

Physical examination of the Cardiovascular System

- Physical Examination

Dr. Jo Jo Hai
Clinical Assistant Professor
Queen Mary Hospital
The University of Hong Kong

**Physical
Examination**

Why do you want to perform a physical examination

Mr Poon

- M/38
- Good past health
- 6 months history of exercise intolerance
- 3 days history of shortness of breath at rest
- What do you want to know?



Why do you want to perform a physical examination

Mr Poon

- M/38
- Good past health
- 6 months history of exercise intolerance
- 3 days history of shortness of breath at rest
- What do you want to know?
 - Reason for exercise intolerance
 - E.g. Heart failure
 - Underlying cause
 - E.g. Hypertension
 - Management
 - E.g. Renal bruit ? Renal artery stenosis?



BEFORE you begin

- + Wash your hands
- + Introduce yourself to the patient check the identity of the patient
- + Ask the patients permission to carry out the examination
- + Privacy
- + Give a brief explanation to the patient before you start.
- + Patient position
 - + Ideally the patient should be reclined at 45 degrees, hands by the side and chest exposed
 - + In female patients the bra will need to be removed for you to carry out the examination effectively. Do not expose the patient's chest until you are ready to examine the precordium.

Components of CV Examination

- + General Examination
- + Arteries and Veins
- + Precordial Examination
 - + Inspection
 - + Palpitation
 - + Auscultation

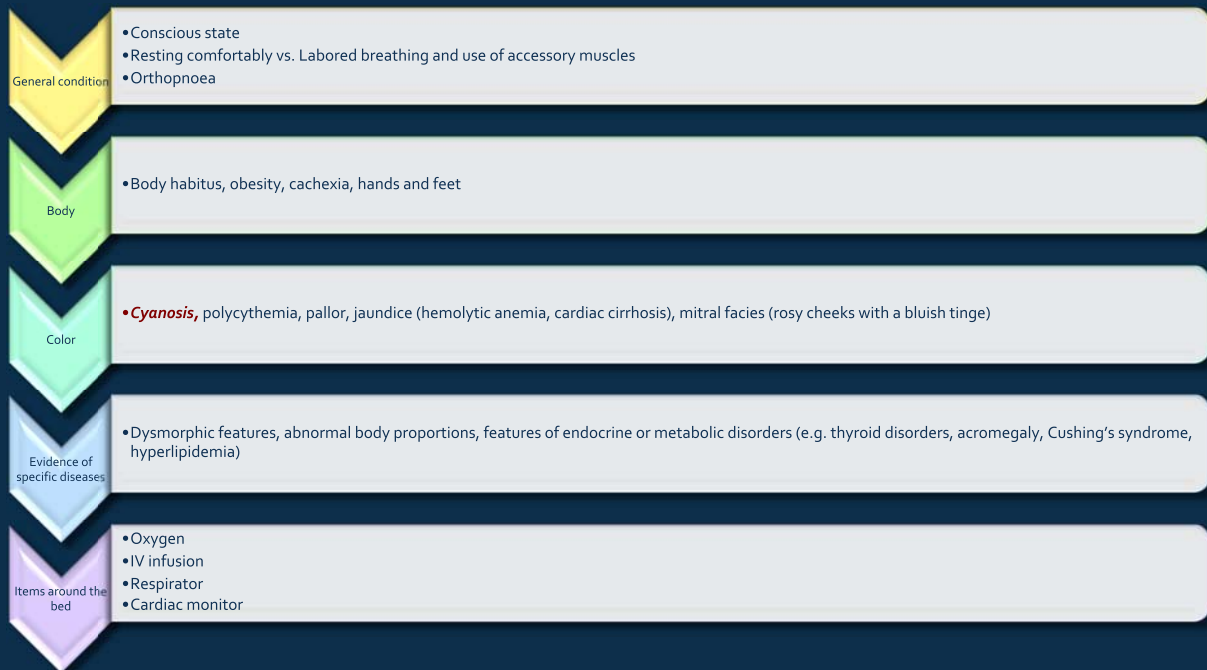
Physical Examination

General Examination

General Examination

- + Severity of the condition
- + CVS diseases → Systemic manifestations
e.g. infective endocarditis, heart failure
- + Systemic diseases → CVS manifestations
e.g. congenital syndromes, metabolic disorders

General Examination

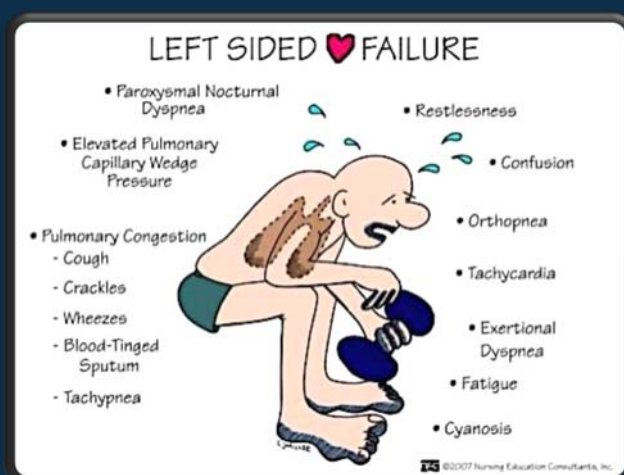


Left sided heart failure

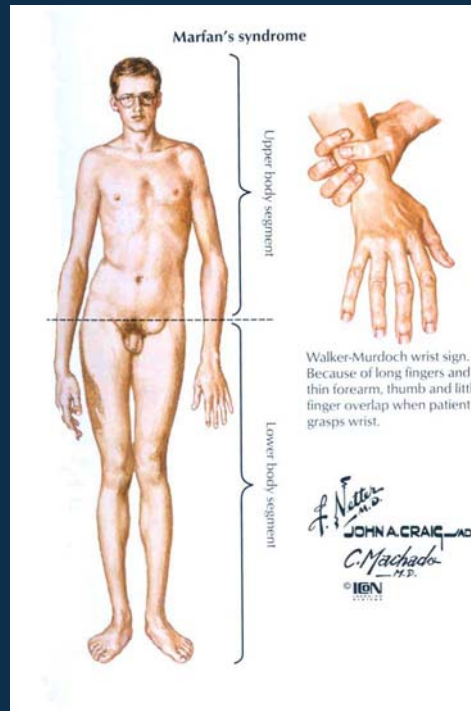
Blood backs up in the lungs and the heart is unable to pump a sufficient amount of blood to the systemic circulation, producing poor tissue oxygenation (left ventricle enlarged)

Right Sided heart failure

Blood backs up into the veins that return blood to the right heart, thereby slowing venous drainage from the head via the jugular vein, causing peripheral edema and engorgement of organ

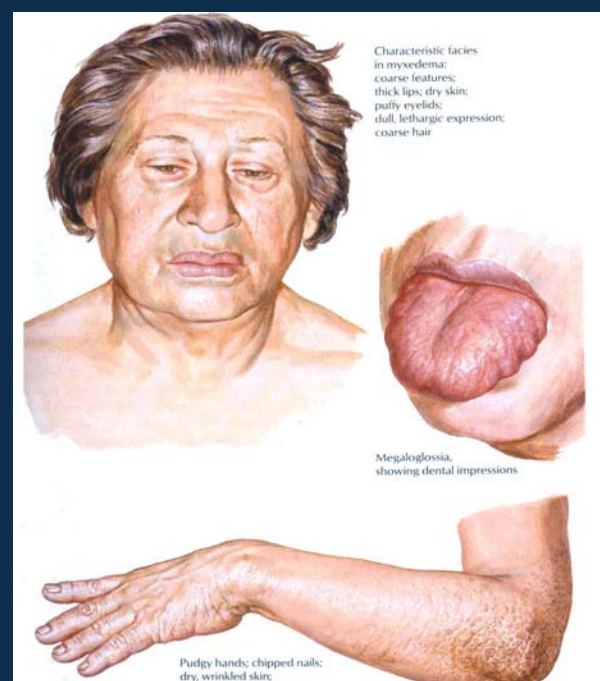
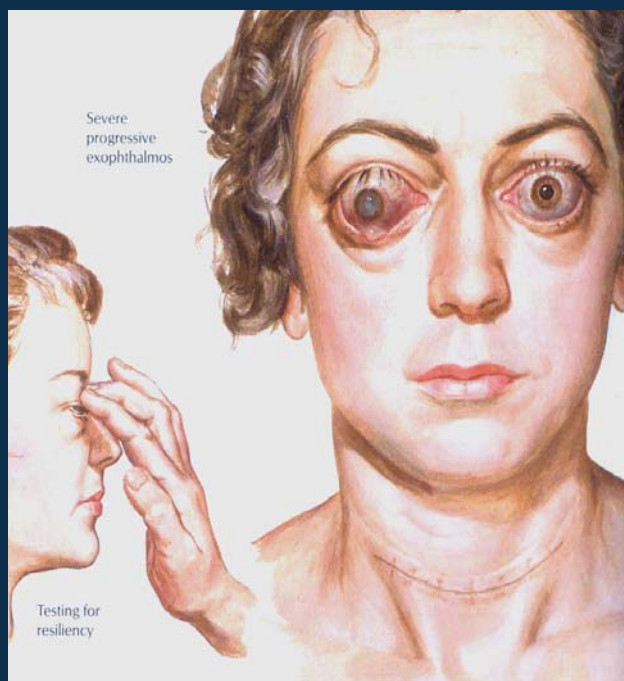


Abnormal body habitus



Netter's Cardiology

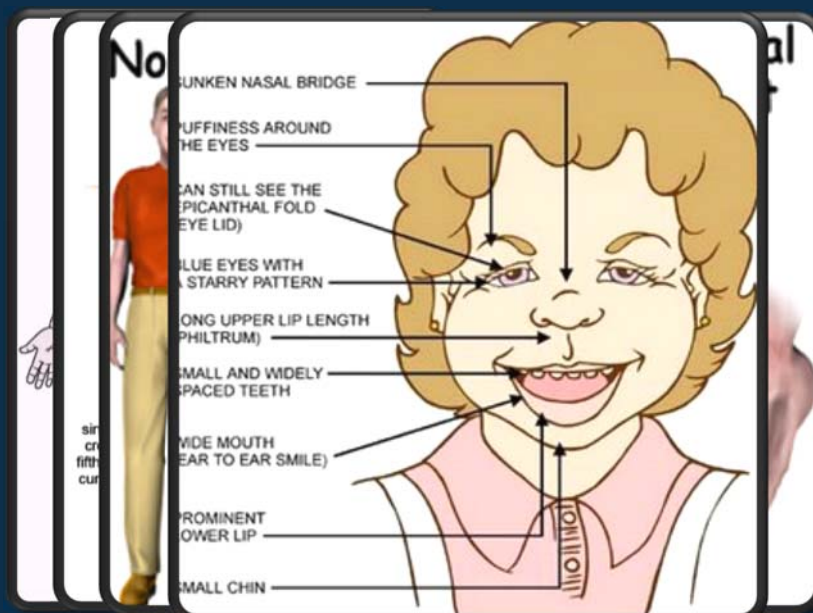
Hyper- and hypo- thyroidism



Xanthelesma and xanthomata



Syndromes



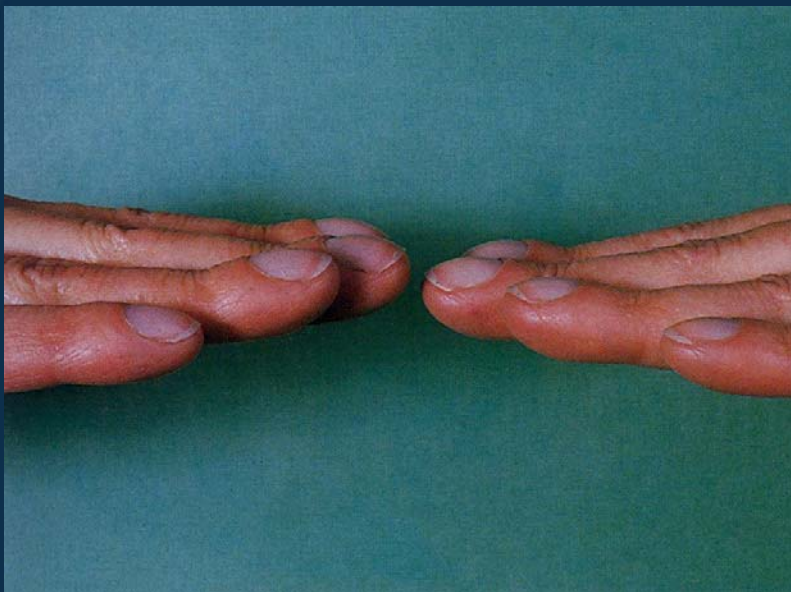
Syndrome	Associated Cardiac Abnormalities
Turner Syndrome	Left side obstruction, Coarctation of aorta, aortic stenosis, HLHS, Bicuspid aortic valve
Down Syndrome (Trisomy 21)	AV canal defect, ASD, VSD Patent ductus arteriosus, Tetralogy of Fallot
Marfans (misfolding fibrillin1)	Prolapse of mitral valve (MVP), Aortic regurgitation, dilated aorta/aortic aneurysm/dissection
Williams Syndrome (Del 7p)	Left and right heart obstruction, Supravalvular Aortic stenosis, PV stenosis

Peripheral signs of infective endocarditis



- Splinter hemorrhage
- Osler's node - painful, tender
- Janeway lesion - painless

Finger Clubbing



- + Some pulmonary diseases (cancer, fibrosis, bronchiectasis, abscess)
- + Cyanotic congenital heart disease
- + Infective endocarditis

- Grade 1: Fluctuation of nail bed
- Grade 2: Obliteration of the Lovibond angle
- Grade 3: Drumstick appearance (some literature split into 2 grades)
- Grade 4: Hypertrophic osteoarthropathy

Central and peripheral cyanosis



- Cyanosis: deoxyhemoglobin ≥ 5 g/dL (2 g/dL when assessed by ABG)
- Central cyanosis: low oxygen saturation
- Peripheral cyanosis: occurred with central cyanosis, or else due to inadequate peripheral circulation
- Differential cyanosis: cyanosis limited to the lower extremities. PDA with pulmonary hypertension and R-L shunt

Lower limb edema and scars



Physical Examination

Arteries and Veins

Arterial Pulses

Exam Technique

- + All accessible arterial pulse should be assessed and compared bilaterally:

radial

brachial

subclavian (auscultation)

carotid

femoral

popliteal

posterior tibial

dorsalis pedis

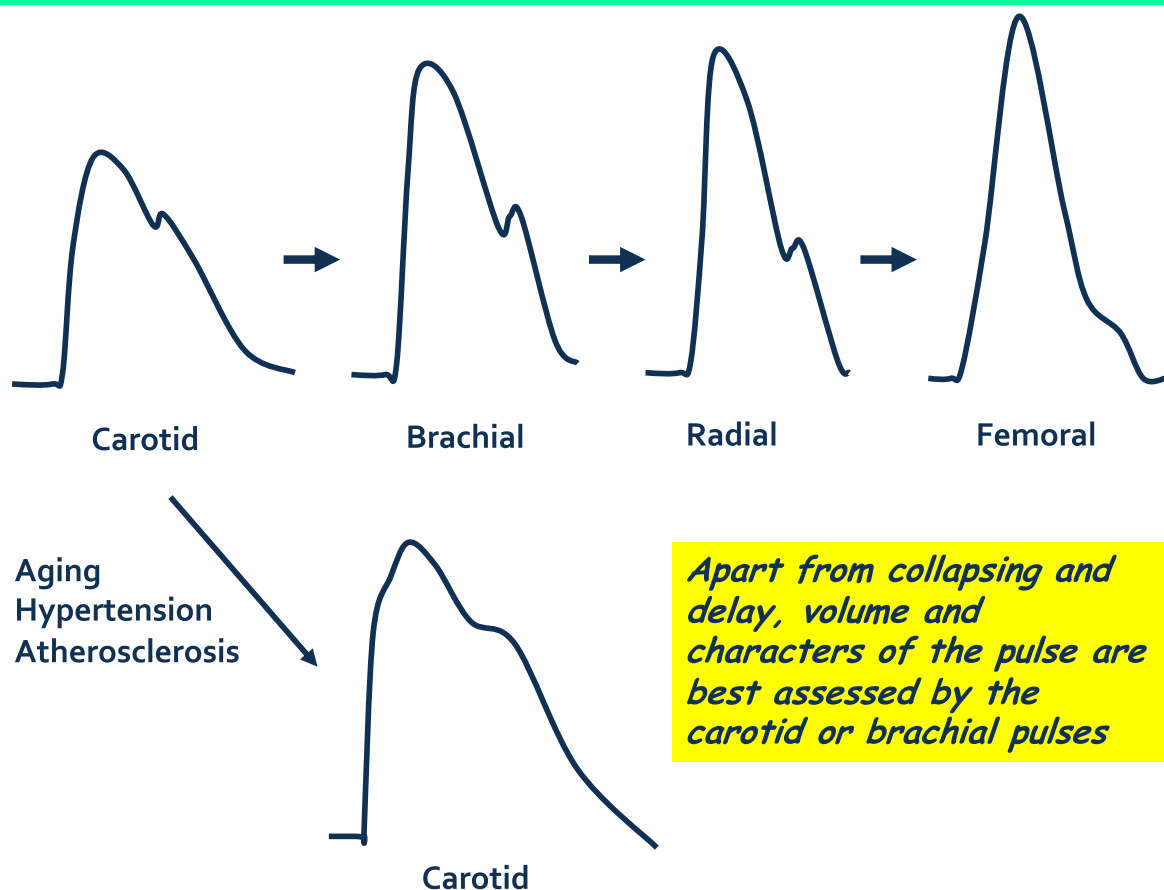
```
graph LR; A[radial<br/>brachial<br/>subclavian (auscultation)<br/>carotid<br/>femoral<br/>popliteal<br/>posterior tibial<br/>dorsalis pedis] --- B[Atherosclerosis<br/>Embolic occlusion<br/>Dissection<br/>Vascular compression<br/>Congenital anomaly];
```

Atherosclerosis
Embolic occlusion
Dissection
Vascular compression
Congenital anomaly

- + Radial pulse: radio-radio delay and radio-femoral delay

Arterial Pulses

- + Rate: 60-100 beats/minute
- + Rhythm:
Regularly irregular → Second degree AVB, ectopics
Irregularly irregular → atrial fibrillation
- + Volume:
Diminished → Poor LV function, LV outflow obstruction, pericardial effusion
Increased → “pounding” pulse
- + Characters:
Collapsing, delay, slow-rising, bisferian
- + Auscultation:
Bruit



Pulse Character Abnormalities (ref)

Pulse type	Physiological cause	Possible disease
small & weak	decreased stroke volume	heart failure, hypovolemia, severe aortic stenosis
	increased peripheral resistance	
large & bounding	increased stroke volume	fever, anaemia, hyperthyroidism, aortic regurgitation, bradycardia, heart block, atherosclerosis
	decreased peripheral resistance	
	decreased compliance	

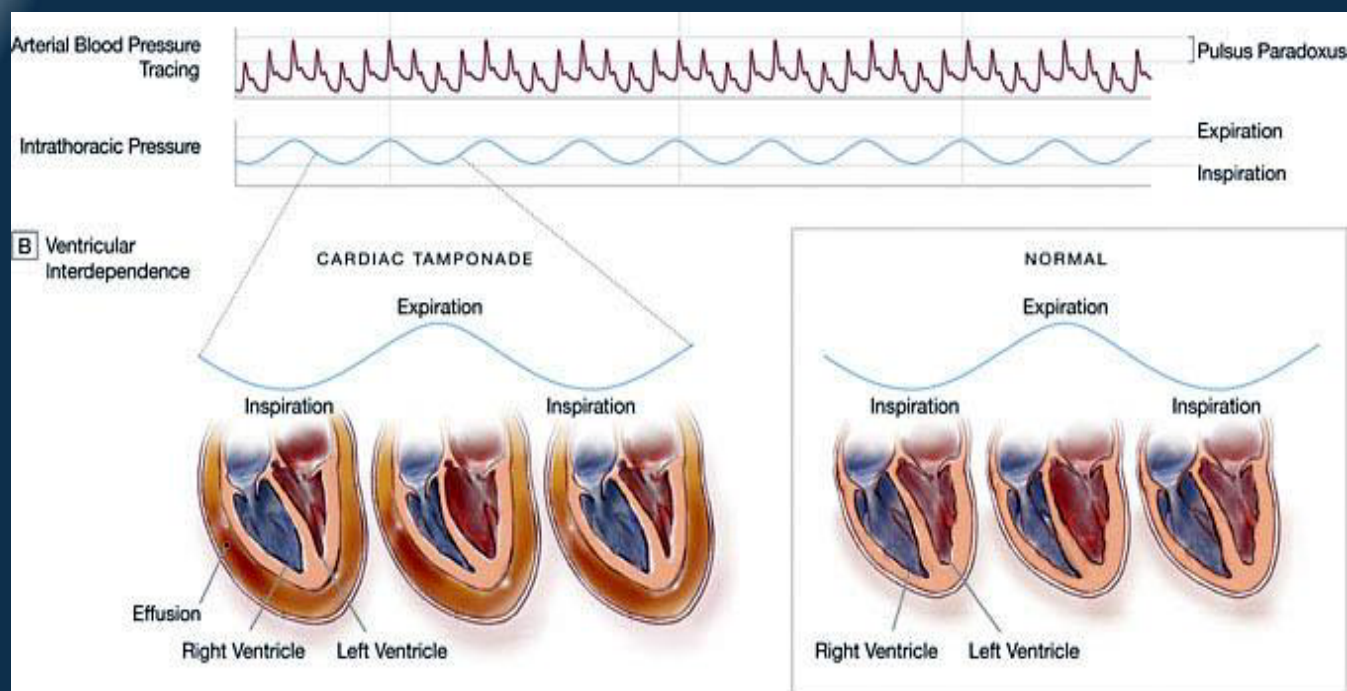
Pulse Character Abnormalities (ref)

Anacrotic pulse	2 upbeats, small volume, slow rising	Aortic stenosis (slow ejection of blood from left ventricle)
Pulsus Parvus (small)	Small, weak pulse, slow rising	Seen in conditions with diminished LV stroke volume and narrow pulse pressure: Aortic, Mitral stenosis, LVF and hypovolemia
Collapsing	Corrigan's sign. Rapid upstroke and downstroke, no dichrotic notch	Aortic regurgitation, anemia, thyrotoxic

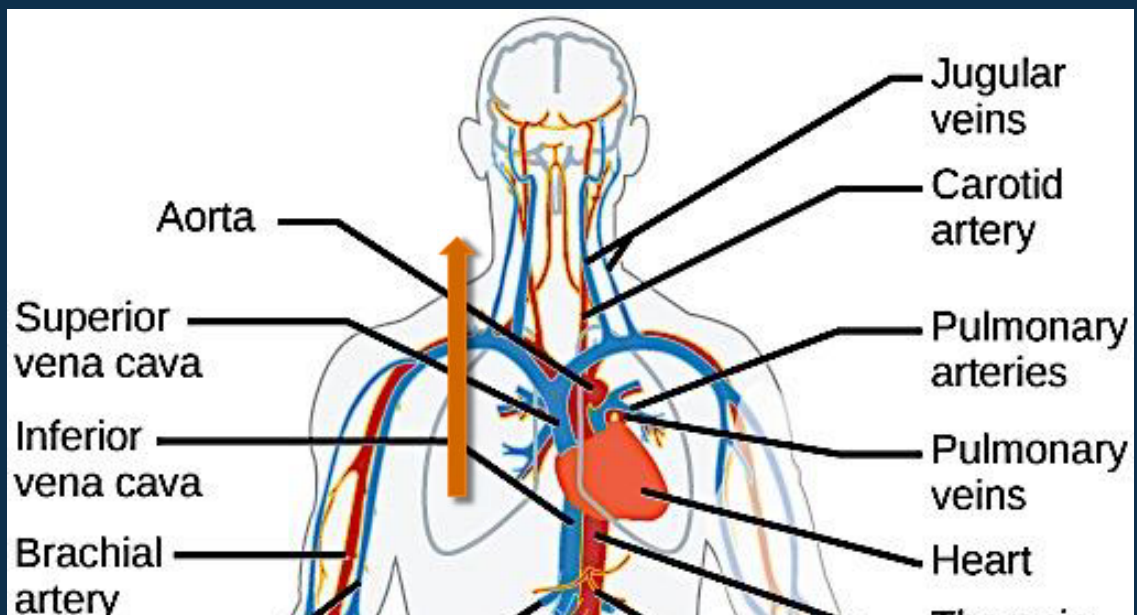
Pulse Character Abnormalities (ref)

Pulse type	Physiological cause	Possible disease
Bisferiens	increased arterial pulse with double systolic peak	aortic regurgitation, aortic stenosis and regurgitation, hypertrophic cardiomyopathy
Pulsus alternans	pulse amplitude varies from peak to peak, rhythm basically regular	left ventricular failure
Pulsus paradoxus	Pulse becomes smaller on deep inspiration (normal fall is 8-10mmHg)	Large pericardial effusion (cardiac tamponade) Constrictive pericarditis

Arterial Pulses



Jugular Venous Pressure

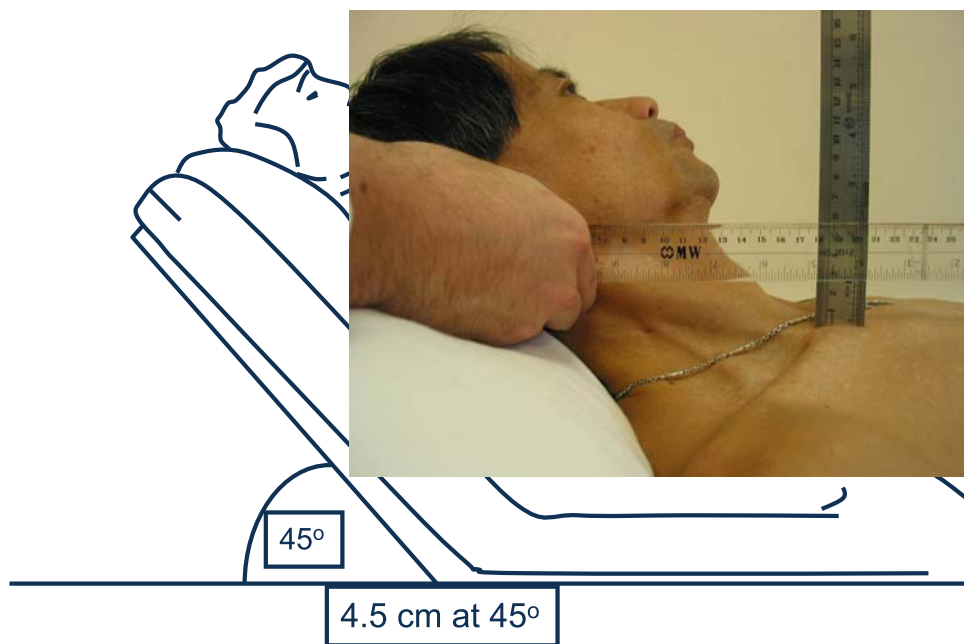


JVP

Identify JVP:
Neck pulsation
Carotid Pulse vs. JVP?

Height

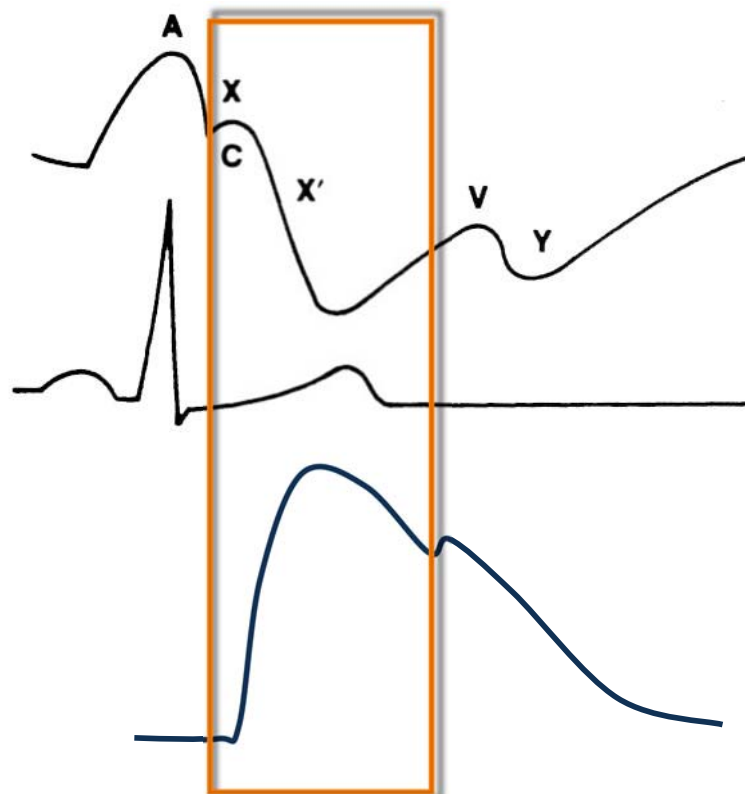
Character



Jugular Venous Pressure

Electrocardiogram

Carotid Pulse



Normal jugular venous pulse

Jugular Venous Pressure

- + A wave: Reflect right atrial contraction and precedes carotid pulse
- + X descent: Reflect right atrial relaxation and passive pulling during right ventricular systole
- + C wave: Reflect closure of tricuspid valve and is separately visible
- + V wave: Reflect filling of right atrial during ventricular systole with tricuspid valve closed and is roughly synchronous with carotid pulse
- + Y descent: Negative deflection of right atrial pressure during opening of tricuspid valve

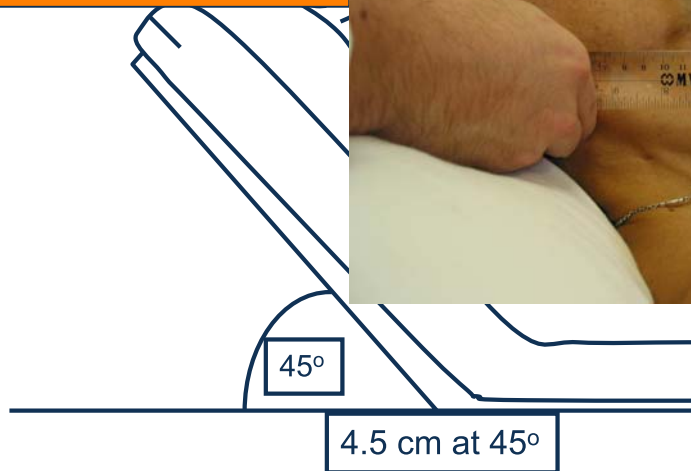
JVP vs. Carotid Pulse

	Internal Jugular Vein	Carotid Artery
Location	Superficial and lateral	Deeper and medial
Contour	Double peak	Single peak
Character	Not palpable	Forceful and palpable
Inspiration	More visible but mean pressure decreases	No change
Posture	Decrease with upright posture	No change
Compressibility	Obliterated by pressure	Cannot obliterated by pressure
Abdominal compression	Transient increase in pressure	No effect

↑ JVP (>4.5 cm)

Causes:

- right ventricular failure
- fluid overload
- SVC obstruction

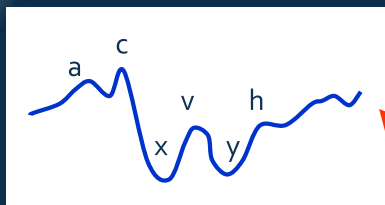


↓ JVP

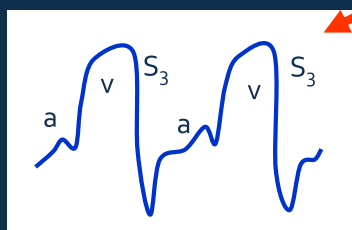
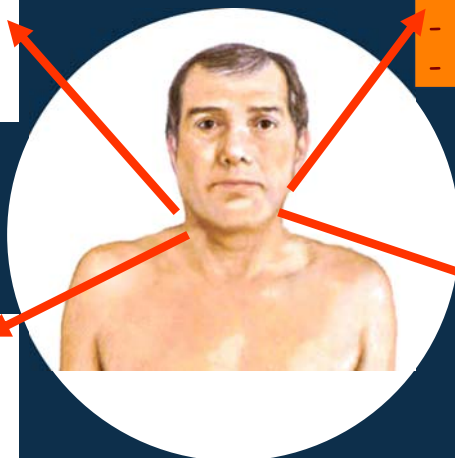
Causes:
hypovolemia
dehydration

Netter's Cardiology

Normal



JVP



Giant V wave:

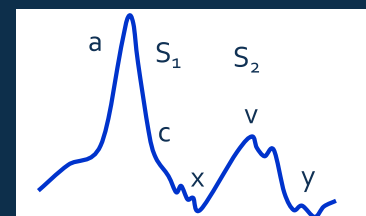
Causes:
TV regurgitation

Cannon A wave:

Atrioventricular dissociation

Causes:

- Complete heart block
- Atrial flutter
- Asynchronous VP, VT



Giant A wave:

↓ RV compliance →
forceful RA contraction

Causes:

- Pulmonary hypertension,
- PV/TV stenosis

Physical Examination

Precordium

Precordium

Exam Technique



Inspection:

- chest wall abnormalities
- visible apex and pulsation
- surgical scar

Palpation:



Localized
apical
pulsations

Left lateral decubitus
Or
Leaning forward
If failed to localize
the apex
(N: 5th ICS, MCL)

Thrills or palpable heart sound

Heaves or lifts:
Parasternal heave
→ RV hypertrophy

Chest Wall Deformity



Scars, Implants

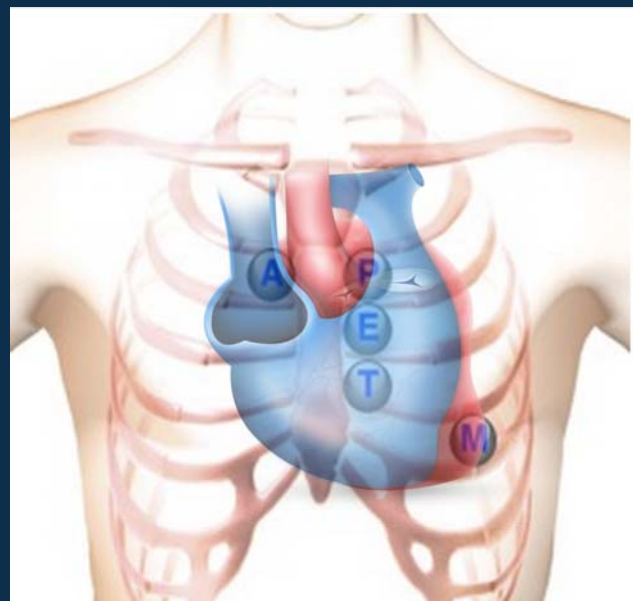


Stethoscope



Where to auscultate

- + M – Mitral area (bell and diaphragm). Left lateral decubitus; axillary radiation
- + T – Tricuspid area (diaphragm)
- + P – Pulmonary area (diaphragm)
- + A – Aortic area (diaphragm). carotids
- + E – Erb's point (diaphragm): lean forward in expiration



What makes the normal heart sounds?

Reflect the turbulence created when the heart valves snap shut, causing changes in blood flow

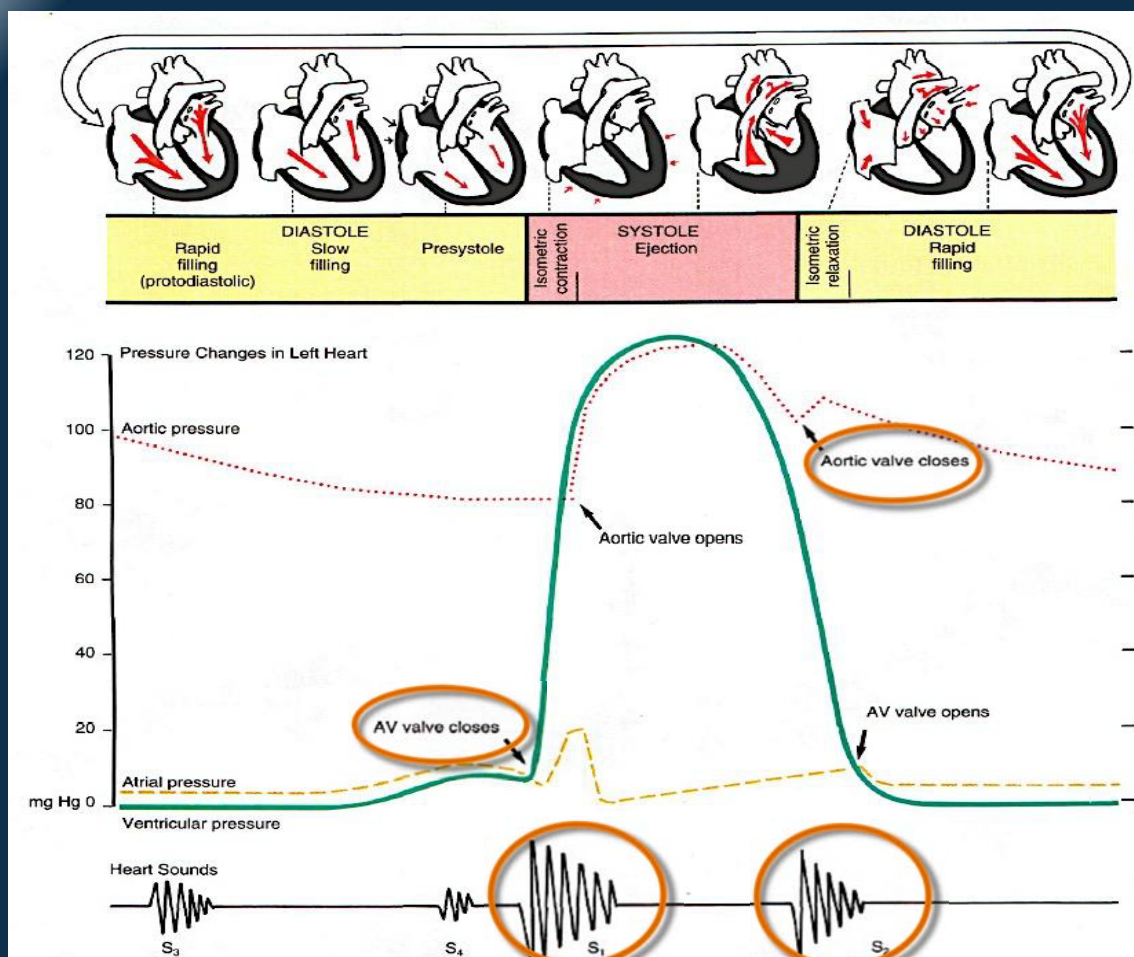
HS1 = the "lub" = M_1 and T_1

HS2 = the "dubb" = A_2 and P_2



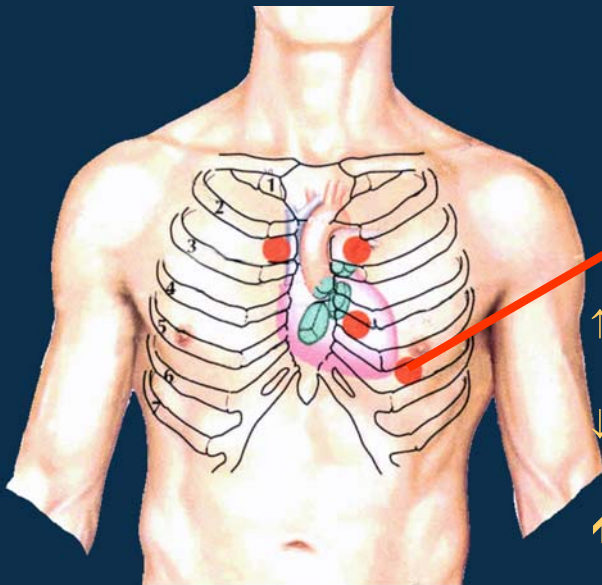
Normally M_1 precedes T_1 slightly. A_2 precedes P_2 especially during inspiration where a split of S_2 can be heard.

Physiological splitting of S_2 normally occurs during inspiration because the 1) increase in venous return to the right ventricle, and 2) decrease in intrathoracic pressure, which increase the time needed for pulmonary pressure to exceed that of the right ventricular pressure.

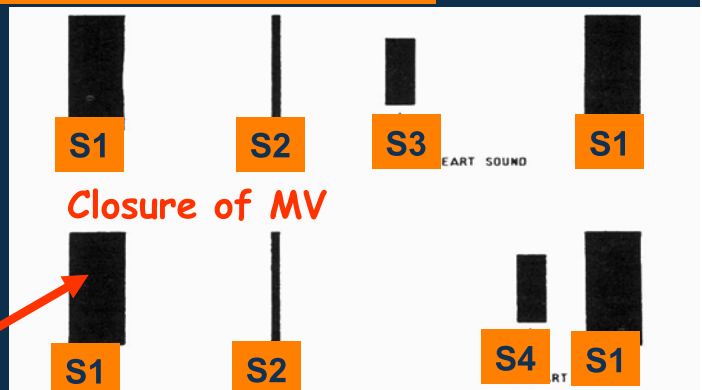


First Heart Sound

Exam Technique: Auscultation



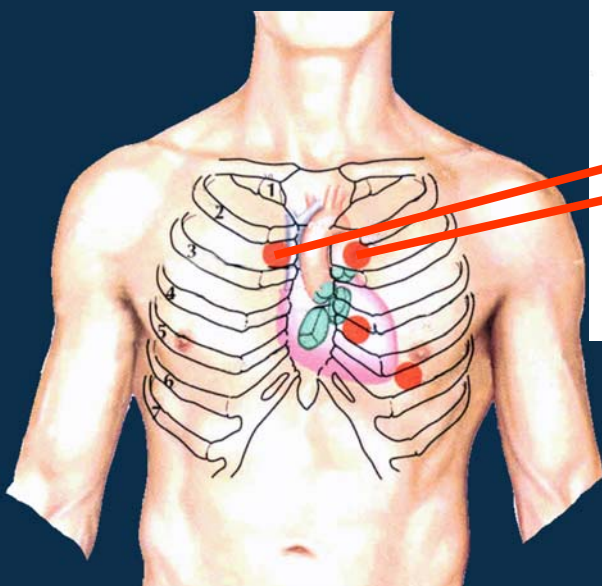
Netter's Cardiology



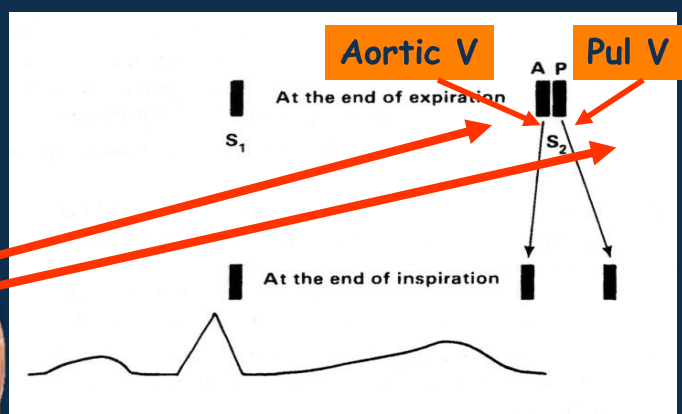
- ↑ S1: tachycardia, mitral stenosis, high cardiac output
- ↓ S1: first degree AV block, impaired LV contraction
- ↑ splitting of S1: TV closes significantly later than MV e.g. RBBB; Absent splitting of S1: e.g. LBBB.
- Varying S1 → complete heart block and atrial fibrillation

Second Heart Sound

Exam Technique: Auscultation



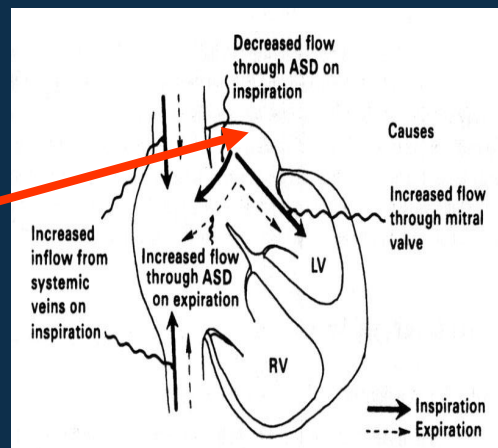
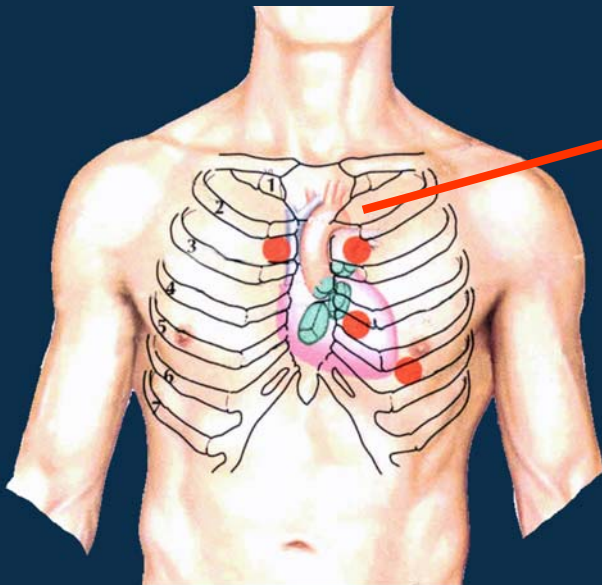
Netter's Cardiology



- ↑ P2: pulmonary hypertension, ASD
- ↑ A2: systemic hypertension
- ↓ S2: Aging, aortic / pulmonary stenosis

Second Heart Sound

Exam Technique: Auscultation



Increased splitting:

Delay closure of PV e.g. RBBB, RV volume overload, pulmonary stenosis

Paradoxical splitting:

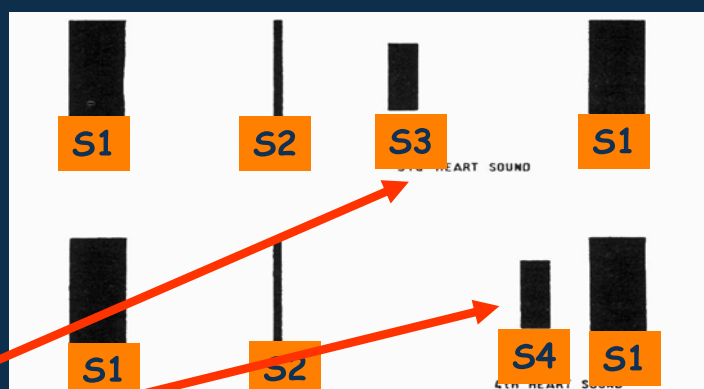
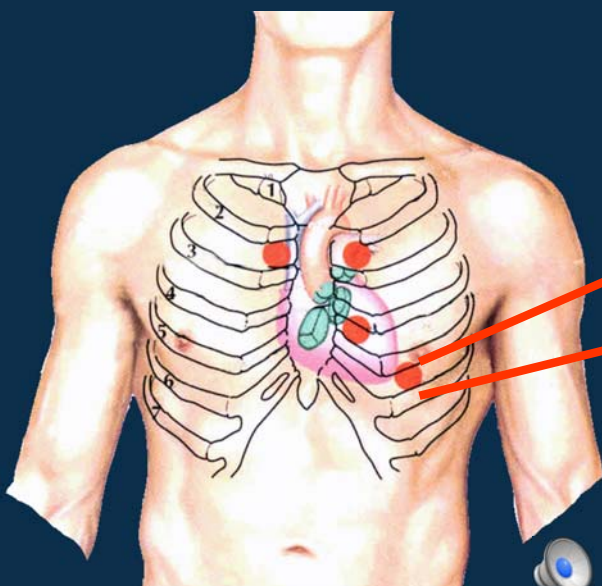
delay closure of AV e.g. LBBB, aortic stenosis, HCM

Fixed Splitting: ASD

Netter's Cardiology

Additional Heart Sounds

Exam Technique: Auscultation



- S3: Oscillation of blood back and forth between walls of ventricles; mid 1/3 of diastole → physiological in young person, pathological in volume overload
- S4: atrial filling against a non-compliant ventricle; immediately before S1 → always pathological
- **Gallop rhythm** → heart failure

Netter's Cardiology

Mechanical Heart Valves

Ball-cage valve



Single tilting disk valve



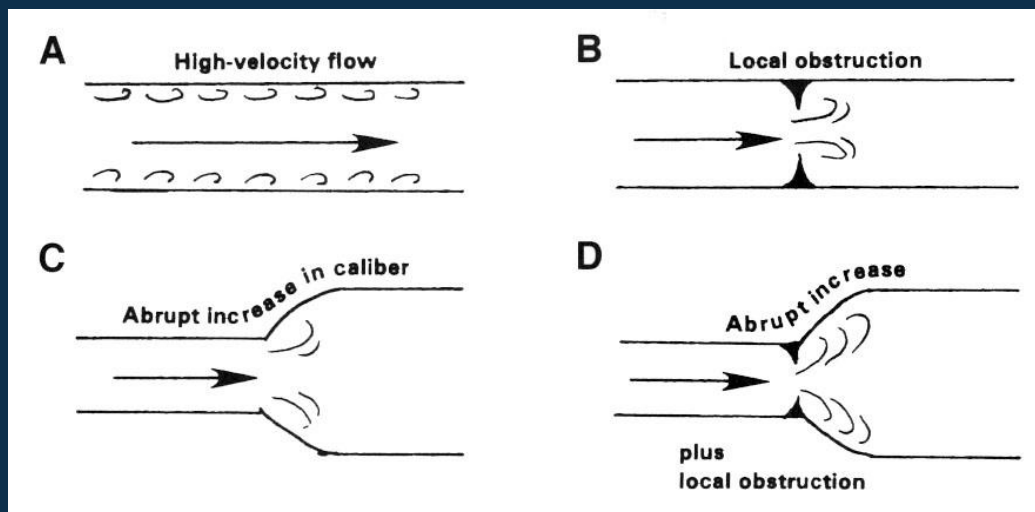
Bileaflet valve



What Makes a Murmur?

A heart murmur is a swishing sound made by turbulent blood flow within the heart.

Can be physiological or pathological.



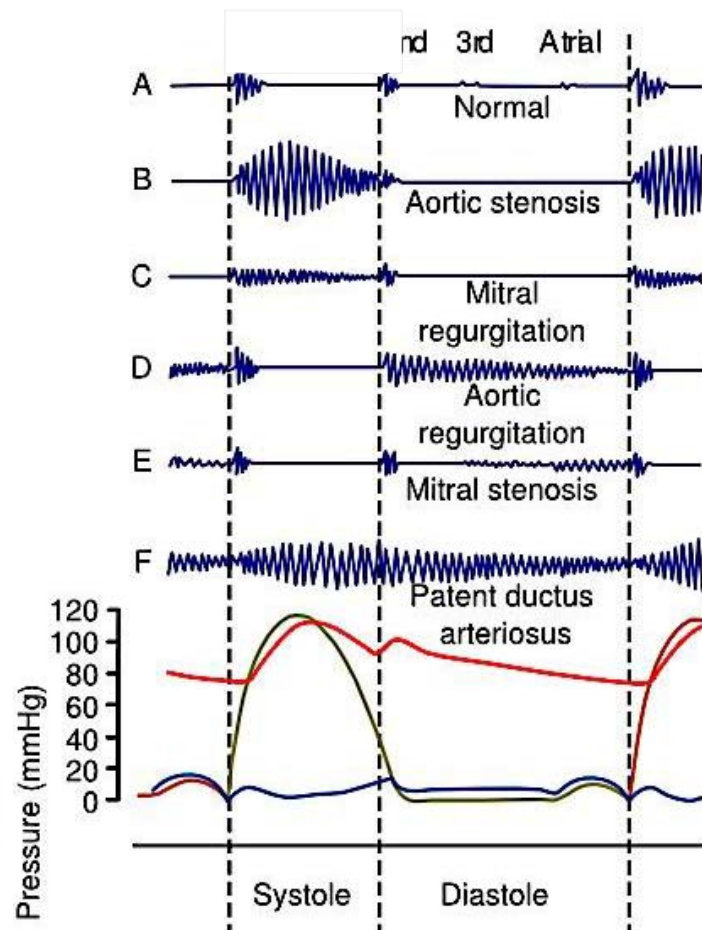
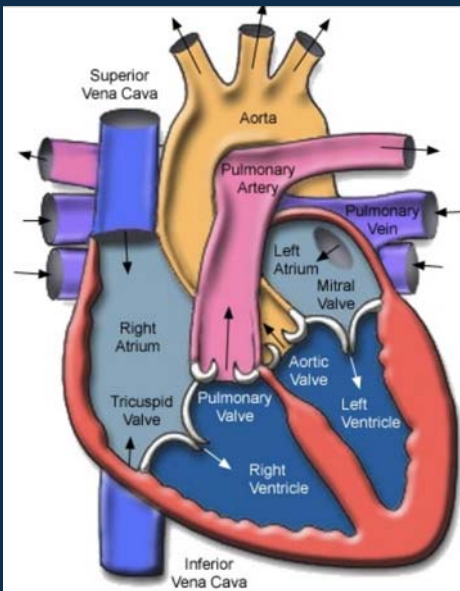
Characterization of a murmur

- + Grading: 1-6
- + Timing: Systolic or diastolic (feel the carotid pulse or apex)
- + Character: pitch (low, medium and high) & quality (Blowing, harsh, musical, rumbling)
- + Site of maximum propagation and radiation: Axilla and neck
- + Effect of respiration: inspiration (Rt) and expiration (Lt)
- + Effect of maneuver (if needed)

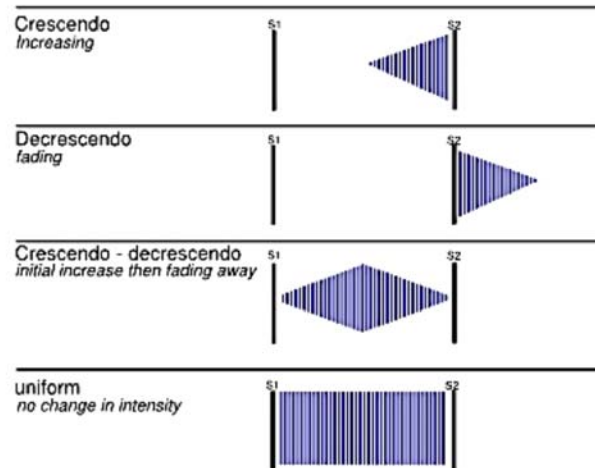
Grading of murmur

Grade	Description
Grade 1	Very faint, heard only after listener has “tuned in”; may not be heard in all positions
Grade 2	Quiet, but heard immediately after placing the stethoscope on the chest
Grade 3	Moderately loud
Grade 4	Loud, with palpable thrill
Grade 5	Very loud, with thrill. May be heard when the stethoscope is partly off the chest
Grade 6	Very loud, with thrill. May be heard with stethoscope entirely off the chest

Timing of murmur



Characters of murmur



Site and radiation of murmur

Pansystolic murmurs :

Mitral regurgitation

- Loudest to apex
- Radiate at axilla

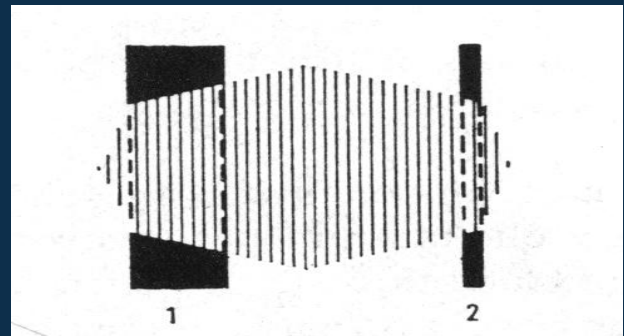
Tricuspid regurgitation

- Tricuspid area

Ventricular septal defect

- loudest at left sternal area
- widely radiating

Pansystolic



Site and radiation of murmur

Ejection Systolic murmurs :

Aortic stenosis

- aortic area
- radiate to carotids

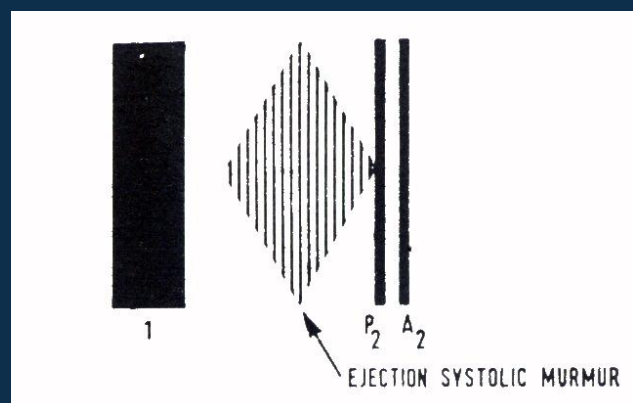
Pulmonary stenosis

- pulmonary area
- May radiate to the back

Atrial septal defect

- pulmonary area
- May radiate to the back

Ejection



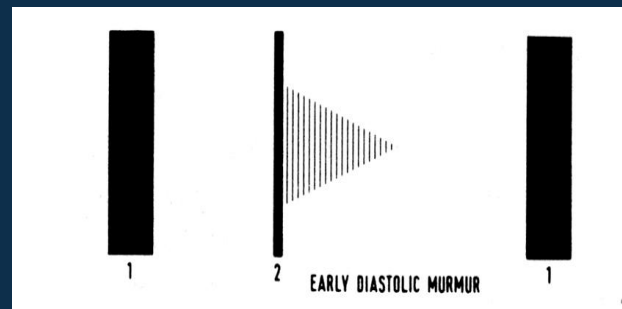
Site and radiation of murmur

Early diastolic murmurs :

Early

Aortic regurgitation

- loudest at left sternal border (Erb's point)
- best with patient exhale and lean forward



Site and radiation of murmur

Mid diastolic murmurs :

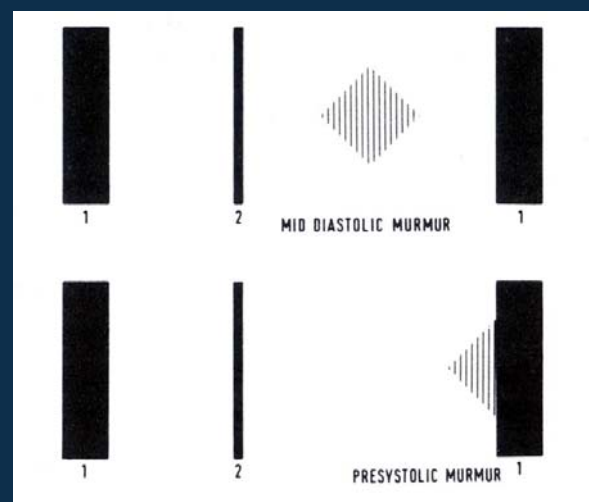
Mid or Late

Mitral stenosis

- loudest at apex
- Left decubitus

Other diastolic murmur

- Graham steel: PR
- Austin flint: AR



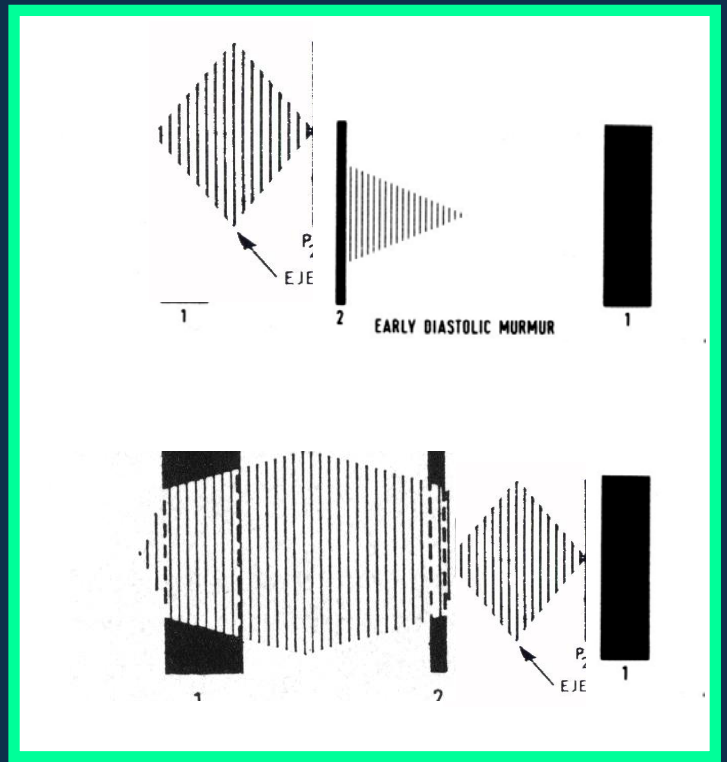
Site and radiation of murmur

Continuous murmur :

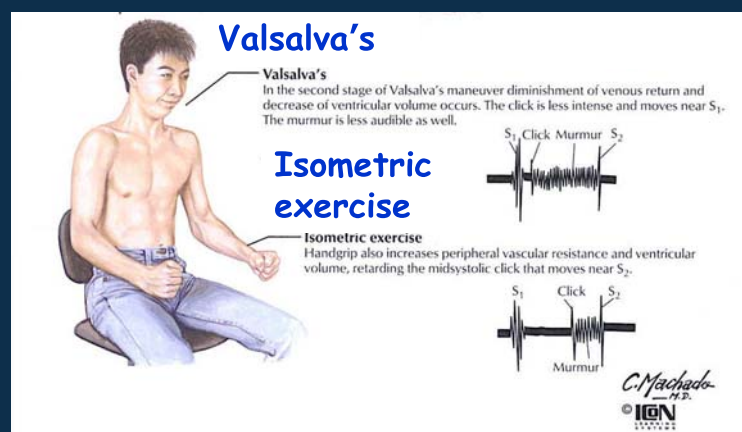
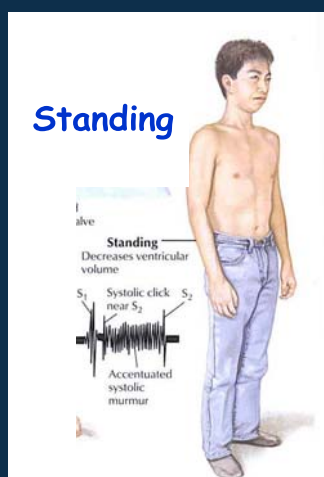
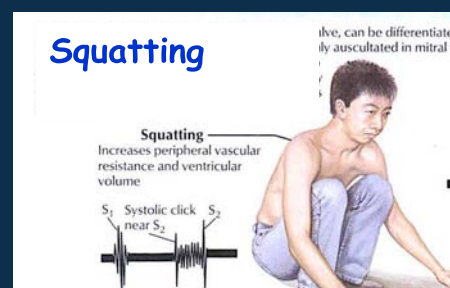
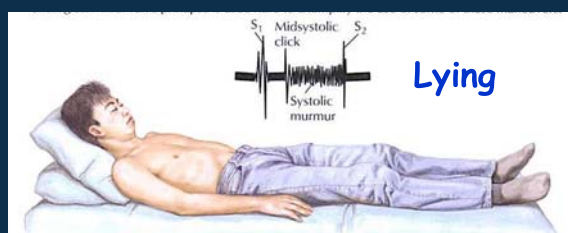
AS/AR

Patent ductus arteriosus

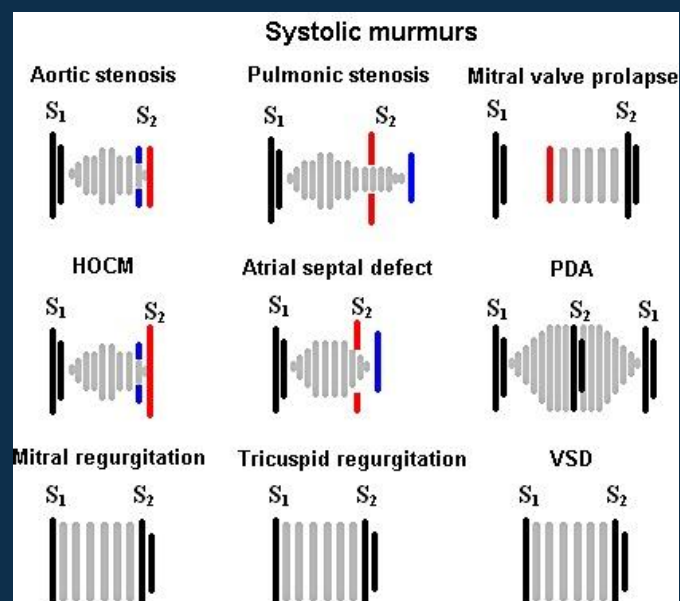
- Left subclavicular area



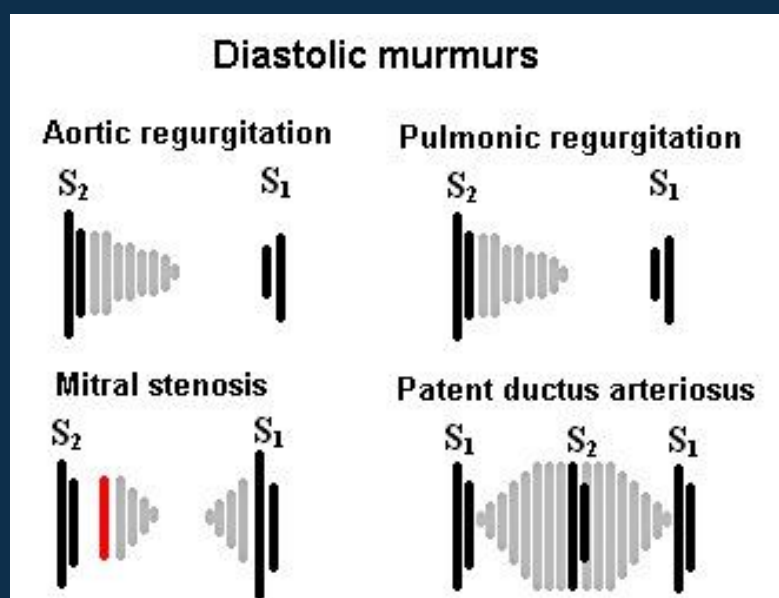
Maneuvers (MVP, HCMP)



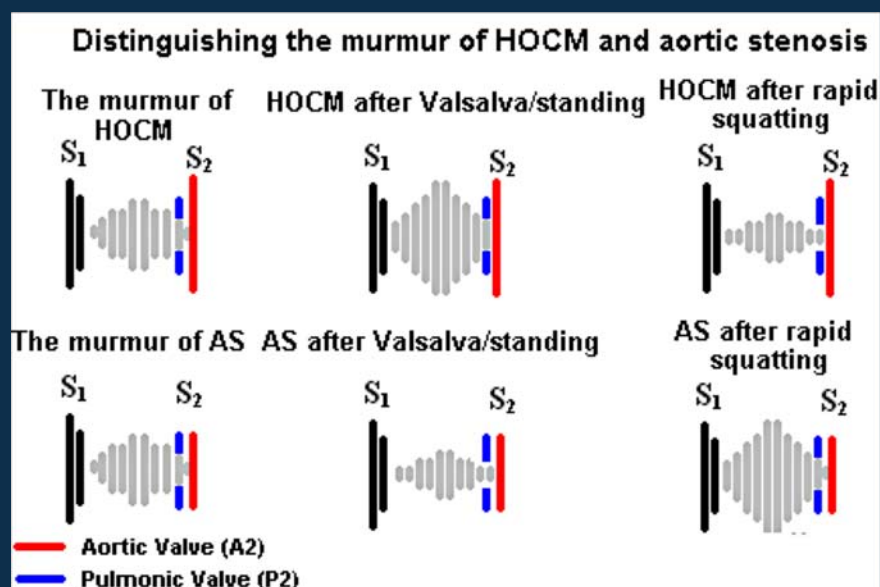
Murmurs: Summary (ref)



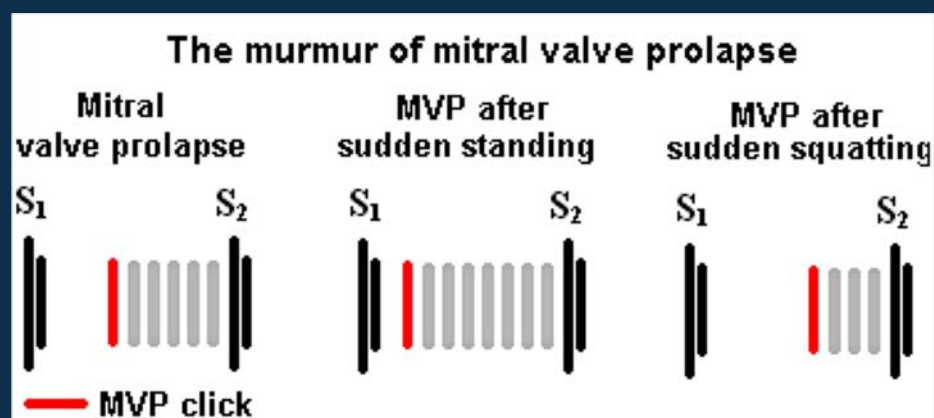
Murmurs: Summary (ref)



Murmurs: Summary (ref)



Murmurs: Summary (ref)



Other Examinations:

Examination of the lungs :

+ Bilateral basal crackles : LHF

Examination of the abdomen :

+ Pulsatile and enlarged liver: TR

+ Ascites and hepatosplenomegaly: RVF and
constrictive pericarditis

Measurement of blood pressure

Examination of the fundi, urinalysis