

General Pathology Paper - Sample Long Answer Question

Below are pathological conditions illustrating different pathophysiological categories of oedema. For each, state a suitable descriptive term for the category, and explain the underlying mechanism resulting in oedema. State the required number of other examples causing each pathophysiological category of oedema where requested.

1. Ascites and pulmonary oedema resulting from congestive heart failure (provide three other examples) (9 marks).
2. Decreased production of albumin in the liver due to protein malnutrition (provide three other examples) (9 marks).
3. Skin swelling following intradermal injection of allergen (7 marks).
4. Distal limb oedema in a dog infected with a tropical filarial parasite (provide two other examples) (7 marks).
5. Generalised intravascular fluid overload in decompensated heart failure (8 marks).

Model answers and marks awarded.

1. Ascites and pulmonary oedema resulting from congestive heart failure.

Increased hydrostatic pressure (3).

This is a result of cardiac insufficiency leading to impaired venous return (1) and passive accumulation of blood (1). The imbalance between the intravascular hydrostatic pressure and extracellular space leads to redistribution of fluid into the latter and ultimately the peritoneal and alveolar spaces (1).

Other examples: other causes of impaired venous return (constrictive pericarditis, liver cirrhosis, thrombosis, external compression), increased blood flow (vasodilation) from heat or hyperemia of acute inflammation (3).

2. Decreased production of albumin in the liver due to protein malnutrition

Reduced plasma osmotic pressure (3).

Severe blood loss of parasitism reduces concentration of protein in the blood (1). Blood protein, primarily albumin, maintains the intravascular colloidal osmotic pressure (1), so lower concentrations result in increased filtration and decreased resorption of fluid from / into the vascular compartment (1).

Other examples: other causes of decreased albumin production such as impaired liver function, examples of protein loss such as protein losing enteropathies, infection with

parasites such as Haemonchus contortus, plasma exudation in severe burns, renal disease (nephrotic syndrome) (3).

3. Skin swelling following intradermal injection of allergen

Increased microvascular permeability / inflammation (3)

Microvascular reaction to the inflammatory stimulus of the injected allergens (1). Inflammatory mediators, such as histamine, bradykinin, substance P, leukotrienes (1), cause endothelial cell contraction and widening of intercellular gaps (1), increasing vascular permeability. Over time, other mediators cause cytoskeletal rearrangements leading to persistent widening of inter-endothelial gaps, e.g. TNF-1, IFN γ , IL-1 (1).

4. Distal limb oedema in a dog infected with a tropical filarial parasite

Decreased lymphatic drainage / obstruction. (3)

Lymphatic drainage is required to remove the slight excess of extracellular fluid that forms during normal fluid exchange (1). If lymphatic flow is compromised, fluid accumulates in the dependent tissue, in this case the limb distal to the infected lymphatic vessel (1).

Other examples: trauma, fibrosis, invasive tumours, post-surgery, post-irradiation, inflammation. (2)

5. Generalised intravascular fluid overload in decompensated heart failure.

Sodium and water retention. (3)

Impaired cardiac output results in renal hypoperfusion (1). This triggers compensatory mechanisms, mediated via intravascular volume and pressure sensors, such as the juxtaglomerular apparatus (1), and the renin-aldosterone-angiotensin system (1), to increase sodium and water retention and therefore plasma volume (1). This initially compensates for the renal hypoperfusion but as cardiac failure progresses this mechanism increases hydrostatic pressure leading to oedema and effusions (1).