Why do we call it Venous Hypertension?

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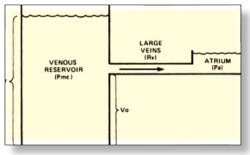
Disclosures; No Conflicts

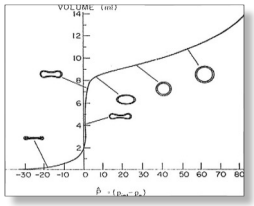
Am Venous Forum	PI Data Management Center, JURY-1 and JURY-2 Study
VA Merit	PI Flow mediated thrombus resolution in DVT (EFFORT)
VA Merit	PI Cognitive Impairment in Carotid Disease-1 (ACCOF-2)
VA Merit	PI COVID pandemic related disruption in surgical care
NIH	PI Management asymptomatic carotid stenosis (CREST-2)
NIH/CMS/Industry	PI National Carotid Registry (C2R)
US Congress	PI Karshi-Khanabad exposure related vascular toxicity (K-2)

Function of veins

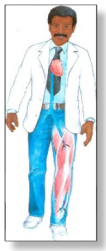


- Return blood to heart for re-oxygenation (conduit)
  - and recirculation
- Storage of blood (tank)
  - 60-80% of total resting blood volume is in the venous system
- Maintain cardiovascular stability (stabilizer)
  - through changes in capacitance
  - through sympathetic mediated smooth muscle tone

Physiology of veins
High capacitance; compliance system

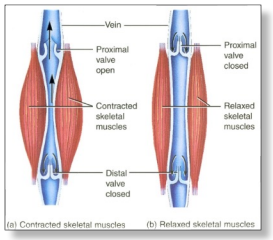


Factors affecting venous return

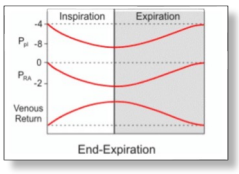


- **Intrinsic Factors**
  - Musculovenous Pump
  - Abdomino-thoracic Pump
  - Cardiac Pump
  - Intra-vascular volume
  - Venous resistance
  - Valve Integrity
  - Sympathetic tone
- **Extrinsic Factors**
  - Gravity
  - External Compression
  - Atmospheric Pressure

1. Musculo-venous pump

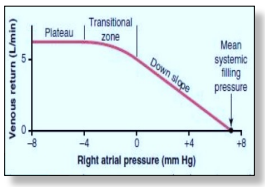


2. Abdomino-thoracic pump



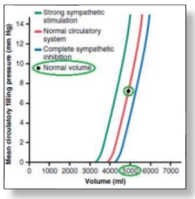
- Upper Extremity Venous flow:
  - Increases with inspiration
  - Decreases with expiration
- Lower Extremity Venous flow:
  - Rib-cage breathing (no increase in intra-abdominal pressure)
    - Increases with inspiration
    - Decreases with expiration
  - Abdominal breathing (increase in intra-abdominal pressure)
    - Decreases with inspiration
    - Increases with expiration

3. Cardiac pump



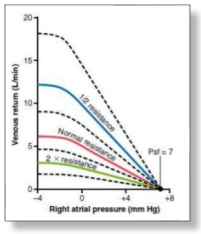
- Left heart pulsations cause negative pressure in RA and RV
  - have an aspiration effect on venous return

4. Intra-vascular volume



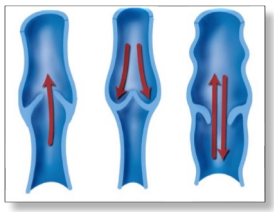
- At 4000 ml vascular volume, the circulatory filling pressure is 0 mmHg
- At 5000 ml vascular volume, the circulatory filling pressure is 7 mmHg

5. Venous resistance



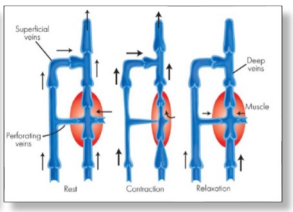
Increasing venous resistance results in decreasing venous return

6. Venous valve integrity

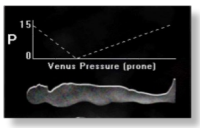


Normal valves in the leg prevent reversed flow

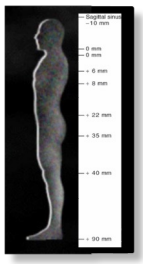
Abnormal valves allow flow reversal



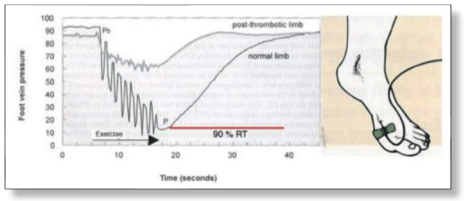
7. Gravity



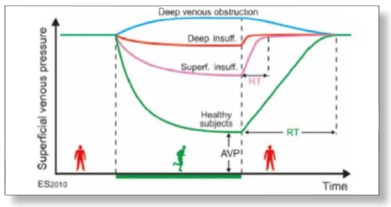
- Supine:
  - RA Pressure 0 mmHg
  - Venous Capillary Pressure 15
  - Gradient 15
- Erect
  - RA Pressure: 0 mmHg
  - Lower extremity Venous pressure: 15 + 80
  - Mean trans-capillary gradient remains the same



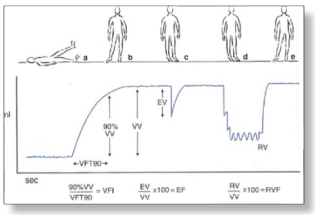
Ambulatory venous pressure



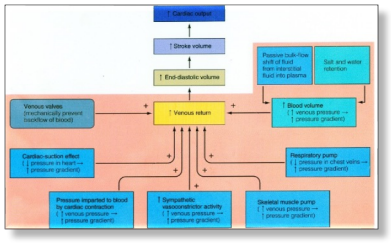
Range of impaired venous return

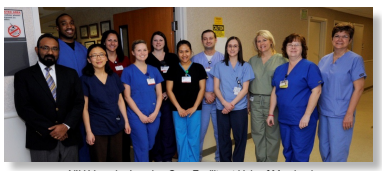


Venous Plethysmography



Summary





NIH Vascular Imaging Core Facility at Univ of Maryland