

Exercise walk-through

10.3

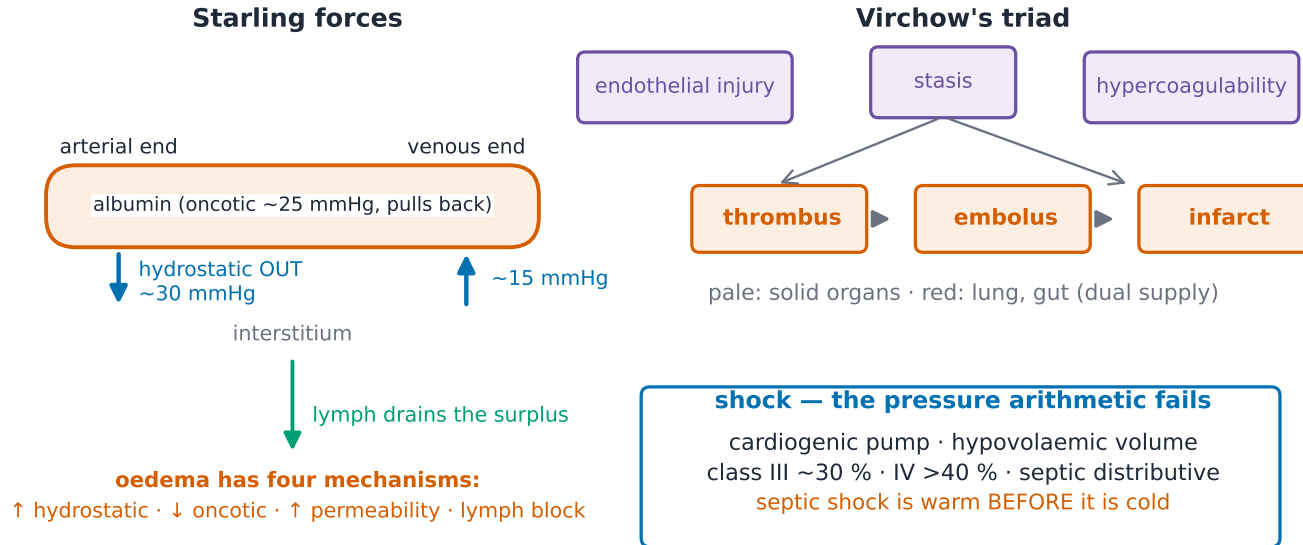
Haemodynamic disorders

University Medicine

Haemodynamic disorders: fluids and clots

- 1 **Starling** Hydrostatic out ~30/15 mmHg · oncotic (albumin) ~25 back · lymph drains the surplus.
- 2 **Oedema** ↑ hydrostatic (failure) · ↓ oncotic (liver/kidney) · ↑ permeability (inflammation) · lymph block.
- 3 **Clots** Injury + stasis + hypercoagulability (**Virchow's triad**) → thrombus → embolus → infarct; shock: cardiogenic, hypovolaemic class III ~30 % / IV >40 %, distributive - septic is warm and vasodilated first.

Starling forces and Virchow's triad



Push out, pull back, drain the surplus — and the three forces that make clots.

Exercises 2.1-2.3

2.1 Name the four oedema mechanisms. [3]

2.2 Which protein provides most oncotic pressure? [3]

2.3 The three elements of Virchow's triad. [3]

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2.1

- $\uparrow$ hydrostatic · $\downarrow$ oncotic · $\uparrow$ permeability · lymph block ✓.
-

2.2 Which protein provides most oncotic pressure? [3]

2.2

- Albumin ✓.
-

2.3 The three elements of Virchow's triad. [3]

2.3

- Endothelial injury, stasis, hypercoagulability ✓.

Exercise 3.1

3.1 A fictional patient: right heart failure with dependent pitting oedema; a second with nephrotic syndrome and periorbital oedema.

For each, trace the Starling term that changed (venous hydrostatic rises; albumin lost ≥ 3.5 g/day so oncotic falls) and explain the different distributions (dependent vs periorbital) ✓. State the two further mechanisms with one example each (permeability – inflammation, exudate; lymph block – post-surgical) ✓. [8]

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3.1

- Right heart failure: venous hydrostatic $\uparrow \rightarrow$ dependent pitting oedema ✓.
- Nephrotic: albumin ≥ 3.5 g/day lost $\rightarrow$ oncotic $\downarrow \rightarrow$ periorbital (loose tissue) oedema ✓.
- Same finding, different arithmetic – blood albumin separates ✓.
- Permeability: inflammation (exudate, protein-rich); lymph block: post-surgical arm swelling ✓.

Exercise 3.2

3.2 A fictional long-haul flight after surgery: calf pain, then sudden breathlessness.

Walk the chain: stasis + post-op hypercoagulability → calf thrombus → embolus to pulmonary arteries ✓. Explain why infarcts are pale in solid organs but red in lung (dual supply, loose tissue) ✓. Classify the three shock families with one example each. [7]

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3.2

- Stasis + hypercoagulability → calf venous thrombus ✓.
- Embolus travels to pulmonary arteries → infarct or sudden death ✓.
- Pale infarcts: solid organs, single supply; red: lung and gut – dual supply, loose tissue bleeds in ✓.
- Shock: cardiogenic (infarct), hypovolaemic (class III ~30 % loss), distributive (sepsis, warm then cold) ✓.