Hemodynamic Disorders

: A detached intravascular solid, liquid, or gas mass transported by blood to a distant site, causing tissue dysfunction or infarction.

- Common Types: Thromboembolism: Most common, from dislodged thrombi. Others: Fat droplets, air/nitrogen bubbles, atherosclerotic debris, tumor fragments, bone marrow, or amniotic fluid.

Consequences:

- Systemic circulation: Ischemic necrosis (infarction).
- Pulmonary circulation: Hypoxia, hypotension, and right-sided heart failure.

Topic	Key Points
Pulmonary Thromboembolism	- Originates from deep vein thrombosis (DVT); >95% from leg veins.- Risks: surgery, pregnancy, malignancy.- Common sites: main pulmonary artery, bifurcation (saddle embolus), smaller arterioles.- Can lead to pulmonary hypertension or sudden death.
Systemic Thromboembolism	- 80% arise from intracardiac thrombi (e.g., left ventricular infarcts).- Common sites: lower extremities (75%), CNS (10%), intestines, kidneys, spleen.- Consequences depend on vessel size, collateral supply, tissue vulnerability.- Leads to infarction in end-arteries.
Fat and Marrow Embolism	- Occurs in skeletal injuries (90%) but clinically significant in <10%.- Causes: mechanical obstruction (fat globules) or biochemical injury (toxic fatty acids).- Fat embolism syndrome: pulmonary issues, petechial rash, anemia, thrombocytopenia.
Amniotic Fluid Embolism	- Rare, severe complication of labor; 1 in 40,000 deliveries.- Mortality ~80%; survivors often have neurological deficits.- Symptoms: sudden dyspnea, cyanosis, hypotension, seizures, DIC.- Caused by amniotic fluid entry into maternal circulation.
Air Embolism	- Caused by gas bubbles in circulation; obstructs blood flow.- Small emboli usually harmless; large emboli (>100cc) can cause death.- Risk factors: surgeries, decompression sickness (divers, unpressurized aircraft).
Decompression Sickness	- Results from rapid pressure changes; nitrogen bubbles form.- Symptoms: joint pain ("bends"), respiratory distress ("chokes"), mental impairment.- Treatment: high-pressure chamber to resorb gas gradually.- Chronic cases affect bone necrosis.

Patients who had one PE is at high risk for more.

A diffuse petechial rash (20%–50% of cases) due to rapid onset of thrombocytopenia → A useful diagnostic feature.

In 1 to 3 days after injury

Morbidity & Mortality: stems from biochemical activation

Placing affected persons in a high- pressure chamber, to force the gas back into solution, treats acute decompression sickness

Infarction

an area of ischemic necrosis caused by occlusion of the vascular supply to the affected tissue.

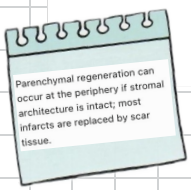
- Infarction commonly affects the heart and brain, causing significant illness.
- Cardiovascular disease (mainly myocardial or cerebral infarction) is the leading cause of death.
- Pulmonary infarction is common, bowel infarction often fatal, and gangrene causes morbidity in diabetics.

Causes of Infarction

1. Arterial Occlusion (most cases):
   - Arterial thrombosis or embolism.
   - Rare causes: vasospasm, intra-plaque hemorrhage, external compression (e.g., tumor), vessel twisting (e.g., testicular torsion), or trauma.
2. Venous Thrombosis:
   - Usually causes congestion.
   - Infarction occurs in organs with a single efferent vein (e.g., testis, ovary).

Morphology

Infarct Type	Causes/Characteristics
Red Infarcts	1. Venous occlusions (e.g., ovarian torsion) 2. Loose tissues (e.g., lung) with blood collection 3. Tissues with dual circulations (lung, small intestine) 4. Previously congested tissues (sluggish venous outflow) 5. Reestablished flow post-infarction (e.g., post-angioplasty)
White Infarcts	1. Occurs in solid organs with end-arterial circulations (heart, spleen, kidney) 2. Wedge-shaped with the occluded vessel at the apex 3. Fibrinous exudate on serosal surfaces 4. Irregular lateral margins from adjacent vessels 5. Fresh infarcts are poorly defined, becoming clearer over days



Factors That Influence Infarct Development

- **Vascular Supply:** Organs with alternative blood flow (e.g., lung, liver) are less a
- **Occlusion Rate:** Slow occlusions allow collateral circulation, reducing infar
- **Tissue Vulnerability:** Neurons die in 3-4 minutes without blood; myocardial cells ir