ATHEROSCLEROSIS,
VASCULITIS AND ANEURYSMS.

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3] **Vasculitis (arteritis)** refers to a variety of inflammatory or immunologically mediated diseases that are primary lesions of the arteries. Focal inflammation of an artery due to spread of a contiguous inflammation, such as occurs in an abscess, is not considered an arteritis. Arteritis includes a number of entities, each with incompletely understood pathogenetic mechanisms. The more common forms are briefly described next.
(a) **Polyarteritis nodosa** refers to a group of systemic necrotizing vasculitides that have a widespread distribution of arterial lesions, with involvement of multiple organ systems and signs of widespread ischaemic tissue injury. These lesions often result in the formation of microaneurysms in affected vessels. The common factor among the polyarteritis nodosa group is the presence of necrotizing lesions (fibrinoid necrosis) of medium-sized and small muscular arteries with neutrophilic and eosinophilic infiltration of the vessel wall.

1. **Incidence and sex.** The disease is uncommon but can be seen in all age groups and is more commonly seen in males.

2. **Aetiology.** Unknown but some patients have hepatitis B virus surface antigen (HBsAg) positive and anti-neutrophilic cytoplasmic antibodies (ANCA). These findings indicate a possible immunological aetiology.
Clinicopathological features.

PAN causes muscle and joint pain, fever, ischaemic lesions in many organs (intestine, spleen and lung), peripheral neuropathy and renal damage (haematuria and arthralgia).

Laboratory investigations.

a) Haematological findings: normochromic normocytic anaemia, leukocytes and eosinophilia with high ESR.

b) Selective angiography may reveal aneurysms.

c) Biopsy of skin, nerve or muscle may show necrotising arteritis.

b) Thromboangiitis obliterans (also called Buerger’s disease) is a recurrent inflammatory disorder of arteries that is characterized by thrombosis of medium-sized vessels, especially the radial and tibial arteries. Although the arteries are the primary sites of inflammation, adjacent veins and nerves can become involved.
(1) **Epidemiology.** Thromboangiitis obliterans occurs almost exclusively in cigarette smokers and is prevalent in men between the ages of 25 and 50 years. It is extremely rare in non-smoking men and in women, although as more women smoke cigarettes, this pattern may change.

(2) **Aetiology and pathogenesis.** The strong epidemiologic association with cigarette smoking suggests that this factor plays a role in the pathogenesis of Buerger’s disease. The exact mechanism, however, is unknown.

(3) **Clinical features.** Affected patients initially may present with recurrent episodes of patchy thrombophlebitis of superficial veins. Once the actual lesion develops, these patients usually complain of pain in the affected extremity, brought on at first by exercise and eventually present even at rest. Ischaemia may cause tissue ulcerations and gangrene. Because individual thrombi can recanalize, the symptoms may abate until a new thrombus forms and ischaemia returns.
(4) **Pathology.** Microscopic examination shows occlusion of the involved arterial segment by a thrombus with varying degrees of organization, recanalization, or both. The thrombus contains microabscesses. A nonspecific inflammatory infiltrate is found at first in the adjacent arterial wall, but as the disease advances, both inflammation and subsequent fibrosis extend through the tunica adventitia to envelop adjacent veins and nerves. This fibrous encasement of artery, vein, and nerve is the histologic hallmark of thromboangiitis obliterans.

c] **Other vasculitic disorders.** Several other disorders are charactered by necrotizing vasculitic component. These conditions include Wegener’s granulomatosis, systemic lupus erythematosus, rheumatoid arthritis, hypersensitivity vasculitis, and allergic granulomatosis of Churg and Strauss.
ANEURYSMS

**Definition:** An aneurysm is defined as a permanent abnormal dilatation of a blood vessel occurring due to congenital or acquired weakening or destruction of the vessel wall. Most commonly, aneurysms involve large elastic arteries, especially the aorta and its major branches. Aneurysms can cause various ill-effects such as thrombosis and thromboembolism, alteration in the flow of blood, rupture of the vessel and compression of neighbouring structures.

**Atherosclerotic aneurysms:** Atherosclerotic aneurysms are the most common form of aortic aneurysms. They are seen more commonly in males and the frequency increases after the age of 50 years when the incidence of complicated lesions of advanced atherosclerosis is higher. They are most common in the abdominal aorta, so much so that all forms of aneurysms of abdominal aorta (fusiform, cylindrical and saccular) should be considered atherosclerotic until proved otherwise. Other locations include thoracic aorta (essentially the ascending part and arch of aorta), iliac arteries and other large systemic arteries.
(2) **Syphilitic (Luetic) aneurysms**  Cardiovascular syphilis occurs in about 10% cases of syphilis. It causes Arteritis – syphilitic aortitis and cerebral Arteritis, both of which are already described in this chapter. One of the major complications of syphilitic aortitis is syphilitic or luetic aneurysm that develops in the tertiary stage of syphilis. It usually manifests after the age of 50 years and is more common in men. The predominant site of involvement is thoracic aorta, especially in the ascending part and arch of aorta. It may extend proximally into the aortic valve causing aortic incompetence and may lead to syphilitic heart disease. Less often, it may extend distally to involve abdominal aorta.
Pathogenesis: About 40% cases of syphilitic aortitis develop syphilitic aneurysms. The process begins from inflammatory infiltrate around the vasa vasorum of the adventitia, followed by endarteritis obliterans. This results in ischaemic injury to the media causing destruction of the smooth muscle and elastic tissue of the media and scarring. Since syphilitic aortitis involves the proximal aorta maximally, aortic aneurysm is found most frequently in the ascending aorta and in the aortic arch.

- **Pathologic changes:** Syphilitic aneurysms occurring most often in the ascending part and the arch of aorta are saccular in shape and usually 3-5 cm in diameter. Less often, they are fusiform or cylindrical. The intimal surface is wrinkled and shows tree-bark appearance. When the aortic valve is involved, there is stretching and rolling of the valve leaflets producing valvular incompetence and left ventricular hypertrophy due to volume overload. This results in massively enlarged heart called 'cor bobinum'.


**Histologically,** the features of healed syphilitic aortitis are seen. The adventitia shows fibrous thickening with endarteritis obliterans of vasa vasorum. The fibrous scar tissue may extend into the media and the intima. Rarely spirochaetes may be demonstrable in syphilitic aneurysm. Often, mural thrombus is found in the aneurysm.

**Effects.** The clinical manifestations are found much more frequently in syphilitic aneurysms than in atherosclerotic aneurysms. The effects include the following:

1. **Rupture.** Syphilitic aneurysm is likely to rupture causing massive and fatal haemorrhage into the pleural cavity, pericardial sac, trachea and oesophagus.

2. **Compression.** The aneurysm may press on the adjacent tissues and cause symptoms such as on trachea causing dyspnoea, on oesophagus causing dysphagia, on recurrent laryngeal nerve leading to hoarseness; and erosion of vertebrae, sternum and ribs due to persistent pressure.

3. **Cardiac dysfunction.** When the aortic root and valve are involved, syphilitic aneurysm produces aortic incompetence and cardiac failure. Narrowing of the coronary ostia may further aggravate cardiac disease.
Dissecting aneurysms and Cystic Medial Necrosis:
The term dissecting aneurysm is applied for a dissecting haematoma in which the blood enters the separated (dissected) wall of the vessel and spreads for varying distance longitudinally. The most common site is the aorta and is an acute catastrophic aortic disease. The condition occurs most commonly in men in the age range of 50 to 70 years. In women, dissecting aneurysms may occur during pregnancy.
Pathogenesis. The pathogenesis of dissecting aneurysm is explained on the basis of weakened aortic media. Various conditions causing weakening in the aortic wall resulting in dissection are as under:

i) Hypertensive state. About 90% cases of dissecting aneurysm have hypertension which predisposes such patients to degeneration of the media in some questionable way.
ii) **Non-hypertensive cases.** These are cases in whom there is some local or systemic connective tissue disorder e.g.

a) Marfan's syndrome, an autosomal dominant disease with genetic defect in fibrillin which is a connective tissue protein required for elastic tissue formation.

b) Development of cystic medial necrosis of Erdheim, especially in old age.

c) Iatrogenic trauma during cardiac catheterization or coronary bypass surgery.

d) Pregnancy, for some unknown reasons.

Once medial necrosis has occurred, haemodynamic factors, chiefly hypertension, cause tear in the intima and initiate the dissecting aneurysms. The media is split at its weakest point by the inflowing blood. An alternative suggestion is that the medial haemorrhage from the vasa vasorum occurs first and the intimal tear follows it. Further extension of aneurysm occurs due to entry of blood into the media through the intimal tear.
Pathologic changes. Dissecting aneurysm differs from atherosclerotic and syphilitic aneurysms in having no significant dilatation. Therefore, it is currently referred to as 'dissecting haematoma'. Dissecting aneurysm classically begins in the arch of aorta. In 95% of cases, there is a sharply-incised, transverse or oblique intimal tear, 3-4 cm long, most often located in the ascending part of the aorta. The dissection is seen most characteristically between the outer and middle third of the aortic media so that the column of blood in the dissection separates the intima and inner two thirds of the media and the adventitia on the other. The dissection extends proximally into the aortic valve ring as well as distally into the abdominal aorta.
Occasionally, the dissection may extend into the branches of aorta like into the arteries of the neck, coronaries, renal, mesenteric and iliac arteries. the dissection may affect the entire circumference of the aortic media or a segment of it. In about 10% of dissecting aneurysms, a second intimal tear is seen in the distal part of the dissection so that the blood enters the false lumen through the distal tear. If the patient survives, the false lumen may develop endothelial lining and 'double-barrel aorta' is formed.
Depending upon the extent of dissecting aneurysms, three types are described:

Type 1: Comprises 75% of cases, begins in the ascending aorta and extends distally for some distance.

Type II. Comprises 5% of cases and is limited to the ascending aorta.

Type III. Constitutes the remaining 20% cases and begins in the ascending thoracic aorta near the origin of subclavian artery.

Types I and II involving ascending aorta are also called as group A dissection, and type III not involving ascending aorta is referred to as group B dissection.
**Histologically,** the characteristic features of cystic medial necrosis are found. These are as under.

– Focal separation of the fibromuscular and elastic tissue of the media.
– Numerous cystic spaces in the media containing basophilic ground substance.
– Fragmentation of the elastic tissue.
– Increased fibrosis of the media.
**Effects:** The classical clinical manifestation of a dissecting aneurysm is excruciating tearing pain in the chest moving downwards. The complication arising from dissecting aneurysms are as under:

1. **Rupture.** Haemorrhage from rupture of a dissecting aneurysm in the ascending aorta results in mortality in 90% of cases. Most often, haemorrhage occurs into the pericardium; less frequently it may rupture into thoracic cavity, abdominal cavity or retroperitomeum.

2. **Cardiac disease.** Involvement of the aortic valve results in aortic incompetence. Obstruction of coronaries results in ischaemia causing fatal myocardial infarction. Rarely, dissecting aneurysm may extend into the cardiac chamber.

3. **Ischaemia.** Obstructin of the branches of aorta by dissection results in ischaemia of the tissue supplied. Thus, there may be renal infarction, cerebral ischaemia and infraction of the spinal cord.
4. Cirrroid aneurysms are aneurysmic arteriovenous fistulas in the form of a tangled mass of intercommunicating vessels. These aneurysms predispose to possible rupture with hemorrhage and can cause heart strain because of arteriovenous shunting of blood.

(5) Mycotic aneurysms. Secondary to weakening of wall from infectious vasculitis, most commonly bacterial (Salmonella).
(b) Anatomic classification

(1) **Saccular aneurysms** are balloon-like arterial dilatations on one side of an artery; the orifice may be small compared to the diameter of the aneurysm. Because the blood usually is stagnant in these aneurysms, the lumen can contain a thrombus.

(2) **Fusiform aneurysms** are spindle-shaped dilatations of an artery, they need not be symmetric around the long axis of the affected artery.

(3) **Cylindroid aneurysms** are abrupt, cylindrical dilatations of an artery (Figure 3). Again, symmetry and mutual thrombosis are variable.

(4) **Berry aneurysms** are small saccular aneurysms, 0.5 cm. to 2 cm in diameter, which resemble berries. They often are congenital and commonly are present in the smaller cerebral arteries, particularly in the circle of Willis.