

Cardiovascular examination

Introduction

- 1- Wash your hands
- 2- maintain privacy
- 3- introduce ur self and take pt profile
- 4- Briefly explain what the examination will involve using patient-friendly language.
- 5-Gain consent to proceed with the examination.
- 6- ask for chaperone
- 7-position :Adjust the head of the bed to a 45° angle.
- 8-exposure : chest + lower legs is also helpful to assess for peripheral oedema and signs of peripheral vascular disease
- 9- Ask the patient if they have any pain before proceeding with the clinical examination.

A-General inspection

Inspect the patient from the end of the bed whilst at rest, looking for clinical signs suggestive of underlying pathology:

- 1-well/ill
- 2-position and comfortability
- 3- Shortness of breath:

- CVS (e.g. congestive heart failure, pericarditis)
- RS (e.g. pneumonia, pulmonary embolism).

- 5-overweight or cachectic

- 6-dysmorphic features :

- down syndrome
- turner syndrome
- marfan syndrome

- 7-Cyanosis:

- peripheral vasoconstriction secondary to hypovolaemia
- inadequate oxygenation of the blood (e.g. right-to-left cardiac shunting).

- 8-Pallor:

- anaemia (e.g. haemorrhage, chronic disease)
- poor perfusion (e.g. congestive cardiac failure).

- 9-petechiae

- 10-Malar flush:

- red discolouration of the cheeks associated with mitral stenosis.

- 11-Oedema: (e.g. pedal oedema) or abdomen (i.e. ascites).

- heart failure

B-Hands

Inspection

- 1-Color :

- pallor suggests poor peripheral perfusion (e.g. congestive heart failure)
- cyanosis may indicate underlying hypoxaemia.
- Tobacco staining: caused by smoking, a significant risk factor for cardiovascular disease (e.g. coronary artery disease, hypertension).

- 2-deformity :

- Arachnodactyly ('spider fingers'): marfan's syndrome

- 3-Dorsal aspect

- tendon Xanthomata: hyperlipidaemia (typically familial hypercholesterolaemia)

- 4-palmar aspect

- Janeway lesions: *non-tender*, haemorrhagic lesions that occur on the thenar and hypothenar eminences of the palms (and soles).
- Osler's nodes: red-purple, slightly raised, tender lumps, often with a pale centre, typically found on the fingers or toes.

Both indicate infective endocarditis

- 5-nails :

- Finger clubbing : congenital cyanotic heart disease, infective endocarditis and atrial myxoma (very rare).
- Splinter haemorrhages: endocarditis

Palpation

1-Temperature

-Cool hands may suggest poor peripheral perfusion (e.g. congestive cardiac failure, acute coronary syndrome).

2-Capillary refill time (CRT)

Delayed CRT >2sec , suggests poor peripheral perfusion (e.g. hypovolaemia, congestive heart failure)

C-Face

1-Eyes

-*Conjunctival pallor*: suggestive of underlying anaemia.

-*Corneal arcus*: > 60y is benign age related , if <f 50 hypercholesterolaemia.

-*Kayser-Fleischer rings*: wilson disease

-*Xanthelasma*: associated with hypercholesterolaemia.

-*fundoscopy* : examining retina for roth's spot (IE) , signs of hypertension ,DM , retinal hemorrhage .

2-Mouth

-*Central cyanosis*: (e.g. a right to left cardiac shunt,HF)

-*Angular stomatitis*: iron deficiency.

-*High arched palate*: a Marfan syndrome which is associated with mitral/aortic valve prolapse and aortic dissection.

-*Dental hygiene*: poor dental hygiene is a risk factor for infective endocarditis.

D-Pulses

*When taking a pulse, assess:

- **rate**: the number of pulses occurring per minute
- **rhythm**: the pattern or regularity of pulses
- **volume**: the perceived degree of pulsation
- **character**: an impression of the pulse waveform or shape.

*The rate and rhythm of the pulse are usually determined at the radial artery; use the larger pulses (brachial, carotid or femoral) to assess the pulse volume and character.

1-Radial pulse :lateral to flexor carpi radialis tendon

- assess the rate and rhythm :if regular for 15 sec *4 , if irregular for the whole 60 sec

-assess For collapsing pulse

-Radio-radial delay : delay mean Subclavian artery stenosis (e.g. compression by a cervical rib) , Aortic dissection , Aortic coarctation

-radio-femoral delay : coarctation of aorta

B-Brachial pulse : antecubital fossa , (medial to the biceps brachii tendon)

-assessing volume and character:

C-Carotid pulse : between the larynx and the anterior border of the sternocleidomastoid

muscle.

-assess volume and character, never assess both carotids at the same time

-Auscultate the carotid artery using diaphragm of the stethoscope

Bruit = carotid artery stenosis or radiated AS murmur

6- Surface markings of the arterial pulses

<i>Factor</i>	<i>Characteristic</i>
Artery	Surface marking
Radial	At the wrist, lateral to the flexor carpi radialis tendon
Brachial	In the antecubital fossa, medial to the biceps tendon
Carotid	At the angle of the jaw, anterior to the sternocleidomastoid muscle
Femoral	Just below the inguinal ligament, midway between the anterior superior iliac spine and the pubic symphysis (the mid-inguinal point). It is immediately lateral to the femoral vein and medial to the femoral nerve
Popliteal	Lies posteriorly in relation to the knee joint, at the level of the knee crease, deep in the popliteal fossa
Posterior tibial	Located 2 cm below and posterior to the medial malleolus, where it passes beneath the flexor retinaculum between flexor digitorum longus and flexor hallucis longus
Dorsalis pedis	Passes lateral to the tendon of extensor hallucis is longus and is best felt at the proximal extent of the groove between the first and second metatarsals. It may be absent or abnormally sited in 10% of normal subjects, sometimes being 'replaced' by a palpable perforating peroneal artery

Abnormal pulses

1- rate and rhythm

4.9 Causes of abnormal pulse rate or rhythm

Abnormality	Sinus rhythm	Arrhythmia
Fast rate (tachycardia, > 100 bpm)	Exercise Pain Excitement/anxiety Fever Hyperthyroidism Medication: Sympathomimetics, e.g. salbutamol Vasodilators	Atrial fibrillation Atrial flutter Supraventricular tachycardia Ventricular tachycardia
Slow rate (bradycardia, < 60 bpm)	Sleep Athletic training Hypothyroidism Medication: Beta-blockers Digoxin Verapamil, diltiazem	Carotid sinus hypersensitivity Sick sinus syndrome Second-degree heart block Complete heart block
Irregular pulse	Sinus arrhythmia Atrial extrasystoles Ventricular extrasystoles	Atrial fibrillation Atrial flutter with variable response Second-degree heart block with variable response

irregularly irregular

regular

irregular

4.11 Common causes of atrial fibrillation

- Hypertension
- Heart failure
- Myocardial infarction
- Thyrotoxicosis
- Alcohol-related heart disease
- Mitral valve disease
- Infection, e.g. respiratory, urinary
- Following surgery, especially cardiothoracic surgery

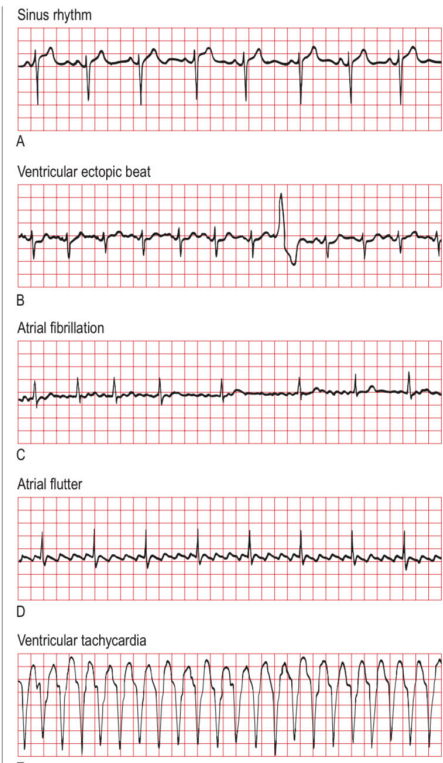


Fig. 4.8 Electrocardiogram rhythm strips. **A** Sinus rhythm. **B** Ventricular ectopic beat. **C** Atrial fibrillation with 'controlled' ventricular response. **D** Atrial flutter; note the regular 'saw-toothed' atrial flutter waves at about 300/min. **E** Ventricular tachycardia, with a ventricular rate of about 200/min.

2- abnormal character

Slow-rising pulse (Pulses parvus et tardus)	gradual upstroke with a reduced peak occurring late in systole,	Aortic stenosis
Collapsing pulse (Water hammer pulse)	The peak of the pulse wave arrives early and is followed by a rapid fall in pressure	Aortic regurgitation
Pulsus bisferiens	increased pulse with a double systolic peak separated by a distinct mid-systolic dip	concomitant aortic stenosis and regurgitation.
Pulsus alternans,	beat-to-beat variation in pulse volume with a normal rhythm	heart failure.
Pulsus paradoxus	exaggeration of the normal variability of pulse volume with breathing. confirmed using a blood pressure cuff (a fall of >10 mmHg during inspiration)	Cardiac tamponade constrictive pericarditis severe asthma

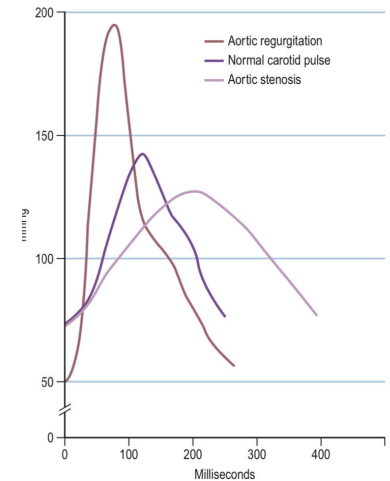


fig. 4.10 Pulse waveforms.

3- abnormal volume

4.12 Causes of increased pulse volume

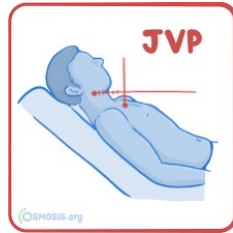
Physiological

- Exercise
- Pregnancy
- Advanced age
- Increased environmental temperature

Pathological

- Hypertension
- Fever
- Thyrotoxicosis
- Anaemia
- Aortic regurgitation
- Paget's disease of bone
- Peripheral atrioventricular shunt

E- Jugular venous pressure (JVP) runs deep to the sternomastoid muscle and enters the thorax between the sternal and clavicular heads.



1- put the patient in recombinant position 45°, turn the patient's head to the left and make sure the muscles are relaxed and assess the The waves or pulsations that are seen on the patient's neck make sure that this waves reflect JVP not carotid pulse

2-compress the patient's right upper quadrant for electing hepatojugular reflex (HJR) : if the waves location goes up = you are right , it's JVP what u r seeing

3- assess :

1- level of JVP normal vs. elevated

-normal JVP : **(normally <7 mmHg = 9cmH2O from R.atrium)**

The sternal angle is approximately 5 cm above the right atrium, so the JVP in healthy pt should be ≤4 cm above this angle when the patient lies at 45 degrees

4.15 Differences between carotid artery and jugular venous pulsation

Carotid	Jugular
Rapid outward movement	Rapid inward movement
One peak per heart beat	Two peaks per heart beat (in sinus rhythm)
Palpable	Impalpable
Pulsation unaffected by pressure at the root of the neck	Pulsation diminished by pressure at the root of the neck
Independent of respiration	Height of pulsation varies with respiration
Independent of the position of the patient	Varies with the position of the patient
Independent of abdominal pressure	Rises with abdominal pressure

2- JVP waves

The 'a' wave : **right atrial contraction** , before S1

The 'c' wave : **closure of the tricuspid valve** and bulging it towards the atrium when the ventricles contract

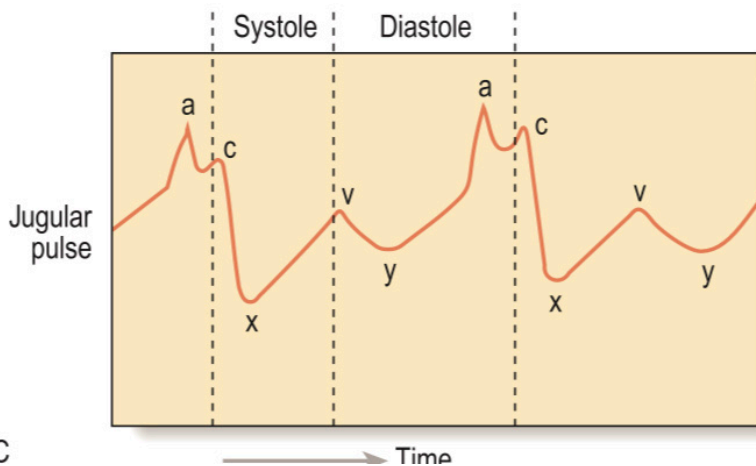
The 'x' descent : The **Tricuspid valve back to its location** with ventricular contraction

The 'v' wave : **atrial filling** during ventricular systole when the tricuspid valve is closed.

The 'y' descent : **Atrial emptying** when tricuspid valve opens

*Kussmaul's sign is a paradoxical rise of JVP on inspiration is seen in pericardial constriction, severe right ventricular failure and restrictive cardiomyopathy.

Ventricular



4.16 Abnormalities of the jugular venous pulse

Condition	Abnormalities
Heart failure	Elevation, sustained abdominojugular reflux > 10 seconds
Pulmonary embolism	Elevation
Pericardial effusion	Elevation, prominent 'y' descent
Pericardial constriction	Elevation, Kussmaul's sign
Superior vena cava obstruction	Elevation, loss of pulsation, <i>absent Hepato-jugular reflex</i>
Atrial fibrillation	Absent 'a' waves
Tricuspid stenosis	Giant 'a' waves
Tricuspid regurgitation	Giant 'v' or 'cv' waves
Complete heart block	'Cannon' waves

E-Measure the blood pressure

4.13 British Hypertension Society classification of blood pressure (BP) levels

BP	Systolic BP (mmHg)	Diastolic BP (mmHg)
Optimal	<120	<80
Normal	<130	<85
High normal	130-139	85-89
Hypertension		
Grade 1 (mild)	140-159	90-99
Grade 2 (moderate)	160-179	100-109
Grade 3 (severe)	> 180	> 110
Isolated systolic hypertension		
Grade 1	140-159	<90
Grade 2	> 160	<90

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Precordium examination

Inspection

1- deformity ;

- Pectus excavatum: funnel chest , Posterior displacement of sternum
- Pectus carinatum: protrusion of the sternum and ribs.

2-skin :

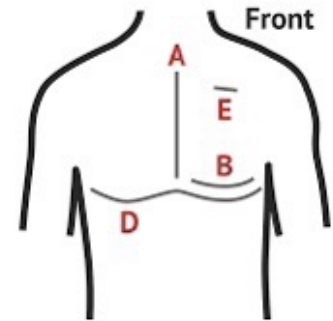
- lesions
- hair loss
- dilated veins
- spider navies

3- scars

-**Midline sternotomy scar**: cardiac **valve replacement** and coronary artery bypass grafts (**CABG**). Usually accompanied by saphenous vein or radial artery graft scar .

-**left submammary scar** : used for **mitral valvotomy** or **aortic valve replacement**

-**Infraclavicular scar**: This surgical approach is used for **pacemaker insertion and defibrillator**



4-Visible pulsations:

- a forceful apex beat may be visible secondary to underlying **ventricular hypertrophy**.
- left parasternal pulsation : right ventricular hypertrophy
- 2ed left second intercostal space : enlarged pul.artery
- epigastric pulsation : enlarge abdominal aorta

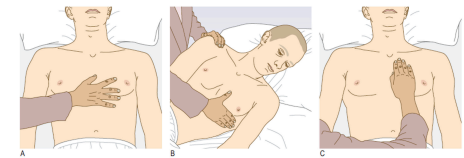


Fig. 4.18 Palpating the heart. (A) Use your hand to palpate the cardiac impulse. (B) Localise the apex beat with your finger if necessary, roll the patient into the left lateral position. (C) Palpate from apex to sternum for parasternal pulsations.

palpation

1- apex beat

the most lateral and inferior position at which the cardiac impulse can be felt results from the left ventricle moving forwards and striking the chest wall during systole.

A- location

Normal	Abnormal
5 th intercostal space mid-clavicular line	<p>A- displaced : inferiorly or laterally</p> <ul style="list-style-type: none"> - dilated cardiomyopathy : post MI , AR , sever AS , ADHF <p>B- right side : dextrocardia</p> <p>C- not felt :</p> <p>Ask the pt to turn to his left side , still can't</p> <p>Physiological : obese , muscular ,</p> <p>Pathological : chest hyperinflation due to COPD , asthma</p>

B- character

Normal	Abnormal
Normally briefly lift your hand/localized	<p>A- forceful but undisplaced apical impulse = apical heave</p> <p>LV hypertrophy : HTN , AS</p> <p>B- The 'tapping' apex beat = a palpable first heart sound</p> <p>mitral stenosis</p> <p>C- double apical impulse</p> <p>hypertrophic cardiomyopathy.</p>

2- heaves

Normal	Abnormal
No parasternal heave	left parasternal heave : RV hypertrophy due to Pulmonary HTN or pulmonary stenosis

3- thrills

Vibratory sensation that is the Tactile equivalent for murmur ,felt by tips of the fingers over the location of valves . B

Auscultation

*Bell vs diaphragm

-The bell of the stethoscope is more effective at detecting low-frequency sounds, including the mid-diastolic murmur of mitral stenosis ,S3 ,S4.

-The diaphragm of the stethoscope is more effective at detecting high-frequency sounds, including the ejection systolic murmur of aortic stenosis, the early diastolic murmur of aortic regurgitation and the pansystolic murmur of mitral regurgitation.

1- Listen with your stethoscope **diaphragm** at the:

Palpate the carotid pulse to be able to identify the heart sound u hear

- apex
- lower left sternal border
- upper right
- left sternal borders.

Auscultate the four heart valves

2- Listen with your stethoscope **bell** at the:

- apex
- lower left sternal border.

3- maneuvers To accentuate systolic murmur

- Listen for radiated murmur of **AS** over the carotid arteries
- Listen for Radiated murmur of **MR** over the axilla

4- maneuvers to accentuate diastolic murmur

- Lean the pt forward , let him take inspiration the expiration and hold his breath (this makes the murmur louder) : **AR**
- Let the pt lean laterally , let him take inspiration the expiration and hold his breath (this makes the murmur louder) : **MS**

5-Auscultate the lung fields posteriorly: bilateral basilar crackles indicate HF

Assess for edema

1-Inspect and palpate the sacrum for evidence of pitting oedema.

2-Inspect and palpate the patient's ankles for evidence of pitting pedal oedema (associated with right ventricular failure).

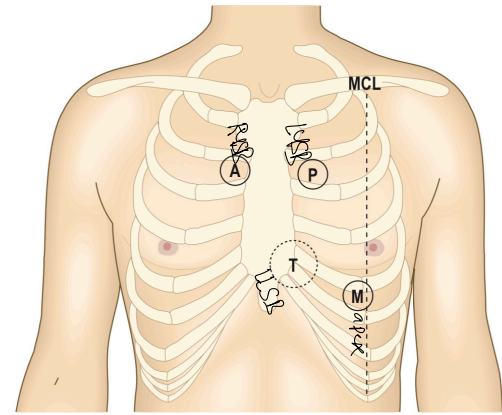


Fig. 4.17 Sites for auscultation. Sites at which murmurs from the relevant valves are usually, but not preferentially, heard. A, aortic; M, mitral; MCL, mid-clavicular line; P, pulmonary; T, tricuspid.

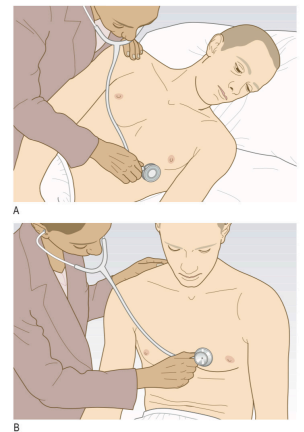
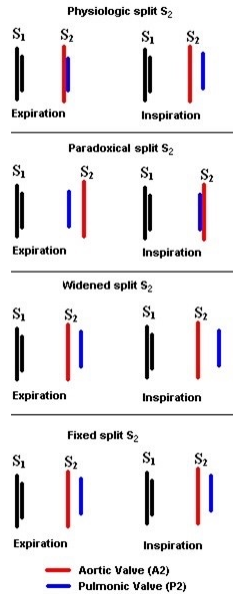


Fig. 4.19 Auscultating the heart. [A] Listen for the murmur of mitral stenosis using the bell lightly applied with the patient in the left lateral position. [B] Listen for the murmur of aortic regurgitation using the diaphragm with the patient leaning forwards.

A- normal heart sounds

S1 (lub)	S2 :exp (lub – dub). Insp (lub – da-dub)
Apex by diaphragm	LUSB By diaphragm
Closure of mitral and tricuspid valves	Closure of aortic and pulmonary valves
Just before carotid pulse	Anytime after the pulse
Beginning of the systole	The end of the systole
Loud in MS (high atrial pressure shut the valve loudly)	Loud in HTN



Split

Widens in inspiration (enhanced physiological splitting)

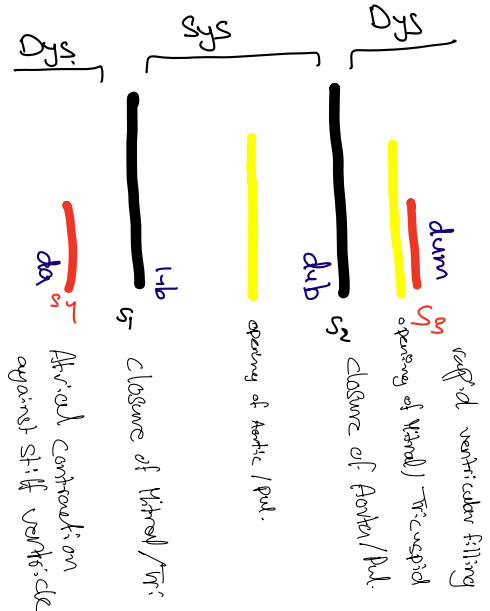
- Right bundle branch block
- Pulmonary stenosis
- Pulmonary hypertension
- Ventricular septal defect

Fixed splitting (unaffected by respiration)

- Atrial septal defect

Widens in expiration (reversed splitting)

- Aortic stenosis
- Hypertrophic cardiomyopathy
- Left bundle branch block
- Ventricular pacing



Abnormal heart sound

1- S3 and S4

S3 (lub – dub – dum)	S4 : (da-lub-dub).
Apex by bell	Apex by bell
Rapid ventricular filling just after opening of mitral or tricuspid valve	forceful atrial contraction against a non-compliant or stiff ventricle
Just after S2 (early diastolic)	Just before S1 (late diastolic)
Physiological in : children , young adults , pregnancy, fever Pathological : if >40y atrial volume overload : mitral regurgitation , Heart failure	Always pathological left ventricular hypertrophy : due to hypertension, aortic stenosis or hypertrophic cardiomyopathy:
, S3 occurs with a tachycardia, referred to as a 'gallop' rhythm, and S1 and S2 are quiet (lub-da-dub).	

2- added sounds

Open snap	ejection click	Mid systolic click	Metallic click
Early Diastolic : after S2	Systolic : after S1	Midway btw S1- S2	Loud sound whenever the valve opens or closes Mitral : Metallic S1 + open snap
Sudden Opening of stenotic mitral	Sudden Opening of congenital stenotic aortic / pulmonary valve	MVP	
Best heard at apex	Best heard USB	Best heard at apex	Aortic : Metallic S2 + ejection click

3- murmurs

Sound that arise due to :

- 1- overflow across normal valve
- 2- turbulent flow across diseased valve

Types

Physiological vs. pathological : diastolic murmurs never physiological

- 1- systolic
- 2- diastolic
- 3- continuous

For each murmur : time , duration , character , radiation , intensity

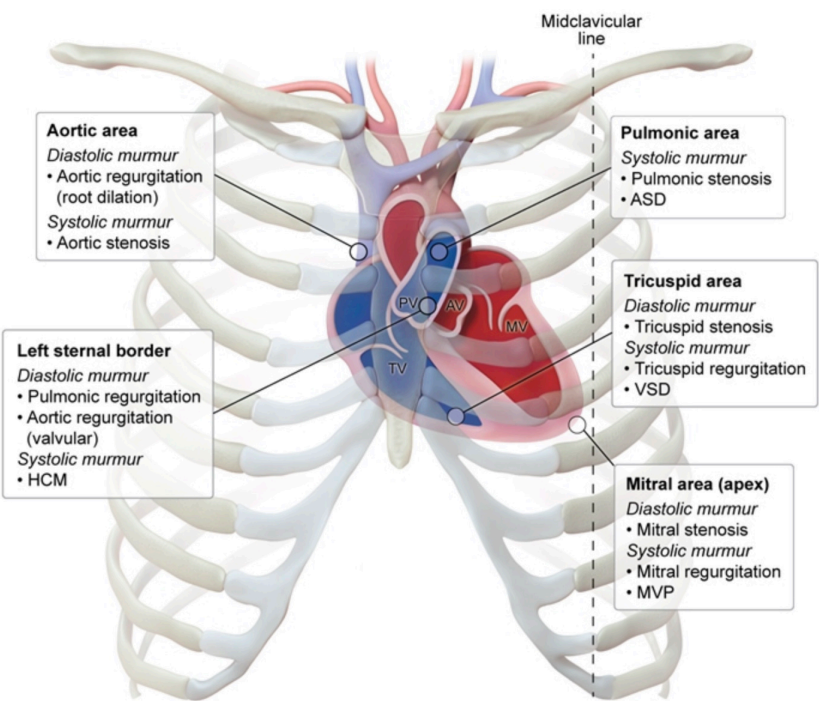
4.20 Grades of intensity of murmur

Grade	Description
1	Heard by an expert in optimum conditions
2	Heard by a non-expert in optimum conditions
3	Easily heard; no thrill
4	A loud murmur, with a thrill
5	Very loud, often heard over a wide area, with thrill
6	Extremely loud, heard without a stethoscope

Pulmonary regurgitation = Graham Steell murmur

Aortic regurgitation = Austin Flint murmur

Cardiac auscultatory locations



ASD = atrial septal defect; AV = aortic valve; HCM = hypertrophic cardiomyopathy; MV = mitral valve; MVP = mitral valve prolapse; PV = pulmonic valve; TV = tricuspid valve; VSD = ventricular septal defect.
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Cardiac murmurs*

Systolic	Aortic stenosis		Crescendo-decrescendo at RUSB, A2 soft & delayed
	Mitral regurgitation		Holosystolic at apex & radiates to axilla
	Hypertrophic cardiomyopathy		Crescendo-decrescendo at mid-left sternal border
	Mitral valve prolapse		Midsystolic click followed by late systolic murmur
	Atrial septal defect		Midsystolic with wide & fixed splitting of S2
	Ventricular septal defect		Holosystolic at left sternal border
Diastolic	Aortic regurgitation		Decrescendo at LUSB (valvular), RUSB (aortic root)
	Mitral stenosis		Opening snap followed by midsystolic rumble with presystolic accentuation
Continuous	Patent ductus arteriosus		Machine-like in interscapular region (posteriorly)

*Pulmonic & tricuspid valve murmurs are similar in character to their aortic & mitral valve counterparts but with different location of optimal auscultation. These murmurs can be further differentiated from their left-sided counterparts by an increase in intensity with inspiration.
LUSB = left upper sternal border; RUSB = right upper sternal border.
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4.21 Causes of systolic murmurs

Ejection systolic murmurs

- Increased flow through normal valves:
 - Severe anaemia, fever, athletes (bradycardia → large stroke volume), pregnancy
 - Atrial septal defect (pulmonary flow murmur)
 - Other causes of flow murmurs (increased stroke volume in aortic regurgitation)
- Normal or reduced flow through a stenotic valve:
 - Aortic stenosis
 - Pulmonary stenosis
- Subvalvular obstruction:
 - Hypertrophic obstructive cardiomyopathy

Pansystolic murmurs

- Mitral regurgitation
- Tricuspid regurgitation
- Ventricular septal defect
- Leaking mitral or tricuspid prosthesis

Late systolic murmurs

- Mitral valve prolapse

4.10 Haemodynamic effects of respiration

	Inspiration	Expiration
Pulse/heart rate	Accelerates	Slows
Systolic blood pressure	Falls (up to 10 mmHg)	Rises
Jugular venous pressure	Falls	Rises
Second heart sound	Splits	Fuses

Geeky medics video : https://youtu.be/XU_xeUMJ3Zc

Easyauscultation : <https://www.easyauscultation.com>

