Gangrene

Gangrene is a condition in which necrotic tissue is invaded by saprophytic and usually putrefactive bacteria. Saprophytes are usually air borne bacteria, so, gangrene occurs in those tissues or organs which have direct or indirect access of air.

Mainly gangrenes are two types: Moist gangrene and dry gangrene.

**Moist gangrene:**

It is the most frequent type of gangrene, occurs in tissues that are well-filled with blood at the time of necrosis begins.

**Microscopic appearances:**

There is mixture of coagulation and liquefaction necrosis where large bacilli are found. Bacilli need not be numerous. In H&E stain, bacteria are bluish but less blue than nucleus and hazy in outline. Gas bubbles may found as variable sized empty spaces, no wall of their own but usually spherical.

**Gross appearances:**

Affected part is swollen, soft, pulpy and usually dark or black in colour. The area has a foul or putrefactive odour, area cool and insensitive to touch.

**Dry gangrene:**

Dry gangrene occurs in those tissues that have a limited content of blood and fluid or in tissues in which necroses have developed slowly with retardation of natural circulation.

The affected area becomes cool, shriveled, leathery and discolored. Dry gangrene spreads slowly. Microscopic characters are almost same as moist gangrene

Gangrenous areas (in both types) are separated from the adjoining living tissues by a sharp outline of demarcation which is grossly swollen, reddish or bluish due to hyperemia and inflammation.

**Causes:**

Causes of gangrene are the causes of necrosis plus exposure to saprophytic bacteria.

- In extremities and intestine, interference with blood supply is the main cause. Thrombus, embolus, twisting, volvulous, parasites etc. may interfere in blood supply.

- In lungs and udder, toxic products of highly lethal bacteria are the usual causes.

Irritant medicines inadvertently inhaled causes gangrenous pneumonia.
Significance and effects:

The principle target is to stop the gangrenous process

- Highly toxic substances are produced during bacterial decomposition of proteins in gangrenous tissues, resulting in:
  
  i. Toxemia - toxin in blood
  
  ii. Sapremia - bacteria in blood and
  
  iii. Septicemia - Toxin plus bacteria both present in blood.

The above conditions may lead to toxic shock and death, so, gangrene is dangerous. Thus, amputation is necessary to preserve patient’s life.

In intestine, surgical removal of gangrenous part and anastomosis of healthy segments is the only hope for survival.

If the patient has good resistance capacity, the gangrenous extremity may drop off and the stump slowly heals. This is the usual outcome of dry gangrene.

Some anaerobic spore-forming bacteria of genus Clostridium is both pathogen and saprophytes. They are able to kill animal tissue and continue to multiply on it as saprophytes. They produce excess gas in the necrotic tissues, so, known as gas gangrene.

Examples:

Black leg - *C. chauvoei*

Malignant edema - *C. septicum*

Black disease - *C. novyi*
Infarcts

An infarct is a localized area of tissue necrosis resulting from sudden obstruction of the blood supply to the affected area.

Area is infarct; Process is infarction.

Ordinarily, infarction occurs in those areas or organs that are supplied by a single end artery, having no co-lateral blood supply, so, the boundaries are sharply delimited.

The necrosis is coagulative type.

Infarcts are two types: (1) Haemorrhagic or red infarcts
(2) Anaemic or pale infarcts

In haemorrhagic infarct, the area is filled with blood (erythrocytes), but in anaemic infarct the area is paler than normal. Congestion and haemorrhage are seen at the peripheral rim of the area. The type of infarct depends on the time of observation or type of tissue involve.

Microscopic appearances:

a. Coagulative necrosis filled with erythrocytes in red infarct or without erythrocytes in pale infarct.
b. The section is triangular or wedge shaped.
c. Zone of inflammation is present around the infarct but cell numbers are less.
d. Old infarcts are chiefly fibrous.
e. If small amount of blood continue to flow, then the structures where have previous access of blood supply may survive and the structure remain as a living oasis in the necrotic desert.

Gross appearances:

a. Red infarct is red in colour, protruded, presence of sharp line of demarcation between infarct and normal tissues, triangular or conical shape and softer than normal.
b. Pale infarct is white, slightly depressed, sharply demarcated, slightly denser and tougher than normal.
c. Old infarcts are sunken on the surface of the affected organ.

Causes:

Most infarcts result from obstruction of arteries and arterioles (single end), e.g. renal, coronary and certain arteries of brain. The common causes of arterial occlusion are:

a. a thrombus
b. an embolus
c. arteriosclerosis

d. mechanical obstruction-
   i. twisting   ii. volvulus   iii. Intussusceptions iv. parasitic larvae etc.

Infarcts can also result secondarily from occlusion of the venous drainage.

Special types of infarcts:

   • Kidney- Found frequently. Infarct is typically conical, apex near the cortico-
     medullary junction. Anaemic type, may be multiple, sometimes healed up with
     fibrous scar. In dogs and pigs, infarct is accompanied with chronic valvular
     endocarditis.

   • Spleen- Always haemorrhagic type, usually sub capsular infarct. Common in
     hog cholera.

   • Myocardium- Either red or pale, common in human but rare in animals.

   • Brain- Usually anaemic, liquefies quickly leaving a hole in the brain.

   • Intestine- Always haemorrhagic.

   • Lungs- Infarct may occur due to embolism in pulmonary artery. If occurs-
     always haemorrhagic. Difficult to differentiate from simple haemorrhage.

   • Liver- True infarct is rare, but may occur due to obstruction of hepatic artery.