

Vasculature

1. Overview

1. vessels as part of system
2. arteries - away from heart
 1. elastic (conducting)
 2. muscular (distributing)
3. arterioles
4. capillaries
 1. continuous
 1. tight junctions
 2. some intercellular clefts
 1. exception: brain capillaries; blood-brain barrier
 2. fenestrated ("windowed")
 1. absorption & filtration
 2. intestines & kidneys
 3. sinusoidal
 1. loose
 2. liver & spleen, filtering
 3. monitoring by specialized macrophages (Kupffer cells) lining endothelium
5. venules
6. veins- towards heart
 1. can hold 65% of blood volume, "capacitance reservoirs"
 2. valves assure one-way flow
 3. varicosities
7. anastomoses "coming together"
 1. collateral channels
 2. provide redundancy
 1. exceptions: kidney, retina, & spleen
 2. blockage results in cell death

2. Anatomy

1. 3 layers
 1. tunica intima- thin & slick
 2. tunica media- thick, muscular, under control of ANS: vasoconstriction
 3. tunica externa- fibrous, protection, & support
 4. larger vessels have vasa vasorum for own supply
2. arteries vs. veins
 1. arteries
 1. high pressure
 2. muscular
 2. veins
 1. low pressure
 2. floppy

3. Physiology

1. terms
 1. blood flow
 1. volume/unit time (ml/min)
 1. total system: blood flow = cardiac output
 2. individual organs vary depending on needs
 2. blood pressure
 1. force per unit area, Newton/m² = Pascal
 1. also reported as mm Hg from manometers
 2. pressure gradient from high to low drives flow
 3. resistance
 1. opposition to flow
 2. mostly peripheral resistance
 3. viscosity of fluid (thickness)
 1. dehydration increases viscosity
 4. total vessel length
 1. one pound of fat = miles of vessels!
 5. vessel diameter
 1. resistance varies inversely with the fourth power of vessel radius!

1. thus if double radius, then increase flow 16 fold (r^4)
2. vice versa

6. turbulence increases resistance

2. pulse

1. systole
2. diastole
3. pulse pressure = systolic - diastolic pressure
4. mean arterial pressure: $MAP = (\text{diastolic} + \text{pulse pressure})/3$
5. how measure?
 1. cuff
 2. squeeze until flow stops
 3. release pressure until hear flow: defines systolic pressure
 4. release pressure until no longer hear flow: defines diastolic pressure
3. blood pressure & velocity
 1. pressure declines further from heart
 2. velocity declines with increasing cross sectional area of system
 3. factors aiding venous return
 1. respiratory pump
 2. muscular pump
4. control of flow
 1. local (figure)
5. systemic flow (figure)
6. maintaining blood pressure
 1. short term
 2. long term
7. capillary exchange