

Examination Of The Cardiovascular System

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1. General

Introduce yourself to the patient Explain to the patient what you are about to do by asking them “I would like to examine your heart and check the pulses, do I have your permission to do this?”

Spend time getting the patient in the correct position, lying at an angle of 45°-this is important for the measurement of the JVP.

Make sure that the patient’s upper and lower parts are covered with **separate** blankets-this will allow you to expose the upper or lower body, leaving the other well clad.

Spend some time now **looking at the patient**-make it obvious to the examiner that you are doing this. If the patient does have features of a disease eg Marfans Syndrome, the examination should be modified to focus on other signs associated with this condition.

Also look around the bed for paraphernalia related to the patient (eg. temperature chart). If there are any such items, take time to examine them carefully.

2. Nails and hands

Examine both the hands quickly-an examiner’s favourite trick is to have a patient with a splinter haemorrhage on the left hand only, which would otherwise be missed.

Make sure you check **capillary return** in one of the nails

In practice all that is required is a quick glance at the hands, checking capillary return in one of the nails. If the examiner stops you and asks what are you examining for, you should recite the following list;

“I am looking at the nails for evidence of...

- 1. koilonychia*
- 2. splinter haemorrhages*
- 3. clubbing...*

and I am examining the hand for...

- 1. nicotine staining*
- 2. Osler nodes*
- 3. Janeway lesions*
- 4. tendon xanthomas*
- 5. peripheral cyanosis”*

4. The radial pulse

Palpate the radial pulse for 15 seconds if it is regular or 30 seconds if it is irregular. Note the **rate** and **rhythm**

An acceptable rate is between 60 and 90 / minute in an adult.

The following rhythms may be found:

- *regular*-this is sinus rhythm
- *irregularly irregular*-this may be due either to multiple ectopic beats or the patient may be in atrial fibrillation. Most clinicians assume if there are periods of regularity, the patient is having multiple ectopic beats, whereas if these do not occur, the patient is in atrial fibrillation. The only true way to tell the difference is with an ECG.
- *speeding up on inspiration*-this is called sinus arrhythmia and is normal in young people. It sounds a bit slicker than just saying regular!

Now ask the patient “***I would like to raise your right arm to check the pulse, do you have any pain in your right shoulder?***” If they say that they don’t have any pain, lift the hand up and feel for the collapsing pulse of aortic regurgitation.

5. ***Blood pressure***

In an exam make sure you state at this point “***I would like to know the blood pressure.***” Take notice of what the examiner tells you. If he states 120/80 mmHg, it is unlikely that there will be a significant problem with the aortic valve. If the gap between systolic and diastolic pressures is large, this is called a **wide pulse pressure** and is consistent with aortic regurgitation. If on the other hand, the gap is small, this is called a **narrow pulse pressure** and is consistent with aortic stenosis.

6. ***The Eyes***

Look at both the eyes quickly. Tell the patient “*I would like to take a look in your eye*” before pulling down one of the lower lids to check for conjunctival pallor.

If the examiner stops you and asks what are you examining for you should reel off the following list:

1. *anaemia*
2. *jaundice* (low grade haemolysis related to valve prosthesis)
3. signs of *Grave’s disease* (lid retraction, lid lag and exophthalmos) as this can be a cause of atrial fibrillation and high output heart failure.
4. *corneal arcus*
5. *xanthelasma*

7 ***The Mouth***

Using your pen torch take a quick look in the patient’s mouth. Ask the patient to stick their tongue “*outwards and upwards towards their nose*” and examine the tongue for **central cyanosis**.

Remember, central cyanosis develops when there is at least 5g/dL unsaturated haemoglobin in the blood. If a patient is centrally cyanosed they will automatically be peripherally cyanosed also. Note the converse is **not** true: conditions such as Raynaud’s Phenomenon cause a sluggish circulation in the extremities, resulting in a patient who is in peripherally cyanosed only.

8 The Neck

Examination of the neck as part of the cardiovascular system focuses on the following three points:

- 1 *carotid pulse*
- 2 *JVP*
- 3 *trachea*

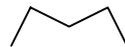
1. The Carotid Pulse

When examining the carotid pulse, it is a good idea to first **auscultate both vessels for a carotid bruit**. Although there is no evidence to support this, it seems logical that if a carotid bruit is located, indicating the presence of atheromatous change, this should not be pressed on as it could dislodge the atheroma and send it embolising towards the brain!

As long as there is no bruit, tell the patient “*I would like to press on the artery in your neck*” before palpating the carotid pulse with the index, middle and ring fingers. The following pulse characters may be found:

- *normal* 
- *collapsing pulse*-this has a rapid upstroke and down stroke and is a feature of aortic regurgitation 
- *slow rising and plateau*-this is indicative of aortic stenosis 
- *bisferiens*-this pulse has features of both a collapsing and a plateau pulse. It is found in mixed aortic valve disease.

2. The Jugular Venous Pressure



When examining the JVP, the patient should be sitting at 45° with their head resting back on a pillow and turned slightly to the left. In this position, the right internal jugular vein should be just visible between the 2 heads of sternocleidomastoid. The JVP is raised if the **vertical height** of the pulse above the sternal angle is greater than 4cm.

Textbooks tend to go into a lot of detail about the JVP. For the purpose of medical finals only a few facts need memorising:

1. A **raised JVP** means increased pressure in the right atrium. Common causes of this include **right ventricular failure** and **fluid overload**.
2. There are **2** waves, the **a** wave represents **atrial contraction** and coincides with the 1st heart sound, whereas the **v** wave represents **venous filling** of the atrium and coincides with the 2nd heart sound

3. In practice, it is difficult to detect whether a or v are actually increased or not, but it is possible to be a bit sly and to impress examiners by making your JVP assessment fit with the rest of the clinical picture!
 - If the patient is clearly in atrial fibrillation, say the a waves are absent.
 - If the patient has obvious ascites, peripheral oedema and a pansystolic murmur, **tricuspid regurgitation is likely** and you should look for a large v wave which may cause the ear lobes to waggle!

3. *The Trachea*

Quickly check that the trachea is central by placing the index and ring fingers either side of the trachea at the sternal angle. This excludes mediastinal displacement as a cause of a displaced apex beat.

9 *The praecordium*

Inspection

Uncover the patient and inspect the praecordium for scars, deformities, visible pulsations and the rectangular swelling produced by a pacemaker box.

Typical scars you may see are the *median sternotomy* scar indicating open heart surgery (probably a CABG but may also be an aortic valve replacement) and a *lateral thoracotomy* scar indicative of mitral valve replacement surgery. If you find a surgical scar in the short case examinations do **not** ask the patient “*what operation was this for?*” as this tends to antagonise examiners !

Location of the Apex Beat

You should now palpate for the apex beat. This should be done by placing the fingers in successive intercostal spaces in the mid axillary line and drawing the fingers forwards and medially around the chest until the heartbeat is felt. When this is achieved the lowest finger that can feel the heart beating is the position of the apex beat. If you cannot feel an apex beat do not despair as it is only palpable in 50% of patients.

It is important to now demonstrate to the examiner that you are correctly locating the apex beat. With the finger of the right hand still in place over the apex beat, find the manubriosternal joint with the left hand. This is about 2 inches below the angle of Louis. When you have found the joint, move the finger laterally-it will automatically come to rest on the second rib. Just below this is the 2nd intercostal space. Count down the next few intercostal spaces until you find the one that is on a level with the apex beat. Now move the finger off the apex beat and go up the chest vertically. Look at the position on the clavicle that corresponds to the position of the apex beat.

Remember, the normal position of the apex beat is the **5th intercostal space in the mid clavicular line.**

Palpation of the rest of the Praecordium

You should now place the base of your hand just lateral to the left sternal edge to palpate for a parasternal heave. If you detect this, it signifies right ventricular hypertrophy due to pulmonary hypertension.

Now place the ulnar borders of each hand over the right and left sides of the sternum in the 2nd intercostal space (i.e. the little fingers should be placed in the intercostal spaces with the thumbs farthest away from the chest.) If you detect a pulsation in the 2nd left interspace this suggests a dilated pulmonary artery, whereas an impulse in the 2nd right interspace this suggests a dilated ascending aorta. These are easy to remember as the 2nd left interspace is the “pulmonary area” for cardiac auscultation, whereas the 2nd right interspace is the “aortic area”.

Auscultation of the Heart

Listen first at the apex of the heart with the bell and then the diaphragm of the stethoscope. This is the mitral area. Then move on to the aortic and the pulmonary areas listening with the diaphragm (to the right and the left of the sternum in the 2nd interspace). Finish by listening in the tricuspid area, which is just left of the sternum in the 5th interspace and in the left axilla as sounds of mitral regurgitation radiate here.

If you locate a murmur, the easiest way to tell whether it is systolic or diastolic is to palpate the right carotid artery at the same time as auscultating. If the murmur coincides with the carotid pulse, it is systolic.

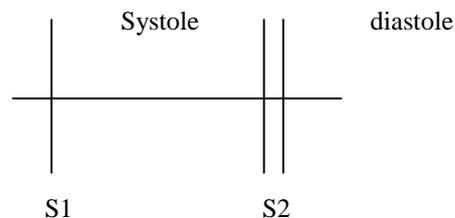
The patient should now be repositioned lying on their left-hand side. If the patient appears frail, ask them “*would you be comfortable lying on your left hand side?*” If they agree, ask the patient “*could you please place your left hand behind your neck*”, before asking them to lie on their left hand side, facing away from you.

With the patient in this position relocate the apex beat and check if it has the tapping quality of mitral stenosis. Listen again over the apex specifically for a low-pitched diastolic rumble, which would also indicate mitral stenosis.

The patient should now be repositioned sitting forwards. Murmurs due to defects in the aortic valve will be accentuated with the patient at the end of expiration in this position. It is important to give the patient clear instructions at this stage- they should be told to “*please breathe in deeply, then breathe out and hold it there*” When the patient is clear about this, perform this manouvre with the stethoscope over the left sternal edge.

Heart Sounds and Heart Murmurs

Although a lot of textbooks make an issue out of **heart sounds**, memorising all the different heart sounds is an arduous task and is out of the scope of final examinations. There are, however, several points worth noticing;



- S1 is produced by the closure of the mitral and tricuspid valves whereas S2 is produced by the closure of the aortic and pulmonary valves. Therefore, the gap between S1 and S2 is **systole**, whereas after S2 and before the next S1 the heart is in a state of **diastole**.
- The addition of S3 causes a cadence that resembles the rhythm when saying “**ken-tucky**”. It is normal in the young, but in old people it indicates impaired left ventricular function.
- The addition of S4 causes a cadence sounding like “**tenne-ssee**”. It is always abnormal and indicates impaired left ventricular function.

If a **heart murmur** is heard, the following facts must be known about it:

1. Its **timing** (whether systolic or diastolic)
2. Its **volume** (whether loud or soft. Murmurs are graded on a scale of 1-6, as follows:

| Grade | Intensity |
|-------|-----------------------------------|
| 1 | Just audible |
| 2 | Quiet |
| 3 | Moderately loud |
| 4 | Loud and associated with a thrill |
| 5 | Very loud |
| 6 | Audible without the stethoscope |

3. Its **character** (e.g. pansystolic or ejection systolic)

4. Its **radiation**

In practice, it is very difficult to elicit all of these findings under the pressure of an exam situation. It is thus a good idea to **learn** the features of the common murmurs and to recognise one of these patterns when examining the patient. However, be aware that a patient might have more than one murmur (eg aortic stenosis and regurgitation often occur together)

Typical features of some common heart murmurs

Aortic Stenosis

Plateau pulse

Harsh, grade 3-4 ejection systolic murmur loudest at the apex radiating towards the carotids

Loudest with the patient sitting forward at the end of expiration

- Narrow pulse pressure (see earlier)

Aortic Regurgitation

- Often exists with aortic stenosis
- Collapsing or “water hammer pulse”
- Wide pulse pressure (see earlier)
- High pitched, grade 2, early diastolic murmur loudest at the left sternal edge, but also can be heard at the aortic area and at the apex.
- There is also an ejection systolic murmur due to the large quantity of blood that flows through the heart with each beat. This is loudest in the aortic area and radiates towards the carotids. It is present even in pure aortic regurgitation.
- If you want to really impress the examiners, you can also mention the following signs which occur with aortic regurgitation;
 1. **Corrigan's sign**-the carotids can be seen pulsating vigorously in the neck
 2. **De Musset's sign**-the head nods with each heartbeat

The Pansystolic Murmurs: Mitral Regurgitation, Tricuspid Regurgitation and Ventricular Septal Defect

It is extremely difficult to define which of the above is causing a pansystolic murmur; in fact the only accurate way to determine aetiology is with the aid of an echocardiogram. It is possible, however to obtain some clues on clinical examination:

- The first thing to bear in mind is **the age of the patient**: a young person is less likely to have a regurgitant valve, whereas a patient with a significant VSD is less likely to live to old age.
- Mitral regurgitation is loudest at the apex of the heart and radiates towards the axilla. It ends to be about grade 4. There may be a systolic thrill at the apex of the heart.
- Tricuspid regurgitation is **rare** in isolation and often coexists with mitral regurgitation when the whole valve annulus becomes stretched in congestive heart failure. The murmur is loudest in the tricuspid area, where it is about grade 2 and doesn't radiate. It is associated with the signs of right ventricular failure, namely
 1. Raised JVP
 2. Peripheral oedema
 3. Ascites
 4. Pulsatile liver

Mitral Stenosis

Practically every case of mitral stenosis is a result of Rheumatic heart disease, which tends to cause mitral regurgitation also. Therefore, for the purpose of medical finals, I would only listen for this murmur if the patient has the apical pansystolic murmur of mitral regurgitation. It is characteristically a grade 1-2, low pitched mid diastolic rumble that doesn't radiate. It is associated with a malar flush, tapping apex beat and a diastolic thrill at the apex of the heart.

10. Examination of the posterior aspect of the chest

At this point in the examination you will have the patient sitting up as you will have just auscultated the left sternal edge at the end of expiration. You should now say to the patient: *"please could you stay sitting up as I would like to examine the back of the chest"*

Examination of the back of the chest can be considered in 3 steps:

- 1. Palpation** for **sacral oedema**
- 2. Percussion** of the lung bases to exclude a **pleural effusion**
- 3. Auscultation** of the lung bases for the fine inspiratory crepitations of left ventricular failure.

11. Finishing off the examination

At this point turn to the examiner and say *"I would like to go on to examine the abdomen and the legs, would you like me to do so?"* It is likely the examiner will say *"no"*, but may want to know what you would be examining for. If this occurs you should recite the following list:

"In the abdomen I would be examining for evidence of...

- *Hepatomegaly (right ventricular failure)*
- *Splenomegaly (infective endocarditis)*
- *An abdominal aortic aneurysm*

...I would also palpate the femoral arteries and listen for renal bruits (to exclude renovascular hypertension.)...

In the legs I would examine for...

- *The peripheral pulses*
- *Evidence of peripheral vascular disease (purple-blue cyanosed appearance, slow capillary return, venous guttering, ulceration, gangrene and reduced skin temperature)*
- *Varicose veins*
- *Oedema*
- *Nail clubbing*
- *Tendon xanthomata."*

It is very important at the stage to say to the patient *"thank you, that completes my examination"* and cover them up with the blanket.

You should complete any examination of the cardiovascular system by turning to the examiner and saying

"I would also like to examine the fundi (for Roth's spots of infective endocarditis or hypertensive change), look at the temperature chart and dipstick the urine for haematuria."