EMBOLISM

Embolus -It is a detached intravascular solid, liquid, or gaseous mass that is carried by the blood from it's point of origin to a distant site, where it is often causes tissue dysfunction or infarction.

PULMONARY EMBOLISM	SYSTEMIC THROMBOEMBOLISM

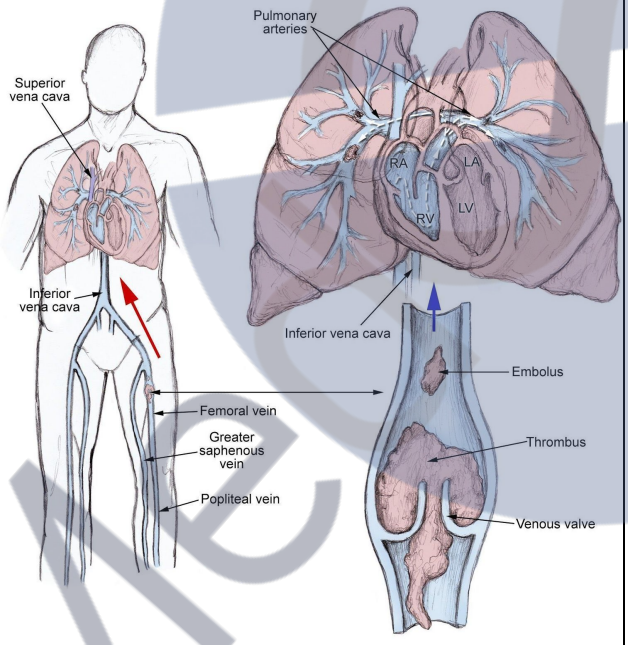
Pulmonary emboli originate from deep vein thromboses and are the most common form of thromboembolic disease.

There is occlusion of the pulmonary arterial tree.

Etiology- Thrombi originate from large veins of lower limbs(popliteal, femoral, iliac) or less commonly from varicosities in superficial veins.

Risk factors- Stasis of blood
-Hypercoaguable states

Pathogenesis-
Detachment of thrombi > formation of thrombo-embolus > flows through the venous drainage > larger veins > Right side of the heart > pulmonary arterial vasculature.



Depending on the size of the embolus, it can block the main pulmonary artery, or straddle the bifurcation (**SADDLE EMBOLUS)** or form multiple small emboli (more common) which are then impacted in a number of small vessels.

Most systemic emboli (80%) arise from intracardiac mural thrombi.
Remaining originate from-
-Aortic aneurysms, atherosclerotic plaques, valvular vegetations or venous (paradoxical) emboli.

These can travel to a wide variety of sites depending on-
1.Source
2.Relative amount of blood flow that downstream tissues receive

Sites are-
Lower extremities (75%)
Brain (10%)
Intestines, kidneys, spleen, upper extremities.

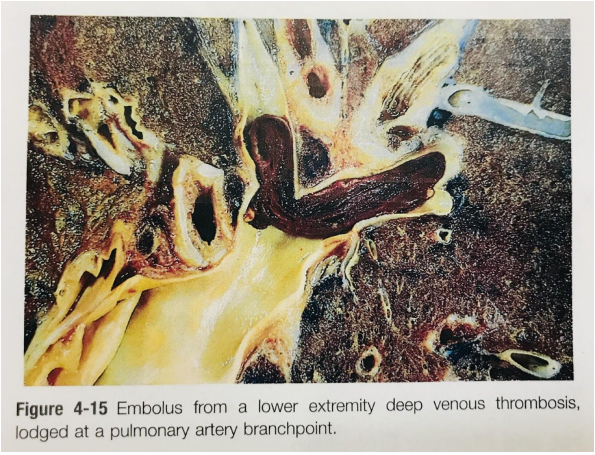
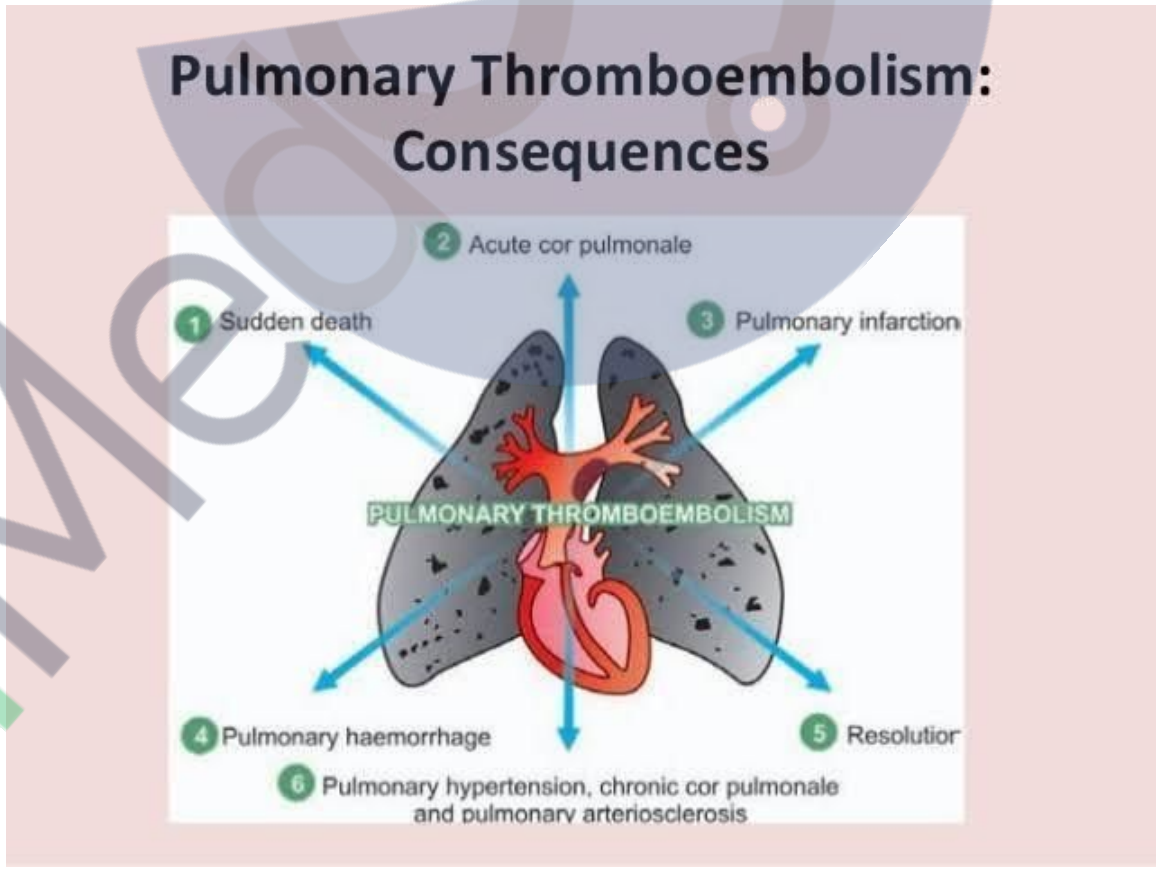


Figure 4-15 Embolus from a lower extremity deep venous thrombosis, lodged at a pulmonary artery branchpoint.

PARADOXICAL EMBOLISM-Occurs rarely, when a venous embolus passes through an interatrial or interventricular defect and gains access to the systemic arterial circulation.

A patient who has had one PE, is at HIGH risk for more.



TYPES OF EMBOLISM

FAT AND MARROW EMBOLISM-

Microscopic fat globules, sometimes with associated haematopoietic bone marrow can be found in the pulmonary vasculature.

Fat and marrow emboli are very common incidental findings after vigorous CPR and usually have no clinical consequence.

FAT EMBOLISM SYNDROME is the term applied to minority of patients who get symptomatic.

Causes-

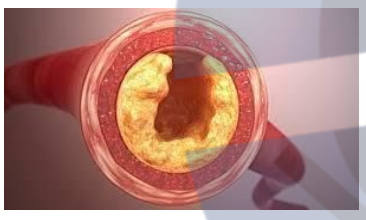
- Traumatic-

Trauma to bones (fracture of long bones, leads to passage of fatty marrow in circulation) or

soft tissue trauma (laceration of adipose tissue, during purpeurium)

- Non-traumatic-

Extensive burns; Diabetes mellitus; Fatty liver; Pancreatitis; Hyperlipidemia; Cardiopulmonary bypass etc.



Pathogenesis of Fat Embolism:

1) Mechanical Theory-
   Mobilisation of fluid fat after trauma > Fat globules released from injured area into venous circulation > Most fat arrested in small vessels in lungs > some globules may pass into systemic circulation; lodge in other organs.

2) Emulsion Instability Theory (Non-traumatic cases)
   Disturbance in natural emulsification of fat > aggregation of plasma lipids > formation of Fat emboli.

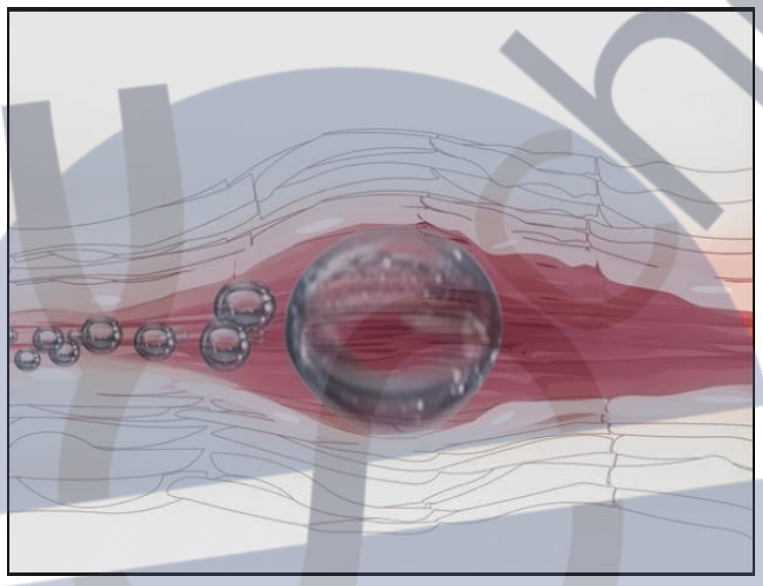
3) Intravascular coagulation theory-
   Stress causing release of some factor > Activation of DIC > aggregation of fat emboli.

4) Toxic injury theory-
   high plasma levels of FFA > injury to small blood vessels of lung > inc. vascular permeability > pulmonary oedema.

Clinical features-
(1-3 days after injury)

Pulmonary-Tachypnoea, Dyspnoea, Hypoxemia
Neurological-Agitation,Restlessness, Delirium, Coma
Dermatological-Petechial rash
Haematological-Anaemia(red cell aggregation or haemolysis) , Thrombocytopenia (platelet adhesion to fat globules)

AIR EMBOLISM



Gas bubbles within the circulation can coalesce to form frothy masses that obstruct vascular flow.

Venous Air Embolism- air can be sucked into the venous system.
- Operations on head, neck, trauma
- Obstetrical operations, trauma
- IV infusion of blood/fluid.
- Angiography

Arterial Air Embolism- entry of air into the pulmonary vein or it's tributaries.
- Cardiothoracic Surgery and trauma
- Paradoxical Air embolism
- Arteriography

DECOMPRESSION SICKNESS- it's a particular form of gas embolism.
It occurs when individuals experience sudden decreases in atmospheric pressure.
eg-Scuba and deep sea divers, underwater construction workers, individuals in unpressurised aircrafts.

Air breathed at high pressure > Inc. amounts of gas dissolved in blood and tissues > rapid ascent (depressurisation) > nitrogen comes out as minute bubbles > accumulate particularly in fatty tissue (high affinity) > may coalesce together to form a large embolism

CAISSON DISEASE-more chronic form of decompression sickness, in bridge construction workers, who suffer both acute and chronic forms of decompression sickness.

Clinical features-

- Acute- due to acute obstruction of small blood vessels

-BENDS-painful condition due to rapid formation of gas bubbles within skeletal muscles and supporting tissue around joints
-CHOKES- accumulation of bubbles in lungs leading to acute respiratory distress.
-CEREBRAL EFFECTS-vertigo, coma

- Chronic-due to foci of ischaemic necrosis throughout the body, especially skeletal system.

-Avascular necrosis of bones
-Neurological symptoms-paraesthesia,paraplegia
-Lung involvement-haemorrhage, Oedema, emphysema,dyspnoea
-Skin-itching, patchy erythema

AMNIOTIC FLUID EMBOLISM

Most serious, unpredictable and unpreventable cause of maternal mortality.

Cause-infusion of amniotic fluid/fetal tissue into maternal circulation via-

- Tear in placental membranes
- Rupture of uterine vessels

Substances in amniotic fluid > biochemical activation of coagulation factors and immune system > Morbidity/Mortality

Onset-Sudden severe dyspnoea, cyanosis, shock
-followed by neurological impairment-
headache, seizures, coma
After initial crisis, pulmonary oedema develops, accompanied by DIC.

Classic findings-

- Squamous cells shed from fetal skin
- Lanugo hair
- Fat from vernix caseosa
- Mucin from fetal respiratory tract/GIT
- Bile from meconium

ATHEROEMBOLISM

Atheromatous plaques (especially from aorta) > form emboli > occlude small/medium arteries.

TUMOUR EMBOLISM

Malignant tumour cells may invade local blood vessels/ form tumour emboli producing metastatic tumour deposits.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