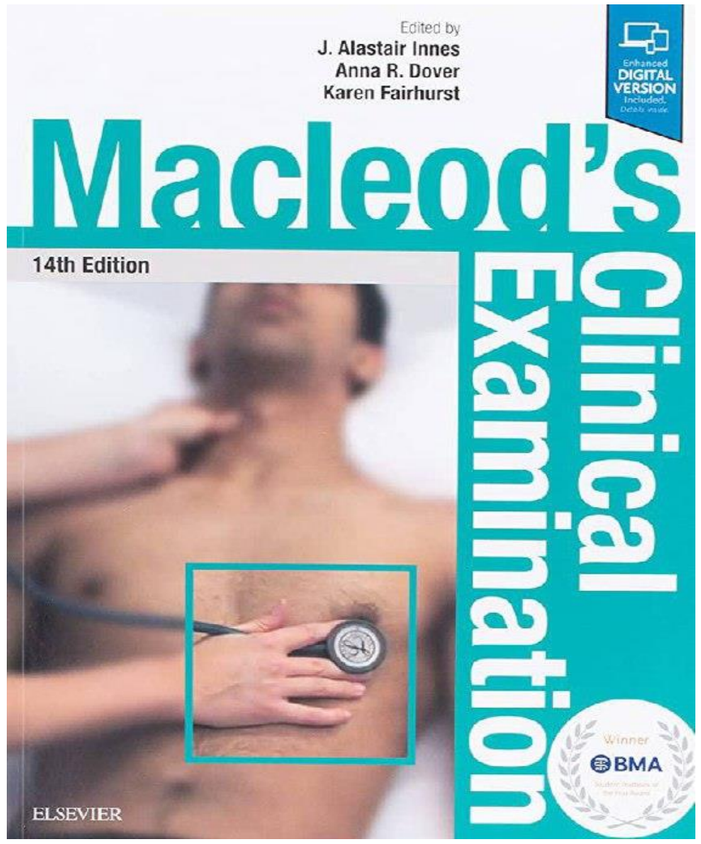


Outlines:

- **Precordium Exam**

  Inspection / Palpation / Auscultation

- **Heart & Added Sounds**
- **Murmurs**

Done By: A.O.Alwikhyan , MD.

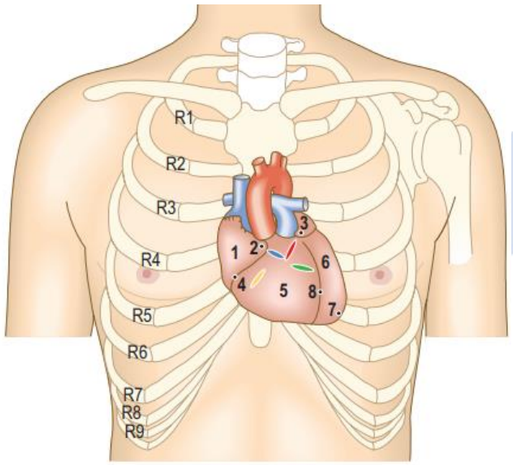
Introductory: Section 2 CH.4 Cardiovascular System Examination .

Note: This summary contains all Macleod's important notes.

For Full Material, please JOIN this WhatsApp Community:

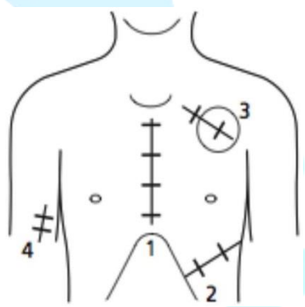
A- Precordium

- is the **anterior chest surface** overlying the heart and great vessels (Fig. 4.16).
- Optimal sites for auscultation (aortic, pulmonary, apex and left sternal border) **do not correspond with the location of cardiac structures** but are where the **transmitted sounds and murmurs are best heard** .
- It is important to note that the heart sounds and some murmurs can be heard **widely** across the precordium, but these sites represent the surface location where the murmur is **loudest or easiest to hear**.



Inspection

- **Pectus Excavatum** (funnel chest; see Fig. 5.6D), a **posterior** displacement of the lower sternum.
- **Pectus Carinatum** (pigeon chest; see Fig. 5.6C) may **displace the heart and affect palpation** and **auscultation**.
- **Midline Sternotomy Scar** usually indicates **previous valve replacement** or **coronary artery bypass surgery**, in which case it may be accompanied by saphenous vein or radial artery graft harvest scars.
- **Left Submammary Scar** is usually the result of **mitral valvotomy** or **transapical transcatheter aortic valve implantation**.
- **Infraclavicular Scars** are seen after **PACEMAKER** or **DEFIBRILLATOR IMPLANTATION**, and the bulge of the device may be obvious.



Palpation

1. **Apex beat** may be visible on inspection
   - defined as 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**.
   - Normally **IN THE FIFTH LEFT INTERCOSTAL SPACE AT, OR MEDIAL TO, THE MID-CLAVICULAR LINE .**

Normal apical impulse : briefly lifts your fingers and is localised.

- The apex beat may be :

✓ **Impalpable** in overweight or muscular people, or in patients with asthma or emphysema .

✓ **Displaced** inferiorly and laterally in left ventricular dilatation, such as after myocardial infarction or in dilated cardiomyopathy.

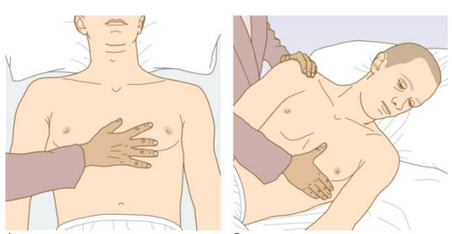
✓ **On The Right Side** In dextrocardia the cardiac apex is palpable but this condition is uncommon, with a prevalence of 1:10,000.

✓ **Forceful but undisplaced** apical impulse in Left ventricular hypertrophy, as in hypertension or severe aortic stenosis.

- The ‘tapping’ apex beat in mitral stenosis represents a palpable first heart sound and is not usually displaced.
- Double apical impulse is characteristic ofhypertrophic cardiomyopathy.

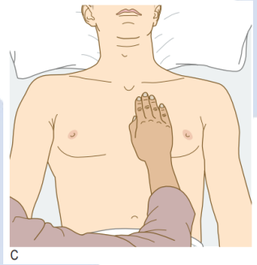
Exam Sequence :

- Place your **right hand flat over the precordium to obtain a general impression of the cardiac impulse** (Fig. 4.18A).
- Locate the apex beat by laying your fingers on the chest **parallel to the rib spaces;** if you cannot feel it, ask the patient to roll on to their left side.



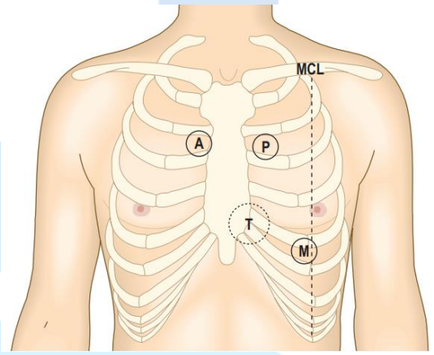
2. **Heave** is a palpable impulse that noticeably lifts your hand.

- Apply the heel of your **right hand** firmly to the **left parasternal area** and feel for a **right ventricle heave**. Ask the patient to hold their breath in expiration.
- Pulsation over the **left parasternal area (right ventricular heave)** indicates **right ventricular hypertrophy** or **dilatation**, most often accompanying **Pulmonary Hypertension.**



3. **Thrill** (Palpable Murmur)

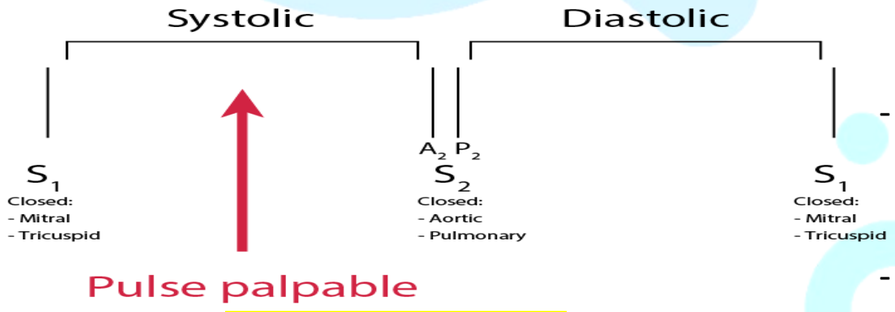
- is the **tactile equivalent of a murmur** and is a **PALPABLE vibration**.
- Palpate for thrills at the **apex** and **on both sides of the sternum** using **the FLAT of your fingers.**
- The most common thrill is that of **aortic stenosis**, which is usually **palpable over the upper right sternal border.**
- The thrill caused by **a ventricular septal defect** is best felt at **the left and right sternal edges**.
- Diastolic thrills are very rare.



There should be **No Parasternal Heave** or **Thrill.**

Auscultation

A. Heart sounds



- Normal heart valves make a sound **only when they close**. The 'lub-dub' sounds are caused by **closure of the atrioventricular** (mitral and tricuspid) valves followed by **the outlet (aortic and pulmonary) valves.**

A- First heart sound 'lub'

- is caused by closure of the mitral and tricuspid valves at the **onset of ventricular systole.**
- It is best heard at **the apex.**
- In **mitral stenosis** the intensity of S1 is increased due to elevated left atrial pressure.

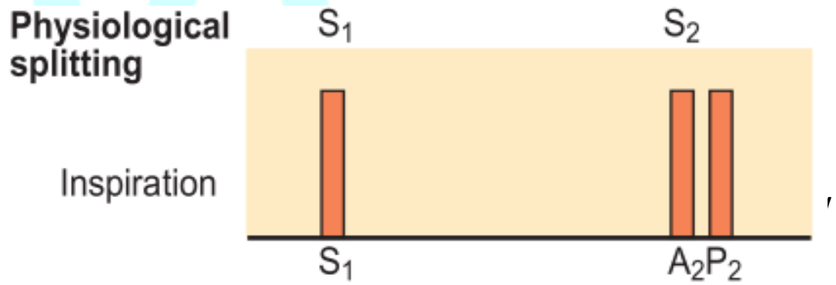
B- Second heart sound 'dub

- is caused by closure of the pulmonary and aortic valves at the **end of ventricular systole** .
- is best heard at the **left sternal edge.**
- It is **louder** and higher-pitched than the S1 'lub', and the **aortic component** is **normally louder** than the **pulmonary component**.
- The aortic component of S2 is sometimes **quiet** or **absent in calcific aortic stenosis** and **reduced in aortic regurgitation** (Box 4.19).
- The aortic component of S2 is loud in systemic hypertension, and the pulmonary component is increased in pulmonary hypertension

Splitting Of S2 :

1. Physiological splitting of S2 occurs because **left ventricular contraction slightly precedes that of the right ventricle** so that the aortic valve closes before the pulmonary valve.

- This splitting **increases** at **end-inspiration** because increased venous filling of the right ventricle further delays pulmonary valve closure. The separation disappears on expiration (Fig. 4.20).
- On auscultation, 'lub d-dub' (inspiration) 'lub-dub' (expiration) is heard.



2. <u>Wide splitting of S2</u> with **normal respiratory variation**.

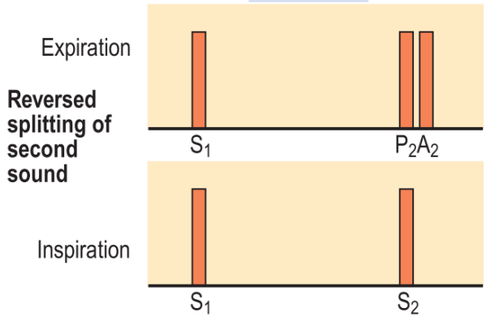
- occurs in conditions that **delay right ventricular emptying**, such **as right bundle branch block** or **Pulmonary Hypertension.**

3. <u>Fixed splitting of S2</u> with **NO VARIATION** with respiration.

- is a feature of **ATRIAL SEPTAL DEFECT** (Fig. 4.21). In this condition the right ventricular stroke volume is larger than the left, and **the splitting is fixed because the defect equalises the pressure between the two atria** throughout the respiratory cycle.

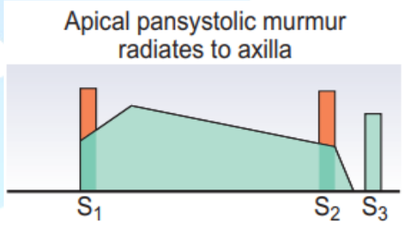
4. <u>Reversed splitting</u>

- the two components of S2 occur together on inspiration and **separate on expiration** (see Fig. 4.20). This occurs when **left ventricular emptying is delayed** so that the aortic valve closes after the pulmonary valve.



- Examples : **Left Bundle Branch Block** & **Left Ventricular Outflow Obstruction.**

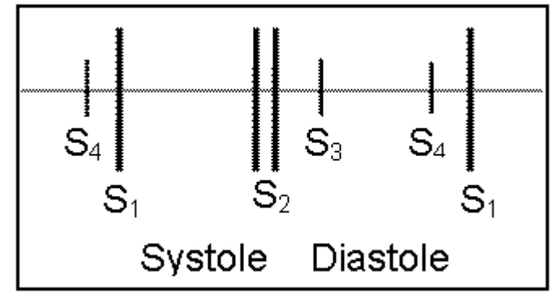
C- Third heart sound



- is a low-pitched **early diastolic sound.**
- best heard with **the bell at the apex**.
- It coincides with **RAPID VENTRICULAR FILLING** immediately after opening of the atrioventricular valves and is therefore heard after the second heart sound as 'lub-dub-dum'.
- **Normal Physiological Finding** in **children**, **young adults** and **febrile patients,** and **during pregnancy.**
- **but is usually pathological** after the age of 40 years. The most common causes are **left ventricular failure**, when it is an early sign, and **mitral regurgitation**, due to volume loading of the ventricle.

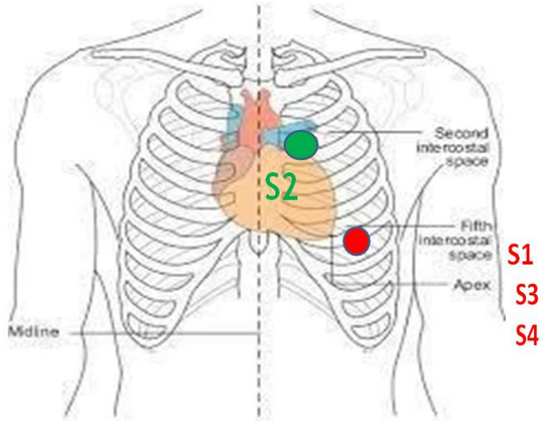
D- Fourth heart sound is less common.

- It is soft and low-pitched, best heard **with the bell at the apex**.
- It occurs **just before S1 (da-lub-dub).**
- **Always Pathological** and is caused by **forceful atrial contraction against a non-compliant or stiff ventricle**.
- heard with **left ventricular hypertrophy** (due to hypertension, aortic stenosis or hypertrophic cardiomyopathy).
- It **CANNOT** occur when there is **atrial fibrillation.**



✓ **Atrial gallop**= S4 gallop= S4+ tachycardia

✓ **Ventricular gallop =** S3 gallop= S3+tachycardia In HF.

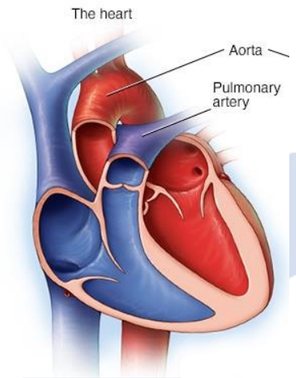


B. <u>Added Sounds</u>

A- Murmurs

- Produced by **turbulent flow** across an **abnormal valve, septal defect** or **outflow obstruction.**
- **'Innocent' Murmurs** :
  are caused by **increased velocity of flow** through **Normal Valve** and occur when **stroke volume is increased**, as in **pregnant women, athletes with resting bradycardia** or **patients with fever**.
- **Examination includes:**
  - ✓ **Timing And Duration**
  - ✓ **Character/Pitch And Intensity**
  - ✓ **Location And Radiation**

RULES :



- **A = P , M = T**
- **AS. MR. & VSD are Systolic Murmurs**
  - Ejection + Systolic / Early + Diastolic = A & P .
  - Pan (Holo), Late + Systolic / Mid + Diastolic = M & T
- **Systolic Murmurs are Strong → Radiate**
  - AS → To Carotids
  - MR → Lt Axilla
  - VSD → Rt Sternal Border
- **Diastolic murmurs are weak → Needs Manuvers to best heard.**
  - AR → Sitting & and held breath on expiration
  - MS → Rolling to the left with bell

1. Timing

- Identify the first and second heart sounds, S1 and S2, respectively. It may help to palpate the patient's carotid pulse while listening to the precordium to determine the onset of ventricular systole. Determine whether the murmur is **Systolic** , **Diastolic** Or **Continuous**.

2. Duration

- ✓ **Pansystolic** → The murmurs of MR & TR start with S1, sometimes muffling or obscuring it, and continue throughout systole
- ✓ **Late Systolic** → MVP does not begin until the mitral valve leaflet has prolapsed during systole.
- ✓ **Ejection systolic murmur** AS & PS begins after S1 reaches maximal intensity in mid-systole, then fades, stopping before S2.

3. Character and pitch

- The quality of a murmur is subjective but terms such as harsh, blowing, musical, rumbling and high- or low-pitched can be useful.
- **High-pitched murmurs → high-pressure gradients**, so the **diastolic murmur of AR is higher-pitched than that of MS .**

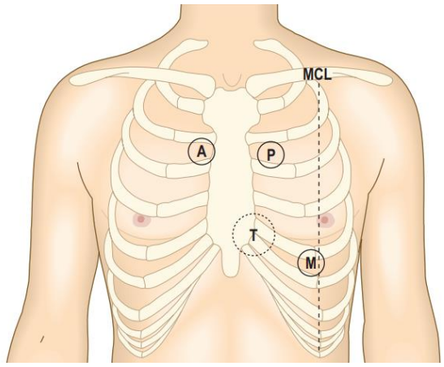
4. Intensity

- Diastolic murmurs are rarely louder than grade 3.
- The **intensity of a murmur does not correlate with severity of valve dysfunction**.
- Rapidly changing murmurs can occur with infective endocarditis because of valve destruction.

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

5. Location



- Record the site(s) where you hear the murmur best. This helps to differentiate diastolic murmurs (mitral stenosis at the apex, aortic regurgitation at the left sternal edge)
- It is less helpful with systolic murmurs, which are often audible across the precordium .

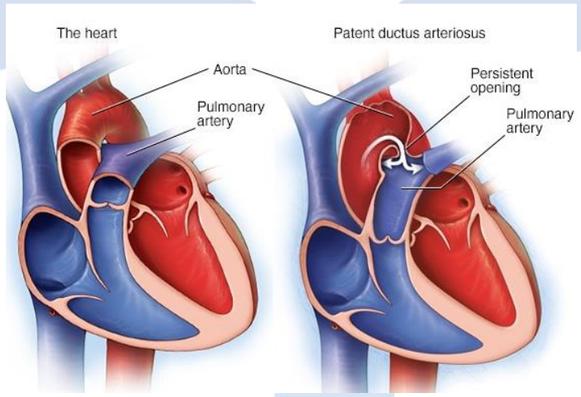
6. Radiation

Differentiate radiation from location.

- Murmurs radiate in the direction of the blood flow to specific sites outside the precordium.
- MR → the **left axilla.**
- VSD → towards the **right sternal edge.**
- Aortic stenosis → suprasternal notch & the **carotid arteries.**

• Continuous Murmurs

- rare in adults.
- The most common cause is a **Patent Ductus Arteriosus**. In the fetus this connects the upper descending aorta and pulmonary artery, and normally closes just after birth.
- The murmur is best heard at the **upper left sternal border** and **radiates over the left scapula.**
- Its continuous character is **'machinery-like'**; as aortic pressure always exceeds pulmonary pressure, there is continuous ductal flow, with the greatest pressure difference in systole.



B- Added sounds

1. Opening Snap

- is commonly heard in **mitral (rarely, tricuspid) stenosis.** It results from **sudden opening of a stenosed valve** and occurs early in diastole, just after the S2 .
- It is best heard with the diaphragm at the apex.

2. Ejection Clicks

- high-pitched sounds best heard with the diaphragm.
- occur early in systole just after the S1, with **congenital PS & AS.**
- do not occur in calcific aortic stenosis because the cusps are rigid.

3. Mid-systolic clicks

- are high-pitched and best heard at the apex with the diaphragm.
- occur in **Mitral Valve Prolapse** and may be associated with a late systolic murmur.

4. Mechanical heart valves

- can make a sound when they **close** or **open**.
- The sounds are **high-pitched, 'metallic' and often palpable, and may even be heard without a stethoscope**.
  - ✓ **Mechanical MITRAL VALVE replacement** makes **a metallic S1** and a sound like a loud opening snap early in diastole .
  - ✓ **Mechanical AORTIC VALVES** have a **loud, metallic S2** and an opening sound like an ejection click at the start of systole . They are normally associated with a flow murmur.

5. Pericardial Rub (Friction Rub)

-is a **Coarse Scratching Sound**, with systolic and diastolic components.
-It is best heard using the diaphragm with the **patient holding their breath in expiration**.

- It is most often heard in **Acute Pericarditis** or a few days after an extensive myocardial infarction.
- **Pleuropericardial Rub** is a similar sound that occurs in time with the cardiac cycle, but is also **influenced by respiration** and is pleural in origin.
- **Pneumopericardium** a 'crunching' noise , caused by gas in Pericardium

Diaphragm & Bell Of The Stethoscope

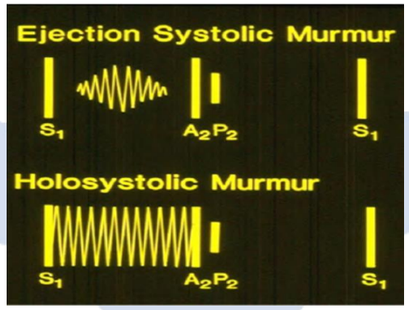
- The diaphragm attenuates all frequencies equally, thus making some **low-frequency sounds less audible**.
- Use the diaphragm to identify the first and second heart sounds, and high-pitched sounds such as the early diastolic murmur of aortic regurgitation.
- Listen with the diaphragm over the whole precordium for a pericardial friction rub.
- **Bell** is particularly useful at the **apex** and **left sternal edge** to listen for the diastolic murmur of **Mitral Stenosis** and **3rd & 4th heart sounds.**

A-Systolic Murmurs

- **Ejection systolic murmurs**

Caused by increased flow through a normal valve (flow orinnocent murmur),or by turbulent flow through an abnormal valve.

- **Pansystolic OR HOLO (like VSD)**



Ejection Systolic Murmurs

- **Increased flow through a normal valve**

Severe anemia/ fever/ athletes/ pregnancy ASD (pulmonary flow murmur) Increased stroke volume (aortic regurgitation)

- **Normal or reduced flow through a stenotic valve**

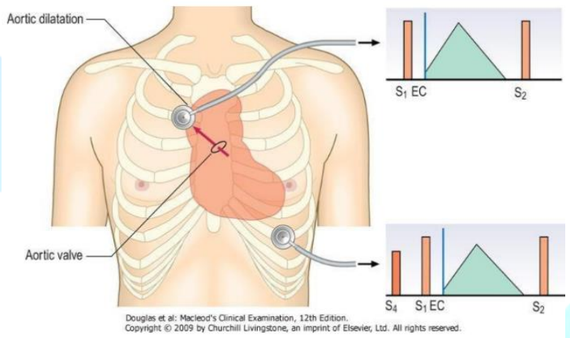
Aortic stenosis / Pulmonary stenosis

- **Subvalvular obstruction** HOCM

1-Aortic Stenosis Murmur

- **Timing**: systolic
- **Duration**: after S1, peaks mid systolic, decrease before S2 (Crescendo- decrescendo murmur)
- **Character**: Harsh, Musical in children
- **Pitch**: high(Audible all over the precordium)
- **Intensity**: May be associated with thrill
- **Location**: Right 2ndICS
- **Radiation**: carotids, suprasternal notch

➔ May follow **ejection click**



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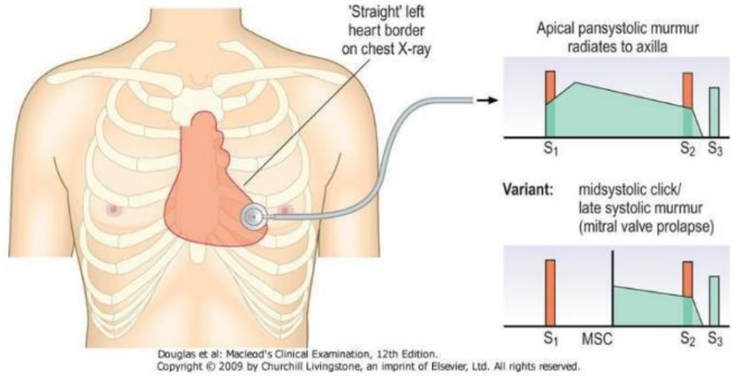
2-Mitral Regurgitation murmur

- **Timing**: systolic
- **Duration**: pansystolic
- **Character**: blowing
- **Pitch**: high
- **Intensity**: may feel a thrill
- **Location**: apex
- **Radiation**: Left axilla



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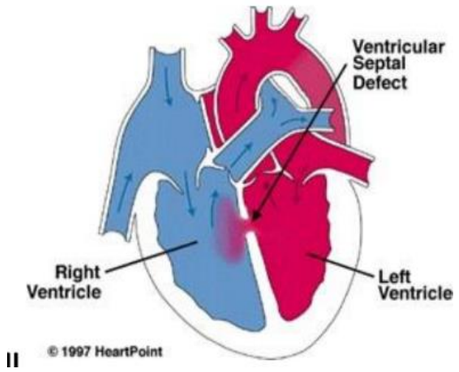
In Mitral Valve Prolapse, regurgitation begins in mid-systole producing a late murmur.

3-Tricuspid Regurgitation

- Heard at the **lower left sternal edge**
- Prominent **V wave in the JVP**
- **Pulsatile liver**

4-Ventricular Septal Defect

- Loud murmur
- At the left sternal border
- Radiates to the right sternal border
- Associated with thrill
- Pansystolic
- Acquired VSD in septal rupture post-MI



B-Diastolic Murmurs

- **Early diastolic murmurs**

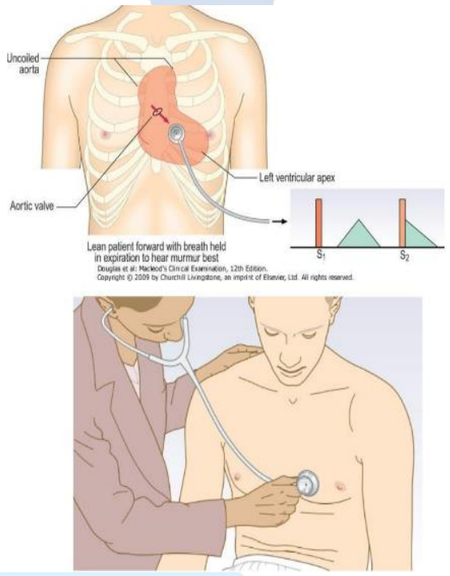
Aortic and Pulmonary regurgitation

- **Mid diastolic murmurs**

Mitral stenosis and Austin flint murmur

1-Aortic Regurgitation

- **Timing:** early diastolic
- **Pitch:** low (ask the pt to lean forward and hold his breath in expiration)
- **Location:** 2 areas (Rt 2nd intercostal space, Lt third intercostal space- Erb's area)
- Can be associated with systolic flow murmur



Austin Flint Murmur

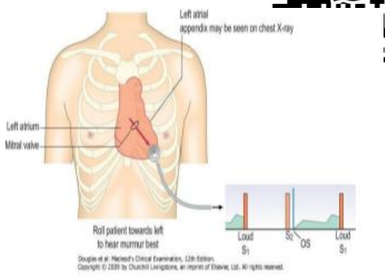
- Mid-diastolic murmur that accompanies aortic regurgitation
- Caused by **regurgitant jet striking the anterior leaflet of the mitral valve**, restricting the inflow to the left ventricle

2-Pulmonary Regurgitation

- May be Pulmonary regurgitation caused by **pulmonary dilatation in pulmonary hypertension** **(Graham Steel murmur)**
- OR Congenital defect of the pulmonary valve

3- Mitral Stenosis

- **Timing**: Mid - late diastolic
- **Character**: blowing
- **Pitch**: low (ask the pt to turn to the left) Using the bell
- **Location:** apex
- May follow **Opening Snap**



C- Continuous Murmurs

- **Patent Ductus Arteriosus is MCC**
- **Timing**: systolic and diastolic
- **Duration**: continuous
- **Character**: machinery-like
- **Pitch**: high pitch, louder in systolic
- **Location**: left infra clavicular
- **Radiation**: left scapula