Benha university ***Pathology Exam. For 3 rd year students*** ***Faculty of veterinary medicine*** ***First semester, January 13th, 2013*** ***Pathology department***
Time allowed : 3 hours

model answer

Please answer all questions

I- Explain the characteristic features of the following (14 marks)

A- Healing of wound by first intention

This occurs mostly in a surgical wound, which characterized by straight borders, absence of infection; minimum loss of the tissues and the borders can be approximate by suturing.

Steps of healing:

1- Blood clot is a short period, the wound filled by blood. Then capillary buds and fibroblasts are formed between blood capillaries and invade the clot (granulation tissue).

2- Granulation tissue formation formed from young capillary buds (angioblasts) and young fibroblast perpendicular on each other.

3- Organization**:** It is a process through which maturation of granulation tissue takes place, and form fibrous connective tissues.

4- Scar formation**:** At the, end of complete epithelization takes place, at 3rd weeks, the capillaries become disappear and the collagen fibers will act as for suturing the wound by contraction. If the healed area has skin appendages such as hair follicles, sebaceous glands and sweat glands (permanent cells) will not replaced by such type of glands.

B- Function of macrophages and eosinophils

Macrophages are large mononuclear cells with single spherical eccentric nucleus.

Macrophage has numerous synonyms such as histiocytes, resting cell polyblast and endothelial cells.

Function

1- It is the main phagocytic cell in the body and so it phagocytized and kills the intracellular organisms.
2- Producing interferon.
3- Stimulating fibroblast proliferation and collagen synthesis.
4- Synthesizing prostaglandin.
5- Releasing complement activator to produce other macrophages.
6- Forming tissue thromboplastin.
7- Secreting plasminogen activator.
8- Macrophages have the ability to destroy tumor cells.
9- Macrophages may be divided and giving epithelioid cells. This cell present in abundant number in many chronic diseases such as tuberculosis and characterized by its foamy cytoplasm.
10- Macrophages may be divided in the tissues to form other macrophages. So it is consider the only inflammatory cells able on division at the site of inflammation.
11- Macrophage may conjugate with each other and giving the giant cells.

Eosinophils:

It constitutes about 5-10 % of the total differential leucocytic count.

It formed in the bone marrow and brings to the inflammation through the circulating blood.

This cells have amoeboid movement, but of low phagocytic power.

The cytoplasm of such cells contains coarse eosinophilic granules.These granules contains antihistamine (histaminase) so, such cells are increased in case of allergy.

Therefore in case of allergic test for diagnosis of tuberculosis, the swelling area formed at the site of injection reveals high number of eosinophils.

Also it increase in cases of asthma and hay fever in human being.

Moreover , it increase in case of parasitic infestation due to the fact that the excreta of the parasites acts as a foreign body causing allergic reaction.

Eosinophils also secrete finbrinolysine.

C- Lymphocytic inflammation

Macroscopical findings:

1- The cardinal signs of inflammation are not prominent as in other types of inflammation.

2- No gross lesion usually detected as in case of brain in rabies except just congestion of its blood vessels.

Microscopical findings:

1- The circulatory and cellular changes of inflammation are present. However, not clear as in case of various type of inflammation.

2 The lymphocytes may be consider the only constituents of the exudates at the beginning of the disease.

3- Later on, macrophages appears at the site of inflammation to remove debris.

4- The lymphocytes accumulate around the wall of the blood vessels to form cuffing (**Perivascular cuffing**) which known as **lymphocytic cuffing.**

D- Chemical mediators

Chemical mediators:

They are substances usually present in inactive form that activated by the injury. Once these substances activated, some of them are self-limiting and some activate other.

Chemical mediators include:

1- Amines:

a- Histamine:

It released from mast cells that present in most tissues especially near very small blood vessels. In addition, histamine released from platelets and basophils

It causes vasodilatation especially to the blood capillaries.

b- Serotonin:

It acts as histamine but only in some animal species.

It secreted from argentaffin cells of GIT, CNS and platelets

2-Polyptides:

Formed by conjugation of number of amino acids and they includes

a- Kinins

It causes vasodilatation of blood vessels after the action of histamine that cause dilation of blood vessels in early stage of inflammation.

It found in the normal serum and cause pain.

b- Leukotaxine:

It is a chemical substance produced by bacteria, neutrophils and the destroyed cells. It pass into the blood till reach the bone marrow and stimulate it to produce more number of neutrophils as possible.

Then, the neutrophils pass to the blood behind the concentration to source of leukotaxine until determine the source of leukotaxine. This process is known as **chemotaxis** that may be positive when the neutrophils pass right toward the source of leukotaxine or negative if it can not reach to the source. Also this process called **positive or negative chemotropism**. e.g. If we place bacteria at 37 ^{o}C with neutrophils the neutrophils will pass to bacteria (positive chemotropism). While if we put sand instead of bacteria, the neutrophils will not reach to the sand that represented the negative chemotropism.

3- Proteolytic enzymes:

It includes the following:

A- Globulin permeability factor and its inhibitors:

They are two factors or types of globulins, one of them increase permeability and are thermostable which not affected by the heat. The second inhibit the action of the first one but it affect by the heat i.e. thermolabile.

So when the temperature is raised, it will stop the action of the thermolabile fraction and so the thermostable one will act and increase the permeability.

B- Plasmine:

It is one of the normal constituent of the plasma, but it found in inactive form (plasminogen) which cause digestion of some blood protein as kalkerin and kinins.

C- Kalkerin:

It present in blood, urine and sank venom. It is consider as a precursor of kinins.

D- Bradykinins:

It increases the permeability and cause vasodilatation and pain.

E- Nucleic acid and its breakdown products:

F-Anaphylotoxin:

4 - Prostaglandin

It causes fever, pain, increase permeability and vasodilatation.

It activated by bradykinins and stimulates the release of histamine.

II- Describe the following **(12 marks)**

A- Pathological atrophy

Pigmented atrophy :

It found in myocardial muscles, muscles of cervical region in old cattle that have chronic wasting disease where their muscle cells are greatly reduces in thickness and have accumulation of brown pigment (lipochrome) at the pole of nuclei. This condition known as **Brown atrophy of the muscles**.

Starvation atrophy:

It is a generalized atrophy of the skeletal muscles and subcutaneous tissue. It is atrophic condition of healthy animals where tissue dehydration occurs resulting from lack of water. The stored

substances of the body i.e. fat and glycogen are firstly wasted. Next some body tissue themselves as CNS, heart and bones with standing lack of nutrients. Sick aged animals show a wasted condition of the body called emaciation.

Toxic atrophy:

Found in some chronic infectious diseases such as, para-tuberculosis, tuberculosis and anaplasmosis. The condition is known as cachexia. It believed due to toxic substances of microorganisms.

Disuse atrophy :

It is local condition due to inactivity e.g. fractured leg of dog that immobilized by spliter.

Neurotic atrophy:

Injury of nerves as Suprascapular nerve result in atrophy of supraspinatus and infraspinatus muscles. Or injury of recurrent laryngeal nerve results in atrophy of laryngeal muscles.

Pressure atrophy:

It resulted from continuous application of force on tissue, so blood supply diminished and the tissue shrunken due to lack of nutrition. Accumulation of fluid or parasitic fluid or when duct of secretory gland is obstructs, the acini dilated and the accumulated secretion resulted in atrophy of glandular parenchyma.

B- Dry gangrene

It occur mainly in skin, ears, tail and in extremities. These organs have a little moisture, heat and blood supply which hinder the bacterial growth.

The principle cause of dry gangrene is ischemia, such as in freezing or vasoconstriction due to ergot poisoning or tight bandages.

Macroscopical findings

1-The gangrenous part become dry (leather - like), cold, contracted and wrinkled.

2- The line of demarcation between the healthy and the gangrenous tissues is well demarcated as swollen-reddish or bluish zone of defense. The function of the line of defense is to prevent the entrance of toxins and bacteria to the healthy tissue.

Microscopical findings

1-The necrotic tissue appears as a homogenous structurless material which loss the ability to stain, so it appears pale in staining.

2-Leucocytic cellular infiltration particularly of mononuclear type are seen with the presence of gas - bubbles.

3-The exudate in the affected areas is little with the presence of clear line of defense formed from dilated blood vessels and leucocytic cellular infiltration mainly neutrophils, macrophages and lymphocytes.

C- Rigor mortis

It means the stiffness of the joints due to muscle contraction.

It starts within 1-8 hours after death and leaves within 20-30 hours. The process enhanced by high temperature.

The muscle glycogen will be exhausted by the glycolytic enzymes into lactic acid, which cause swelling of myosingen. The muscle become swollen and contracted lead to stiffness of the joints

The most active and well-nourished muscles are firstly affected. This process start with the eyelids, heart, diaphragm, thorax, jaw, neck and finally end by extremities.

Presence of blood in left ventricle indicates that either rigor mortars did not occur or weak myocardium.

Rigor mortars start immediate after death with tetanus or strychnine poisoning as well as in weak and emaciated animals

D- Types of necrosis and discuss fully one of them

Types of necrosis

Coagulative, liquifactive, caseous and fat necrosis considered the most common types.

Caseous necrosis

(caseation)

Definition:

It is that type of necrosis which characterized by disappearance of both tissue architecture and cellular details and the affected tissue is replaced by granular cheesy materials.

Etiology :

It usually seen in chronic granulomatous diseases such as tuberculosis, ovine caseous lymphadenitis and in case of other granulomas.

Macroscopical findings

The necrosed tissues appear as a dry, firm and easily crushed into grayish-white material.

Microscopical findings :

The necrosed tissue appear as structureless eosinophilic and basophilic

substances, sometimes the necrosed tissue represented by cells mainly of mononuclear type.

Both tissue architecture and cellular details are lost.

III- Write short notes on **(12 marks)**

A- Jaundice

According to pathogenesis there are 3 forms of

1-Obestrutive or post-hepatic jaundice.

2 Toxic or hepatic jaundice.

3 Hemolytic or pre-hepatic jaundice.

Obstructive jaundice:

This form arises from obstruction of the bile duct , which hinders the excretion of bile.

Obstruction may be:

a) Within the lumen of the duct as presence of flukes, ascaris or gall stones.

b) From the wall as in case of inflammation (cholangitis or duodenitis).

C) Pressure from outside by neoplasms, granulomas or abscesses.

The stasis of bile leads to dilatation of the bile ducts, and bile canalculi. There may be rupture of some the dilated bile canalculi, with the passage of bile in the circulation.

As a result there is hypercholibilirubinaemia which not only cause icteric staining but also cause intoxication due the action of bile acid on the internal organ. These intoxication causes the development of icteric nephrosis. Also it cause focal necrosis in the liver.

Toxic jaundice :

This form is observed in a number of infectious and toxic condition

A) Endotoxins of *Leptospira conicola* and the virus of infectious canine hepatitis.

B) The salts of heavy metal like lead, arsinate and alkaloids.

These infectious and toxic agents causes dystrophic changes in the liver cells. The liver cells loose the capacity to extract bilirubin, detoxicate it and secret it in the bile. In this case, there are a higher amounts of haemo-bilirubin and cholibilirubin in the blood.

Hemolytic jaundice:

This form is caused by diseases accompanied by excessive haemolysis of RBCs as:

A- Parasitic infection: piroplasmosis and anaplasmosis.

B-Bacterial infection: *Hemolytic streptococci* , *Clostridium haemolyticum bovis*, and *Bacillus anthracis* infection.

C- Viral diseases: as equine infectious anemia.

D- Chemical toxins : lead, saponin, and snake venom.

B- Siderosis

Iron dust is inhaled chiefly as hematite or iron oxide from mines.

The mineral does not incite fibrosis or an inflammatory reaction.

Microscopically, hematite and iron oxide appears as red crystals of varying size, demonstrated specifically with the Prussian blue reaction.

C- Cloudy swelling

Cloudy swelling is a process of disturbance of cellular protein metabolism, by which rough protein granularity appears inside the cytoplasm of parenchymatous organs. The accumulation of protein in cells leading to an increased cytoplasmic density and the cells become swollen and cloudy in appearance. The organ as a whole increased in the size and its cut surface looking gray as if boiled.

Microscopic appearance

The cells are swollen with granular cytoplasm, which has cloudy appearance:

In the kidneys , the swelling is very demonstrative in the cells of the proximal convoluted tubules of the kidney. The cells project unevenly and reduce the lumen to star shaped slits. While in thee heart, the granularity masks the striation of the swollen myocardium.

In the liver , the hepatic cells swollen and compress the sinusoids.

Macroscopic appearance

The organ is swollen, with anemic or pale appearance.

The borders are rounded with dull bulging cut surface.

D- Sago spleen

In this form the amyloid infiltrate the reticular fibers of the lymph follicles, beginning from the periphery and spreads to the center, where the follicular artery is involved in the same time. Exerted pressure and lack of blood supply cause atrophy of the lymphocytes. Finally, the changed follicle transformed into

homogenous semitransparent mass, which grossly looks like sago grain, hence the term **sago-spleen**.

IV- Write full account on (12 marks)

A- Causes and classification of thrombosis

Causes:

1- Injury to the endothelial cells lining the vessel wall, this may due to:

- External twisting, legation, or contusion of the vessels.
- Bacteria as Streptococcus or Erysiplothrix.
- Parasites as Strongylus vulgaris in the mesenteric artery and its branches or Dirofilaria immitis
- Diseases of the vessels wall e.g. Arteriosclerosis, atheroma or aneurysm

2- Slowing or stasis of the blood stream: This will help certain elements of the blood to adhere and accumulate on the damaged endothelium, and it is produced in the following conditions;

- Venous congestion.
- Aneurysm.
- Extensive inflammation.

3- Changes in the composition of the blood, which favor coagulation and predispose to the thrombosis.

- Increased number of the platelets.
- Parasites e.g. Dirofilaria immitis in the pulmonary artery of the dog.
- Clumps of bacteria in the blood.

- Emboli as fragment of heart valve thrombus circulating in the blood.

Classification of the thrombi:

A. According to location in cardiovascular system:

1- **Cardiac thrombi**: They are located inside the heart and may be:

a- Valvular thrombi : they are attached the heart valves e.g. in Erysiplothrix in pig and *Streptococcus equi* in the horse.

b- Mural thrombi : they are attached to the wall of the heart.

2- **Arterial thrombi**: are located within the arteries e.g. in the anterior mesenteric arteries due to Strongylus vulgaris larvae.

3- **Venous thrombi**: they are located within the veins of broad ligaments of the uterus, in scrotal plexus of the horse and in the nasal vascular sinus of cow and horse.

4- **Capillary thrombi**: They are located within the capillaries

B-According to the infectious agent:

a- **Septic thrombi** : contain bacteria.

b- **Aseptic thrombi** : don't contain bacteria or parasites.

c- **Parasitic thrombi** : contain parasites.

C- According to the color:

a- **White or pale thrombus** : it is white in color and composed of platelets and fibrin. It is forming in the moving blood stream.

b- **Red thrombus**: It is red in color because it is composed of platelets, erythrocytes , leucocytes and fibrin. It occurs in blood vessels where the flow of blood sluggish or near stasis

c- **Mixed thrombus** : It is composed of both white and red intravascular clots and is the most common type. The white portion is formed where the flow of blood through the area is rapid and the red portions are formed when the circulation is sluggish.

B- Gross and microscopic lesions of infarct

Microscopic appearance:

1- Infarct appears as triangular areas of coagulative necrosis with or without filling of the tissue spaces with blood.

2- An infarct is separated from the rest of the organ by an inflammatory zone.

3- This inflammatory zone consists of dilated capillaries and collection of leucocytes.

4- Old infarct is replaced by fibrous tissue.

Gross appearance:

1- Infarcts in domestic animals usually affect the spleen, kidneys, intestine and brain and less commonly in the liver and lungs because they have double blood supply. Infarct of the heart is most common in man and less in animals.

2- Infarct appears as cone- shaped with the apex of the cone at the arterial obstruction and the base of the cone at the periphery of the organ.

3- In the early stage, the infarct area become swollen, dark red and sharply raised above the surrounding tissues.

4- After 18-72 hours, the infarct area become pale with a red margin and slightly depressed.

5- The hemorrhagic infarcts may be softened.

6-The pale infarcts are tougher and denser than the surrounding.

7- The old infarcts are sunken under the surface.

C- General non inflammatory oedema

It is usually non inflammatory. It may be :

- Cardiac edema
- Renal edema
- Parasitic edema
- Starvation edema

Cardiac edema:

It occurs due to valvular lesion or myocardial weakness.

These lesion leads to chronic general passive hyperemia, consequently an increase in the venous capillary hydrostatic pressure and the fluids accumulate in the tissue and body cavities.

Edema of the limb is more pronounced in this type of edema

Renal edema:

- It occurs in the kidney diseases characterized by nephrosis or nephritis. These lesions are associated with the following changes
- Albuminuria and consequently hypoproteinaemia with a decrease in the colloidal osmotic pressure.
- Retention of injuries waste products in the blood results in an increase in the permeability of the capillaries.

Parasitic edema:

It observed in case of heavy stomach worm infestation in sheep. Where there is a constant loss of plasma protein through the blood sucking bites and possibly an anticoagulant toxin, which resulted in a repeated minute hemorrhage in a large number and consequently decrease in the colloidal osmotic pressure.

Starvation or nutritional edema

It occurs in case of starvation, protein deficiency and cachexia which lead to a serious deficiencies of blood protein and consequently decrease in the colloidal osmotic pressure.

D- Nutmeg liver

Causes:

i-Interference with the venous circulation of the liver (hepatic veins, posterior vena cava).
ii-Lung or heart affections.

Macroscopic Pictures:

i-**Color:** is dark red, brownish or yellowish due to release of hemosiderin.
ii-**Size:** increase in the early stage and decrease (atrophied) later.
iii-**Consistency:** firm.
iv-**Cut surface:** shows characteristic ***"nutmeg liver"*** due to red and yellow mottled appearance with blood oozed from cut sections.
v-**The hepatic lobules** can be enumerated and represented by red spots (congested CV).

Microscopic Pictures:

i-Congestion of central and portal veins and hepatic sinusoids.
ii-Pressure atrophy of the hepatic cords and hepatic cells.
iii-Brown pigment (hemosiderin) engulfed by kupffer cells.
iv-CT proliferation around the central veins are present.
v-Fatty changes in the hepatic cells of peripheral zones (due to hypoxia).

Best wishes