

ARTERIAL DISEASES

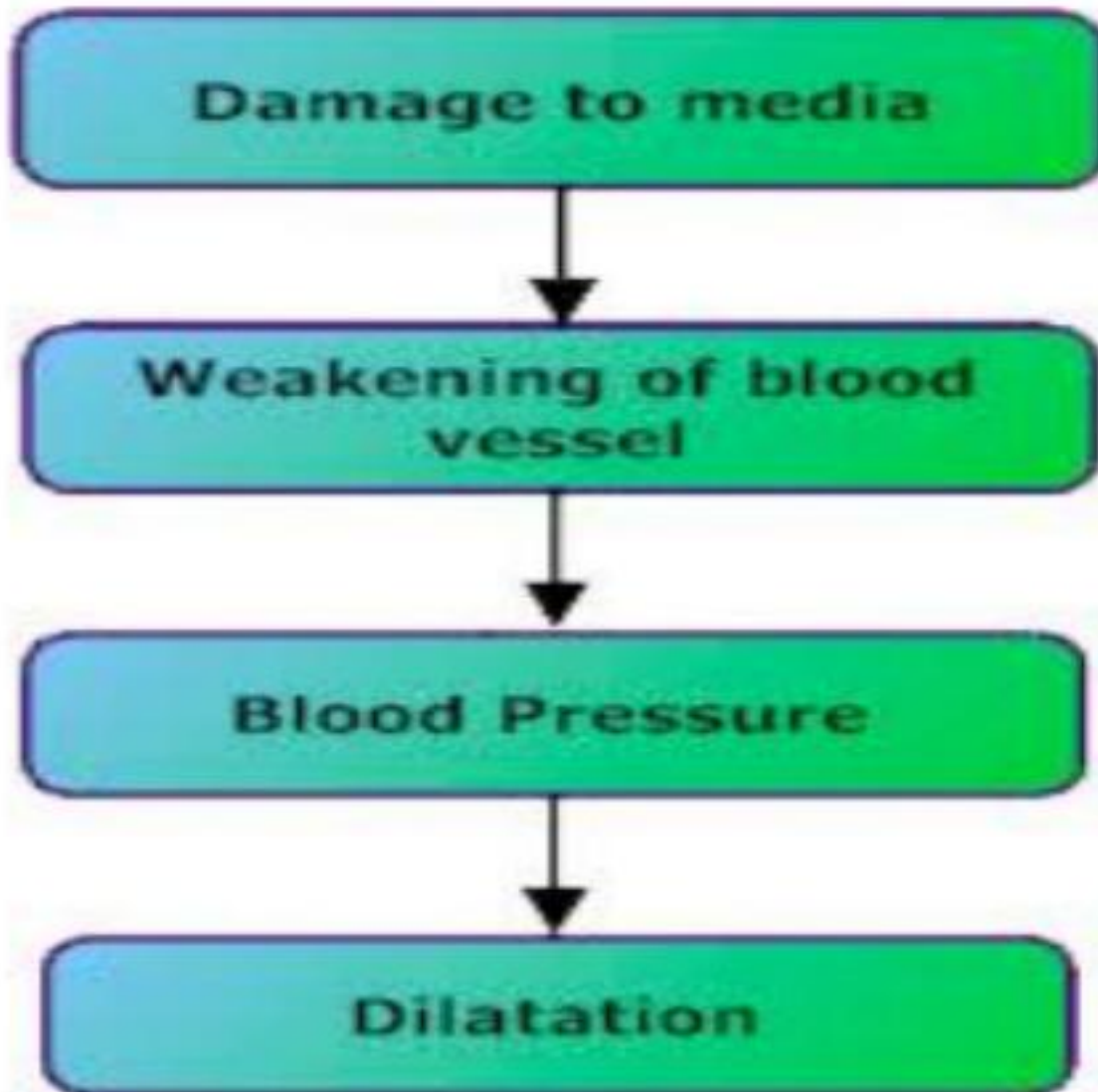
Aneurysm

Definition: Localized circumscribed dilatation of an artery, vein or cardiac chamber leading to **formation of sac**.

Etiology

- Physical - trauma
- Infected emboli or tuberculous lesion may cause **destruction of media** and **weakening of the vessel wall**
- Parasite - Strongylus vulgaris, Spirocerca lupi
- Toxins- Aflatoxin
- Disease of artery wall - atheroma
- Congenital weakness of vessel wall

Pathogenesis:



Gross pathology: Intima, intact, Depressed, Rough, Covered with thrombus

Histopathology: Media / intima, wholly or partially ruptured, Fibrosed

Types of aneurysm

- True aneurysm: The sac is formed by the wall of the artery
- False aneurysm: Here the wall of the artery is ruptured and hence the sac is formed by the surrounding connective tissue.
- Dissecting aneurysm: This is not a true aneurysm. Here no dilatation of the wall occurs.

In aorta the wall is dissected and so blood circulates within the media of the wall itself.

The outer wall may rupture leading to fatal haemorrhage.

This is usually due to degenerative lesion in the media.

- Saccular aneurysm: Here the dilatation is characterized by the formation of pouch on one

True Aneurysm



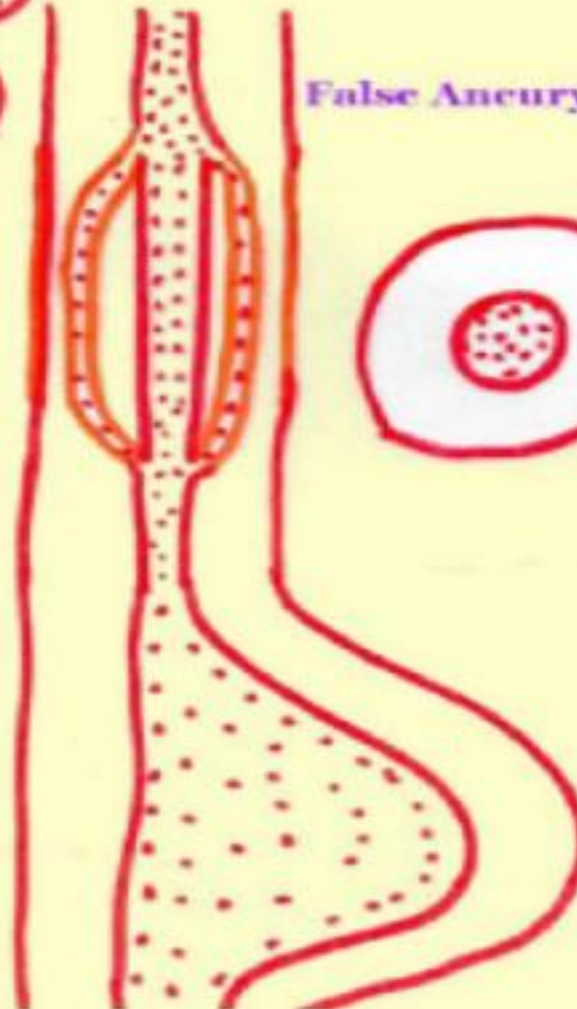
False Aneurysm



Dissecting Aneurysm



Saccular Aneurysm



) **Fusiform aneurysm**: Here a long segment of the vessel is uniformly dilated around the whole circumference.

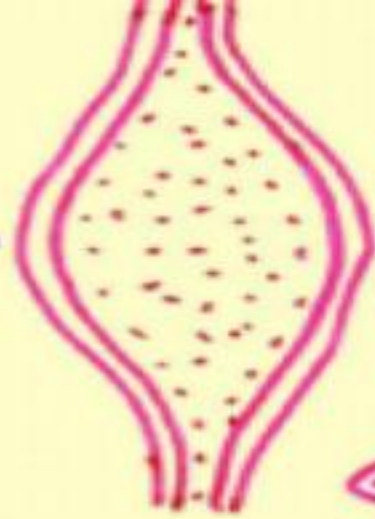
♣ This is usually seen in the **aorta and its branches**.

) **Miliary (Berry) aneurysm**: This aneurysm occurs in the minute arteries as in the brain.

♣ This is congenital in origin.

) **Arteriovenous aneurysm (Aneurysmal varix)**: It is an **abnormal acquired communication between an artery and a vein** due to simultaneous injury to both.

Fusiform



Miliary



Artery



Vein



Growth disturbances

Arterial hypertrophy

- ⊗ It is the **increase of wall thickness of arteries**
- ⊗ The affected vessels are generally **muscular arteries**.
- ⊗ Pathologically, the lesion occurs on **muscular pulmonary arteries** of cats (**due to lung worm and *Toxocara spp.* infection**), of dogs (***Dirofilaria immitis***).
- ⊗ **Compensatory hypertrophy of the wall of the artery is common.**
- ⊗ Usually the elastic lamina and muscles are involved to withstand the increased blood pressure.

- *Atrophy*

Ergot poisoning

Ergot Poisoning

Contraction of Arteritis

Ischemia

Atrophy of Arteritis

Necrosis of Surrounding
Tissue

Gangrene

Umbilical arteries
severed at birth

Umbilical Arteries
Severed at Birth

Contract

Artery filled with
Hemolysed and Clotted

Atrophy

DEGENERATION AND NECROSIS

Generalized **vascular degenerative diseases** in animals are classified into three principal groups:-

- ✚ Arteriosclerosis
- ✚ Atherosclerosis
- ✚ Medial sclerosis

Arteriosclerosis

Definition: Thickening of wall with narrowing of lumen of a small artery and arteriole .

- Arteriosclerosis is **an age related disease** that is frequent in many animal spp. but rarely causes clinical manifestations.
- Abdominal aorta is the most frequently affected vessel.

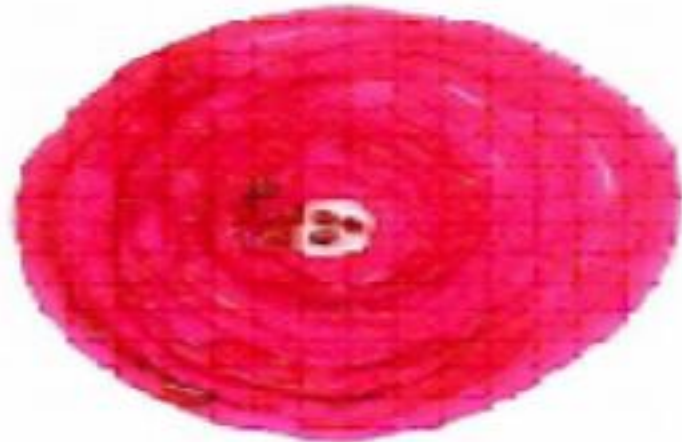
Site of occurrence: Kidney, spleen, pancreas

Etiology

- Johne's disease, Toxins
- Hypertension , Hypothyroidism in old dogs

Gross pathology: Artery

- Thick, hard
- On section, stand prominently
- Lumen - narrow
- Loss of elasticity



Histopathology

- Wall of artery – Thick with homogenous pink collagenous fibrosis
- Intima to media - Hyaline degeneration, fibrosis and calcification

Atherosclerosis : clogging or hardening of arteries caused by plaques of fatty deposition. it means a soft, mushy, gruel like substance accumulated.

- In this condition such a substance is deposited in the intima of larger elastic arteries.

Site of occurrence

- Commonly affected – Aorta and its primary branches

Etiology: Contributing factors are:

- Heredity, Lack of physical activity
- Stress, hypercholesterolaemia
- Diabetes mellitus, Hypothyroidism
- Obesity, Hypertension
- Senility, Intramural haemorrhages
- Smoking, Toxins

Athero Sclerosis



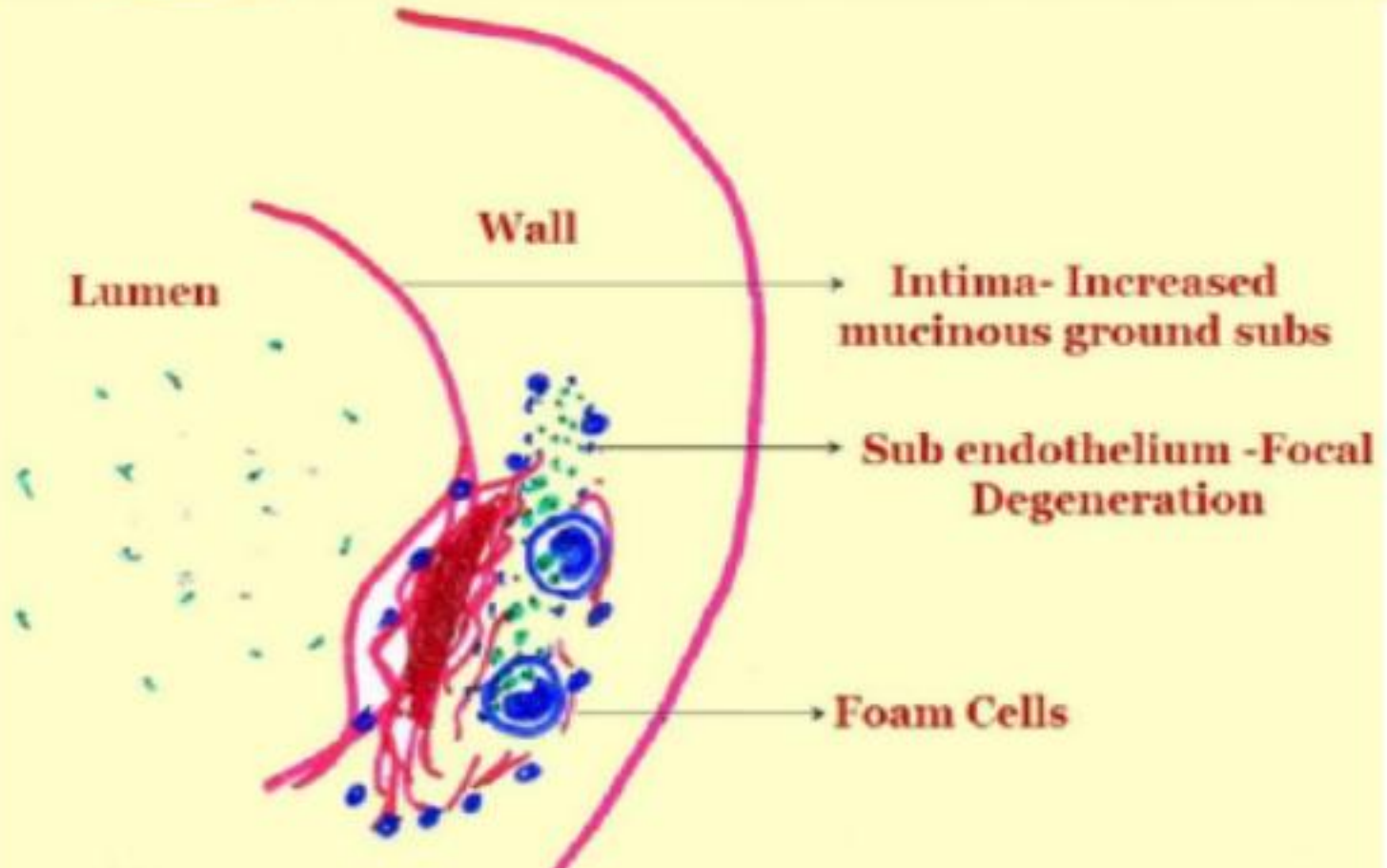
Lumen

Wall

→ Intima- Increased mucinous ground subs

→ Sub endothelium -Focal Degeneration

→ Foam Cells



Gross pathology

- The affected vessel is enlarged, less pliable and the wall is thickened
- The intima of aorta may reveal round or oval fatty areas (0.1 to 2.0 cm diameter)

Histopathology - Aorta

- ▶ The endothelium shows **hydropic degeneration** and appears **thickened**
- ▶ Foam cells appear in the area (Subendothelial or middle and outer layers)
- ▶ Fibroblastic proliferation occurs around the lesion

Medial sclerosis

- It involves medium sized muscular arteries and characterized by **fatty degeneration and hyalinization of muscular tissue of medial arteries leading to necrosis.**

Occurrence: Cattle and old dogs

Etiology

- ✗ Old age
- ✗ Excessive administration of epinephrine (adrenaline)
- ✗ Nicotine, Vitamin D toxicity
- ✗ Hyperparathyroidism

Pathogenesis

- Endothelium - Intact
- Muscular tissue- Degeneration Fatty / hyaline Necrosis Calcification (Heterotopic ossification)

Macroscopic and microscopic features

- Hardening of medium sized arteries
- Hyaline, fatty changes and calcification of arterial wall
- Fatty changes, hyalinization of muscular layer of medium sized

Manchester wasting disease of cattle

Calcific arteriosclerosis

- A frequent lesion in an animal that often have concurrent **endocardial mineralization** and involves both elastic and muscular arteries.

Etiology: Excessive Vitamin D, Toxins causing hypercalcaemia

Signs: Progressive wasting, arched back

Gross pathology: Major arteries – thick, hard and

brittle, Intima – plaque

Histopathology: Medial layer of muscle fibres in arteries show degenerative

INFLAMMATION

Arteritis: Definition:

- Inflammation of the wall of artery is called **arteritis**.
- Inflammation of **tunica intima** is called **endarteritis**

Types: Based on the course, arteritis is classified as

acute and chronic arteritis

Acute arteritis

Route of infection:

- **Perivascular** extension of infection is common as in pneumonia, mastitis and metritis,

Etiology

- Physical trauma
- Nutritional – vitamin E and C deficiency (microangiopathy in pigs)
- Bacteria – Pyogenic
- Virus – Equine viral arteritis, equine herpes virus, infectious canine hepatitis and feline infectious peritonitis
- Parasite
- Fungi
- Toxins – Uremia

Gross lesion: Hyperemia, oedema

Histopathology: Intima and media –
Infiltrated with lymphocytes and Connective

Chronic arteritis

Etiology: Larvae of *Strongylus vulgaris* in the anterior mesenteric artery of horse

Gross pathology: Artery:

- ♣ Dilated / aneurysm forms which may rupture with fatal haemorrhage; Wall: Loss its resiliency; Intima: Rough, has thrombus which contains larvae - Shows series of fine tracts

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Histopathology: Artery wall - Loss of Elastic tissue - Fibrosis; Media- Degeneration of muscles; Intima - Has thrombus which contains parasite and fibrin deposits.

Neoplasms

- Neoplasms arising from vascular endothelial cells develop in many different organs.
- Hemangiomas are benign neoplasms often found in the skin of dogs.
- Neoplasms, hemangiosarcoma (spleen and right atrium of dogs)
- hemangiopericytoma (skin of dogs) are of vascular origin.

Circulatory Disturbances

Thrombosis/Thrombus: Definition

-) it is the formation within a vascular lumen of a thrombus,
-) an aggregate of coagulated blood containing platelets, fibrin and entrapped cells.

- **Thrombi** differ from **simple clots**, in that clots involve only the activation of coagulation cascade and can develop in-vitro or in post-mortem tissue.

- Thrombosis is a pathologic process that represents a **blood clot within the uninterrupted blood vascular system**.

Predisposition to thrombosis:

- ⊗ Endothelial injury
- ⊗ Stasis of blood flow

causes of endothelial injury

- o Substances circulating in the blood. E.g. bacteria, toxins, chemicals, etc
- o Diseases of vessel wall. E.g. atheromas, arteriosclerosis, parasitic aneurysm
- o Pressure from outside. E.g. tumour, ligature

Mechanism

Endothelial injury exposes collagen to platelets

Activation of platelets leads to platelet release reaction

Platelet release reaction stimulates coagulation and aggregation

Platelets adhere to endothelium or sub-endothelial collagen

Clotting factors from platelets and serum enhance adhesion and aggregation

Aggregation- clumping of the platelet plug and interaction with fibrin occur

The clot is consolidated by formation of firm platelet-fibrin binding

When the fibrin around the platelet thrombus becomes fully polymerised circulating platelets no longer adhere to it

Consequences of thrombosis

- ⌘ Obstruction of blood vessel to cause embolism and infarction
- ⌘ Prove to fatal if they occur in blood vessels of visceral organs such as lungs, heart, and intestines
- ⌘ **E.g.** Strongyle infestation in horses-aneurysm in the anterior mesenteric artery.
- ⌘ Swine erysipelas in the hear

Embolism/Emboli

- Embolism is a sudden blocking of an artery or vein by a solid mass (emboli) that circulates in the blood stream.

Causes of emboli:

- **Thrombi:** the condition is known as thrombo-embolism.
- Thrombus that is formed in the **veins** goes to the heart and trapped in the pulmonary capillaries of the lungs causing **pulmonary thrombo-emboli** and sudden death.
- **Arterial thrombi travel** to the smaller vessels and of the arterial system to cause infarction.
- **Parasitic emboli:** is caused by live and dead parasites that enter blood stream. E.g. :
 - *Dirofilaria immitis* in dogs- heart parasites
 - *Strongylus spp.* in horses in the mesenteric artery

- **Fat emboli** – arises from bone fracture, prolonged surgery, or osteomyelitis
- **Air or nitrogen bubbles**- arises from intravenous injection of gas bubble
- **Septic emboli**, foreign material, tumour cells

The consequences of emboli may be:

- ♣ infarction
- ♣ heart failure or death of the animal depending on the part of the body affected, size of the tissue deprived and the presence or absence of collateral drainage or blood supply.

VENOUS DISEASES

Dilatation (Varicose veins):

∞ Dilatation of veins from weakened vascular wall is termed **varicosity** (localized involvement) or **phlebectasia** (generalized alteration).

Etiology:

- + Trauma, high blood pressure, hindrance to flow as in mitral stenosis
- + Pulmonary emphysema and cirrhosis of liver
- + Ageing and standing for long time in human beings

Histopathology - Veins

- Muscular hypertrophy is followed by atrophy
- Elastic tissue is replaced by fibrous tissue and the affected areas may dilate.

The pathogenesis of varicose veins is due to the following factors:

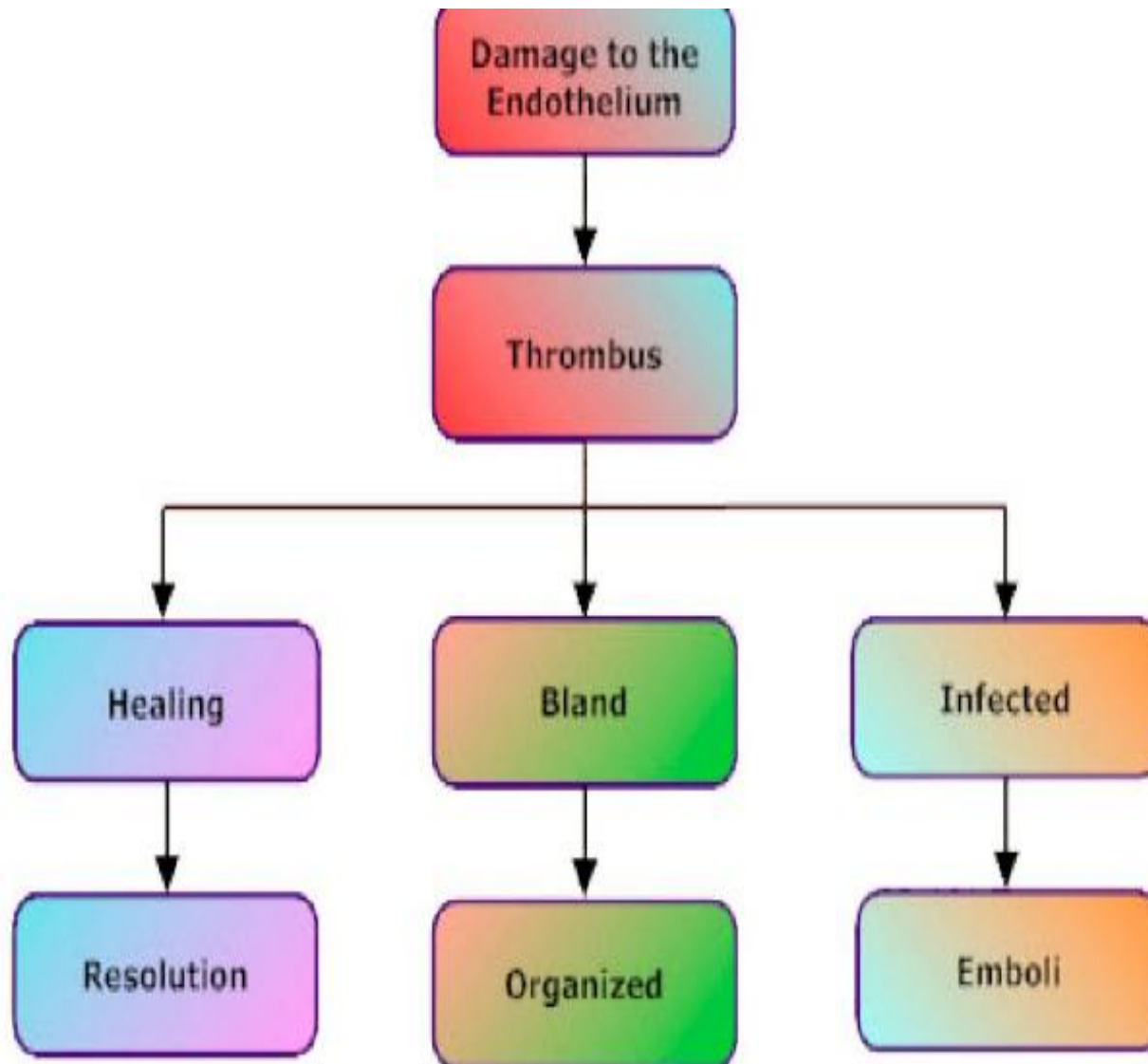
Telangiectasis

- Here sinusoids of liver are widely dilated locally.
- It is seen in bovine liver due to Spherphorus infection.
- In human beings it is seen in subcutis.

Inflammation

- **Phlebitis:** means inflammation of veins
 - *Acute phlebitis:* It is caused by intravenous infusion of irritants, traumatic reticuloperitonitis and through extension from wounds.

→ Chronic phlebitis. e.g. Tuberculosis



Etiology

- Systemic infections by salmonellosis
- Local extension of infections, such as in metritis or hepatic abscesses
- Faulty intravenous injections of irritant solution
- Parasites (Schistosomiasis) the adult parasites are present in mesenteric and portal veins
- Naval infection in calves

Macroscopic and Microscopic feature

- ◆ Wall of vein is thickened
- ◆ Vein contain large thick necrotic material
- ◆ Lumen dilated
- ◆ Inner surface of vein is rough and hyperemic.
- ◆ Infiltration of neutrophils in the wall of veins and Wall of vein becomes thick due to inflammatory cells and/or proliferation of

Omphalophiebitis

- Omphalophiebitis or navel ill is inflammation of the umbilical vein
- usually occurs in neonatal farm animals due to bacterial contamination of the umbilicus following parturition

LYMPH VESSEL DISEASES

Dilatation and rupture

Lymphangiectasis:

- It is dilatation of lymph vessels.
- It is caused by obstruction of lymph drainage by invading masses of malignant neoplasms.
- Lacteals in the intestinal villi are the most affected in dogs in which there is a condition known as protein-losing enteropathy.
- Bovine pasteurellosis also causes

-)} **Rupture of the thoracic duct** causes chylothorax in dogs and cats.
-)} It results from trauma or spontaneous rupture.
-)} Chylothorax could also occur without injury to the thoracic duct and attributed to lesions that interfere with central venous return.

Inflammation

Lymphangitis

- It is the inflammation of lymph vessels
- characterized by aggregation of lymphocytes around lymphatics, oedema of dependent parts and distension of lymphatics.

Etiology

- *Corynebacterium avis* causes caseous lymphangitis and lymphadenitis
- Equine epizootic lymphangitis

Macroscopic and microscopic features

- ✚ Distension of subcutaneous lymph vessels, nodules of lymphoid aggregates
- ✚ Edema due to failure of lymphatic drainage.
- ✚ Lymphoid aggregation around lymphatics.
- ✚ Lymphatics distended
- ✚ Edema of dependent tissue.

Neoplasms

- lymphangioma and lymphangiosarcoma are commonly affecting lymph vessels