Cardiovascular Exam

• **Includes**
  • appropriate history and ROS
  • Vital Signs: Blood pressure; Pulse: rate, rhythm, volume
  • Assessment distal vasculature (legs, feet, carotids) → vascular disease (atherosclerosis) is a systemic illness!
  • Pulmonary Exam (coming soon)

• **4 basic PE **components:**
  • Observation, Palpation, Percussion (omitted in cardiac exam) & Auscultation
Thoughts On Gown Management & Appropriately/Respectfully Touching Your Patients

• Several Sources of Tension:
  • Area examined **reasonably exposed** – **yet patient** modesty preserved
  • **Palpate sensitive areas** to perform accurate exam - requires touching **people w/whom** you’ve **little acquaintance** – awkward, particularly if **opposite gender**
  • **Exam not natural/normal** part of interpersonal **interactions** - as newcomers to medicine, you’re particularly aware & hence sensitive → a good thing!
Keys To Performing a Respectful & Effective Exam

• Explain what you’re doing (& why) before doing it → acknowledge “elephant in the room”!
• Expose minimum amount of skin necessary - “artful” use of gown & drapes (males & females)
• Examining heart & lungs of female patients:
  • Ask patient to remove bra prior and/or learn to work around bra
  • Expose side of chest to extent needed
  • Enlist patient’s assistance → positioning breasts to enable cardiac exam
• Don’t rush, act in a callous fashion, or cause pain
• PLEASE... don’t examine body parts thru gown:
  • Poor technique
  • You’ll miss things
  • You’ll lose points on scored exams (OSCE, CPX, USMLE)!
Observation

• Pay attention to:
  • Chest shape
  • Shortness of breath (@ rest or walking)?
  • Sitting upright? Able to speak?
  • ? Visible impulse on chest wall from vigorously contracting ventricle (rare)
Surface Anatomy
Finding The Sternal Manubrium Junction (aka Angle of Louis) – Key To Identifying Valve Areas

**Manubrium** slopes in one direction while **Sternum** angles in different direction. Highlighted by q-tips → intersection defines **Sternal Manubrium Junction**
Valves And Surface Anatomy

- Areas of **auscultation** correlate with rough **location** of each **valve**
- Where you listen will determine what you hear!

More Anatomy @:

http://www.blaufuss.org/tutorial/indexTut.html

PIE Group: http://pie.med.utoronto.ca/PIE/PIE_whatWeDo_valves.html
Palpation - Technique

**Left ventricle**
- **Fingers** across chest, under breast (explain 1st)
  - Point of Maximal Impulse (PMI) → apex ventricle that pin-points w/finger tip; ~70% of patients - if not palpable, repeat w/patient on L side
- **Size** of LV – increased dimension if PMI shifted to L of mid-clavicular line
  - **Vigor** of contraction
  - Palpable **thrill** (rare) - associated w/regurgitant or stenotic murmurs (feels like sensation when kink garden hose)
Palpation – Technique (cont)

- **Right ventricle:**
  - Vigor of **contractility**
    - heel of R hand along sternum
  - Rarely abnormal with RV (pulmonary hypertension)
Auscultation: Using Your Stethoscope

They all work - most important part is what goes between the ear pieces!

Diaphragm $\rightarrow$ Higher pitched sounds

Bell $\rightarrow$ Lower pitched
What Are We Listening For?

- Normal valve closure creates **sound**
- **First** Heart Sound =s $S_1 \rightarrow$ closure of Mitral, Tricuspid valves
- **Second** Heart Sound =s $S_2 \rightarrow$ closure of Pulmonic, Aortic valves

Nice animation linking cardiac events to Wiggers, ECG and Heart Sounds: https://library.med.utah.edu/kw/pharm/hyper_heart1.html

Courtesy Wilbur Lew, M.D.
What Are We Listening For? (cont)

- **Systole** = time between S1 & S2; **Diastole** = time between S2 & S1
- Normally, S1 & S2 = distinct sounds
- **Physiologic splitting** = 2 components of second heart sound (Aortic & Pulmonic valve closure) audible with inspiration

Auscultation Technique

• Patient **lying @ 30-45** degree incline

• **Chest exposed** (male) or loosely fitted gown (female)
  • need to see area where placing stethoscope
  • stethoscope must contact skin

• Stethoscope w/*diaphragm* (higher pitched sounds) engaged
Remember – Don’t Examine Thru Clothing or “Snake” Stethoscope Down Shirts/Gowns!

NO!

NO!

NO!

NO!
Exam Options When Listening to Female Patients
Auscultation Technique (cont)

1. Start over **Aortic area** → **2nd Right** Intercostal Space (ICS) – Use Angle of Louis as landmark

2. **Pulmonic** area (2\textsuperscript{nd} L ICS)

3. Inch down sternal border → **Tricuspid** area (4\textsuperscript{th} L ICS)

4. Inch towards **Mitral** area (4\textsuperscript{th} ICS, mid-clavicular)

Listen in ~ 6 places - precise total doesn’t matter – gives you sense of change in sounds as change location
Auscultation

• In each area, ask yourself:
  • Do I hear S1? Do I hear S2? Which is louder & what are relative intensities?
  • Interval between S1 & S2 (systole) is shorter then between S2 & S1 (diastole)
  • Can also determine timing by simultaneously feeling pulse (a systolic event)
  • Listen for physiologic splitting of 2nd heart sound w/inspiration
Murmurs

• Murmurs: Sound created by turbulent flow across valves:
  • Leakage (regurgitation) when valve closed
  • Obstruction (stenosis) to flow when normally open

• Systolic Murmurs:
  • Aortic stenosis, Mitral regurgitation
    (Pulmonary stenosis, Tricuspid regurgitation)

• Diastolic Murmurs:
  • Aortic regurgitation, Mitral stenosis
    (Pulmonary regurgitation, Tricuspid stenosis)
Murmurs (cont)

- Characterized by: **position** in cycle, **quality**, **intensity**, **location**, **radiation**; can try to draw it’s shape:

  - **Intensity Scale:**
    1 – barely audible  2 - readily audible  3 - even louder 4- loud + thrill  5 - audible with only part of diaphragm on chest  6 – audible w/out stethoscope

- **Intensity doesn’t necessarily correlate w/severity**

- Some **murmurs** best appreciated in certain **positions**:
  - **Mitral**: patient on **L side**; **Aortic**: sitting up and leaning **forward**

- Example – **Mitral Regurgitation**: Holosystolic, loudest in mitral area, radiates towards axilla.

Blaufuss Medical: [http://www.blaufuss.org/tutorial/indexTut.html](http://www.blaufuss.org/tutorial/indexTut.html)

UCLA Heart Sound Simulator: [http://www.med.ucla.edu/wilkes/intro.html](http://www.med.ucla.edu/wilkes/intro.html)
Extra Heart Sounds – S3 & S4

• **Ventricular** sounds, occur during diastole
  • normal in young patient (~ < 30 yo)
  • usually LV, rarely RV

• S3 → **follows S2**
  • caused by blood from LA colliding w/”left over” blood in LV
  • associated w/heart failure.

• S4 → **precedes S1**
  • caused during atrial systole
  • when blood squeezed into non-compliant LV
  • associated w/HTN
Extra Heart Sound (cont)

• **S3** & **S4** are *soft, low pitched*

• Best heart *w/ bell*, laid over **LV**, w/patient lying on **L side** (brings apex of heart closer to chest wall)

• Abnormal beyond age ~30

• When present, **S3 or S4** are referred to as **“gallops”**

University of Washington, Simulated **S3 & S4**

http://depts.washington.edu/physdx/heart/demo.html
Auscultation – An Ordered Approach

• Do I hear S1? Do I hear S2?
  • Listen in each major valvular area – think about which sound should be loudest in each location (S1 loudest region of TV & MV, S2 loudest AV & PV)

• Do I hear physiologic splitting of S2?

• Do I hear something before S1 (an S4) or after S2 (an S3)?

• Do I hear murmur in systole? In diastole?

• If a murmur present, note:
  • intensity, character, duration, radiation

• As listen, think about mechanical events that generate the sounds.
Carotid Arteries

- **Anatomy**
- **Palpation** (ea side separately!)
  - Rhythm
  - Fullness
- **Auscultation**
  - **Radiation** of murmurs
  - ? **Intrinsic atherosclerosis** – may produce “shsshing” noise known as **bruit**

http://sfgh.medicine.ucsf.edu
Jugular Venous Pressure (JVP)

- **Anatomy** of Internal Jugular Vein
- Straight line with **RA**
- **Manometer** reflecting Central Venous Pressure (**CVP**)
JVP Technique

• **Find** correct area – helps to first identify SCM & triangle it forms w/clavicle

• Look for **multi-phasic pulsations** (‘a’, ‘c’ & ‘v’ waves)

• **Isolate** from carotid pulsations, respirations

• Tangential **lighting**

• **Hepatojugular reflux** (gentle pressure over liver pushes blood back into IJ & makes pulsations more apparent)
JVP Technique (cont)

- **JVP = s 5cm** (height sternal manubrium jxn is above RA) + vertical distance from sternal manubrium jxn to top of pulse wave

- Normal < 8 cm

Example of elevated JVP:

http://meded.ucsd.edu/clinicalmed/cvp_movie.htm

Courtesy Chinese University of Hong Kong
http://www.cuhk.edu.hk/cslc/materials/pclm1011/pclm1011.html
Lower Extremity Vascular Exam – General Observation, Including Femoral Region

- **Expose** both legs, noting: asymmetry, muscle atrophy, joint (knee, ankle) abnormalities

- **Focus on Femoral Area:**
  - Inspect - ? Obvious swelling → femoral hernia v large lymph nodes (rare)
  - **Palpate** lymph nodes
Femoral Region (cont)

- Identify **femoral pulse**
- **Listen** over femoral artery with diaphragm stethoscope for **bruits** (if suggestion **vascular disease** by hx, exam)
Popliteal Pulse (behind the Knee)

• W/knee **slightly bent**, push **fingers into popliteal fossa** → assess **popliteal artery**
  • Relevant if distal pulses diminished

• Detailed examination of internal structures knee (ligaments, meniscus, etc.) → **MSK Session**
Vascular Disease of The Lower Leg

Components:
- outflow (arterial)
- return (venous, lymphatic)

Clinical Presentations:

Arterial:
- pain (supply-demand)
- wound healing
- RFs for atherosclerosis

Venous:
- Edema
- Local v systemic etiology

Lymph (relatively uncommon):
- Lymphedema:
- From obstruction, disruption

http://www.reshealth.org/images/greystone/em_2396.gif
Clinical Appearance – Varies With Type of Vascular Disease

- **Peripheral Arterial Disease**
- **Venous Insufficiency**
- **Lymphedema**
Feet and Ankles

• Lower leg & feet @ greatest risk for atherosclerosis (in particular if vascular dz risk factors: DM, HTN, Smoking, Hyperlipidemia, age, known dz elsewhere)

• Observe
  • ? swelling (edema), discoloration, ulcers, nail deformities
  • Look @ bottom of feet, between toes (problem areas)
  • Symmetry?

Blue discoloration from chronic venous insufficiency

Red discoloration from acute infection

Nail thickening and discoloration from chronic fungal infection
Feet and Ankles (cont)

• Palpation
  • **Temperature**: Use back of examining hand - warm → inflammation; cool → atherosclerosis &/or hypo-perfusion
  • **Capillary refill**: push on end of toe or nail bed & release → color returns in < 2-3 seconds; longer → atherosclerosis &/or hypo-perfusion
Feet and Ankles - Edema

- Change in balance of starling forces (pressures in vessels vs tissues; oncotic forces in vessels vs tissues) → Edema

- Local leg problems:
  - Deep Vein Thrombosis
  - Infection, trauma
  - Lymphatic obstruction

- Systemic problems:
  - Heart failure
  - Pulmonary disease (pulmonary hypertension, sleep apnea, thrombosis, etc.)
  - Kidney disease
  - Liver disease
  - Venous stasis

http://www.eurobloodsubstitutes.com/images/heartCircul_arteries.gif

http://slideworld.org/notes/2844737.jpg
Quantifying Edema

- A marker of volume status
- **Trace** (minimal): subtle loss of tendons on top of foot, contours maleolous
- **Scales** (none validated or compared)
  - 0 to 4+
  - Depth of pitting left (after applying pressure w/a finger) in mm
  - Extent of edema (e.g. limited to feet v up to knee)
Quantifying Edema

1+ Minimal Barely detectable impression 2mm
2+ Mild Slight indentation 4mm
3+ Moderate Deeper indentation 6mm
4+ Severe Very deep indentation 8mm

*Changes in Weight Very Helpful Clinically for Assessing Total Body Volume and impact of Diuretics*

Average Marble 1cm Diameter
Dorsalis Pedis Pulse

• Palpate Dorsalis Pedis pulse
  • Just lateral to extensor tendon great toe
  • Use pads of 2-3 fingers of examining hand
  • Push gently
  • If unsure whether feeling your pulse vs patient’s, measure your carotid or their radial w/other hand
  • Graded 0 (not detectable) to 2+ (normal)
Posterior Tibial Pulse

- Palpate **Posterior Tibial** Pulse
  - Located **posterior** to **medial malleolous**
  - Start on top of malelous & work towards Achilles tendon
  - Use pads of **2-3 fingers**, pushing gently
  - Same rating scale as for dorsalis pedis
Summary Of Skills

- Wash hands; gown & drape appropriately
- Inspect precordium
- Palpation of RV and LV; Determination PMI
- Auscultation – patient @ 30 degrees
  - S1 and S2 in 4 valvular areas w/diaphragm
  - Try to identify physiologic splitting S2
  - ? Murmurs
  - Assess for extra heart sounds (S3, S4) w/bell over LV
- Carotid artery palpation, auscultation
- Jugular venous pressure assessment
- General lower extremity observation
- Assess femoral area (palpation for nodes, pulse); auscultation over femoral artery
- Knees – color, swelling; popliteal pulse
- Assess ankles/feet (color, temperature, pulses, edema, cap refill)
- Wash hands

**Pocket Pex Checklist App:**


Time Target: ~ 15 min