Auscultation of the Heart

Normal heart sounds = S1 and S2

First heart sound (S1) is caused by the closing of the atrioventricular (tricuspid and mitral) valves. This happens at the start of systolic contraction of the ventricles. (As the ventricles try to push blood out of the heart, the valves between the atria and the ventricles need to close to prevent blood from flowing back into the atria)

The second heart sound (S2) is caused by the closing of the semilunar (aortic and pulmonary) valves, once the systolic contraction is complete, to prevent blood flowing back from the pulmonary arteries/aorta into the ventricles.

S1 and S2 can be heard as a 'lub dub' sound.

Third heart sound (S3) – heard roughly 0.1 seconds after the second heart sound. Quite subtle.

Caused by rapid ventricular filling, causing the chordae tendinae to pull to their full length and 'twang' like a guitar string.

This can be normal in young patients (15 to 40 years old) because the heart functions so well that the ventricles easily and rapidly fill with blood.

In older patients it can indicate heart failure because the ventricles and chordae are stiff and weak and reach their limit much quicker than normal.

Sounds like "lub de dub"

Fourth heart sound (S4) – heard directly before S1. Always abnormal, relatively rare to hear.

Sound caused by turbulent flow from an atria contracting against a non-compliant (stiff or hypertrophic) ventricle

Sounds like "le lub dub"

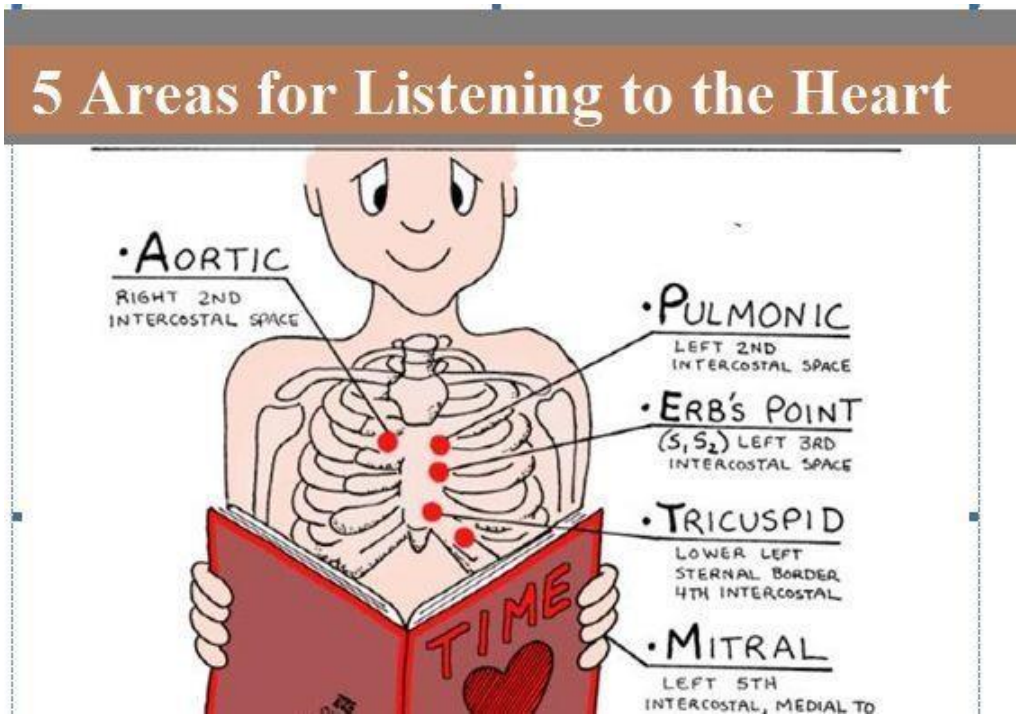
Auscultate with:

- the bell of your stethoscope to hear low pitched sounds ("a church bell giving a deep bong")
- the diaphragm of your stethoscope to hear high pitched sounds ("a child high pitched squeal from their diaphragm")

Listen over the four different valve areas:

- Pulmonary area in the 2nd intercostal space on the left sternal border
- Aortic area in the 2nd intercostal space on the right sternal border
- Tricuspid area is in the 4th intercostal space on the left sternal border
- Mitral area is in the 5th intercostal space in the mid-clavicular line (apex area)

Can also listen at Erb's point (3rd intercostal space on the left sternal border) – this is the best place for listening to the heart sounds (S1, S2, S3 and S4)



Special manoeuvrers you can use:

- Roll the patient on their left-hand side to listen to mitral stenosis
- Sit the patient up, lean them forward and ask them to take a deep breath out and hold = helps you hear aortic regurgitation

To assess features of a murmur use SCRIPT pneumonic

Site = where is the murmur loudest

Character = soft, blowing, crescendo (getting louder), decrescendo (getting quieter) or crescendo decrescendo (getting louder and then quitter)

Radiation = can you hear this murmur going to the carotids (as you would hear in aortic stenosis)? Or going to the left axilla (as you would in mitral regurgitation?)

Intensity = what grade is the murmur?

- Quite subjective, can be helpful to assess the severity of the defect
    - Grade 1: Difficult to hear
    - Grad 2: Quiet

- Grade 3: Easy to hear
- Grade 4: Easy to hear and with a palpable thrill (can feel the murmur with your hand)
- Grade 5: When you can hear the murmur with your stethoscope barely touching their chest
- Grade 6: When you can hear the murmur with your stethoscope off the chest (just nearby)

Pitch = is it high pitched or is it low and grumbling? indicates the velocity of the murmur

Timing = is it systolic or diastolic?

When the heart muscle is pushing against a stenotic valve, it has to work a lot harder to get blood through that valve -> results in hypertrophy

Mitral stenosis => left atrium is pushing really hard against that mitral valve, left atrial hypertrophy

Aortic stenosis = left ventricle is pushing really hard against that aortic valve, left ventricular hypertrophy

(pressure overload: concentric wall hypertrophy without chamber dilatation)

When you have a leaky valve that allows blood to flow back into the chamber, it stretches the muscle and results in dilatation. Mitral regurgitation, reversed flow into the left atrium, left atrial dilatation. Aortic regurgitation, blood flowing back from the aorta into the left ventricle = left ventricular dilatation

(volume overload; eccentric wall hypertrophy and chamber dilatation)

Mitral stenosis

Mitral valve becomes narrowed, makes it difficult for the left atrium to push blood through to the ventricle it's caused by two things: *RHD and IE.*

Causes a *mid-diastolic, low pitched, rumbling murmur* due to the low velocity of the blood flow (narrow area, flows slowly, rumbles its way through). Loud S1 due to the thick valves that require a large systolic force to shut. Once the systolic force reaches a certain threshold, the valve shuts very suddenly.

Loud "lub", then a "dub der"

You will be able to palpate a tapping apex beat due to the loud S1

Malar flush = flushing of the patients cheeks due to a back pressure of blood into the pulmonary system, causing a rise in CO2 and vasodilation.

Also commonly associated with atrial fibrillation = left atrium struggling to push blood through a stenotic valve causing strain, electrical disruption and resulting fibrillation

Mitral Regurgitation

Incompetent mitral valve allows blood to flow back through during systolic contraction of the left ventricle. It results in congestive heart failure because the leaking valve causes a reduced ejection fraction and a backlog of blood that is waiting to be pumped through the left side of the heart.

Causes a *pan-systolic, high pitched* "whistling" murmur due to high velocity blood flow through the leaky valve. The murmur radiates to the left axilla. You may hear a third heart sound (S3)

Causes:

- Idiopathic weakening of the valve with age
- Ischaemic heart disease
- Infective endocarditis
- Rheumatic heart disease
- Connective tissue disorders such as Ehlers Danlos syndrome or Marfan syndrome

Aortic Stenosis

Aortic stenosis is the most common valve disease you will encounter.

It causes an *ejection-systolic, high pitched* murmur (high velocity of systole).

Has a *crescendo-decrescendo* character due to the speed of blood flow across the valve during different periods of systole (flow during systole is slowest at the very start and end and fastest in the middle)

Other signs:

- Slow, rising pulse and reduced pulse pressure
- The murmur radiates to the carotids as the turbulence continues up into the neck
- Patients may complain of exertional syncope (light-headedness and fainting when exercising) due to difficulty maintaining good flow of blood to the brain

Causes:

- Idiopathic age-related calcification
- Rheumatic heart disease

Aortic regurgitation

Typically causes an *early diastolic, soft murmur*.

It is also associated with a Corrigan's pulse = a collapsing pulse, a rapidly appearing and disappearing pulse at carotid as the blood is pumped out by the ventricles and then immediately flows back through the aortic valve back into the ventricles.

Aortic regurgitation results in heart failure due to a back pressure of blood waiting to get through the left side of the heart.

It can also cause an "Austin-Flint" murmur. This is heard at the apex and is an early diastolic "rumbling" murmur. This is caused by blood flowing back through the aortic valve and over the mitral valve causing it to vibrate.

Causes:

- Idiopathic age-related weakness (calcific aortic stenosis a.k.a aortic sclerosis)
- Connective tissues disorders such as Ehlers Danlos syndrome or Marfan syndrome