PATHOLOGY

◉ Sheets ○ Slides

Number: 10

Done by: Yasmeen mansour

Corrected by: Aya qteish

Subject: Inflammation 5

Doctor: .....

00/00/0000

.....

Acute inflammation

We will discuss three topics:

Outcome of acute inflammation, the morphology of acute inflammation, chronic inflammation

In the past lectures we talked about the acute inflammation and its mechanism, today we will discuss the fate of acute inflammation.

What is the outcome of the acute inflammation??

In acute inflammation everything can go back to normal that means we will have a complete resolution, or the acute inflammation can be modified and altered to chronic inflammation, or there will be fibrosis and scarring rather than a complete resolution.

So, there are three possibilities if the patient has an acute inflammation:

1. Everything goes back to normal which is resolution.
2. The body tries to reach resolution but the tissue injured can't go back to normal thus fibroses takes place.
3. The acute inflammation will change to a chronic one.

Resolution is when everything goes back to normal homeostasis.

I. When does resolution occur??

It occurs when the inflammatory response terminates.

But why we have resolution sometimes, other times we have fibroses or there will be a development of chronic inflammation in other word why **there is 3 different outcomes??**

The outcome chosen depends on:

1. The severity of inflammation
2. Type of cells involved (if they can repair or not, if yes so resolution occur if no they can't repair thus fibroses occur)

So resolution occur if the injury is

- Mild,

- Limited and short-lived,
- There is no or minimal tissue damage,
- The tissue can regenerate and repair itself.

Example: A patient has an inflammation in his cardiac muscle cells which is mild and there is a minimal tissue damage does resolution occur or not?

Answer: No, since the cardiac muscle cells have no regeneration property so it can't repair itself, so fibroses is the one that can occur not resolution.

II. When does the chronic inflammation take place?? In other words when does the acute inflammation alter and change to a chronic inflammation??

The acute will be altered to chronic when the offending agent of the injurious agent is not removed; also even if the inflammatory response is mild as long as the response is continuous the acute inflammation will change to chronic inflammation.

Example: Tuberculosis (TB) the bacteria stays there, the body can't get rid of it so the inflammation instead of being acute it will transform into chronic inflammation.

Acute inflammation change into chronic inflammation if there is an auto-immune disease meaning there is an autoimmunity towards our antigens, so the offense in this case is our own antigen hence the body can't get rid of it , so the offense will stays there triggering the acute inflammation to transform into a chronic inflammation.

III. When does scarring and fibrosis occur??

Scarring and fibrosis occur if the injury is severe or the tissue can't undergo repair.

These are the three outcomes of acute inflammation.

Morphology of acute inflammation:

The acute inflammation has four morphological patterns:

1) Serous inflammation

2) Fibrinous inflammation

3) Suppurative inflammation

4) Ulcer formation

These are the 4 types of morphologic patterns that we can see in acute inflammation

I. Serous inflammation:

This type of inflammation is characterized by the occurrence of edema. We previously said that the first change to happen in inflammation is vascular changes and edema formation, so if the inflammation is very minimal and mild all what we can see is edema. Is this type of inflammation the edema is characterized by minimal amount of proteins , mainly fluid without cells transudates.

So a transudate which is composed mainly of fluid where there is no many protiens in the site of the injury this is the mildest form of acute inflammation.

Example: *Skin blisters as a result of burns (while cooking) is a form of mild acute inflammation with few edema fluids.

*Skin Blisters as a result of viral infections.

Thus serous inflammation:

- Is very mild inflammation

The outcome of this type is resolution in most cases

- It is composed only of fluid edema
- It can occur in body cavities ex: sometimes if there is a mild inflammation in the lungs, transudation of fluids to pleural cavity may occur. It is called serous pleural or pericardial effusion
- It is a mild inflammation that occurs in the lining epithelium of cavities as (peritoneum, pleura, pericardium, or abdomen)
- Good example is skin blister either from burns or viral infection , and serous mild inflammations of the cavities

II. Fibrinous inflammation:

It is mild but more severe than serous inflammation, thus not only fluids comes out. The gap junction allows some proteins to pass through the blood vessels, the most important one among them is the fibrin and this protein is the one that gives this inflammation its name. Thus in fibrous inflammation we have = fluid+ some proteins. That what makes the fibrinous inflammation more severe than the serous inflammation.

Fibrinous inflammation happens mainly in the cavities especially around the heart as in fibrinous pericarditis (means inflammation of the pericardium characterized by severity more than serous due to fluids plus proteins mainly fibrin), so we expect the outcome to be resolution however if it is severe fibrosis may occur.

Still the main outcome in most cases is resolution (note that we are saying pericardium not heart so it can regenerate and resolute if severe so fibrosis takes place)

What is the mechanism of resolution when it occurs?

1. There is fluid in inflammation these fluids will be drained and up taken by lymphatics, get rid of it thus restoring hemostasis. This mechanism arise in serous and fibrous inflammation..

2. Fibrin in fibrous inflammation needs to be degraded by fibrinolysis for everything to go back to normal however don't forget that fibrous inflammation if severe will lead to fibrosis rather than resolution..

3. If there is any cell passes through the gap , it will resolute by apoptosis

Fibrin is a protein which appears under the microscope as a pinkish mesh-work (see the picture) the whitish color is the fibrin.

Note that for the fibrin to do the clotting function, all of the clotting cascade must be activated, platelets and also certain coagulation factors, fibrin alone can't do the clotting function. Fibrin is a circulating protein it comes out with other protein in the fibrous inflammation; this inflammation is called so according to the fibrin protein since this protein can be seen under the microscope. Just for that reason that it is called fibrous. Fibrin has no function in the inflammation.

3-Suppurative inflammation

- this is a severe inflammation usually due to bacteria

-it is more severe than fibrinous inflammation because I don't have only fluid and proteins I have also cells and the main cells in acute inflammation are neutrophils so we have a collection of neutrophils and this collection if it increases a lot it causes abscess (collection of pus that has built up within the tissue of the body)

-The most important reason of suppurative inflammation is the bacterial infection

-The usual outcome is scarring **Why????**because it is severe so because I have more severe inflammation I can end in scarring .

4-Ulcer inflammation :

- the most severe morphological change .

-Local defect which happens in mucosal membrane (gastric ulcer, duodenal ulcer)or in the skin (we have skin ulcer)and we have a tissue defect so we are talking about more and more severe inflammation and because we have a tissue damage the outcome will be scarring .

NOTE : the outcome is not always scarring , we can have complete healing of ulcer and this depend on the severity and depth of ulcer .

-This inflammation destruct the tissue so the formation of the cavity starts (ulcer)

-And as ulcer formed ,the sloughing (shedding) of inflammatory cells and of the epithelial cells starts also so we will have ulcer formation and again the main outcome is scarring .

-We can have complete healing of ulcer

- Bedsores can cause ulceration specially in the sacral area ,Also stasis and people who don't move a lot .

Chronic inflammation

1-Cellular changes are the same cellular changes the happen in acute inflammation

2-But the main cells are macrophages and other cells but the major cells are macrophages

3-Mechanisms are the same ,Same vascular changes ,Same cellular changes even they are not the same cells

-So we are going to talk just about the mechanisms in chronic inflammation that differ from acute inflammation

-**Chronic inflammation to say that it's a chronic inflammation we have to have :**

1-infiltration with momonuclear cells (macrophages, monocytes, eosinophils, lymphocytes)

Note :neutrophils are poly-nuclear have a nucleus or poly looped nucleus

2-Tissue destruction and there is repair at the same time

3-Long time ,long duration so I have to see those three things to say it's chronic inflammation(infiltration, tissue destruction and repair)

-The causes of chronic inflammation:

1-Acute can alter to chronic

2-Autoimmune disease it's always chronic from the beginning

3-Prolonged exposure to toxins such as :Uric acid crystals , cholesterol crystals in atherosclerosis.

4-Infectious agent (as in tuberculosis) which does not resolve “resistant infection"

NOTE: again and again ,The main cells of chronic inflammation are macrophages but they can play a role in chronic inflammation.

The main cells of acute inflammation are neutrophils but they can also play a role in chronic inflammation .

So, all WBC play a role in acute and chronic inflammation .

Macrophages

they are derived from blood monocytes ,circulating monocytes in the blood go out of the vessel to tissue , when they presents in the tissue we call them macrophages

-We have certain macrophages with different names according to the place :

1-Liver(kupffer cells)

2-Brain or CNS(microglial cells)

3-Lymph nodes(sinus histiocytes)

4-Lungs(alveolar macrophages)

Those are the mononuclear phagocyte system which means the monocytes that live in different places in our body

NOTE:Monocytes are the same of macrophages and the same of epithelioid macrophages and are the same of histiocytes,They mean the same thing.

The mononuclear macrophages are alwayes present in those places they don't wait inflammtion to go out and they play a role in getting rid of microbes and other things.

-During inflammtion the macrophages will be stimulated (monocytes in the blood) will go out of the blood vessel with the same mechanism of neutrophils (margination then rolling then firm adhesion then transmigration then chemotaxis)

-The macrophages can stimulated by two pathways(in the tissue after they go out of the blood)"after the monocytes become macrophages":

1-The classical pathway

2-The alternative pathway

In the classical bathway The macrophages are stimulated in order to cause an inflammatory response ,The macrophages here are called M1 macrophages

At the same time other macrophages are stimulated by the alternative pathway ,which called N2 macrophages and these have anti-inflammatory effects .

So this the balance that our God make to us in order the inflammtion to be self -controlled or limited

So macrophages M2 are inflammatory macrophages stimulated by classical pathway and macrophages M2 are anti- inflammatory stimulated by alternative pathway.

M2 stimulate repairing , fibrosis and scarring formation.

In neoplasia we are going to Talk about them because the play a role in cancer

-The other cells in chronic inflammation like lymphocyte are converted to plasma cells when they start forming anti-bodies

-Lymphocytes and macrophages in inflammation they stimulate each other by directional stimulation(bidirectional way),Macrophages stimulate lymphocytes and lymphocytes stimulate macrophages.

So it's a cycle and that's why chronic inflammation is severe inflammation and persistent ,Because we have potent mediators that go out from lymphocytes and from macrophages , and this happens a lot in granuloma formation

One of the morphological patterns of chronic inflammtion is the formation of granuloma (a collection of macrophages usually with a rim of lymphocytes)

Eosinophils

Are predominant in two conditions

1- allergy

2- 2- or parasitic infection

So here eosinophils play a very important role

Granuloma

-aggregates of epithelioid histiocytes , this is happen due to persistent infection and foreign body

Because macrophages is trying to phagocytes something but it can't do ,like It is trying to phagocyte bacilli of tuberculosis but it it can't so it do this granuloma

And also if it can't phagocyte the foreign bodies like some crystals or suture materials.

-In granuloma , some of macrophages combine and form one big cytoplasm with many nuclei and this is called multinucleated giant cells

Granuloma associated with very important diseases:

1- Tuberculosis

2- leprosy

3- sarcoidosis

Very important note:

In the centre of certain granuloma , we can have necrosis because of the low oxygen supply which will kill the cells in the centre and this will cause caseous necrosis (cheesy like material) , so if I have a patient with tuberculosis and I open his Lungs I will find caseous necrosis so Caseating granuloma happens only only only In tuberculosis but tuberculosis can cause normal granuloma or caseating granuloma .

Sorry for any mistake …