- All surgical wounds are contaminated by microbes, but in most cases infection does not develop because of innate host defences. A complex interplay between host, microbial, and surgical factors ultimately determines whether infection takes hold and how it progresses
- **3rd most common hospital infection** **(Detailed in the schedule below)**

- **Characteristic:**
    - Systemic and local signs of inflammation
    - Infection within 30 days after operation
    - Infection within 1 year if prosthetic device used (e.g. vascular graft, artificial heart valve, or mesh for hernia repair)
    - Bacterial counts ≥ 10^5 cfu/mL
    - Purulent or nonpurulent
    - The length of stay (LOS) effect
    - Economic effect

[9] used to be called Surgical wound infection

- **Classified into:**

incisional		organ/space SSI (30%)
Superficial SSI (50%)	**Deep SSI** (20%)	
involves only the skin or subcutaneous tissue. Infection occurs within 30 days after the operation.	involves the deep soft tissue, which include the fascia and muscle layers. Infection occurs within 30 days after the operation if no implant is in place or within 1 year if implant is in place and the infection appears to be related to the operation and the infection involves deep soft tissue (e.g. fascia and muscle layers).	involves any part of the anatomy, other than the incision. • **generalized** (peritonitis). • **abscess.** Infection occurs within 30 days after the operation if no implant is in place or within 1 year if implant is in place and the infection appears to be related to the operation and the infection involves any part of the anatomy, other than the incision, which was opened or manipulated during the operation.
		
Treatment		
open surgical wound and drainage, antibiotics for cellulitis or sepsis		Source control[10], antibiotics for sepsis
diagnosis		
erythema, edema, discharge and pain (take a swab of any discharge)	no local signs, fever, pain, hypotension. Needs investigation (e.g. CBC, blood & urine cultures, CXR, CT scan)	—

- **Risk factors:**

There are things we can control and things we can't (such as old age). Before surgery if a patient has DM we should try to control it first, also if the patient is obese we encourage them to lose weight before the surgery. But if it's an emergency surgery we don't have the time to correct them and we proceed with the surgery, even if there are risk factors.

  - **Operation factors:** Duration of surgical scrub, Maintaining body temperature, Skin antisepsis, Preoperative shaving, Duration of operation, Antimicrobial prophylaxis, Operating room ventilation, Inadequate sterilization of instruments, Foreign material at surgical site, Surgical drains, Surgical technique (poor hemostasis, failure to obliterate dead space, tissue trauma).

[10] e.g. Abscess

- **Patient characteristics:**
  - Age.
  - Diabetes: HbA1C and SSI, glucose > 200 mg/dL post-operative period (<48 hours).
  - Nicotine use: delays primary wound healing.
  - Steroid use: controversial.
  - Malnutrition: no epidemiological association.
  - Obesity: 20% over ideal body weight.
  - Prolonged preoperative stay: surrogate of the severity of illness and comorbid conditions.
  - Preoperative nares colonization with Stapylococcus aureus: significant association.
  - Perioperative transfusion: controversial.
  - Coexistent infections at a remote body site.
  - Altered immune response.

Influence of pre-operative shaving on SSI:

Shaving the surgical site with a razor induces small skin lacerations, causing a potential sites for infection, disturbs hair follicles (which are often colonized with S.aureus).
The risks are greatest when done the night before the operation, that's why patient education is important! be sure patients know that they should not do you a favor and shave before they come to the hospital!

Group	No Hair Removal	Depilatory	Shaved
Number	155	153	246
Infection rate	0.6%	0.6%	5.6%

- **Causative organisms:**
  - **S. aureus** is the most common organism
  - **E coli, Enterococcus & other Enterobacteriaceae** deep infections
  - **B. fragilis** intra-abdominal abscess

• Types Of Surgery: The doctor said it is a super important table :

Classes		Site	Infection
I	**Clean**[11]	hernia repair, breast biopsy and Thyroid surgery	1.5 %
II	**Clean-contaminated**[12]	Cholecystectomy, planned bowel resection	2-5 %
III	**Contaminated**[13]	Unprepared bowel resection -better give a prophylactic antibiotic-	5-30 %
IV	**Dirty/Infected**[14]	perforation (content of bowel/ feces in the peritoneal cavity) , abscess	5-30 %

for example : A 35-year-old woman undergoes an elective laparoscopic **cholecystectomy** for symptomatic cholelithiasis. Which of the following wound classes best describes her procedure?
Answer : class II clean-contaminated
if the rate of infection goes above average, the surgeon may be questioned as there may be a problem with the sterilization or the performance.

Occupational Blood Borne Virus Infection -getting an injury during work by mistake-			
Virus	HBV	HCV	HIV
Risk from needlestick	30%	2%	0.3%
Chemoprophylaxis	Yes	No	Yes
Vaccine	Yes	No	No

when HIV transmission is susceptible, we start chemoprophylaxis immediately
the infection of HCV is more critical than HBV because it **doesn't** have chemoprophylaxis nor vaccine

[11] The area I'm working on is sterile and I only have to deal with normal flora, so there should NOT be an infection.
[12] The area is clean but there is a risk the bile will spill and contaminate the area.
[13] The area is contaminated so a certain percentage of post-op infections can happen.
[14] The area is filled with microbes & some surgeons won't even scrub for cases like this because they say they're "cleaner than this area"

Prophylactic Antibiotic

Antibiotics given for the purpose of preventing infections when infection is not present but the risk of postoperative infection **is** present. We give one dose before surgery when required (depending on the patient and the type of surgery).

You need to ask yourself these Qs before giving them:

- Which cases benefit?
- Which drug should you use?
- When should you start?
- How much should you give?
- How long should antibiotics be continued?

Surgical Site Prevention

- Use antibiotics appropriately
- Maintain normal body temp
- Maintain normal blood glucose
- Optimize oxygen tension
  أو إذا جتني وحدة ورنها زايد اقول لها تنزله قبل العملية (يعني انا optimizing أي شيء أقدر أتحكم فيه)
- Avoid shaving site

Types of inflammatory responses:

1.Localized.

2.Systemic inflammatory response Syndrome (SIRS): Defined as Two or more of the following criteria:

- Temperature: <36 or >38
- Heart rate: >90
- Respiratory rate: >20
- WBC: <4,000 or >12,000

Soft tissue infections:

A. **Cellulitis:** Diffuse infection with severe inflammation of dermal and subcutaneous layers of the skin. Diagnosis: Pain, warmth, hyperesthesia. **Treatment:** antibiotics. Common pathogens: skin flora (streptococcus/staphylococcus)
B. **Furuncles and Carbuncles:** are cutaneous abscesses that begin in skin glands and hair follicles. Furuncles are the most common surgical infections. **Treatment** of furuncles is incision & drainage and **carbuncles** must be treated by excision and antibiotics.
C. Hidradenitis : skin infection of the axillae or groin Consisting of multiple abscesses of the apocrine sweat glands. The condition often becomes chronic. **Treatment :** usually an antibiotic & drainage of the individual abscess
D. Abscess: Infectious accumulation of purulent material (Neutrophils) in a closed cavity. Sx: Fluctuant: Moveable and compressible. **Treatment:** Drainage.

Diffuse Necrotizing infections:

1. **Clostridial Infections** :
   - Necrotizing cellulitis.
   - Myositis.

They are fastidious anaerobes, gram+ve, large, rod-shaped bacteria . **Clinical Findings :** Crepitant abscess or cellulitis , Invasion is usually superficial to the deep fascia and may spread very quickly,producing discoloration.

2. **Non-clostridial Infections** :
   - Necrotizing fasciitis.
   - Streptococcal gangrene.

Caused by multiple nonclostridial bacteria. Microaerophilic streptococci, staphyloccci, aerobic gram-negative bacteria, and anaerobes, especially peptostreptococci and bacteroides . **Clinical Findings :** Usually begins in a localized , hemorrhagic bullae are usually the first sign of skin death. The skin is anesthetic and crepitus , At operation, the finding of edematous, dull-gray, and necrotic fascia and subcutaneous tissue , The fascial necrosis is usually wider than the skin appearance indicates .

Treatment: Prevention: wound debridement, IV antibiotics (penicillin) , T toxoid: if previously immunized and booster taken >10 years ago .

Surgical Site Infections (SSI) :

3rd most common hospital infection , **Characteristic** : Systemic and local signs of inflammation , Infection within 30 days after operation , Infection within 1 year if prosthetic device used (e.g. vascular graft, artificial heart valve, or mesh for hernia repair) , Bacterial counts ≥ 105 cfu/mL , Purulent or nonpurulent , Economic effect .

A. **Superficial Incisional SSI** : involves only the skin or subcutaneous tissue. Infection occurs within 30 days after the operation

B. **Deep Incisional SSI** : involves the deep soft tissue, which include the fascia and muscle layers. Infection occurs within 30 days after the operation or within 1 year if no implant is in place .

C. **Organ/Space SSI** : involves any part of the anatomy, other than the incision

- Generalized
- Abscess

Infection occurs within 30 days after the operation or within 1 year if implant is in place and the infection appears to be related to the operation and the infection involves any part of the anatomy, other than the incision.

Treatment : open surgical wound and drainage, antibiotics for cellulitis or sepsis , Source control, antibiotics for sepsis

Diagnosis: erythema, edema, discharge and pain (take a swab of any discharge)

1. A 21 y/o male patient presents with pain in the left leg due to trauma while playing sports. Examination reveals diffuse redness and warmth of the skin around the site of trauma. Which is the most likely organism causing this infection?
    A. Corynebacterium.
    B. Clostridium perfringens.
    C. Staphylococcus aureus.
    D. Micrococcus.

Answer: C

2. A 30 y/o female presents with a large, red and painful nodule with a central opening filled with pus on the nose. What is the best approach to treat her?
    A. Excision.
    B. Incision followed by drainage.
    C. Excision followed by antibiotics.
    D. Drainage followed by antibiotics.

Answer: B

3. A 29 y/o female presents with painful, abscess containing, pea-sized lumps in the axillary region. What other regions could be affected?
    A. Abdomen and groin.
    B. Under the breasts and between buttocks.
    C. Under the breasts and abdomen.
    D. Between the buttocks and behind the neck.

Answer: B

4. A 27 y/o male came to the ER after sudden onset of pain in the leg during a hiking trip. On examination, the doctor found an ulcer between the toes and some dark discoloration of the skin. Upon further investigation, crepitus is positive and gram-negative bacteria was seen under the microscope. What's the most likely diagnosis?
    A. Necrotizing cellulitis.
    B. Myositis.
    C. Necrotizing fasciitis.
    D. Clostridial infection.

Answer: C

5. A 55 y/o man with a history of coronary artery disease and diabetes mellitus will undergo elective coronary artery bypass graft surgery. His last hemoglobin A1c value was 7.8% and his plasma glucose level 2 hours prior to scheduled surgery was 239 mg/dl (13.2 mmol/L). Hemoglobin is 11.9 g/dL. Which of the following interventions will most likely contribute to a decreased risk of surgical site infection for this patient?
    A. Blood transfusion.
    B. Maintenance of operative hypothermia.
    C. Mupirocin nasal ointment at the time of anesthesia.
    D. Preoperative intravenous insulin therapy.

Answer: D

6. An 11 y/o girl is brought to the emergency department with a 2 day history of right sided abdominal pain, fever and vomiting. After further investigations, it was apparent that the patient has acute appendicitis and an appendectomy must be done. What is the classification of this surgical procedure?
    A. Clean.
    B. Clean-contaminated.

C. Contaminated.
D. Dirty/infected.

Answer: B

7. A 48 y/o female in good health undergoes abdominal hysterectomy and develops a fever of 38.7C on post-op day 1. She remains febrile on day 2 and develops minimal pain at the incision site but is hemodynamically stable. Upon examination, there's no redness or heat around the surgical wound. Laboratory shows WBC of 10500. What's the most likely cause of the fever?
    A. Atelectasis.
    B. UTI.
    C. Pneumonia.
    D. Wound infection.

Answer: A