Pathology

INFLAMMATION

LECTURE (1)

As a doctor you should know what can threaten your patient's life
you should know what makes your patient suffers from pain
THAT'S WHY YOU LEARN PATHOLOGY

Definition: BLUE Examples:GREEN Important: RED Extra explanation:GRAY Disease names: **UNDERLINE**.

Objectives for All inflammation Lectures

- Be able to identify the cardinal and systemic signs of inflammation and to understand the underlying mechanisms that produce these signs.
- Understands the vascular changes occurring as a response to tissue injury.
- Appreciate the importance of fluid production in inflammation including the differences between exudates and transudates.
- Have some understanding of the various chemical mediators of inflammation and their link with the complement system and potentially with coagulation factors.
- Have good knowledge about the types and functions of the various inflammatory cells including their role in both acute and chronic inflammation.
- Be aware of the various complications of the inflammatory response, formation of pus and the production and manifestations of chronic inflammation.
- Understands the concept of healing and repair with wounds healing by first and second intention as an example.
- Knows the factors leading to poor healing and inadequate tissue repair.
- Appreciate the high prevalence of granulomatous diseases in the Kingdom of Saudi Arabia with special emphasis on tuberculosis.
- Understands the mechanisms and causes of granuloma formation with special emphasis on interaction between T lymphocytes, macrophages and epithelioid histiocytes.

Lecture(1) Outlines

- Definition of inflammation.
- Recognize the cardinal and systemic signs of inflammation.
- General features of inflammation.
- Types of inflammation.
- List cells and molecules that play important roles in acute and chronic inflammation.

Definition of inflammation.

Definitions:

- Is a defensive host response to foreign invaders and necrotic tissue, but it is itself capable of causing tissue damage.
- It is a defense mechanism against any agent that comes from outside the body.
- In short: inflammation is the tissue reaction to cellular injury.

The difference between inflammation and infection:

If we're talking about "infection" it means an invasion of an organism (Virus, Bacteria, Parasite and fungi)
But "inflammation" is a (response) or phenomena that is caused by any cell injury.
SO, Infection is a term used to describe a biological agent inside a tissue causing inflammation.

NOTE:
The use of "-itis" in the end of the word mean inflamed tissue or organ.
- For Example: Pancreatitis means inflammation of the pancreas.

Cellulitis(التهاب النسيج الخلوي) :
Inflammation in the interstitial underneath the skin because of bacteria.

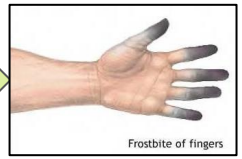
NOTE:
Inflammation is not always a bacterial infection.
مثلا : لدغة نحلة ,كسر باليد ,دخل بالليد شوكة أو خشبة .. هنا مافي بكتيريا بس بيكون فيه خلايا التهابية كثيرة ونسمي هالأشياء (physical injury)

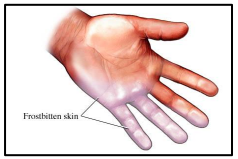
Causes of inflammation.

Causes:

- Bacteria.
- viruses.
- parasites.
- Fungi.
- Radiation.
- Physical injury.
- Thermal injury.
- Trauma.
- Frostbite.(الصقيع)
- Burns.
- immunological reactions.
- Fractures.(الكسور)
- infection after surgeries.
- Toxic substances.

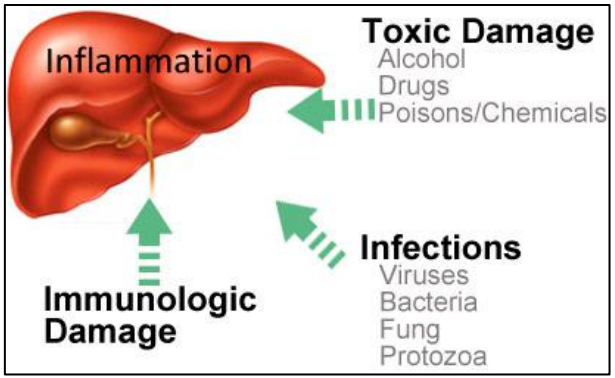
Frostbite





infection after surgeries.

EXTRA IMAGE



"Keep in mind"

Whenever there's an infection, there's an inflammation, but NOT every inflammation is caused by an infection!

Signs of inflammation.

Inflammation can cause local signs and systemic signs.
A Sign : is what you discover during clinical examination.

Local signs: (at location of illness, injury, or infection) are restricted to a specific area.

1- Redness (Rubor): because of increased vascular congestion, increased hemodynamic or we can say vascular dilatation.

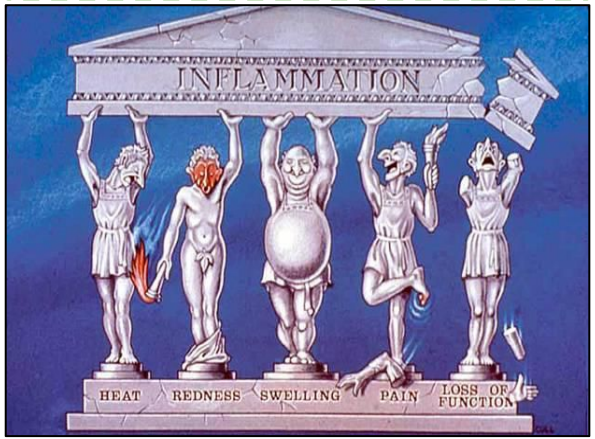
2- Swelling (tumor): usually because of edema.

3- Warmth (Calor): local heat.

4- Pain (dolor)

5- Loss of function (Functio laesa)

(The patient can have all of these signs or some of them)



NOTE : These signs appears in the Surface of the skin and also in the internal organs.
Like acute Appendicitis.(التهاب اللزائدة الدودية الحاد)
(in the internal organs instead of the redness there is vascular congestion(احتقان) and it is the cause of the redness that appears in the skin)

Systemic manifestations (signs): affect the entire body or present all over the body and aren't restricted to a specific area.

1- Fever.

2- Headache.

3- Chills (ارتجاف).

4- Malaise(توعك أو ارتخاء عام): feeling of illness and discomfort.

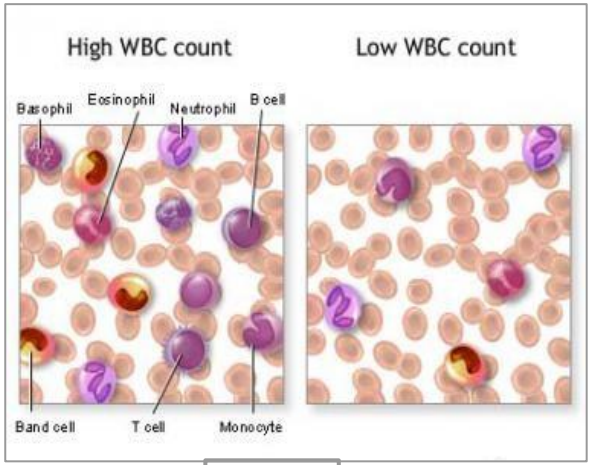
5- in children they usually have vomiting as a systemic sign (حتى لو ماله علاقة بالجهاز الهضمي غالباً مايكون عند الاطفال نتيجة الالتهاب)

Signs of inflammation.

General Laboratory Findings (Non-specific tests): doesn't show the site or cause of the inflammation, but it tells me that there's an inflammation.

1) Leukocytosis: Increase in leukocyte (WBCs) count. you can realize that through the CBC which is "Complete Blood Count" test.

EXTRA IMAGE



WBCs

2) Increase ESR "Erythrocyte Sedimentation Rate"(ترسيب). VIDEO.

When the ESR is increased, the blood which is put in the test tube will go down very quickly. (if there was inflammation)

EXTRA IMAGE

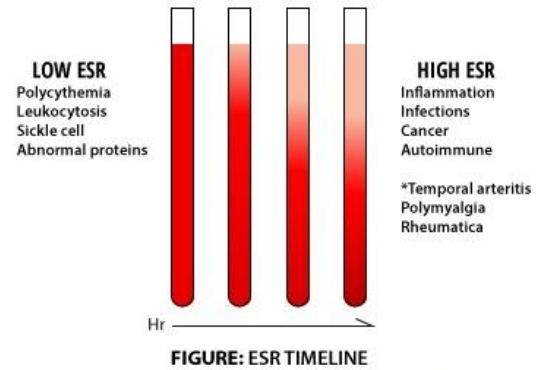


FIGURE: ESR TIMELINE

"Erythrocyte Sedimentation Rate"

3) Increased levels of C-reactive proteins. (is a type of acute phase proteins secreted by the liver to the circulation in response to inflammation)

it doesn't lead you to the place of inflammation but it's secreted when there is an inflammation (non-specific)

أي مريض فيه التهاب أو نيكروزيز بتكون هالبروتينات موجودة بكثرة بس ما تحدد موقع الالتهاب بالضبط

4) Complement protein.

لمن أسوي الفحص وألقى هذه البروتينات بكثرة يعني فيه التهاب في مكان ما

We will discuss it later

General features of inflammation.

The main components of inflammation are:

- **Vascular reaction.**
- **Cellular response.**

(Both are activated by mediators derived from plasma proteins and various cells)

We will discuss it later

The steps of the inflammatory response can be remembered as **THE FIVE R's :**

1. **Recognition of the injurious agent.**
2. **Recruitment of leukocytes.**
3. **Removal of the agent.**
4. **Regulation of the response.**
5. **Resolution.**

FROM ROBBINS BOOK

SUMMARY

General Features of Inflammation

- Inflammation is a defensive host response to foreign invaders and necrotic tissue, but it is itself capable of causing tissue damage.
- The main components of inflammation are a vascular reaction and a cellular response; both are activated by mediators derived from plasma proteins and various cells.
- The steps of the inflammatory response can be remembered as the five *R*s: (1) *r*ecognition of the injurious agent, (2) *r*ecruitment of leukocytes, (3) *r*emoval of the agent, (4) *r*egulation (control) of the response, and (5) *r*esolution (repair).
- The outcome of acute inflammation is either elimination of the noxious stimulus, followed by decline of the reaction and repair of the damaged tissue, or persistent injury resulting in chronic inflammation.

Types of inflammation.

Acute inflammation.

Cells :
Neutrophil.
Days to weeks.
Caused by:
- Bacteria.
- Toxin.
- Trauma.

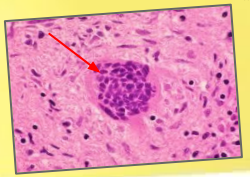
Chronic inflammation.

Cells :
- Lymphocytes.
- Plasma cells.
- Giant cells.
- Fibroblast.

Month to years.
Caused by:
- Viruses.
- Persistent injury.
- Autoimmune diseases.

One of the most important functions of inflammatory response is to deliver leukocytes to the site of injury and activate them.

Giant cells :
عبارة عن تجمّع عدد كبير من المايكروفيجيز في الخلية



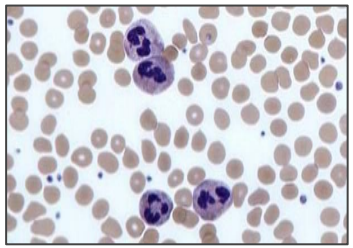
CELLS IN BOTH :
- Eosinophil.
- Macrophages (another name histiocytes): found in Late acute inflammation + chronic inflammation.
- Lymphocytes.

Cells involved in acute and/or chronic inflammation.

1- Polymorphonuclear leukocyte (Neutrophils)

Structure

- It has 3-5 loops nucleus
- has large number of lysosomes.
- 63% in the blood.



Function

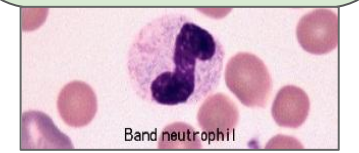
It has a strong phagocytic activity.
It also secretes many enzymes inside the lysosomes to help in foreign body digestion.
like :(Oxidase ,Protease)
Called: (Proteolytic enzymes)

Importance

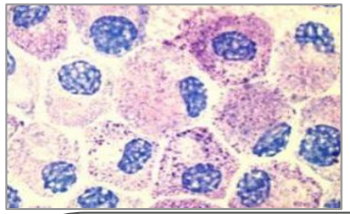
It's one of the major cells for acute inflammation, So, if there is an increased number of neutrophils then the patient most likely has acute inflammation not chronic, and most likely (not always) due to to bacterial infection.

In severe acute inflammations

The huge demand on the bone marrow to produce more neutrophils to the point that it will not be able to take the pressure and it will produce immature neutrophils called : (band neutrophils) or shift to the left.

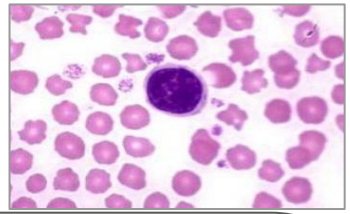


Cells involved in acute and/or chronic inflammation.



2- Lymphocytes

They can be classified into two types



1- Plasma cells (transferred B-lymphocytes)

- B-cells will transfer into **plasma cells** when it's activated, in which it'll secrete immunoglobulins that are **responsible of humoral immunity.**

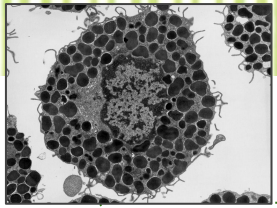
Plasma cells can't be seen in peripheral blood, they're only in tissue and bone marrow (if you see them in the blood that induces a problem or disease such as leukemia).

- It's nucleus is extrinsic (clock like nucleus).
- It shows mostly in mucosal surface.
- It's usually associated with **chronic inflammation.**

2- T-lymphocytes

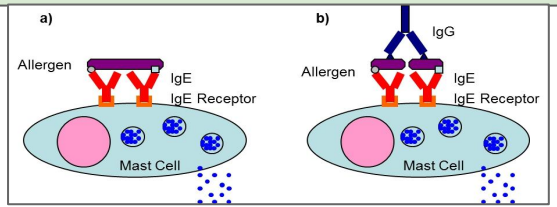
- It's **responsible for cellular immunity. (Cell-mediated immunity) CMI**
- Lymphocytes cannot phagocytose.
- Most of the lymphocytes cells in the circulation blood are T-lymphocytes.
- It produce various types of lymphokines which have local effects.
- Increased number of lymphocytes is associated with **chronic inflammation.**

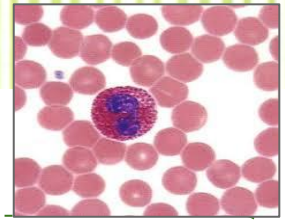
Cells involved in acute and/or chronic inflammation.



3- Mast cells

- **Have a lot of granules.**
- **Plays a role in allergic reactions especially type I hypersensitivity reactions and coated with IgE molecules.** (When there is allergic the immunoglobulin IgE will bind on the receptor which is on the surface of the mast cell and when this binding occurs ,the mast cell will release the granules which contains histamine).
- **The histamine which inside the granules ,the serotonin ,and the mast cells are found in the bone marrow and the tissue.**





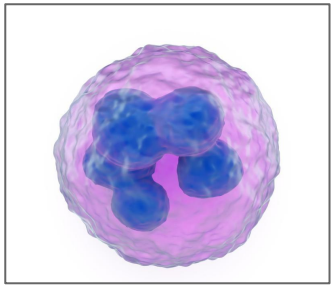
4- Eosinophils

- **They usually consist of two lobes.**
- **They have eosinophilic granules (reddish and acidophilic) (major basic proteins).**
- **They are weakly phagocytic unlike neutrophils or macrophages.**
- eosinophilic possess many of the neutrophils enzymes, and they can dispense anti-histamine in the area of histamine release.
- **They can be seen in acute and chronic inflammation and parasitic inflammation or allergic conditions.**
- Normal count in blood is 1-2%
- Abnormal count in blood is 20% (tested in stool).
- **It's increase in patients with: parasites infection, hypersensitivity infection ,allergic reactions like bronchial asthma.**

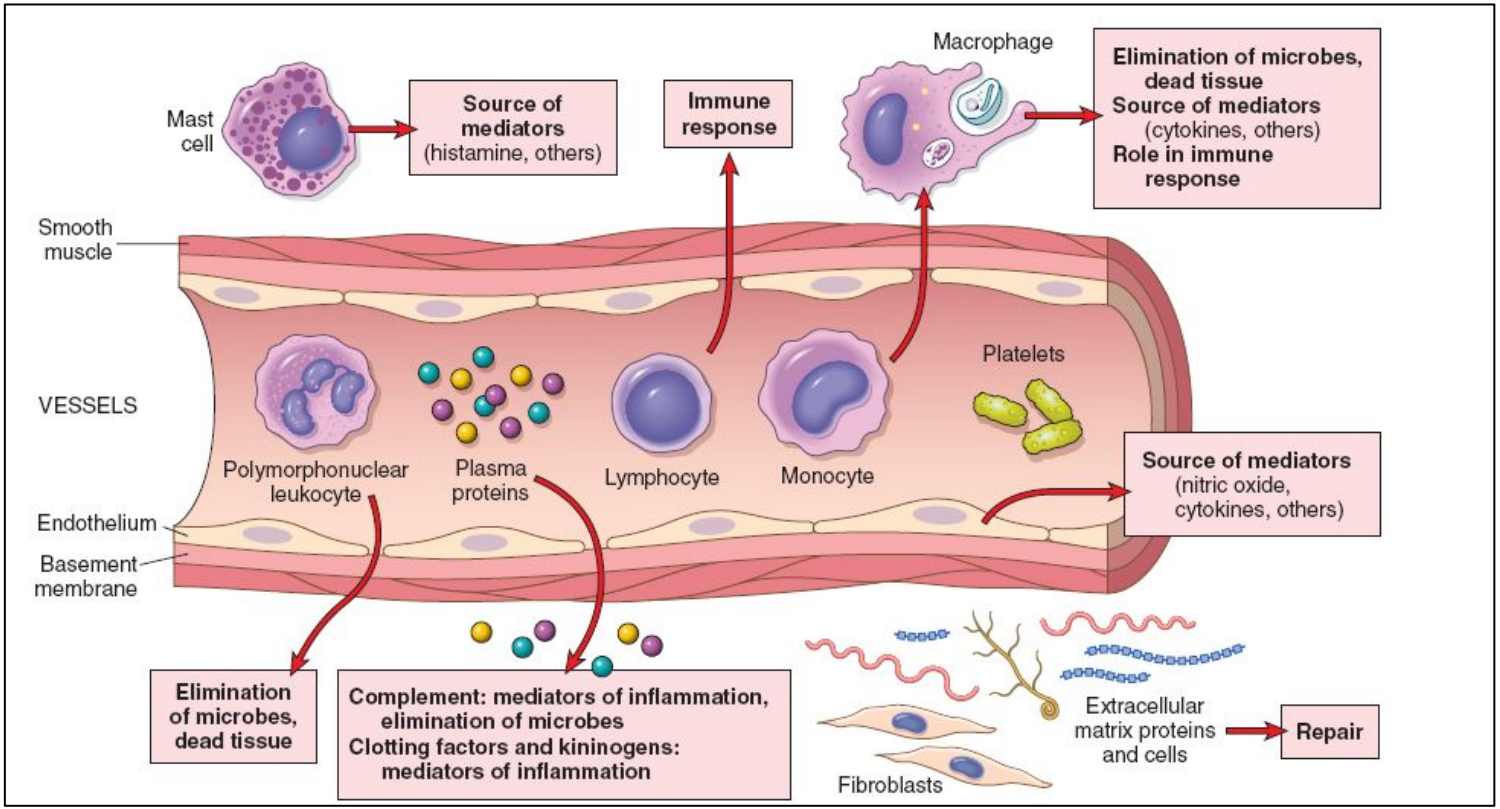
Cells involved in acute and/or chronic inflammation.

5- Macrophages

- They're very powerful phagocytic cells.
- They can be seen in both acute and chronic inflammation.
- Just like the mast cells they're seen only in tissue.
- Histiocyte is the inactive form of macrophage.

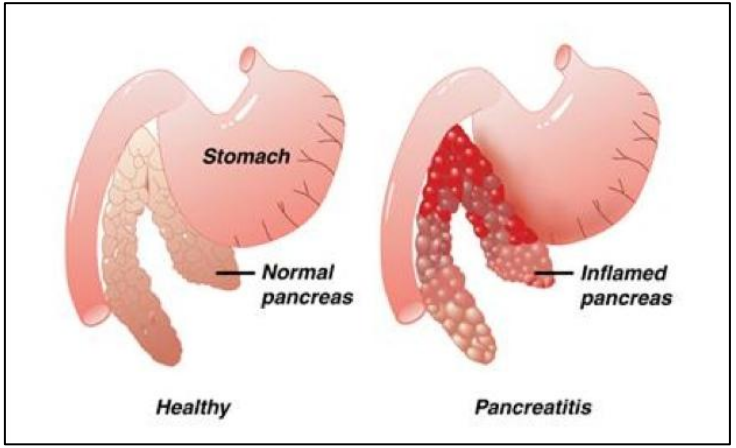


The components of acute and chronic inflammatory responses and their principal functions.

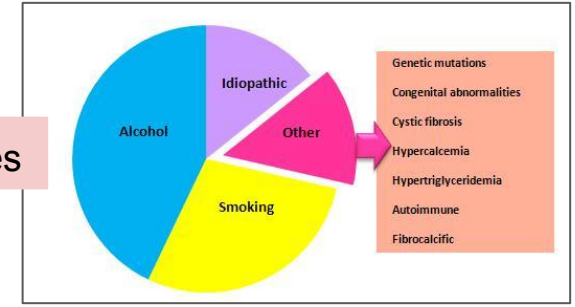


Clinical Ceases

Pancreatitis(1)



causes



acute pancreatitis

symptoms

- sudden onset of severe pain in the upper abdomen usually persists for several days.
- Nausea and vomiting.
- Fever.

chronic pancreatitis

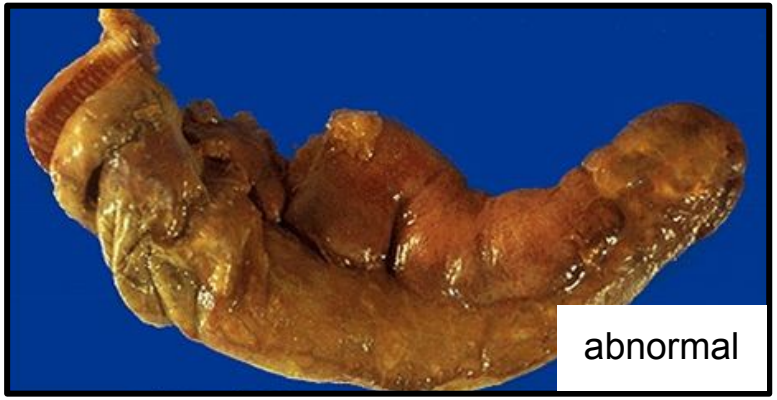
symptoms

- abdominal pain.
- Greasy or oily stools (steatorrhea).
- Weight loss.

* the enzymes (amylase + lipase) are released to the blood vessels and to the abdomen.
* The enzymes in the blood helps us in diagnosis.

Clinical Ceases

Acute Appendicitis(2)



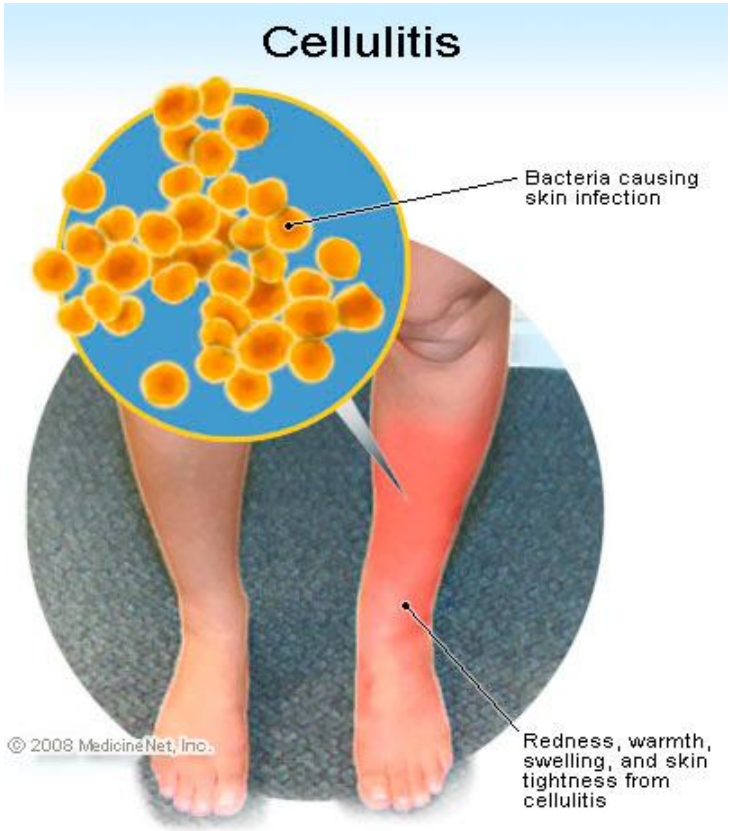
symptoms

lower right side abdominal pain - loss of appetite - nausea (feeling of sickness with an inclination to vomit) - vomiting - diarrhea - constipation - abdominal swelling - low grade fever

treatment

- in rare cases → antibiotics and a liquid diet
- in most cases → surgery

Clinical Ceases



Cellulitis(3)

symptoms

- Pain and tenderness
- Redness
- Skin sore/rash
- Tight and glossy
- Warm
- Fever

causes

One or more types of bacteria, which enter the body via ***cuts/openings*** in the skin.

Most common bacteria:

- Streptococcus
- Staphylococcus

treatment

Cellulitis is treated with oral or intravenous **antibiotics**.

HOPEFULLY WE DID A GREAT JOB

ONLINE TEST

FOR ANY QUESTIONS AND SUGGESTIONS CONTACT US ...

PATHOLOGY435@GMAIL.COM

@PATHOLOGY435

To make sure that all students are aware of any changes, please check out this link to know if there are any additions or changes.
The same link will be used for all of our work:
(Pathology Edit)

BOYS TEAM:

- ❑ **Wael Al Oud**
- ❑ Abdulaziz AlHammad
- ❑ Mana AlMuhaideb
- ❑ Abdulaziz Redwan
- ❑ Abdullah AlGhizzi
- ❑ Abdullah Aldhibaib
- ❑ Abdulrahman Thekry
- ❑ Ahmad Alkhiary
- ❑ Ahmed Alrwaly
- ❑ Ahmed AlYahya
- ❑ Ammar Almansour
- ❑ Anas Ali
- ❑ Faris Alwarhi
- ❑ Naif Alhadi
- ❑ Saleh Alkhalifa
- ❑ Rayan Almuneef

GIRLS TEAM:

- ❑ **Samar AlOtaibi**
- ❑ Ghaida Aljamili
- ❑ Nurah AlQahtani
- ❑ Nojood AlHaidri
- ❑ Reem Albahlal
- ❑ Amjad Alduhaish
- ❑ Kowthar Akmousa
- ❑ Johara Almalki
- ❑ Lina Ismael
- ❑ Ghadeer Asiri
- ❑ Atheer Alnashwan
- ❑ Reem Alageel
- ❑ Demaah Alrajhi
- ❑ Lojain Alsiwat
- ❑ Noura Altawil
- ❑ Haifa Bin Taleb
- ❑ Aljohara Almazroua
- ❑ Hissah Almuzini
- ❑ Meynial Bawazier
- ❑ Sarah AlHussein

DIFFICULTIES IN YOUR LIFE DON'T COME TO DESTROY YOU.. BEST OF LUCK