Examination Of The Cardiovascular System

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Review of Systems

• All organ **systems** have a review of **symptoms**
• Questions designed to uncover problems in that area
• Clinicians need to know the right questions – as well as what the responses might mean!
• Example: [http://meded.ucsd.edu/clinicalmed/ros.htm](http://meded.ucsd.edu/clinicalmed/ros.htm)
Cardiovascular Exam

- **Includes** Vital Signs (see earlier lecture), in particular:
  - Blood pressure
  - Pulse: rate, rhythm, volume

- **Includes** Pulmonary Exam (coming soon)

- **Includes** (today) assessment distal vasculature (legs, feet, carotids) - vascular disease (atherosclerosis) systemic!

- **4 basic 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 pt to remove bra prior (can’t hear well thru fabric)
  – 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**)

Hammer & Nails icon indicates A Slide Describing Skills You Should Perform In Lab
Manubrium slopes in one direction while Sternum angles in different direction. Highlighted by q-tips→intersection defines Angle of Louis.
Valves And Surface Anatomy

- Areas of **auscultation** correlate w/rough location of ea valve
- Where you listen will determine what you hear!

More Anatomy @:
- [Blaufuss Medical](https://www.blaufussmedical.com)
- University of Toronto: PIE Group
Palpation

**Right Ventricle**

- Vigor of contractility
  - Felt with heel of hand
  - Prominence described as a “lift” or “heave”

- Thrill – rare **palpable sensation** associated w/regurgitant or stenotic murmurs (feels like sensation when kink garden hose)
Palpation - Technique

**L ventricle**

- **Fingers** across chest, under breast (explain 1st to female pts!)
- 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 **thrust** (rare)
Palpation – Technique (cont)

- **Right ventricle:**
  - Vigor of **contractility**
    → **heel of R hand** along sternum
Auscultation: Using Your Stethoscope

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

Diaphragm ➔ Higher pitched sounds

Bell ➔ Lower pitched
What Are We Listening For?

- Normal valve closure creates sound
- **First** Heart Sound =s S1 → closure of Mitral, Tricuspid valves
- **Second** Heart Sound =s S2 → closure of Pulmonic, Aortic valves

Figure 4: Cardiac cycle in left and right hearts

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 w/inspiration

Ohio State University – Heart Sound Simulations and their Physiological Basis
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!
Good Exam Options When Ausculting Female Patients
Auscultation Technique (cont)

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

2. **Pulmonic** area (2nd L ICS)

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

4. Inch towards **Mitral** area (4th 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 than 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)

*Figure 4: Cardiac cycle in left and right hearts*
Murmurs (cont)

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

  ![Diagram of Murmurs](image1)

  - **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.

**UCLA Heart Sound Simmulator**
**Blaufuss Medical**
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
  – assoc w/heart failure.

• **S4** → precedes S1
  – caused during atrial systole
  – when blood squeezed into non-compliant LV
  – assoc 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) – can also check over **RV** (4\(^{th}\) ICS, L parasternal)
- Abnormal beyond age ~30
- When present, **S3 or S4** are referred to as “gallops”

S3 & S4 Simulator:
Ohio State University – Heart Sound Simulations and their Physiological Basis
Auscultation – An Ordered Approach

• Do I hear **S1**? Do I hear **S2**?
  – Listen in *ea major valvular* area – think about which sound should be loudest in ea 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 “shshing” 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)

http://sfgh.medicine.ucsf.edu
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-manubrial angle is above RA) + vertical distance from sternal-manubrial angle to top of pulse wave
- Normal < 8 cm

[UCSD - Example of Elevated JVP](http://www.cuhk.edu.hk/csic/materials/pclm1011/pclm1011.html)

Courtesy Chinese University of Hong Kong
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

**Note:** Ok to skip femoral observation today in anatomy lab!
Femoral Region (cont)

- Identify **femoral pulse**
- **Listen** over femoral artery with diaphragm stethoscope for **bruits** (if suggestion of **vascular disease** by hx, exam)

University of Washington SOM
http://depts.washington.edu/msatlas/
Popliteal Pulse (behind the Knee)

- W/knee slightly bent, push fingers into popliteal fossa → assess popliteal artery
- Detailed examination of internal structures knee (ligaments, meniscus, etc) → later in year!
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 (uncommon):
- Edema (uncommon)
- obstruction, disruption

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

Peripheral Arterial Disease

Venous Insufficiency

Lymphedema
Feet and Ankles

• Lower leg & feet @ greatest risk **atherosclerosis** and neuropathy (in U.S.) – particularly if Diabetes

• 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 dz (pulmonary htn, 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

- One marker of volume status
- **trace** (minimal), can be subtle loss of tendons on top of foot, contours malleolous
- 4+ =s “a lot” - pitting (divot left in skin after pressure applied)
- Or assess depth of pit in mm.
- Determine how extensive (e.g. limited to feet v up to knee)
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 v 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 malleolous & work towards achilles
  - Use pads of **2-3 fingers**, pushing gently
  - Same rating scale as for dorsalis pedis
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 fem art
Knees – color, swelling; popliteal pulse
Assess ankles/feet (color, temperature, pulses, edema, cap refill)
Wash hands

Time Target: ~ 15 min