Objectives

- Introduce the physiology of circulation
  - Blood Flow
  - Blood Pressure
  - Blood Resistance
- Identify key components that contribute to Atherosclerosis

Physiology of Circulation

**Blood Flow** – Volume of blood flowing through a vessel, organ or the entire circulation. Units ml/min (F)

**Blood Pressure** – Force per unit area exerted on a vessel wall by the contained blood. Blood flows from Higher to Lower pressure. Measured in (mm Hg)

Taking Blood Pressure

**Systolic Pressure** – Pressure exerted by the blood on blood vessel walls during ventricular contractions. Highest in the Aorta. Average 120 mm Hg in adults.

**Diastolic Pressure** – When BP drops to lowest level, occurs when semilunar valves in the heart shut. Usually 70-80 mm Hg.

Arterial Blood Pressure

Depends upon 2 factors:

I. Compliance or distensibility of elastic arteries near the heart.

II. Volume of blood that is forced through the arteries at any given time.

**MAP** – BP that propels blood to the tissues.

Terminology related to pressure

- Pulse pressure: Difference between Systolic & Diastolic pressure.
- MAP* (Mean Arterial Pressure): Estimate of average blood pressure. Diastolic pressure + 1/3 pulse pressure.

Significance?
- MAP is correlated to the perfusion pressure seen by the organs.
- MAP below 60 mm Hg the organ will have insufficient blood flow -> Ischemia
Ischemia = Insufficient blood flow
Can lead to tissue damage.

http://en.wikipedia.org/wiki/Ischemia

Hypertension
aka
High Blood Pressure

A condition of sustained elevated arterial pressure of 140/90 or higher.

Diastolic pressure is actually more significant because it can be indicative of occlusions in the arteries. aka Hardening of the arteries.

Hypertension vs. Arteriosclerosis

Atherosclerosis

Athero – Greek for “gruel” or “paste”
Scleros – Greek for “hard”

>>> Hardening of the Arteries

Effects:
1) Systolic blood pressure can rise
2) Capillary beds can be damaged
3) Velocity of blood flow through vessel will increase.
4) Vessels may rupture if exposed to high pressures.

Atherosclerosis vs. Arteriosclerosis

Complications of Hypertension

Prolonged hypertension is a major cause of heart failure, vascular disease, renal failure, and stroke.

Often persistent in obese people.

Why the concern?

Hypertension can contribute to:
> Propensity for stroke
> Possible kidney damage
> Damage to delicate vessels e.g. in eye
> Heart failure

Hypotension

Low Blood Pressure when systolic pressure is below 100 mm Hg.

Not a cause for alarm usually
Types:
1) Orthostatic – seen in elderly
2) Chronic – often seen with anemia
3) Acute – Sign of shock
Resistance

Opposition to flow, a measure of friction as the blood flows through a vessel. (R)

aka: Peripheral resistance

Size i.e. diameter of the vessel contributes most significantly to peripheral resistance. Larger vessel → less resistance.

Contributing factors to Blood Resistance

1) Blood viscosity
2) Total Blood Vessel Length
3) Blood Vessel Diameter

* Blood Resistance is the MOST important factor to local blood flow.

>Lowering R, increases blood flow.

Relationships affecting Blood Flow

Blood Pressure (diff P)

Blood Flow (F) = Peripheral Resistance (R)

Why is this important?

Flow/Perfusion affects the rate of the delivery of oxygen and nutrients to tissues as well as the removal of waste products from tissues.

Poiseulle’s Law

F directly proportional to:
> pressure gradient
> vessel radius

F inversely proportional to:
> vessel length
> blood viscosity.

Preview for next time

You should now be able to answer review questions 49 – 74 in your study guide.

Preview to next lecture:
- Regulation of Blood pressure
- Movement of fluids out of capillaries
- Shock
- Fetal circulation
Measuring Blood Pressure

- Pressure is released slowly and the examiner listens for sounds of Korotkoff with a stethoscope.
- Sounds first occur as blood starts to spurt through the artery (systolic pressure, normally 110–140 mm Hg).
- Sounds disappear when the artery is no longer constricted and blood is flowing freely (diastolic pressure, normally 70–80 mm Hg).

Variations in Blood Pressure

- Blood pressure cycles over a 24-hour period.
- BP peaks in the morning due to levels of hormones.
- Age, sex, weight, race, mood, and posture may vary BP.