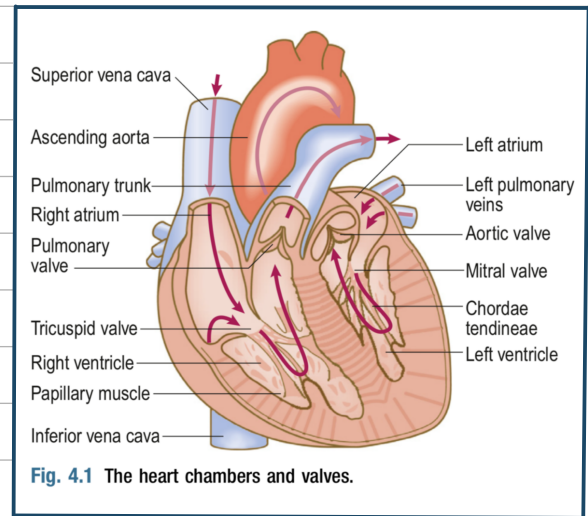


THE CARDIOVASCULAR SYSTEM

► The Heart :

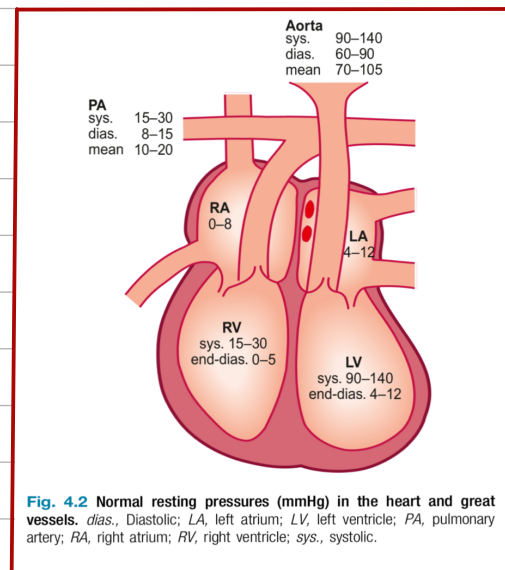
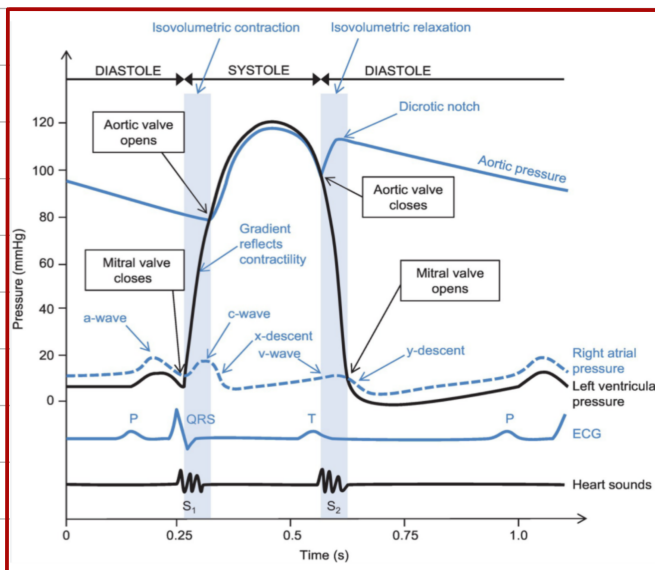
• Anatomy :

The heart is a four-chambered organ enclosed by the pericardium, a serous sac that permits frictionless movement during the cardiac cycle and respiration. It functions as two pumps in series : The right heart (RA, RV) pumps blood to the pulmonary circulation, while the left heart (LA, LV) pumps blood to the systemic circulation. Blood flow is directed by four valves : the tricuspid, mitral, pulmonary and aortic valves.



• Physiology :

The heart works through a coordinated sequence of electrical activation and mechanical contraction. The SA node initiates the impulse, producing atrial contraction followed by ventricular contraction (systole). Ventricular relaxation (diastole) allows reopening the AV valves and ventricular filling. The right heart operates at low pressure to perfuse the lungs, whereas the left heart generates high pressure to supply the systemic circulation.



• The History:

Common presenting symptoms:

* Chest pain

1 Intermittent chest pain:

* Stable angina:

- tight or pressing sensation, felt diffusely
- may radiate to arms and jaw.
- precipitated by exertion and walking in cold weather.
- pain relieved by rest and/or GTN.
- lasts for less than 10 minutes.

* Unstable angina:

- abrupt onset or worsening of chest pain.
- may occur at minimal exertion or at rest.

* Musculoskeletal problems:

- may occur at any site of the chest
- vary with posture or specific movements.
- may be associated with tenderness to palpation.

* Esophageal causes:

- Gripping, tight or burning sensation
- may radiate to back and arms.
- exacerbated by lying flat and relieved by nitrates but **not** rest.

2 Acute chest pain:

* Myocardial Infarction

- more severe and prolonged than angina pectoris.
- associated w/ nausea, vomiting, SOB, and angor animi.
- **Not** relieved by rest or nitrates.

* Pericardial pain

- constant ant. central chest pain that may radiate to shoulders.
- sharp or stabbing pain.
- exacerbated by lying down, relieved by sitting forwards.
- secondary to viral infx, CT disease, MI, or after surgery or radiotherapy.

* Aortic dissection

- abrupt onset of very severe, tearing chest pain.
- associated w/ profound autonomic stimulation.
- predisposing factors: Marfan's syndrome.

* Dyspnea

* can be acute or chronic with heart failure being the most common cause in both cases.

* Other causes include :

pulmonary edema → better when sitting upright.

PE → better when lying flat.

Arrhythmias

* Dyspnea caused by myocardial ischemia → angina equivalent → occurs in: females, elderly, and DM pts.

* Orthopnea: dyspnea on lying flat → HF pts.

* Palpitations

Unexpected or unpleasant awareness of the heart beating.



* Syncope and presyncope

Syncope is a transient loss of consciousness due to transient cerebral hypoperfusion. causes include postural hypotension, arrhythmias, obstruction to cardiac output.

Presyncope is a sensation of lightheadedness and impending loss of consciousness without loss of consciousness.

conditions associated with syncope :

1. Hypertensive carotid sinus syndrome
2. Bradyarrhythmias → AV block / SA disease → Stokes - Adams attacks
3. Supraventricular tachyarrhythmias
4. Aortic stenosis or HOCM
5. Massive PE
6. Cardiac tumors

* Edema

- * Seen around the ankles or sacrum (in pts lying in bed)
- * Unilateral lower limb edema → DVT
- * bilateral lower limb edema → HF

⇒ Past Medical History:

Ask about:

- DM, HTN, Hyperlipidemia
- Rheumatic fever during childhood
- Recent Dental work
- Connective tissue diseases. eg: Marfan's syndrome

⇒ Past Drug History

Ask about:

1. Drugs that may cause or exacerbate cardiac symptoms:

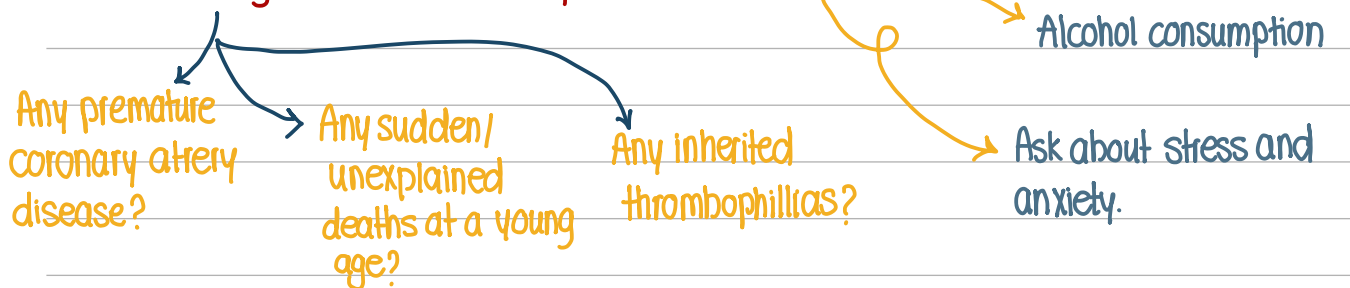
beta blockers → dyspnea

Ca²⁺ Channel blockers → syncope / edema

B₂ stimulants → palpitations

2. OTC drugs: NSAIDs: angina, edema

⇒ Family and Social History



• PHYSICAL EXAMINATION:

General examination:

⇒ ABC LOOKS ✨

A Alert, conscious, oriented? O connected to O₂?

B breathlessness? O Odor / distinct smells?

C cyanosed, pale, jaundice K obese?

L iv lines? tubes? S symmetry & obvious deformities

⇒ Down's syndrome !: ASD, VSD

Turner's syndrome !: Bicuspid aortic valve, coarctation of aorta

Marfan's syndrome !: Aortic dissection

Ankylosing spondylitis !: Aortic dissection

⇒ VITALS

⇒ Urinalysis

Inspection:

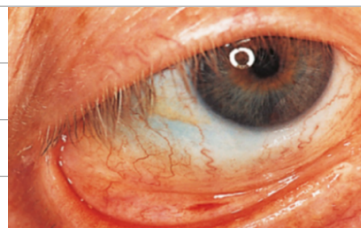
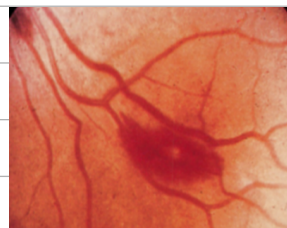
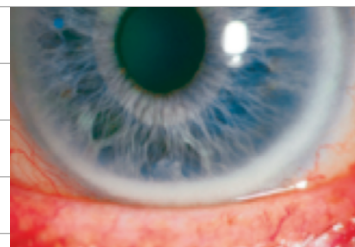
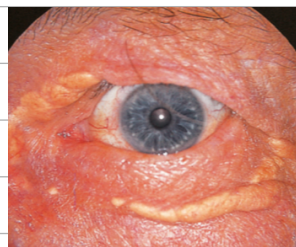
Hands:

- Tarr staining
- Cyanosis
- Splinter hemorrhage & Other nail changes
- Xanthoma
- Osler nodes and janeway lesions
- palmar erythema
- Tremors
- Sites of drug abuse
- Clubbing
- Capillary refill



Face:

- Pallor, jaundice
- Xantholesmata
- Corneal arcus
- ptecheal rash
- Roth spots
- Malar flush
- Central cyanosis
- oral Hygiene
- fasial plathora



• Radial Pulses:

Assess the:

Rate } at the radial artery
Rhythm }

Volume } at the brachial, carotid or femoral
Character }

⇒ Rate and Rhythm:

* Normal heart rate 50 → 95 bpm

Bradycardia < 60

Tachycardia > 100 bpm

causes:

- medications
- athletic conditioning
- SA/AV dysfunction

regular

• sinus tachy

irregular

regularly irr. Atrial flutter

irregularly irr. A. fib.

⇒ Volume and Character

- large pulse volume eg: aortic coarctation, thyrotoxicosis, pregnancy
- low pulse volume eg: hypovolemia, mitral stenosis, HF
- Radioradial delay → aortic dissection
- Radiofemoral delay → aortic coarctation
- Slow rising pulse: severe aortic stenosis
- Collapsing pulse: aortic regurgitation
- Pulsus bisferiens → concomitant aortic stenosis and regurgitation & HOCM
- Pulsus alternans → advanced HF
- Pulsus paradoxus → Cardiac tamponade

• Blood Pressure:

* Measured using a sphygmomanometer

* Interpreted as a 1. Numerical value eg. 120/75

2. Location eg. Lt arm

3. position eg. pt was sitting upright w/ hand at level of heart

* Hypertention:

Defined as a systolic pressure of ≥ 140 mmHg and/or a diastolic pressure ≥ 90 mmHg

Mostly asymptomatic and primary (w/ no identifiable cause)

• Jugular venous pressure

* JVP is estimated by observing the level of pulsation in the internal jugular vein.

* JVP reflects the right atrial pressure and is normally $\leq 4\text{cm}$ above the sternal angle

* Examination sequence:

1. Position: lying on 45° angle, pillow under head, head tilted to left.

2. Inspection: w/ a torch: double inward movement

3. Palpation: Impalpable

4. 4 special maneuvers to insure its internal jugular **not** carotid art.

① JVP $\uparrow$ w/ expiration & $\downarrow$ w/ inspiration

② JVP $\uparrow$ w/ pt lying flat & $\downarrow$ w/ sitting upright

③ +ve abdominal jugular reflex

④ Absent JVP when applying pressure at the root of the neck

5. Measure height from sternal angle and add 5cm $\rightarrow$ ideally $\leq 9\text{ cm H}_2\text{O}$

* It might be elevated in:

HF, PE, SVC obstruction, pericardial effusion.

• Precordium:

Inspection:

foot of the bed:

① symmetry "bilateral sym. chest rise"

② deformities "pectus excavatum, carinatum"

③ Shape "elliptical"

④ breathing pattern "thoracoabdominal"

⑤ acc. muscle use

Right side of the patient:

① Scars "median sternotomy, thoractomy.."

② Masses, swelling

③ Hair distribution

④ dilated veins

⑤ pulse at apex w/ torch

⑥ devices "icd.."

palpation

1. Apex beat:

position: Left 5th intercostal space, midclavicular line

character: gently tapping

2. palpated heave?

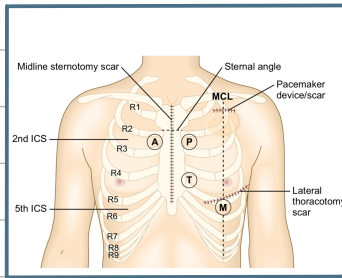
3 positions: Rt vent. at Lt parasternal, VSD at Rt parasternal, and Lt vent. at apex. palpated w/ heel of hand.

3. Thrills? are the tactile equivalent of a murmur.

palpated w/ palms of fingers

Auscultation:

Locations:



Stethoscope:

Diaphragm → S₁, S₂, High pitched sounds

Bell → S₃, S₄, low pitched sounds

eg: Mitral Stenosis

• Normal Heart sounds

1 First heart sound, S₁

closure of the mitral and tricuspid valves
best heard at apex

What could go wrong?

High S₁ → ↑CO, MS, Short P-R

Quiet S₁ → ↓CO, MR, Long P-R

Variable S₁ → A.fib, Extrasystoles

2 Second heart sound, S₂

closure of aortic and pulmonary valves
best heard at the Lt. sternal edge
splitting is normal during inspiration

Fixed split: ASD

Wide split: RBBB, PHTN

Reversed split: LBBB

↳ A₂ is late, split on expiration

• Third heart sound, S₃

early diastolic sound → AV opening & vent. filling
best heard at apex
could be normal & associated w/ Lt vent. failure and MR

• Fourth heart sound, S₄

presystolic, forceful atrial contraction
always pathological eg: Lt vent. hypertrophy

• Prosthetic Valve sounds

Louder, higher pitch w/ metallic quality

• Added sounds:

* Opening snap → MS

* Ejection Clicks → AS

* Midsystolic clicks → Mitral valve prolapse

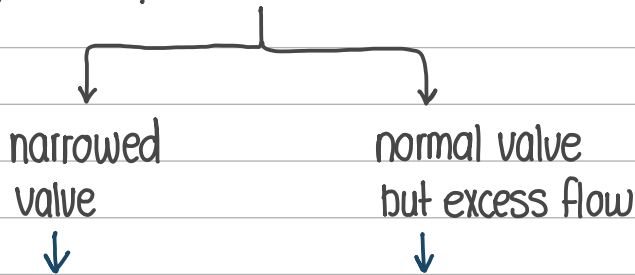
* Pericardial rub → Pericarditis

MURMURS:

SYSTOLIC MURMURS:



Ejection systolic murmurs:



findings:

Slow rising pulse
early ejection systolic click
radiation to carotid

Pansystolic murmurs

note: can mask S2 sound

- * Mitral regurge → may radiate to axilla, displaced apex, S3
- * Tricuspid regurge → ↑ w/ inspiration, ↑ JVP (cv wave), pulsatile liver
- * VSD → ! Down's syndrome

Late Systolic murmurs

↳ Mitral valve prolapse

preceded by a midsystolic click

! marfan's syndrome

DIASTOLIC MURMURS:



Early diastolic

Aortic regurgitation

- Collapsing pulse
- wide pulse pressure
- Accompanied by

- 1) Ejection systolic murmur (↑EDV)
- 2) Austin Flint murmur (partial obstruction of mitral valve)

Mid diastolic

Mitral Stenosis

↳ tapping apex hear
opening snap

Continuous Murmur:

- PDA
- Auscultation on Lt infraclavicular area

▷ Peripheral Arterial System

* History:

1 Leg pain:

Asymptomatic ischemia

lower limb ischemia is defined as an ankle-to-brachial pressure index of < 0.9 at rest.

The legs are 8 times more affected than the arms.

Intermittent claudication

It is pain felt in the legs on walking due to arterial insufficiency.

It disappears within few minutes of rest.

Most common symptom of PAD.

Night/rest pain

Night pain: patient goes to sleep but is then woken up 1-2 hours later with severe pain in the foot.

Rest pain: when blood flow is insufficient to meet the metabolic demands of the tissues even at rest.

both are considered a red flag and prompt urgent vascular surgery.

Tissue loss

- Trivial injuries do not heal
- Gangrene develops
- Amputation and/or death.

Acute limb ischemia 6P's

Pain

Pallor

Paralysis

Praesthesia

Pulselessness

Perishing cold

Compartment Syndrome

↓ perfusion due to ↑ pressure in fascial compartments of limb

- causes: trauma & reperfusion injury

2 Abdominal pain

Mesenteric ischemia

- Severe pain develops 10 minutes after eating → significant weight loss
- Acute mesenteric ischemia is a **medical emergency**. It's commonly caused by embolus from the heart.

Abdominal aortic aneurysm

- dilation $>150\%$
- abdominal or back pain, but usually asymptomatic
- rupture → pain, pulsatile mass, syncope & SHOCK !

3 Digital ischemia

⇒ Blue toe syndrome

⇒ Vasospastic symptoms: Raynaud's phenomenon has 3 phases:

- 1 pallor
- 2 cyanosis
- 3 Reactive hyperemia

1° → Raynaud's disease

2° → " Syndrome

Physical Examination:

Exposure: bilateral lower limbs

Inspection:

Hair loss, shiny skin, discoloration, ulcer (w/ further description), muscle wasting, dilated veins, nail changes, between toes.

Palpation:

- 1 Tenderness
- 2 Edema (w/ thumb)
- 3 Temperature
- 4 Capillary refill
- 5 Pulses: 1. Dorsalis Pedis (Dorsi-flex to locate tendon → lateral to it)
2. Popliteal
3. Posterior tibial

- 6 Ask pt to sit still for reactive hyperemia

* Special tests

Buerger's test (rise leg for 2 min and observe pallor)

Measure the ankle : brachial pressure index

▷ Peripheral Venous System

* History

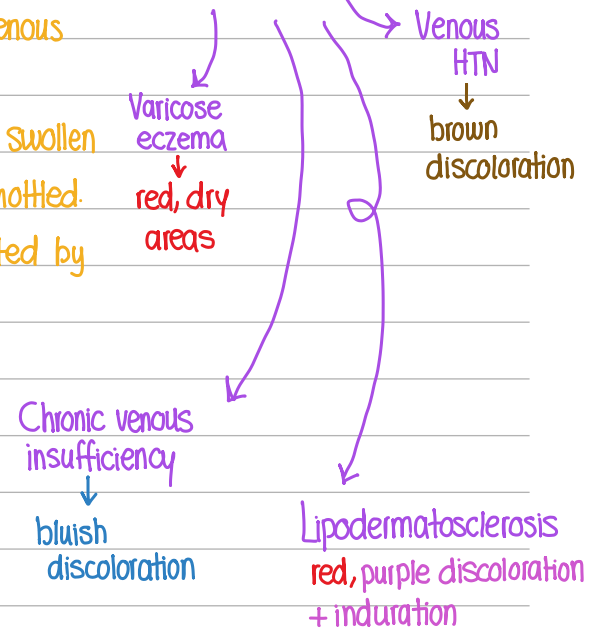
1 Pain

- Varicose veins : aching leg discomfort, itching (↑ w/ standing)
- DVT : pain and tenderness (usually the calf)
- Superficial thrombophlebitis : red, palpable, painful area
- Varicose ulceration : painless

2 Limb Swelling

- * associated w/ LL venous disease.
- * Upper limb DVT : arm swollen and skin cyanosed & mottled.
- * Symptoms exacerbated by Activity.

3 Skin changes



The End :)

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Group A2 Sub18