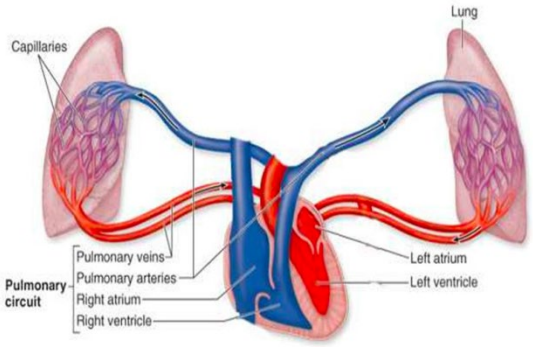
Condensed Chapter Material
Chapter 15: Cardiovascular II, Blood Vessels

Circulation Types:

1) Pulmonary Circulation
    a) Venous blood from SVC and IVC-> Right atrium-> Tricuspid valve-> Right ventricle-> Pulmonic valve->Pulmonary artery-> Arterioles-> Capillaries (oxygen transfer)->Pulmonary venules (oxygenated blood)-> Pulmonary veins-> Left atrium



2) Systemic Circulation
    a) Left atrium-> Mitral valve-> Left ventricle-> Aortic valves-> Aorta-> Systemic arteries->Arterioles->Capillary body in tissues (oxygen exchange)-> Venules (CO_2 rich, deoxygenated blood)-> Systemic veins-> IVC and SVC-> Right atrium

Contrast: Arteries vs. Veins

Arteries	Veins
Thicker; More smooth muscle	Less Sturdy
Less ability to stretch/expand	More distensible (acts as a reservoir)
Subject to more pressure	Contain valves (to help keep blood moving in one direction
Leading from the heart Examples: Aorta (carries oxygenated blood out of the left ventricle to body) and Pulmonary artery (carries deoxygenated blood from right ventricle to lungs)	Leading to the heart Examples: SVC (carries deoxygenated blood from upper body to right atrium), IVC (carries deoxygenated blood from lower body to right atrium)

Circulatory changes seen in infants, pregnant women and older adults:

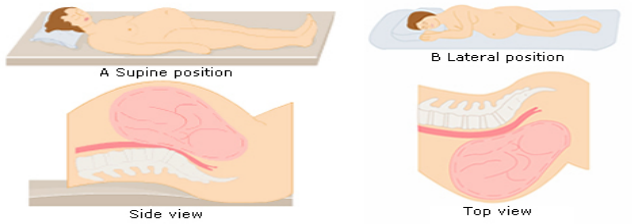
Infants:

a) Cutting of umbilical cord causes infant to begin breathing → expansion of the lungs → pulmonary vascular resistance decreases → increasing blood flow to the lungs
b) Systemic vascular resistance change: Once systemic pressure is greater than pulmonary vascular resistance →blood flows into pulmonary arteries rather than the foramen ovale (opening between the left and right atrium). This is a functional closure.

c) Ductus arteriosus (shunt between descending aorta and main pulmonary artery) closes within first 14 hours.

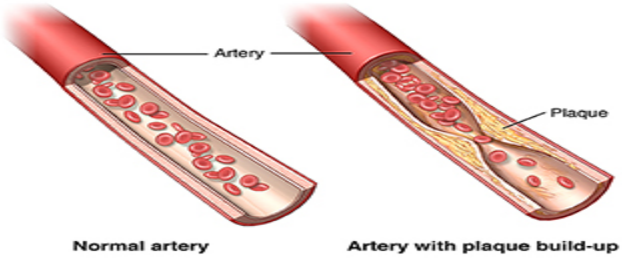
Pregnant women:

a) Peripheral vasodilation → decrease in systemic vascular resistance → can cause palmar erythema and spider telangiectasias
b) Decrease in both systolic and diastolic pressure (greater decrease in diastolic)
c) Effects of body position on blood pressure: In third trimester lying supine → compression of vena cava → impaired venous return → lower blood pressure
d) Enlarged uterus → compression of inferior vena cava and pelvic veins → pooling of blood in lower extremities → edema, varicosities of legs and vulva and hemorrhoids.



Older adults:

a) Calcification and plaque buildup in arterial wall →stiffness, dilation, decreased elasticity, decreased vasomotor tone →increased peripheral vascular resistance →increased blood pressure (especially systolic)



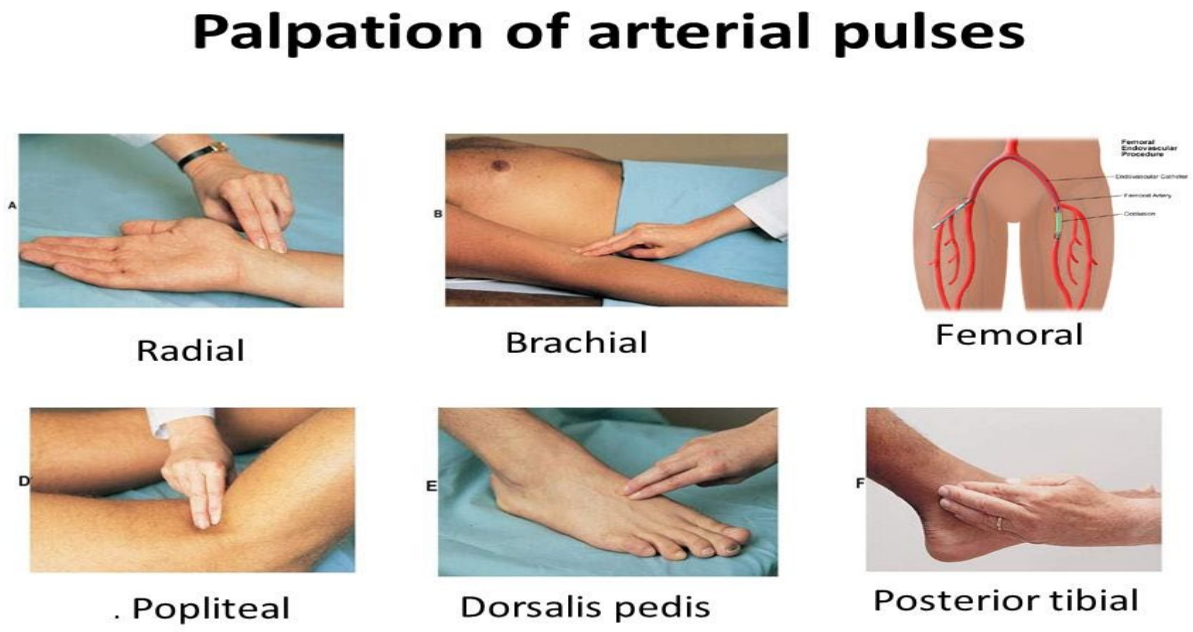
Important aspects of the history of present illness regarding cardiovascular health with an emphasis on delineating causes of vascular compromise:

Complaint	Pertinent Topics to Discuss
Leg pain/cramp	1) Onset and Duration 2) Relationship of complaint with activity/rest 3) Recent injury 4) Character 5) Location (eg. constant burning in toes, pain in thighs or butttocks, pain over specific location) 6) Constant vs intermittent 7) Skin changes (e.g. temperature, pallor, sores, redness, visible veins, darkened or ischemic) 8) Limping: pain in buttock/calf with walking (claudication) 9) Waking at night with leg pain
Swollen ankles	1) Onset and duration (e.g time of day, constant vs progressive, sudden vs

	insidious onset) 2) Related circumstances: recent long airplane travel, recent travel to high elevations 3) Associated symptoms: urinary symptoms (nocturia, frequency), shortness of breath (consider pulmonary embolism) 4) Treatment attempted (rest, massage, heat, elevation) 5) Medications: heparin, warfarin, diuretics, antihypertensive medications.

Palpation of peripheral arteries:

a) Pulses best palpated over arteries that are close to the surface of the body and lie over bones.
b) Commonly palpated arteries include: carotid, brachial, radial, femoral, popliteal
    i) Do not palpate both carotids simultaneously because excessive carotid sinus massage can cause slowing of pulse, drop in blood pressure, compromise of blood flow to the brain causing syncope. If you have difficulty feeling pulse, rotate patients head to the side being examined.
c) Pulse is a bounding wave of blood. Intensity decreases the further from the heart.
d) Palpate firmly but not to the extent that you occlude the artery
e) Palpate pulse to assess heart rate, rhythm, pulse contour, amplitude (force), symmetry (lack of symmetry suggests impaired circulation) and obstruction to blood flow.



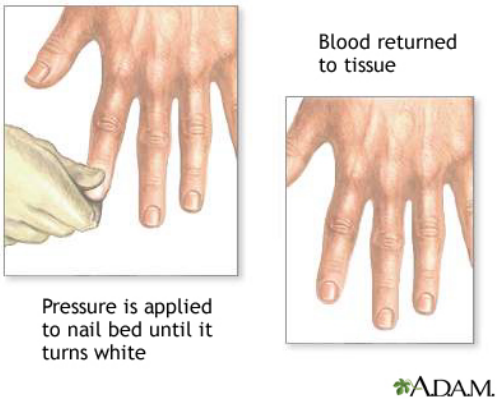
Grading of pulse amplitude	
4	Bounding, aneurysmal
3	Full, increased
2	Expected
1	Diminished, barely palpable
0	Absent, not palpable

Auscultation of the carotid artery:

1) Ask patient to hold their breath (so respirations do not interfere) and listen over the carotid artery
    a) Listen for carotid artery bruits (a murmur or unexpected sound)
    b) Heard above medial end of the clavicle and anterior margin of the sternocleidomastoid muscle
    c) Mild obstruction produces short, localized bruit. Greater stenosis lengthens duration and increases pitch. Complete stenosis may eliminate bruit. Narrowing of vessel occurs due to atherosclerosis, arteritis (inflammation of artery) and fibromuscular dysplasia (abnormal growth within an artery)
    d) Other causes: transmitted murmurs (sound created from other areas are transmitted to the carotid arteries; e.g. aortic stenosis, aortic regurgitation), vigorous left ventricular ejection

Capillary Refill Time: Time for capillary bed to fill after it is occluded by pressure

1) Blanch nail bed with a sustained pressure for a few seconds (fingernail and toenail)
2) Release pressure
3) Observe time elapsed before nail regains full color
    a) Intact vascular system refills in less than 2 seconds.
    b) Compromised system (e.g. peripheral arterial disease, hypovolemic shock or hypothermia) will cause refill time to be greater than two seconds.



Classification of blood pressure for adults:
Blood Pressure Categorization for Adults

	Systolic		Diastolic
Normal	<120	AND	<80
Prehypertension	120-139	OR	80-89
High blood pressure	Stage 1: 140-159 Stage 2: Greater or equal to 160	OR OR	90-99 Greater or equal to 100

Properly obtaining a blood pressure measurement:

1) Have patient seated and measure right arm on bare skin.
2) Center deflated bladder of BP cuff tightly over the brachial artery, just medial to biceps tendon, with lower edge 2-3cm above the antecubital crease.
3) Flex patient's arm to be at the level of the heart with patient's arm supported by the table or your hand.
4) First check palpable systolic BP to avoid being misled by an auscultatory gap (when sound disappears and reappears 10 to 15mmHg below systolic reading)
    a) Use fingers to palpate radial pulse.
    b) Inflate cuff 20-30mmHg above point in which you no longer feel peripheral pulse ->deflate cuff slowly (2-3mmHg per second) until you feel 2 beats of pulse (that is your palpable systolic BP).
5) Place bell of stethoscope over brachial artery->inflate cuff 20-30mmHg over palpable systolic BP-> deflate cuff slowly at 2-3mmHg per sec->listen for two consecutive beats (systolic reading). Be aware of the concept of an auscultatory gap to prevent underestimation of BP.
6) Note point at which initial crisp sound becomes muffled=first diastolic sound.
7) Note point which sounds disappears=Second diastolic sound.
8) Deflate cuff completely.

Blood pressure is read as a systolic pressure over the second diastolic sound.
Pulse pressure=Systolic minus diastolic pressure.

Extra Learning:

Differentiate the severity of edema:

Edema: Inspect extremities for edema

a) Press index finger over bony prominences (e.g. tibia and medial malleolus) for several seconds
b) Depression that does not rapidly refill indicates orthostatic (pitting) edema

c) Causes:
   i) Right sided heart failure (not pumping well which causes a backup of blood) →elevated hydrostatic pressure in vascular space normally emptying into right heart →edema
   ii) Other causes include: Deep vein obstruction (blood clot formed in deep veins) or venous valve incompetence (dysfunctional valves causes pooling of blood in direction of gravity)

Grading of edema:

0+ No pitting edema
1+ Mild pitting edema. 2 mm depression that disappears rapidly.
2+ Moderate pitting edema. 4 mm depression that disappears in 10–15 seconds.
3+ Moderately severe pitting edema. 6 mm depression that may last more than 1 minute.
4+ Severe pitting edema. 8 mm depression that can last more than 2 minutes.