SABS I: Vascular Physiology

VEINS & VENULES

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IV. Veins and Venules

A. Fundamental facts: The venous system

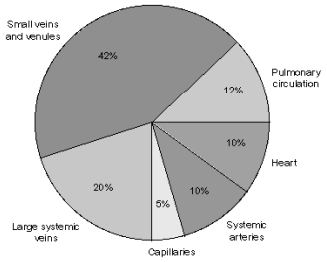
1. is a large blood reservoir (75% TBV)
2. assists in the return of blood to the heart by venous pumps
3. is involved in the regulation of cardiac output

IV. Veins and Venules

B. Venous Reservoir

- Distribution of blood volume
  - Most of the blood is in the venous system; primarily in small veins and venules
  - Changes in venous tone alter venous volume and thereby influence the end diastolic volume of the heart and cardiac output (SV vs. EDV; Frank-Starling law of heart)

Blood Volume Distribution

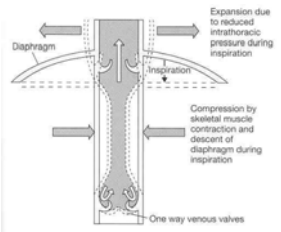


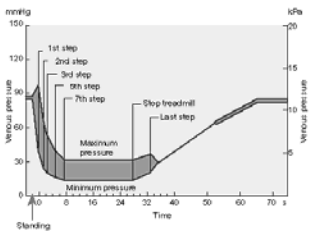
IV. Veins and Venules

C. Venous Pumps

- Ventilation pump & Skeletal muscle pump
  - Promote venous flow by altering venous pressures
  - Efficient function requires presence of valves

Venous "Pumps"





IV. Veins and Venules

D. Venous Return and Cardiac Output

- VR = CO
- $VR=\Delta P/R=(MCFP-CVP)/R_{VR}$
  - VR = Venous Return
  - MCFP = Mean Circulatory Filling Pressure
  - CVP = Central Venous Pressure

IV. Veins and Venules

D. Venous Return and Cardiac Output

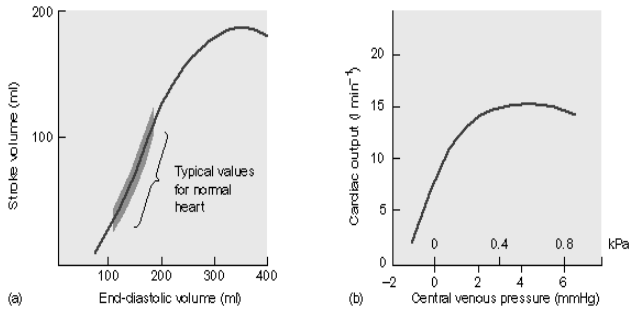
- MCFP = Mean Circulatory Filling Pressure
  - Estimate of average venular pressure (~7-10 mm Hg)
  - Elevated by:
    - ⇑ total blood volume
    - ⇑ venous tone (venoconstriction)
  - Decreased by
    - ⇓ in total blood volume
    - ⇓ in venous tone (venodilation)

IV. Veins and Venules

D. Venous Return and Cardiac Output

- CVP = Central Venous Pressure
  - CVP = RAP (right atrial pressure)
  - Normally ~0 mm Hg (range –4 to 30 mm Hg)
  - CVP is the filling pressure or preload for the heart

- CO vs CVP (Frank-Starling Mechanism)



Summary of Factors Affecting CO by Changes in Total Blood Volume and Venous Volume

	TBV	Vv	EDV	CO
Hemorrhage	↓			
Dehydration	↓			
Diuretics	↓			
Blood doping	↑			
Aerobic training	↑			
↓ Renal function	↑			
↑ GI absorption	↑			
Capillary absorption	↑			
Venous pooling	NC			
Venous constriction	NC			

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