# Heart and Blood Vessel Examination

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# Objective

- On diagram, label the areas for auscultation of the heart.
- Describe the correct position of the client during examination of murmur sound.
- Identify the physiologic basis for the heart sound.

# Heart: Anatomy and Physiology

Position and surface- land mark

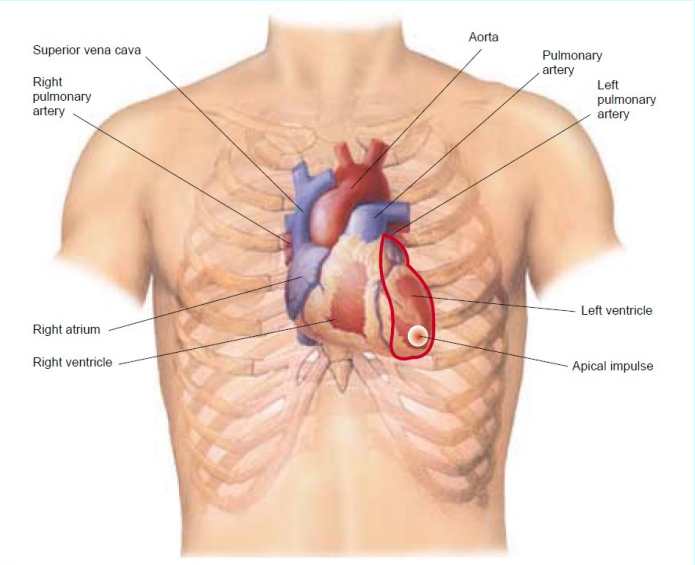
The precordium;

- A double-walled fibro serous membrane (area of anterior chest) that encloses the heart and the roots of its great vessels.
- The heart extends from the 2nd to the 5th intercostal space and from the right border of the sternum to the left mid- clavicular line.

# Cont…d

- Think of the heart as an upside down triangle in the chest.
- The "Top of the heart is the broader base and the "bottom" is the apex, which point down and to the left (LV).
- During contraction the apex beats against the chest wall, producing an apical impulse.
- This is palpable in most people, normally at the $5^{th}$ intercostals space (7-9cm lateral to MSL, D:1-2.5cm).

# Cont…d


Superior vena cava
Right pulmonary artery
Aorta
Pulmonary artery
Left pulmonary artery
Left ventricle
Apical impulse
Right atrium
Right ventricle

# Cont…d

- The great vessel lie above the base of the heart.
- The superior and inferior venacava return deoxygenated venous blood to the right side of the heart.
- The pulmonary artery leaves the right ventricle, bifurcates, and carries the venous blood to the lungs.

# Cont…d

- The pulmonary veins return the freshly oxygenated blood to the left side of the heart and the aorta carries it out to the body.
- The right and left sides of the heart are separated by septum with each side having an atrium and ventricles
- The atriums are reservoirs of blood and ventricles are muscular pumping chambers.

# Cont…d

- The four chambers are separated by a unidirectional valve to prevent back flow of the blood.
- There are four values in the heart the two atrio-ventricular values separate the atria and the ventricles, which is the tricuspid on the right and the bicuspid or mitral value on the left.

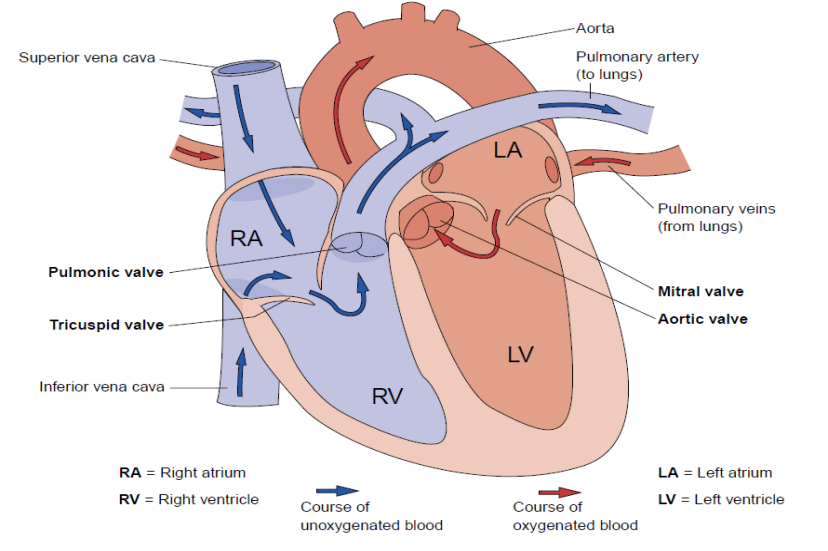
# Cont…d

- The AV values:
  - Open during the heart's filling phase, or diastole to allow the ventricles to fill with the blood.
  - Close during systole (heart's pumping phase), to prevent regurgitation of blood back up to the atria.

# Cont…d

- The semilunar values are the pulmonic value in the right side of the heart and the aortic value in the left side of the heart.
- They open during pumping or systole to allow blood to be ejected from the heart.

# Cont…d


Superior vena cava
Aorta
Pulmonary artery
(to lungs)
LA
Pulmonary veins
(from lungs)
RA
Pulmonic valve
Mitral valve
Aortic valve
Tricuspid valve
LV
Inferior vena cava
RV
RA = Right atrium
RV = Right ventricle
Course of
unoxygenated blood
Course of
oxygenated blood
LA = Left atrium
LV = Left ventricle

# Cont…d

Cardiac cycle

- The rhythmic movement of blood through the heart is the cardiac cycle.
- It has two phases.
  - ❖Diastole and
  - ❖Systole.

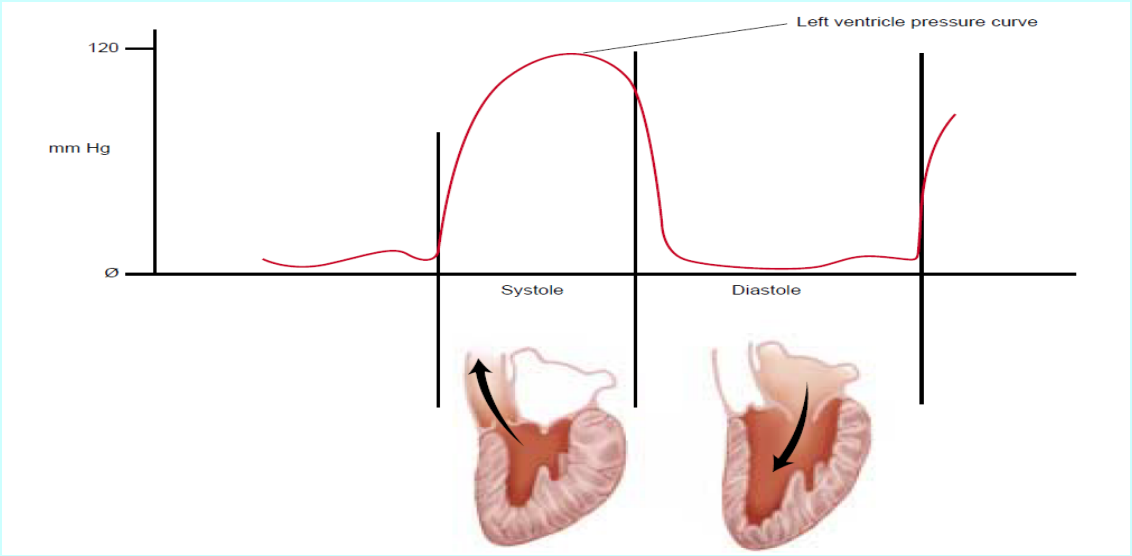
# Cont…d

- In diastole, the ventricles relax and fill with blood.
- The heart's contraction is systole, during systole blood is pumped from the ventricles and fill the pulmonary and systemic arteries.
- During systole there is closure of the AV values contributing the first heart sound($S_1$) that signal the beginning of systole.

# Cont…d

- After the ventricles contents are ejected its pressure falls causing the aortic and pulmonic value shut.
- This closure of the semilunar valves causes the second heart sound (S2) and signals the end of systole.

# Cont…d



# Cont…d

Heart sounds

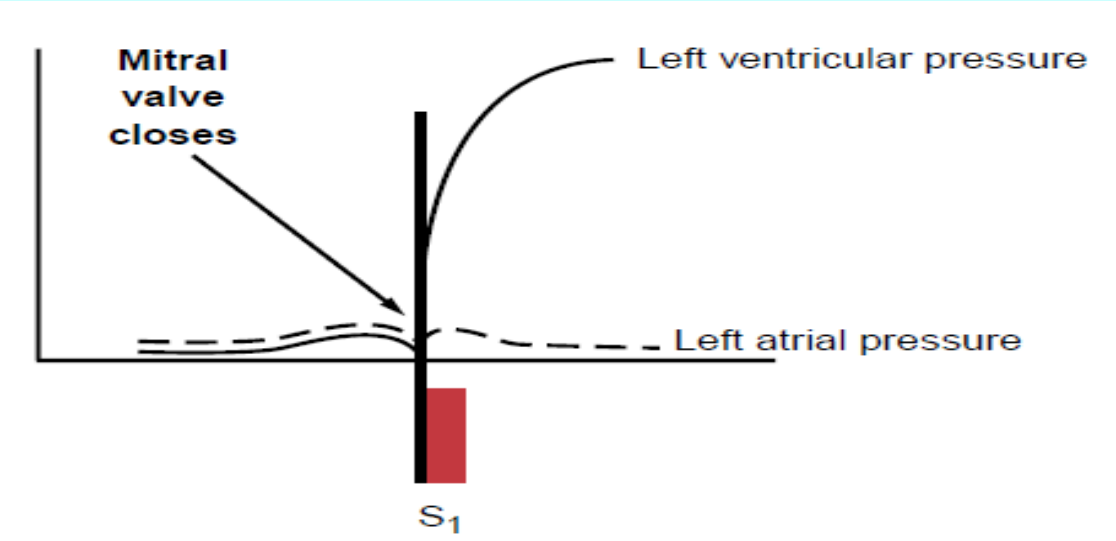
- Events in the cardiac cycle generate normal heart sounds and occasionally, extra heart sounds and murmurs (athletic person) that can be heard through a stethoscope.

# Cont…d

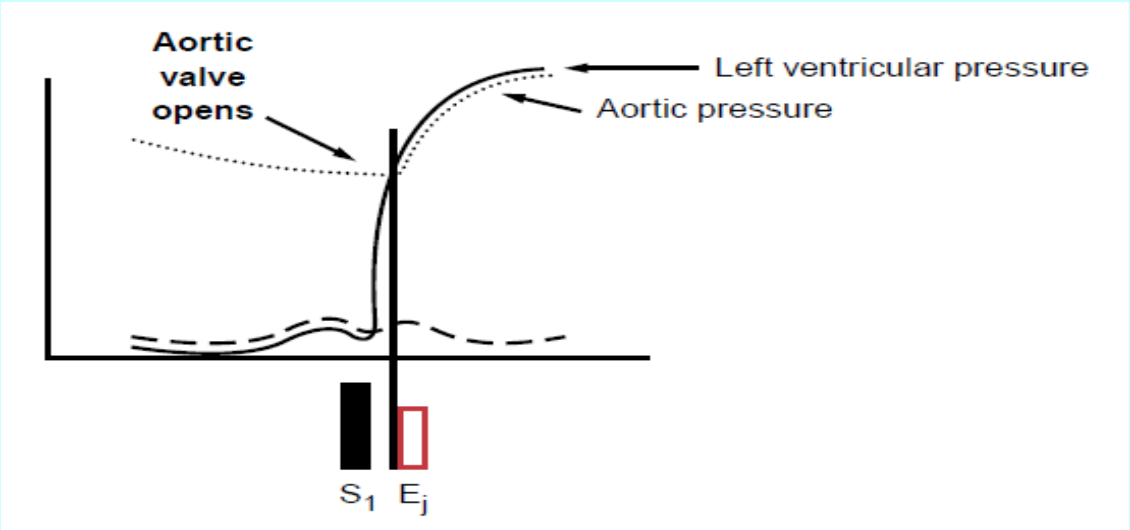
Normal heart sounds

- The 1st heart sound ($S_1$) occurs with closure of AV values and thus signals the beginning of systole.
- You can hear $S_1$ over all the pericardium but usually it is loudest at the apex.
- The second heart sound ($S_2$) occurs with closure of the semilunar valves and signals the end of systole. $S_2$ is loudest at the base.

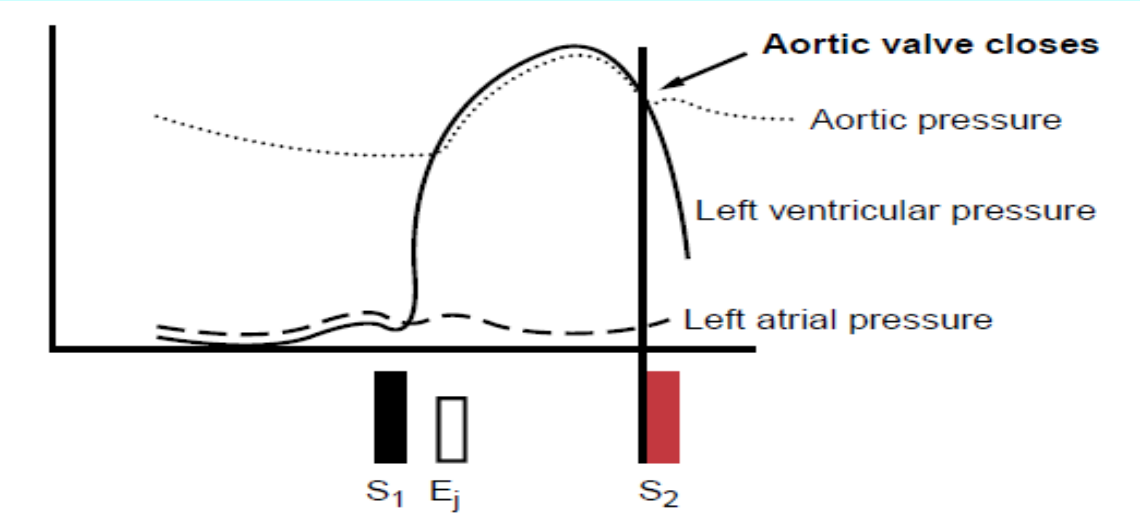
# Cont…d


Mitral valve closes
Left ventricular pressure
Left atrial pressure
S1

# Cont…d


Aortic
valve
opens
Left ventricular pressure
Aortic pressure
S1
Ej

# Cont…d


Aortic valve closes
Aortic pressure
Left ventricular pressure
Left atrial pressure
S1
Ej
S2

# Cont…d

Extra heart sound

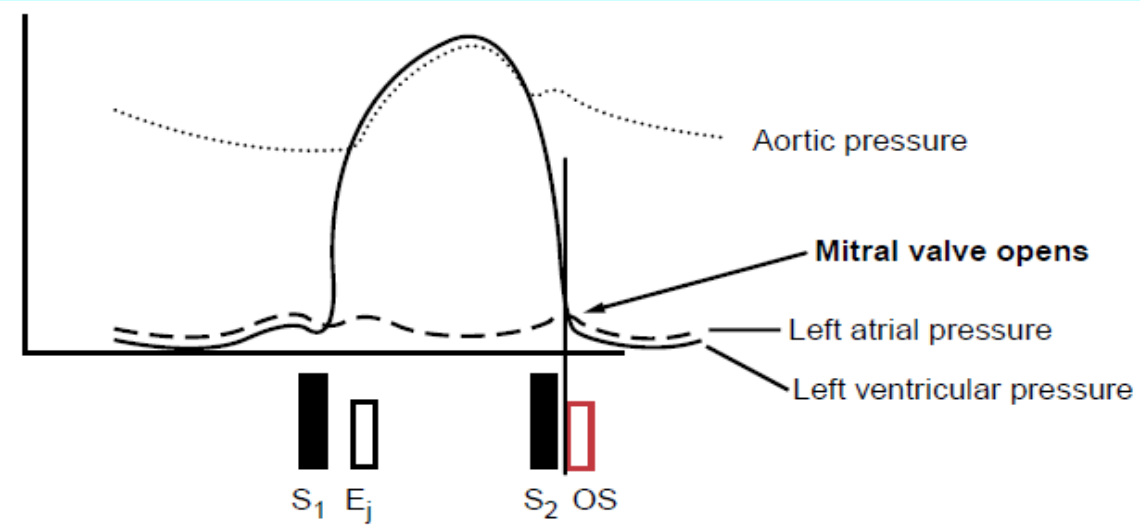
Third heart sound ($S_3$);

- Normally diastole is a silent event.
- How ever in some conditions, ventricular filling creates vibration that can be heard over the chest. These vibration are $S_3$.
- In children & young adult $S_3$ is normal.

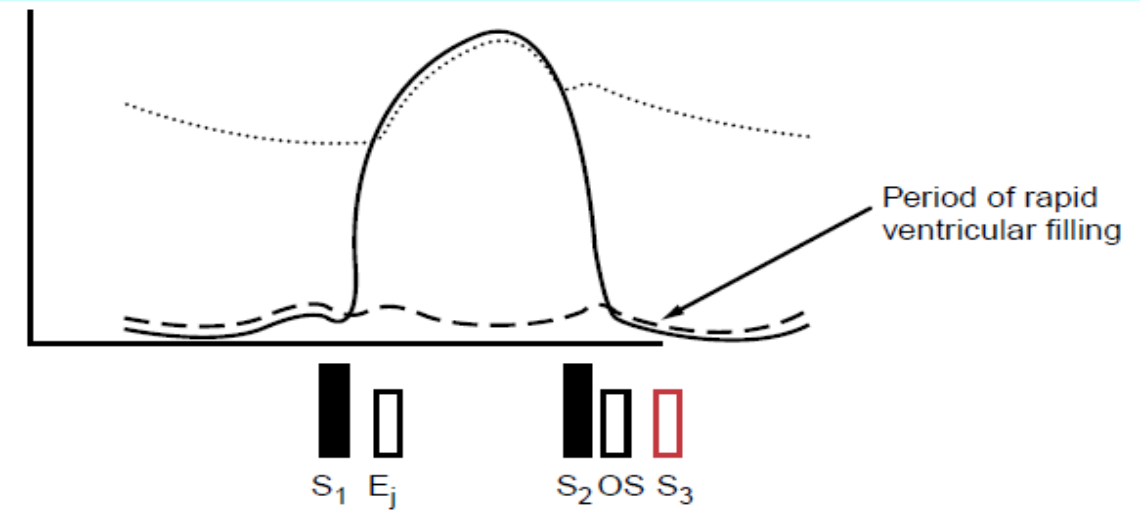
# Cont…d

- $S_3$ occurs when the ventricles are resistant to filling during the early rapid filling phase (protodiastole).
- This occurs immediately after $S_2$ when the Av values open and atrial blood first pours in to the ventricle.
- Abnormal in older adults.

# Cont…d


Aortic pressure
Mitral valve opens
Left atrial pressure
Left ventricular pressure
S1 Ej
S2 OS

# Cont…d

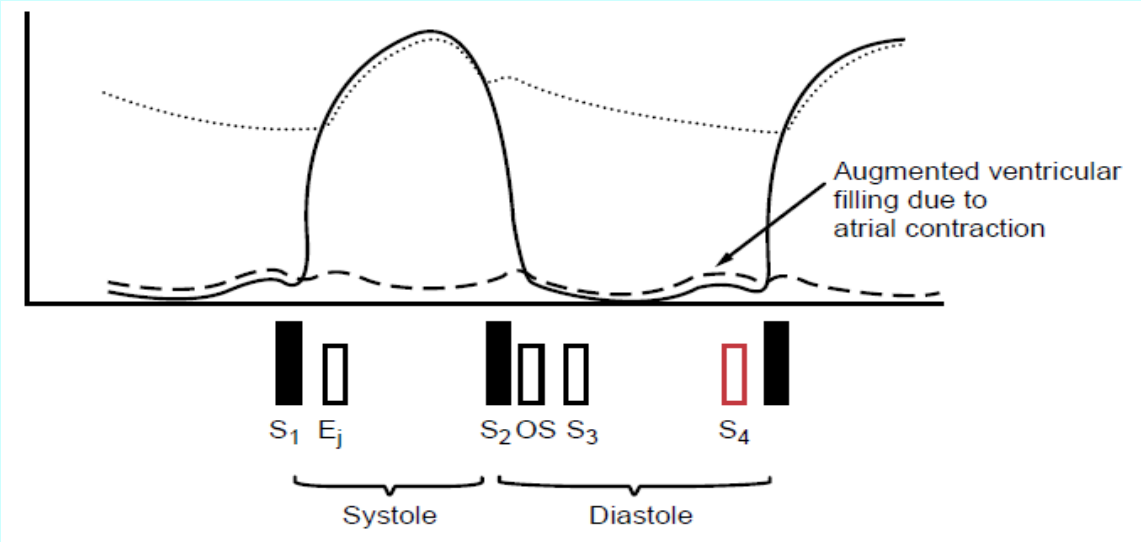


# Cont…d

Fourth heart sound ($S_4$);

- $S_4$ occurs at the end of diastole at pre-systole when ventricle is resistant to filling.
- The atria contract and pushes blood in to a non compliant ventricle.
- This creates vibrations that are heard as $S_4$ .
- $S_4$ occurs just before $S_1$.

# Cont…d


Augmented ventricular filling due to atrial contraction
S1 Ej
S2 OS S3
S4
Systole
Diastole

# Cont…d

Murmur

- Blood circulation through normal cardiac chambers and valves usually makes no noise.
- However, some conditions create turbulent blood flow that result in a murmur.
- A murmur is a blowing, swooshing sound, which can be heard on the chest wall.

# Cont…d

**Conditions resulting in murmur include;**

- Velocity of blood increases as in exercise, thyrotoxicosis.
- Viscosity of blood decrease as in anemia.
- Structural defects in the valve (stenosis or incomplete closure).

# Heart: Examination

**Purpose of cardiovascular examination;**

- To assess the patient appearance.
- To assess effectiveness of the heart as a pump.
- To assess filling volume and pressure.
- To assess the cardiac out put.
- To identify the presence of compensatory. mechanism that help to maintain cardiac out put.

# Cont…d

**Subjective data**

- Ask for any chest pain (MI, AP, DAA), dyspnea, orthopnea, cough, fatigue, cyanosis or pallor, edema, nocturia, past history, family history, personal habit,(nutrition, smoking, alcohol, exercise)

# Cont…d

**Objective data**

The neck vessels;

1. Carotid arteries

Palpate carotid artery:

- Each carotid arteries medial to the sternomastoid muscle in the lower third of the neck.
- Excessive vagal stimulation here could slow down the heart rate and palpate gently.

# Cont…d

- Palpate only one carotid at a time to avoid compromising arterial blood to the brain.
- Feel the contour and amplitude of the pulse.
- Normally the contour is smooth and the normal stroke is 2+ or moderate. Your finding should be the same bilaterally.

# Cont…d

# Cont…d

- Diminished pulse feels small and weak occurs with decreased stroke volume.

Auscultate the carotid artery:

- For persons older than middle age or who show symptoms or signs of cardiovascular disease, auscultate each carotid artery for the presence of bruits.

# Cont…d

- Bruit is blowing, swishing sound indicating blood flow turbulence.
- Normally there is none.
- Ask the person to hold his or her breath while you listen so that tracheal sounds do not mask or mimic a carotid artery bruit.

# Cont…d

2. Jugular vein

- From the jugular vein you can asses the central venous pressure(CVP) and thus the heart efficiency as pump.
- Although the external jugular vein is easier to see, the internal (esp. the right) is attached more directly to the superior venacava and thus is more reliable for assessment.

# Cont…d

- You can not see the internal jugular vein it self but you can see its pulsation.
- Position the person any where from a 30-45 degree angle, where ever you can best see the pulsations.
- Turn the person's head slightly away from the examined side.

# Cont…d

- Note the external jugular vein overlying the sternomastoid muscle.
- In some persons, the veins are not visible at all; where as in others, they are full in the supine position.
- As the person is raised to a sitting position, these external jugulars flatten and disappear, usually at 45 degree.

# Cont…d

- Full distention of external jugular veins above 45 degree signify increased CVP.
- Now look for pulsation's of the internal jugular vein in the area of the supra sternal notch or around the origin of the sternomastoid muscle around the clavicle.

# Cont…d

- You must be able to distinguish internal jugular vein pulsation from that of the carotid artery.
- It is easy to confuse because they lie close together.

# Cont…d

| Internal Jugular Pulsations | Carotid Pulsations |
|---|---|
| Rarely palpable | Palpable |
| Soft, rapid, undulating quality, usually with two elevations and two troughs per heart beat | A more vigorous thrust with a single outward component |
| Pulsations eliminated by light pressure on the vein(s) just above the sternal end of the clavicle | Pulsations not eliminated by this pressure |
| Level of the pulsations changes with position, dropping as the patient becomes more upright. | Level of the pulsations unchanged by position |
| Level of the pulsations usually descends with inspiration. | Level of the pulsations not affected by inspiration |

# Cont…d

| Sequence of the Cardiac Examination | |
|---|---|
| **Patient Position** | **Examination** |
| Supine, with the head elevated 30° | Inspect and palpate the precordium: the 2nd interspaces; the right ventricle; and the left ventricle, including the apical impulse (diameter, location, amplitude, duration). |
| Left lateral decubitus | Palpate the apical impulse if not previously detected. Listen at the apex with the bell of the stethoscope. |
| Supine, with the head elevated 30° | Listen at the tricuspid area with the bell.<br>Listen at all the auscultatory areas with the diaphragm. |
| Sitting, leaning forward, after full exhalation | Listen along the left sternal border and at the apex. |

# Cont…d

Precordium;

Inspect the anterior chest:

- You may or may not see the apical impulse (pulsation of left ventricle,) when visible it occupies the fourth or fifth intercostals space at the mid-clavicular line.

# Cont…d

- Easier to see in children or those with thinner chest walls.

Abnormal

- A heave or lift of the ventricle during systole with ventricular hypertrophy.

# Cont…d

Palpation

Palpate the apical impulse ( apex beat):

- Localize the apical impulse precisely using one finger pad.
- Asking the person to “exhale and then hold it” aids to find the pulsation.
- You may need to roll the person midway to the left to find it.

# Cont…d

# Cont…d

Note:-

- Location- the apical impulse should occupy only one inter space the fourth or fifth, and be at or medial to the midclavicular line.
- Size- normally 1cm X 2cm.
- Amplitude- normally a short gentle taps.
- Duration– short, normally occupies only first half of systoles.

# Cont…d

- The apical impulse is palpable in about half of adults and not palpable in obese person or persons with thick chest wall.
- With high cardiac out put (anxiety, fever and anemia) the apical impulse increase in amplitude and duration.

# Cont…d

Palpate across the precordium

- Using the palmer aspect of your fingers, gently palpate the apex, the left sternal border and the base scorching for any other pulsation.
- Normally there are none. If any are present note the timing.

# Cont…d

# Cont…d

Abnormal:-

- A thrill is a palpable  vibration. It feels like throat of a purring cat.
- It signifies turbulent blood flow and accompanies loud murmurs.

# Cont…d

Percussion

- Has been used to out line the heart's borders, replaced by the chest x- ray study.
- Which is more accurate in detecting heart enlargement.

# Cont…d

- To search for cardiac enlargement in out patient or at home, place your stationary finger in the person's fifth intercostals space on the left side of the chest near the anterior axillary line.
- Slide your stationary hand to ward your self percussing as you go, and note the change of sound from resonance over the lung to dull over the heart).

# Cont…d

- Normally, the left border of cardiac dullness is at the mid clavicular line in the 5$^{th}$ interspaces and slopes in toward the sternum as you progress upward that by the second interspaces the border of dullness concede with the left sternal border.
- The right border of dullness normally matches the sternal border.

# Cont…d

Auscultation

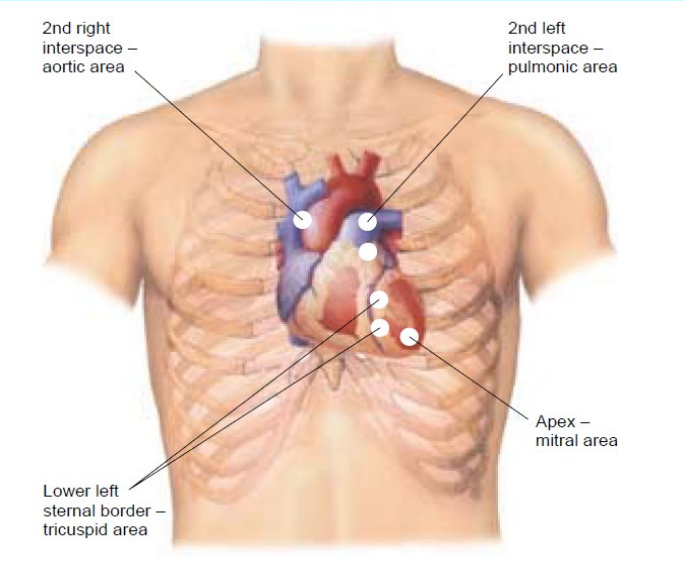
- Identify the auscultatory areas where you will listen.
- These include the four traditional valve “ areas”.
- The valve areas are not over the actual anatomic location of the valves but are the sites on the chest wall where sounds produced by the valves are best heard with the direction of blood flow.

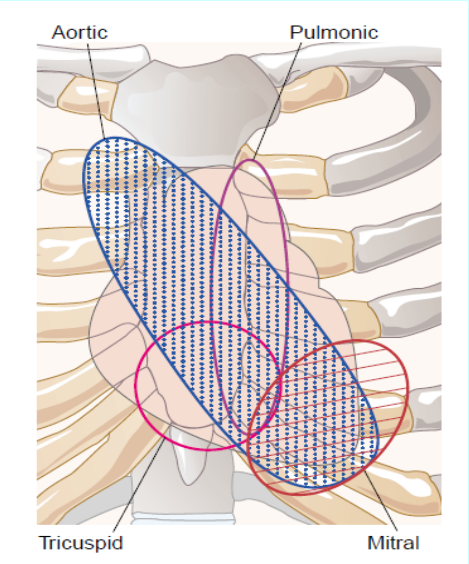
# Cont…d

- Second right inter space – aortic valve area.
- Second left inter space – pulmonic valve area.
- Third left inter space- Erb's point.
- Left lower sternal border – tricuspid valve area.
- Fifth interspace at around left midclavicular line- mitral valve area.

Summarized by ***"All People Eat Three Meals"***

# Cont…d


2nd right interspace – aortic area
2nd left interspace – pulmonic area
Apex – mitral area
Lower left sternal border – tricuspid area


Aortic
Pulmonic
Tricuspid
Mitral

# Cont…d

- Use diaphragm for relatively higher pitched sounds and the bell for relatively lower pitched sounds.
- Concentrate, and listen selectively to one sound at a time.

# Cont…d

- Begin with the diaphragm end piece and use the following routine;

1. Note the rate and rhythm.
2. Identify $S_1$ & $S_2$.
3. Assess $S_1$ and $S_2$ separately.
4. Listen for extra heart sounds.
5. Listen for murmurs.

# Cont…d

1. Note the rate and rhythm:- the rate ranges normally from 60 to 100 beats/ minutes and the rhythm should be regular.

Abnormal:-

- Premature beat:- an early isolated beat or a pattern occurs early sound every third or fourth beat.
- Irregularly irregular:- no pattern to the sounds; beats come rapidly and at random intervals.

# Cont…d

2. Identify $S_1$ and $S_2$ ;

- $S_1$ is the first pair of lub-dup.

3. To distinguish $S_1$ from $S_2$ ;

- $S_1$ is louder than $S_2$ at the apex; $S_2$ is louder than $S_1$ at the base.
- $S_1$ coincides with the carotid artery pulse. Feel the carotid gently as you auscultator at the apex; the sound you hear as you feel each pulse is $S_1$.

# Cont…d

- $S_1$ coincides with the R- wave (the upstroke of the QRS complex) if the person is on an ECG monitor.

4. Listen to $S_1$ and $S_2$ separately:– note whether each heart sound is normal or diminished.

- Focus on systole then on diastole and listen for any heart sounds.

# Cont…d

- Listen with the diaphragm and then switch to bell covering all the auscultatory area.
- When you detect an extra heart sound, listen carefully its characteristics and 3$^{rd}$ or 4$^{th}$ heart sound either may be normal or abnormal.

# Cont…d

5. Listen for murmurs;
   - A murmur is a blowing, swooshing sound that occurs with turbulent blood flow in the heart or great vessels.
   - If you hear a murmur describe it by indicating these characteristics:

# Cont…d

1. Timing – its occurrence in systole or diastole. You must able to identify S1 and S2 accurately to do this. Describe as being early, mid or late in systole or diastole.
2. Location- describe the area of maximum intensity of the murmur (where it is best heard) by noting the valve area or intercostal space.
3. Loudness – describe the intensity in terms of six grades.

# Cont…d

| Grade | Assessment description |
|---|---|
| 1 | Barely audible, heard only in a quite room and then with difficulty. |
| 2 | Clearly audible but faint. |
| 3 | Moderately loud. |
| 4 | Loud associated with a thrill palpable on the chest wall. |
| 5 | Very loud, heard with one corner of the stethoscope lifted off the chest wall. |
| 6 | loudest, still heard with entire stethoscope lifted just off the chest wall. |

# Cont…d

Change the position;

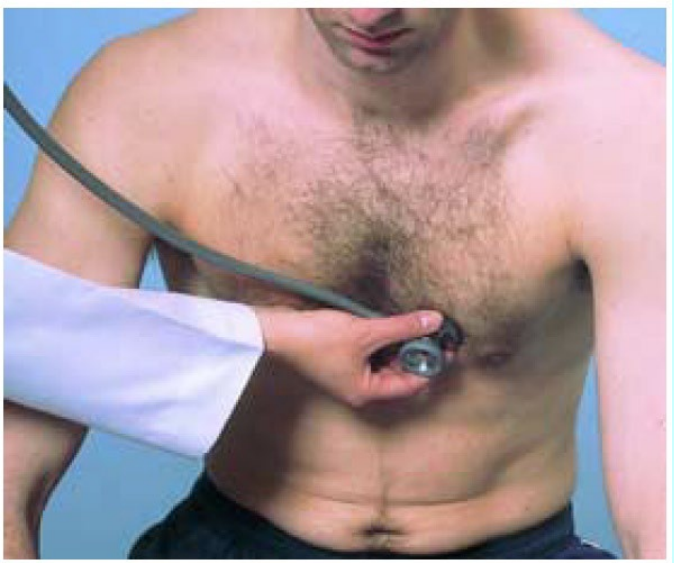
- After auscultating in the supine position , roll the person to ward his or her left side
- Listen with the bell at the apex for the presence of any diastolic filling sounds.
- $S_3$ , $S_4$ and the murmur of the mitral stenosis some times may be heard only when on the left side.

# Cont…d

# Cont…d

- Ask the person to sit up and lean forward slightly
- Listen with the diaphragm at the base, right and left side.
- Check for the high pitched diastolic murmur of aortic or pulmonic regurgitation.
- Murmur of aorta regurgitation some times may be heard only when the person is leaning forward in the sitting position.

# Cont…d



# Cont…d

Summery:

1. Neck
   - ✓ Carotid pulse- observe and palpate.
   - ✓ Observe jugular venous pulse.
   - ✓ Estimate jugular venous pressure.

# Cont…d

2. Pericardium

a) Inspect and palpate:
   - Describe location of apical pulse.
   - Note any heave(lift) or thrill.

b) Auscultation:
   - Identify anatomic areas where you listen.
   - Note rate and rhythm of the heart beat.
   - Identify $S_1$ and $S_2$ and note any variation.

# Cont…d

- Listen in the systole and diastole for any extra heart sounds.
- Listen in systole and diastole for any murmur.
- Repeat the sequence with bell.
- Listen at the apex with person in left lateral position.
- Listen at the base with person in sitting position.

# Blood Vessel: Anatomy and Physiology

Arteries;

- Each heart beat creates a pressure wave (pulse) which makes the arteries expand and recoil.
- All arteries have pulse all over the body, but you can feel it only at body site where the artery lies close to the skin and over a bone.

# Cont…d

The following arteries are accessible to examination:

- Temporal artery
- Carotid artery
- Aorta
- Arteries in the arm -the brachial artery and its branch, the ulnar and radial arteries

# Cont…d

- Arteries in the leg- the major artery to the leg is femoral artery, which travels down the thigh, moves posteriorly at the lower thigh and termed as a popliteal artery.
- Below the knee the popliteal artery divides.

# Cont…d

- The anterior tibial artery travels down the front of the leg on the dorsum of the foot, where it become the dorsalis pedis.
- In back of the leg the posterior tibial artery travels down behind the medial malleous, and in the foot forms the plantar arteries.

# Blood Vessel: Examination

- Inspect and palpate the arms.
- Lift both the person's hand in your hands.
- Inspect and note colour of skin and nail beds, presence of any lesion, edema or clubbing. Palpate and note the pulse, temperature, capillary refill, & texture.
- With the person's hand near the level of the heart check capillary refill from the thumb (large surface area).

# Cont…d

- This is an index of peripheral perfusion and cardiac out put.
- Depress and blanch the nail beds, release and note the time for color return.
- Usually the vessels refill with in a fraction of a second.
- Normally returns  less than 1 or 2 seconds.

# Cont…d

- Refill > 1 or 2 sec signifies vasoconstriction or decreased cardiac out put (hypovolemia, CHF or shock).
- Hands are cold, clammy & pale.
- The two arms should by symmetric in size.
- Palpate the peripheral pulses for rate, rhythm, symmetry & equal force.
- The force (amplitude) of pulse graded on a four point scale as follows;

# Cont…d

| Grade | Assessment description |
|---|---|
| 4 | Bounding |
| 3 | Increased |
| 2 | Normal |
| 1 | Week |
| 0 | Absent |

# Nursing Diagnosis

- Alteration in tissue perfusion related to hypovolemia as manifested by increased heart rate.
- Decreased cardiac out put related to structural problems as manifested by dyspnea and cough.

Thank you for your attention!!!