



General Veterinary Pathology

Necrosis

&

Gangrene

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Veterinary Pathology: Necrosis

Somatic Death: It is the death of the body as a whole and it is due to either respiratory or cardiac failure.

Physiological Death: It is local death of cells occur constantly in an individual and loss is replaced by multiplication.

Necrosis: It is the sum of morphological changes that follows death of cell or tissue with in the living individual. **This damage of the cell couldn't be replaced.** Morphological change in necrotic cell is more marked in nuclear changes.

Veterinary Pathology: Necrosis

Causes:

- I. Poisons: Chemical poisons, Plant poisons, Animal poisons, Poisons of pathogenic organism.
- II. Loss of Blood Supply.
- III. Mechanical injuries.
- IV. Physical agents: Heat, Cold, Electric current, X-ray.

Veterinary Pathology: Necrosis

Macroscopic Changes:

- ❖ Area of necrosis is paler in colour, cooked appearance, soft & friable.
- ❖ It is clearly demarcated from the surrounding normal tissue.
- ❖ It is usually surrounded by a red zone of inflammatory reaction.

Veterinary Pathology: Necrosis

Microscopic Changes:

1. Nuclear changes:

- ❖ Pyknosis:- **Condesation** of nuclear material leading to shrinkage of nucleus.
- ❖ Karyoschisis:- Appearance of **cracks** over the nucleus.
- ❖ Karyorrhexis:- **Fragmentation** of nucleus.
- ❖ Karyolysis: **Lysis of nucleus** and disintegration of the nuclear material.
- ❖ Chromatolysis: Disappearance of nucleolus, chromosomes.

Veterinary Pathology: Necrosis

Microscopic Changes:

1. Cytoplasmic changes:

- ❖ Cytoplasm become more granular, swollen, homogenous and stain instantly pink with eosin.
- ❖ Cell membrane fuses with cytoplasm and entire cell become an opaque anuclear mass.

Veterinary Pathology: Necrosis

Types of Necrosis:

1. **Coagulative Necrosis:** Necrotic tissue is White, Opaque, dry and cooked appearance.
2. **Caseous Necrosis:** Necrotic tissue is Cheese like.
3. **Liquefactive Necrosis:** Necrotic tissue is Liquid mass.
4. **Fat necrosis:**
 - ❖ Traumatic fat necrosis
 - ❖ Enzymatic fat necrosis
 - ❖ Nutritional fat necrosis

Necrosis: Coagulative Necrosis

- ❖ **Coagulative necrosis** is most common type. Architectural details of the area persist but **cellular details are lost**.

Etiology:

- ❖ Heat, ischemia & infarction
- ❖ Toxicity with mercury and phenol
- ❖ Bacteria toxins like Streptococci, *Spherothorax necrophorus*
- ❖ White muscle disease

Necrosis: Coagulative Necrosis

Gross appearance:

- ❖ Necrotic tissue is white, opaque, dry & homogenous.
- ❖ It is slightly depressed than the normal tissue.
- ❖ It has cooked appearance and firm in consistency.

Microscopic changes:

- ❖ Cellular details of area lost but architectural details persist.
- ❖ Cytoplasm is granular and coagulation of the protein of cytoplasm by intracellular enzymes.
- ❖ Nucleus become pyknotic.

Necrosis: Caseous Necrosis

- ❖ **Caseous necrosis** is characterized by the **absence of both architectural & cellular details** of necrotic tissue and conversion of dead tissue into a “homogenous granular mass” resembling cheese.

Etiology:

- ❖ Tuberculosis in animals.
- ❖ Caseous lymphadenitis & Oesophagostomiasis in sheep

Necrosis: Caseous Necrosis

Gross appearance:

- ❖ The tissue is dry, cheese like and granular but creamy in consistency.
- ❖ It is soft, friable and white or grey in colour.
- ❖ Calcium salts are frequently deposited in the dead tissue.
- ❖ Caseous mass is enclosed with in a connective tissue capsule.

Necrosis: Caseous Necrosis

Microscopic changes:

- ❖ Loss of both architectural & cellular details of area.
- ❖ Tissue appears as finely granular mass.
- ❖ Calcification occurs in certain necrotic areas.
- ❖ Fibrous capsule is present around the necrotic area.

Necrosis: Liquefactive Necrosis

❖ **Liquefactive necrosis** is characterized by disintegration of necrotic material into a liquid mass in which both, architectural and cellular details are lost.

Types: It is of two types-

- I. **Liquefaction by Autolysis:** It occurs in brain which is caused by ischemia & traumatic injury to brain. Intracellular autolytic enzymes present in brain and nervous tissue converts necrotic tissue into a liquid or semiliquid mass.
- II. **Liquefaction by Heterolysis:** It occurs in abscess where aggregation of large number of neutrophils is present. Proteolytic enzymes of neutrophils lead to liquefaction of tissue.

Necrosis: Liquefactive Necrosis

Macroscopic changes :

- ❖ Liquified necrotic material is present which is watery or semisolid in consistency and white, yellow or green in colour.

Microscopic changes:

- ❖ **Loss of both architectural & cellular details** of area.
- ❖ Dead tissue is homogenous and stains pink with eosin.
- ❖ **A cyst like space is visible** because liquefied material is usually lost during processing of the tissue.
- ❖ Neutrophils and bacteria are present in necrotic area.

Necrosis: Fat Necrosis

- ❖ **Fat necrosis** is death of adipose tissue within the living individual.
- ❖ It is of three types- Traumatic, Enzymatic and Nutritional Fat necrosis.

1. Traumatic fat necrosis:

- ❖ It occurs in subcutaneous fat due to external injury.
- ❖ Due to injury, rupture of fat cells or adipose tissue cells which release their content in connective tissue producing inflammation.
- ❖ Macroscopically necrotic fat appears as white, opaque & firm mass in the area of injury.

Necrosis: Fat Necrosis

2. Enzymatic/Pancreatic fat necrosis:

- ❖ It occurs in abdominal cavity due to action of lipases enzymes on the surrounding adipose tissue. These enzymes escape out from pancreas and also act on adipose tissue of mesentry & omentum.
- ❖ Lipases hydrolyse fat into fatty acid and glycerol. Fatty acids combined with calcium, potassium and sodium to form soaps which are **visible as white chalky material**.
- ❖ Macroscopically, the necrotic areas are characterized by the presence of white chalk like masses in the pancreatic, omental and mesenteric fat.

Necrosis: Fat Necrosis

2. Enzymatic/Pancreatic fat necrosis:

- ❖ Microscopically, around the white chalky mass, an inflammatory reaction is seen in which the macrophages, giant cells and fibroblast are seen.
- ❖ When calcification occurs, small spherical masses present which, stain blue with haematoxylin and eosin.

3. Nutritional fat necrosis:

- ❖ It is a necrobiotic alteration in fat which is associated with extreme emaciation & debilitated condition of an animal like tuberculosis or paratuberculosis in cattle and sheep.

Necrosis: Fat Necrosis

3. Nutritional fat necrosis:

- ❖ Macroscopically it is commonly observed in abdominal fat like perineal, omental and mesenteric fat appears as opaque, white, chalky and firm mass.
- ❖ Microscopically adipose tissue cells contain a pale, pink granular material with numerous crystals. Calcium combines with fatty acid in necrotic tissue and appears as **blue, spherical mass on staining with H & E**.
- ❖ Chronic inflammatory reaction is seen at the junction of necrotic and living tissue.



Veterinary Pathology: Gangrene

Definition:

❖ The invasion and putrefaction of necrotic tissue by saprophytic bacteria is known as gangrene.

Types of Gangrene:

1. Dry Gangrene
2. Moist Gangrene
3. Gas Gangrene

Veterinary Pathology: Gangrene

Dry Gangrene:

- ❖ Dry gangrene usually occurs on **extremities**. For eg. Ear, nails and tail etc.
- ❖ It is caused by **slow occlusion of blood vessels** by cold, tight bandage.
- ❖ When necrosis occurs, circulation is no longer maintained and fluid is not brought to that area. The necrotic tissue then gets dehydrated by evaporation and it becomes dry and part becomes cool.
- ❖ Since the bacteria require moisture for growth, therefore growth rate, invasion and spread of bacteria are slow. It has minimal putrefaction thus has little smell and little gas production.

Veterinary Pathology: Gangrene

Macroscopic Changes:

- ❖ Area becomes **dry, shrink and mummified**.
- ❖ A **sharp line of demarcation develops** between the living and dead tissue where several inflammatory reaction develops.
- ❖ The necrosed area has grey or black colour because putrefaction of the dead tissue produces H₂S. This Hydrogen Sulphide gives offensive smell and combines with iron of haemoglobin, liberated from disintegrating erythrocytes.
- ❖ Iron sulphide is formed which imparts grey or black colour to the tissue.

Veterinary Pathology: Gangrene

Moist Gangrene:

- ❖ It usually occurs in **internal organs** such as intestine, lungs, heavy or thick muscles and mammary glands.

Macroscopic Changes

- ❖ There is **no line of demarcation** between the living and dead tissue.
- ❖ Gangrenous tissue is moist and green, grey or black in colour.

Veterinary Pathology: Gangrene

Microscopic Changes: Both dry and moist gangrene have **similar basic characteristics-**

- ❖ Architectural details may or may not be present depending upon the amount of putrefaction.
- ❖ No cellular details are present.
- ❖ Numerous bacteria may be seen.
- ❖ Numerous gas bubbles are present particularly in moist gangrene.
- ❖ Necrotic tissue stains pink.
- ❖ Acute inflammatory reaction is seen at the junction of living and dead tissue.

Veterinary Pathology: Gangrene

Gas Gangrene:

- ❖ It is caused by anaerobic spore forming bacteria of the *Clostridium* group which cause necrosis and putrefaction of the tissue.
- ❖ Trauma may cause necrosis of tissue in which these anaerobic bacteria grow, multiply and by their powerful toxins kill the adjacent tissue.
- ❖ Organelles produce gas which accumulates in the tissue, gives a **characteristic crackling noise** when pressed.

Veterinary Pathology: Gangrene

Macroscopic Changes

- ❖ The affected muscles are black in colour, give a foul odour or smell and shows evidence of gas.
- ❖ On section, a **sarco-sanguinous fluid gives foul smelling** is drain out.

Microscopic Changes

- ❖ The muscles cells appeared ruptured.
- ❖ Necrotic tissue is oedematous with non specific inflammatory reaction.
- ❖ The oedema fluid as well as necrotic tissue shows numerous rod shaped gram positive spores forming organism.

Difference: Dry and Moist Gangrene

| S. No. | Feature | Dry Gangrene | Moist Gangrene |
|--------|--|--|---|
| 1. | Location | It usually occurs on extremities. Eg. Ear, tail, nail etc. | It usually occurs in internal organs. Eg. Intestine, lungs, Heavy and thick muscles, mammary gland. |
| 2. | Etiology | Slow occlusion of blood supply by cold, tight bandage | Sudden occlusion of blood supply due to obstruction and clot. |
| 3. | Demarcation between living and dead tissue | There is sharp line of demarcation | No line of demarcation |
| 4. | Consistency | Area is dry, shrink and mummified | Area shows hemorrhage and oedema |
| 5. | Gas bubbles | Less | More |

Difference: Dry and Moist Gangrene

Tail gangrene in severe condition



Dry Gangrene: Tail Gangrene

Moist Gangrene of Intestine

Veterinary Pathology: Apoptosis

Definition:

- ❖ Apoptosis is a **genetically programmed type of cell death** which is designed to **eliminate unwanted host cells without inciting inflammatory process**. It occurs through activation of a coordinated, internally programmed series of events brought about by a set of gene products.
- ❖ Apoptosis usually involve single cells or cluster of cells that appear in H&E stained sections as round or oval masses of intensely eosinophilic cytoplasm and dense chromatin nuclear fragments.

Veterinary Pathology:Apoptosis

- ❖ Apoptosis is responsible for programmed cell death in several physiological and pathological conditions such as :-
 1. Programmed destruction of cells during embryogenesis
 2. Hormone dependent physiological involution as involution of endometrium during menstrual cycle
 3. Certain pathological conditions such as irradiation and viral infections

Veterinary Pathology: Apoptosis

- ❖ During Apoptosis, following morphological changes occur in cells :-
 1. **Cell shrinkage:** The cell is smaller in size, cytoplasm becomes dense and organelles are tightly packed.
 2. **Chromatin condensation:** It is the most characteristic feature of apoptosis. The nuclear chromatin gets condensed and aggregates peripherally under the nuclear membrane into well defined dense masses of various shape and size.
 3. **Fragmentation of DNA**

Veterinary Pathology: Apoptosis

- 4. Formation of cytoplasmic buds & apoptotic bodies:-** The apoptotic cells shrink rapidly, formation of bud which gets fragmented into a number of membrane bound apoptotic bodies. These bodies are composed of fluid portion of cytoplasm (cytosol) and tightly packed organelles with or without nuclear fragments.
- 5. Phagocytosis of apoptotic cells :** It is done by macrophages or near by healthy cells.

Veterinary Pathology: Apoptosis

Mechanism of Apoptosis: It involves four components-

1. **Signalling:** Apoptosis is triggered by a variety of stimuli which are transmitted via plasma membrane and initiate a death cascade. There is **extrinsic and intrinsic signaling pathways**.
2. **Control and Integration:** It is performed by specific proteins.
3. **Death (Execution):** It occurs by following pathways that are Protein cleavage, Protein cross linking and DNA break down.
4. **Removal of dead cells**

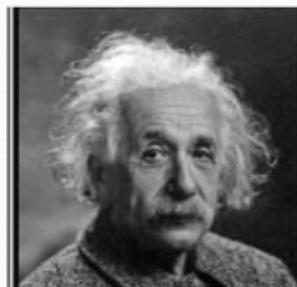
Difference: Necrosis and Apoptosis

| S. No. | Necrosis | Apoptosis |
|--------|--|---|
| 1. | Inflammatory reaction present | Inflammatory reaction absent |
| 2. | Necrosis is a premature cell death | Apoptosis is programmed cell death |
| 3. | Necrosis is an unregulated random event | Apoptosis is a highly regulated timely event |
| 4. | Not Genetically controlled | Genetically Controlled |
| 5. | Necrosis is not a pre-planned cell death pathway | Apoptosis is a pre-planned cell death pathway |
| 6. | Necrotic cell deaths are always pathological (not natural) | Apoptotic cell deaths are natural/normal |

Difference: Necrosis and Apoptosis

| S. No. | Necrosis | Apoptosis |
|--------|---|---|
| 7. | Necrotic cell death are not naturals and always require proper treatment | Apoptotic cell death usually do not require any treatment |
| 8. | Necrotic cell death always occurs after signals from external agents such fungal or bacterial toxins | Apoptotic cell death is initiated by self-generated signals from inside or outside the cells |
| 9. | Cells undergoing necrosis do not take part in any events in the death pathway | Cell undergoing apoptosis are actively take part in cell death pathway |
| 10. | A passive process and do not required ATP | An active process hence require energy from ATP molecules |
| 11. | Necrosis is caspase independent cell death pathway | Apoptosis is a caspase dependent cell death pathway |
| 12. | Integrity of mitochondria usually maintained during the initial phases of necrotic cell death. | Integrity of mitochondria usually lost during initial phases of apoptosis |

धन्यवाद



Be a loner. That gives you time to wonder, to search for the truth. Have holy curiosity. Make your life worth living.

(Albert Einstein)