1 Examination of the cardiovascular system

NB Systematic approach: inspection, palpation, percussion, and auscultation.

Preparation

- *Cross infection*: wash and dry hands, bare below the elbow
- *Introductions*: yourself and the task; confirm patient's name and age
- *Consent*: to the procedure
- *Pain*: is the patient in pain
- *Privacy*: ensure privacy, e.g. curtains drawn around bed
- *Position*: ideally on the bed at 45° – if this is not possible, report that back to the observer
- *Exposure*: from the waist up, may not be appropriate to expose from the start of the exam for female patients

The peripheries

Inspection

- *Environment*: fluid restriction, glyceryl trinitrate (GTN) spray, oxygen, infusions, cardiac monitor
- *Patient*: breathlessness, distress, position, orthopnoea, pallor

NB Before you take their hand, double check again about pain.

Medical Student Survival Skills: Clinical Examination, First Edition. Philip Jevon, Elliot Epstein, Sarah Mensforth, and Caroline MacMahon.

Companion website: www.wiley.com/go/jevon/medicalstudent

- *Hands*
  - Observe colour (pallor or peripheral cyanosis)
  - Feel for temperature
  - Measure capillary refill time (CRT) (Box 1.1): normal CRT < 2 seconds
  - Look for tendon xanthomata (Figure 1.1), tar staining, clubbing, splinter haemorrhages (Figure 1.2), Janeway lesions, and Osler's nodes

Box 1.1 Measuring CRT

- Raise extremity (e.g. finger) slightly above the level of the heart
- Blanche the skin for 5 seconds and then release
- Note the CRT (normal is < 2 seconds; prolonged CRT > 2 seconds may be caused by circulatory shock, pyrexia, or a cool ambient temperature

Figure 1.1 Tendon xanthomata – usually indicates hypercholesterolemia.

Figure 1.2 Splinter haemorrhages – may be seen in infective endocarditis.

OSCE Key Learning Points

✔ Stigmata of infective endocarditis include splinter haemorrhages, Janeway lesions/Osler's nodes, and clubbing

OSCE Key Learning Points

✔ Cardiac causes of clubbing include endocarditis and congenital heart disease

- *Face*
  - Look for malar flush (suggestive of mitral stenosis), central cyanosis (hypoxaemia), xanthelasma (hypercholesterolaemia) (Figure 1.3), corneal arcus (hypercholesterolaemia) (Figure 1.4), and pallor of the mucous membranes (anaemia)
- *Neck*
  - Observe the jugular venous pressure (JVP): position, waveform, and carotid pulsation
  - Measure the JVP (Figures 1.5a and b). The patient's position can affect JVP (Figure 1.5c)

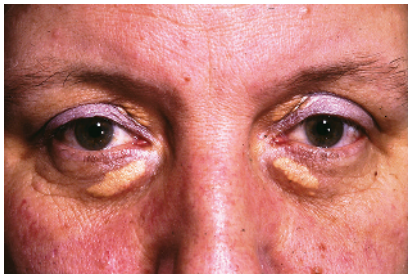

Figure 1.3 Xanthelasma – usually indicates hypercholesterolaemia.

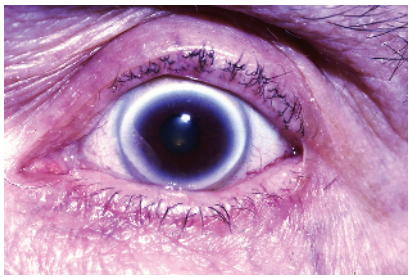

Figure 1.4 Corneal arcus – usually indicates hypercholesterolaemia.

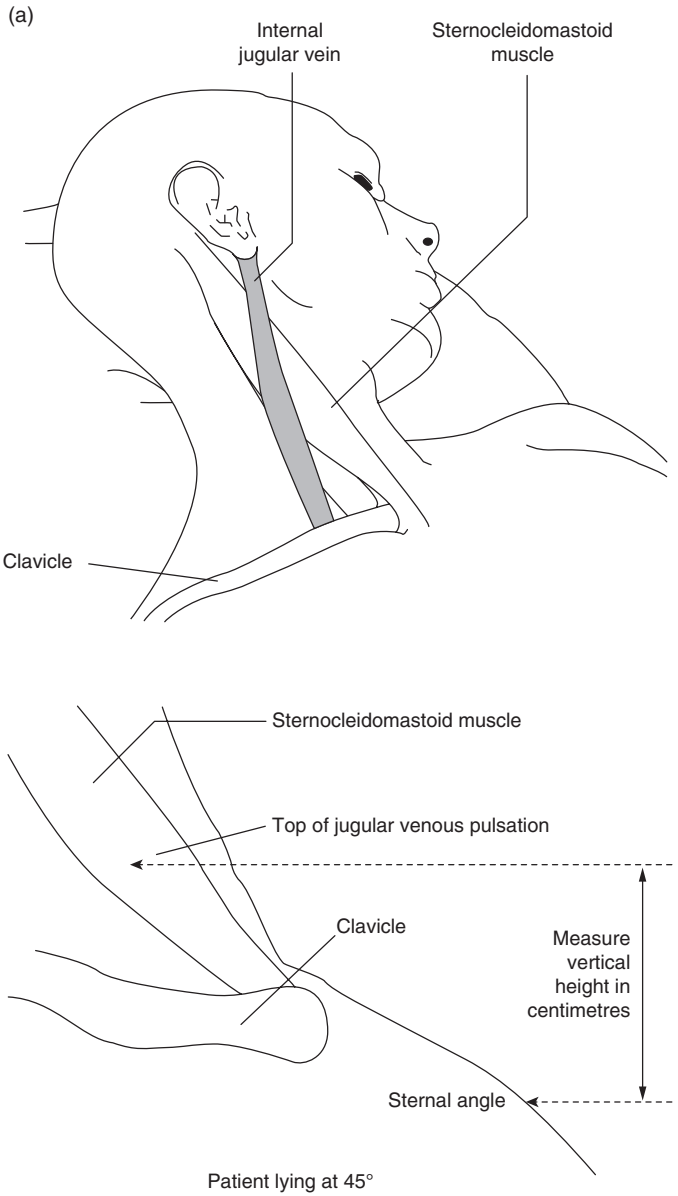

Figure 1.5 (a) Measurement of JVP: anatomy of the jugular veins and measuring the height of JVP. (b) Measurement of JVP. (c) The patient's position can affect JVP. Source: (a & c) Jevon, P. (2009). Clinical Examination Skills. Oxford: Wiley Blackwell. Reproduced with permission of Wiley.

(b)

(c)

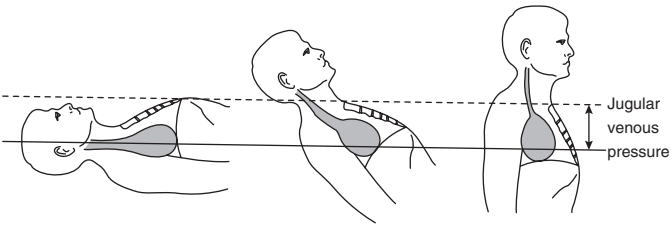

Figure 1.5 (Continued)

Common misinterpretations and pitfalls

The patient's position can significantly affect JVP (Figure 1.5c).

OSCE Key Learning Points

Cardiovascular causes of a raised JVP include

- ✔ Right-sided or congestive cardiac failure
- ✔ Cardiac tamponade
- ✔ Obstruction of superior vena cava, e.g. tumour
- ✔ Pulmonary embolism
- ✔ IV fluid overload

OSCE Key Learning Points

Distinguishing between a carotid pulse and JVP

✔ JVP moves down with inspiration, and rises with pressure on the right abdomen (liver: hepatojugular reflux – explain the procedure first!) and is impalpable

Palpation

- Pulses: palpate for 30 seconds
  - Palpate radial pulse or brachial pulse
  - Determine rate (bradycardia < 60 beats per minute [bpm], tachycardia > 100 bpm)
  - Assess rhythm (regular or irregular); if irregular, any pattern to irregularity or irregularly irregular
  - Assess pulse character at the carotid
  - Compare R + L for radioradial delay
  - Compare radial and femoral for radiofemoral delay
  - Assess for collapsing radial pulse (Box 1.2) – explain the procedure first!
- Request blood pressure (BP)

OSCE Key Learning Points

Four common causes of bradycardia

✔ Medications, e.g. beta-adrenoceptor blockers
✔ Ischaemic heart disease
✔ Hypothermia
✔ Normal finding, e.g. athletes

OSCE Key Learning Points

Four common causes of tachycardia

✔ Medications, e.g. salbutamol
✔ Ischaemic heart disease
✔ Circulatory shock
✔ Exercise/anxiety

Box 1.2 Assessing for a collapsing pulse (a marker of aortic regurgitation)

- Explain to the patient they will need to lift their arm swiftly upwards – check about shoulder pain and movement limitations first
- Stand to the side of the patient
- Locate the radial pulse with your fingertips. Then adjust so the flat of your palm around the first metacarpophangeal (MCP) joint is flush against the pulse area
- Swiftly elevate and straighten the arm: a collapsing pulse is felt against your hand – normally the pulse will not be palpable in this position

NB Do not forget to ask for the BP – it can give you clues if you hear a murmur later!

The precordium

Inspection

- Look for scars (coronary artery bypass graft (CABG), drains, implantable cardiac devices (ICDs), chest wall deformities, visible heaves or pulsations
- If a median sternotomy scar is present, check the calves for vein graft harvest (their presence suggests that the sternotomy scar relates to CABG)

Palpation

- Palpate the apex beat using the finger tips. This is normally located in 5th intercostal space (ICS), mid-clavicular line. Ensure you demonstrate finding the location by counting the rib spaces. Note the rhythm and character of the apex beat (Box 1.3). If the apex beat is displaced, check the trachea. If also displaced this indicates mediastinal shift
- Check for heaves and thrills using the flat of your hand

Box 1.3 Character of the apex beat

Normal:	short and sharp
Heaving:	sustained and forceful due to an obstruction to the flow of blood out of the heart, e.g. aortic stenosis
Thrusting:	volume overload
Tapping:	mitral stenosis
Diffuse:	left ventricular failure and cardiomypathy

OSCE Key Learning Points

Causes of an impalpable apex include

- ✔ High body mass index (BMI)
- ✔ Emphysema
- ✔ Pericardial effusion
- ✔ Dextrocardia

Auscultation (Figure 1.6)

- At the apex – left 5th ICS, mid-clavicular line normally
- At the mitral area (M) – left 5th ICS, mid-clavicular line
- At the tricuspid area (T) – left 4th ICS, lateral to the sternum
- At the pulmonary area (P) – left 2nd ICS, lateral to the sternum
- At the aortic area (A) – right 2nd ICS, lateral to the sternum

  Auscultate for S1 and S2 in each area:
  - Check that S1 matches with the carotid pulse in the neck (Figure 1.7). This skill will take practice, but is important
  - Once you have identified S1 and S2, listen between the sounds for murmurs

Perform the manoeuvres for each murmur as routine, whilst you progress through the four areas, or afterwards. In the mitral area:

- Roll the patient into the left lateral to amplify a mitral murmur
- Listen with the bell (mitral stenosis [MS])
- Listen in the axilla (radiation of mitral regurgitation [MR])

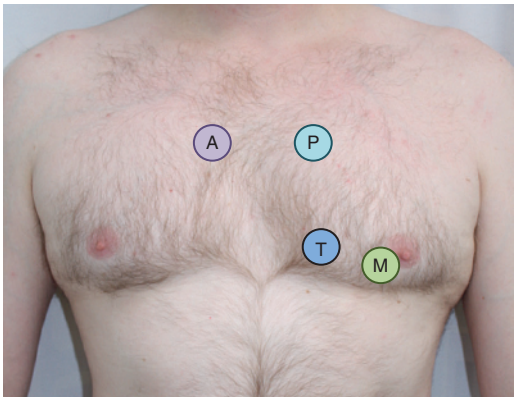

Figure 1.6 Auscultation of the precordium.

Figure 1.7 Checking that S1 matches with the carotid pulse in the neck.

For aortic murmurs:

- Listen to the carotid area of the neck for murmur radiation (of aortic stenosis [AS])
- Ask to sit forwards, place your stethoscope at the lower left sternal edge (LLSE) and then listen in end-expiration (radiation of aortic regurgitation [AR])

For any murmur (Table 1.1):

- Listen in inspiration and expiration:
  - Left-sided murmurs (aortic and mitral) become louder in expiration
  - Right-sided murmurs (pulmonary and tricuspid) become louder in inspiration

Table 1.1 Characteristics of Common Murmurs

	Aortic stenosis	Aortic regurgitation	Mitral stenosis	Mitral regurgitation
Systolic/diastolic?	Ejection systolic	Early diastolic	Mid diastolic	Pan systolic
Loudest at …?	R 2nd ICS	LLSE	L 5th ICS	L 5th ICS
Manoeuvre	Listen at carotid	Listen at LLSE leaning forward in end expiration	Listen with the bell	Roll to left lateral
Radiation?	Carotids	LLSE	—	Axilla
Effect on apex?	Heaving, Undisplaced	Displaced, Hyperdynamic	Tapping	Hyperdynamic
Effect on pulse?	Slow rising	Collapsing	None	None
Effect on BP?	Narrowed	Widened	None	None

Other sounds:

- S3 – a low pitched sound heard just after S2. It can be normal in young fit people or pregnancy, or a sign of left ventricular function impairment and dilation
- S4 – a low pitched heart sound just before S1. This indicates forceful atrial contraction against stiff ventricles, and is always abnormal
- Pericardial friction rub – often described as a creaking sound similar to walking on firm snow; due to pericarditis. Ask the patient to hold their breath to make this more audible

Ken – – – tuck – y S1 – – – S2 – S3 T – enne – – – ssee S4 – S1 – – – S2	The rhythm of the words 'Kentucky' and 'Tennessee' are often used to remember the added sounds' timing relative to S1 and S2

Auscultation continued

- Whilst they lean forward (as you check for AR):
  - Auscultate the lung bases for signs of pulmonary oedema
  - Inspect and palpate for sacral oedema

To complete the examination

- Inspect the legs for oedema, scars, ulcers and trophic changes
- Request blood pressure
- Offer to check radioradial and radiofemoral delay (if not done earlier)
- Examine the other peripheral pulses
- Perform a peripheral vascular examination – if appropriate
- Thank the patient
- Cover the patient up and ensure they are comfortable
- Request appropriate investigations, e.g. oxygen saturations and electrocardiogram (ECG)

OSCE Key Learning Points

Cardiovascular system: example presentation

- ✔ On examination round the bed I note that there is GTN spray at the bedside. This elderly gentleman appears comfortable sitting upright.
- ✔ On examination of the peripheries there are no signs of infective endocarditis or heart failure, I do note corneal arcus of the eye. The pulse has a normal volume and regular rhythm at a rate of 78 bpm. The blood pressure is 146/86 mmHg.
- ✔ On examination of the precordium, there were no scars, heaves nor thrills. I could hear heart sounds 1 and 2, with an added murmur. This was systolic and loudest in the aortic area. Its character was ejection systolic, and I conclude that this could be aortic stenosis.
- ✔ To complete the examination I would examine the peripheral pulses and inspect the legs, which I did not manage to complete in the time allowed.