HEART SOUNDS AND MURMURS

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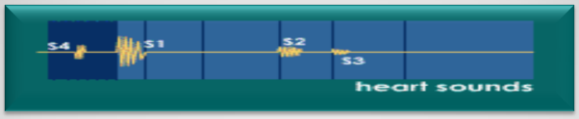
Cardiac Cycle

HEART SOUNDS

HEART SOUNDS

- **Detected over anterior chest wall by:**
  - **Auscultation:** … (Stethoscope)

  - **Phonocardiography:** (sound recording device)



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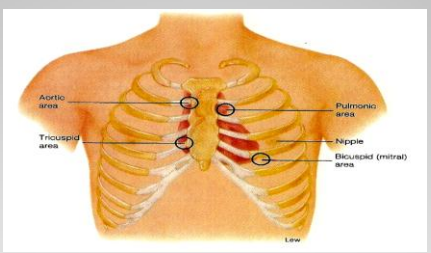
HEART SOUNDS' WINDOWS

- **Best heard at 4 certain areas:**



- **Pulmonary area:**
  - 2nd Lt intercostal space
- **Aortic area:**
  - 2nd Rt costal cartilage
- **Mitral area:**
  - 5nd Lt intercostal space crossing mid-clavicular line, or
  - 9 cm (2.5-3 in) from sternum
- **Tricuspid area:**
  - lower part of sternum towards Rt side

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How many heart sounds?

- '4' heart sounds:
  - 1st & 2nd ht sounds … (usually heard)
  - 3rd & 4th ht sounds … (sometimes detected)

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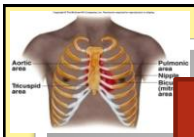

Different Heart Sounds

	S1	S2	S3	S4
Cause	Sudden closure of AV-vs	Sudden closure of semilunar vs	Rush of bl during rapid vent filling → vibration of vent ms.	Vibration produced by cont of atrial ms (attributed to vent filling)
C-cycle	Marks beginning of vent systole (Isovolumetric cont)	Marks beginning of vent diastole (When vent press fall below arterial press)	Max vent filling phase of diastole	Atrial systole (just before 1st HS)
Duration	0.15 sec (Longer)	0.11-0.125 sec (Shorter)	0.05 sec	0.04 sec
Frequency	25-35 Hz	50 Hz		
Character	Low pitch (LUB) (Louder)	High pitch (DUB) (Softer, sharper) Split into 2 sounds during inspiration = Physiological splitting (due to delay closure of pulm v).	Usually not audible	Usually not audible (Rarely heard)
Best heard	M & T	A & P	M	M

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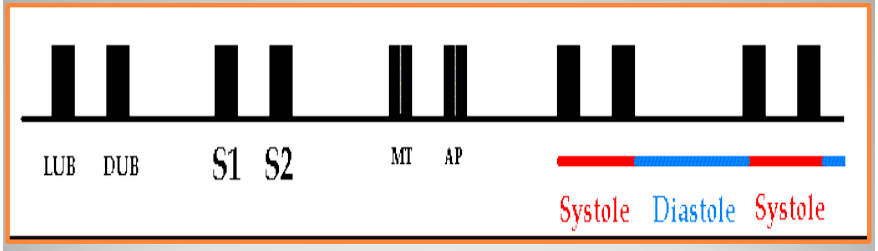
Normal Heart Sounds



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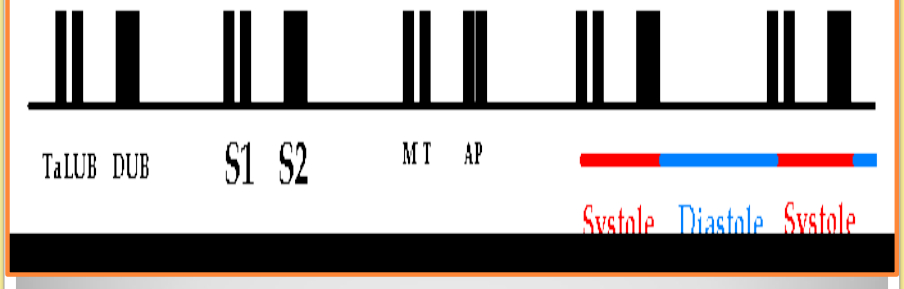
Split (S1)



S4

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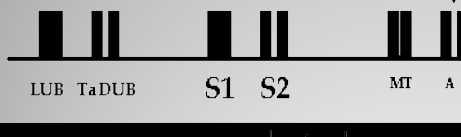
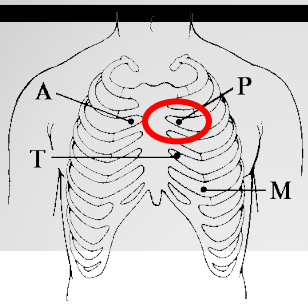
Split (S2)

Physiological splitting during INSPIRATION



S3



ABNORMAL CONDUCTION

1. **Fixed split S2**
2. **Paradoxical split**

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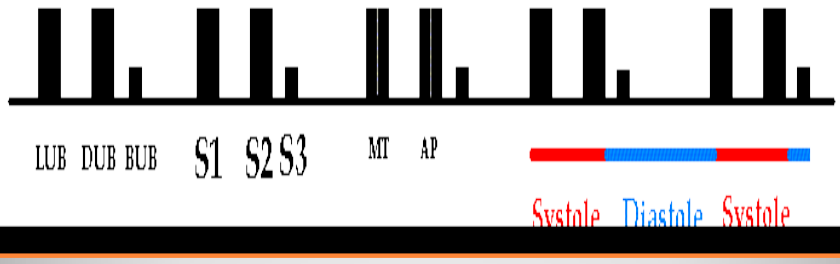
(S3)



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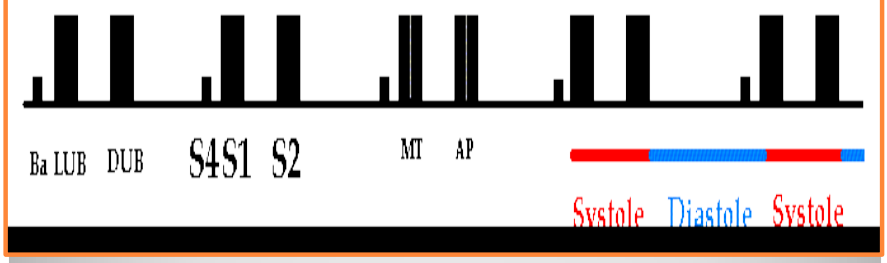
(S4)



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Significance of heart sounds?

Important for diagnosis of valvular heart diseases and abnormal heart sounds (murmurs)

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WHAT MAKES NOISES IN THE HEART?

- **Valves closing:**
  - Atrioventricular (S1), &
  - Semilunar (S2)
- **Increased flow across normal valves:**
  - In pregnancy, anemia, or hyperthyroidism
- **Turbulent flow through an abnormal valve**
- **Blood striking the left ventricle:** S3 & S4

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HEART MURMURS

= **Abnormal extra heart sounds heard during cardiac cycle, produced by turbulence of blood flow through the heart & its valves**

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Causes of Heart Murmurs

1. **Physiological Murmurs:**
   ↑ blood flow across normal valves:
   e.g. in pregnancy, hyperthyroidism, anemia, fever, children

2. **Pathological Murmurs: (? Congenital)**
   Turbulent flow through abnormal valves, or septal defect:
   e.g. tight valve (stenosis), or leaky valve (regurgitation or insufficiency)

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How to Describe Heart Murmurs?

- Timing (systolic or diastolic)
- Shape
- Location
- Radiation
- Intensity
- Pitch
- Quality

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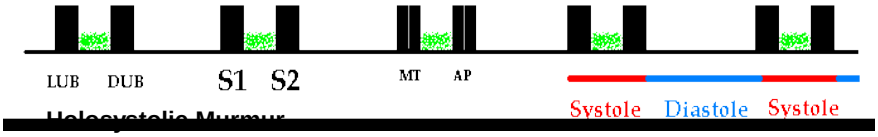
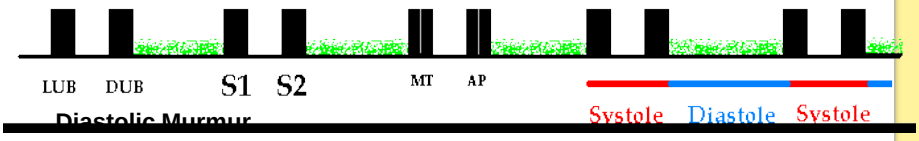
Describing a heart murmur

1. Timing

- Systolic, diastolic, or continuous
- Can be distinguished from heart sounds by palpation of carotid arterial pulse
- Murmurs are longer than heart sounds



Holosystolic Murmur



Diastolic Murmur

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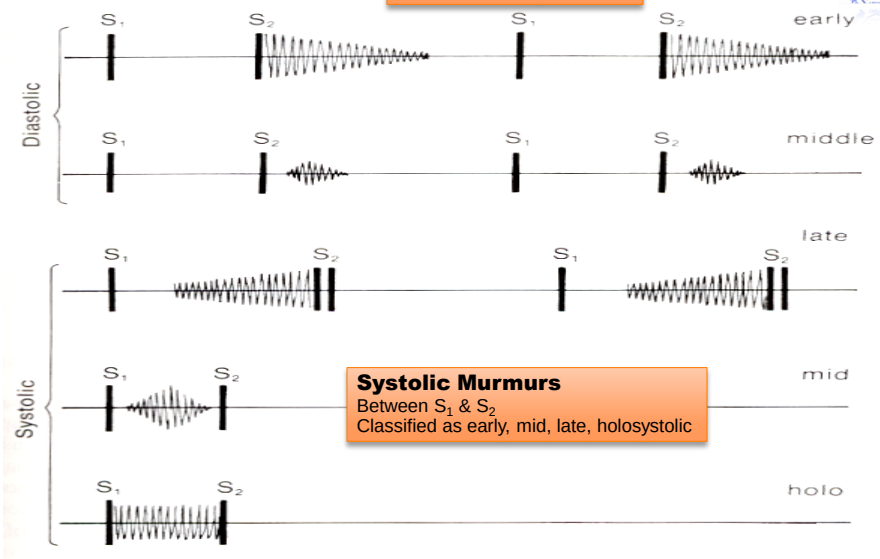
Diastolic Murmurs
Between S_2 & S_1
Classified as early, mid, late



Systolic Murmurs
Between S_1 & S_2
Classified as early, mid, late, holosystolic

FIGURE 12–3. Murmurs described according to position in the cardiac cycle.

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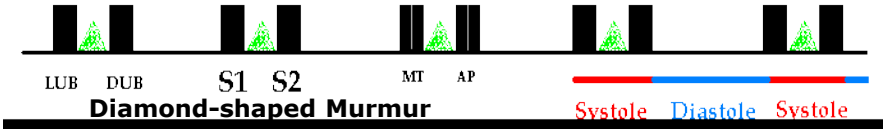
Describing a heart murmur … (Cont.)

2. Shape

Crescendo (grows louder), decrescendo, crescendo-decrescendo, plateau



Diamond-shaped Murmur

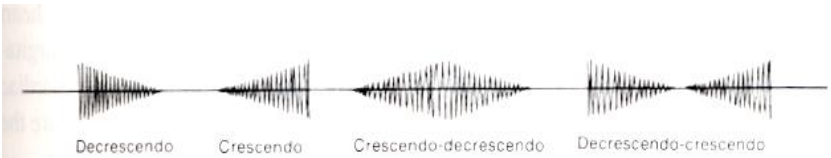


FIGURE 12–4. Murmurs described according to the waxing and waning of the sound.

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Describing a heart murmur … (Cont.)

3. Location of maximum intensity

Determined by the site where the murmur originates e.g. A, P, T, M listening areas

4. Radiation

Reflects intensity of the murmur & direction of blood flow

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Describing a heart murmur ... (Cont.)

5. Intensity

Graded on a 6 point according to Levine scale:

Grade 1 = lowest intensity - very faint

Grade 2 = low intensity - quiet but heard immediately

Grade 3 = medium intensity - moderately loud

Grade 4 = medium intensity - loud

Grade 5 = loud intensity - heard with stethoscope partly off the chest

Grade 6 = loudest intensity - no stethoscope needed

***Note: Thrills are assoc. with murmurs of grades 4 - 6**

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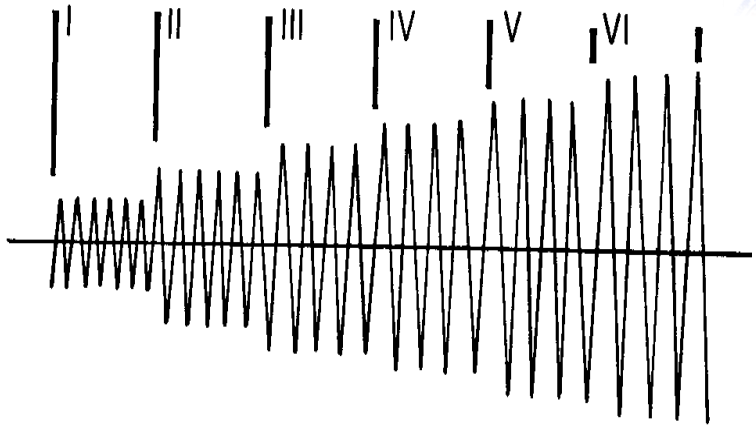

FIGURE 12–2. Classification of murmurs by loudness.

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Heart murmurs Intensity

I / VI	need quiet room and trained ear to hear. (difficult to hear even by expert listeners)
II / VI	audible to anyone who listens attentively (usually audible by all listeners)
III / VI	loud, but not palpable (easy to hear even by inexperienced listeners, but without a palpable thrill)
IV / VI	loud and palpable: it produces a precordial thrill
V / VI	audible with your stethoscope placed perpendicular to chest wall
VI / VI	audible without a stethoscope

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Describing a heart murmur … (Cont.)

6. Pitch

High, medium, low

7. Quality

Blowing, harsh, rumbling, & musical

8. Others:

i. Variation with respiration

Right sided murmurs change > left sided

ii. Variation w position of patient

iii. Variation w special maneuvers

Valsalva ⇒ Murmurs ↓ in length & intensity

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COMMON MURMURS AND TIMING:

I. Systolic Murmurs: Harsh, turbulent flow

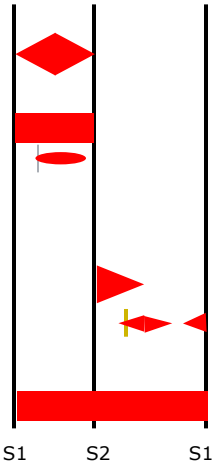
1. Aortic stenosis – ejection murmur
2. Pulmonary stenosis – ejection murmur + spilling S2
3. Mitral / Tricuspid regurgitation – holosystolic
4. Mitral valve prolapse – mid-late systole
5. Ventricular septal defect (VSD)

II. Diastolic Murmurs: Softer, blowing, gurgle

1. Aortic regurgitation - early diastole
2. Mitral stenosis - mid to late (pre-systolic)diastole

III. Continuous Murmurs:

1. Patent ductus arteriosus (PDA)
2. ? Ventricular septal defect (VSD)



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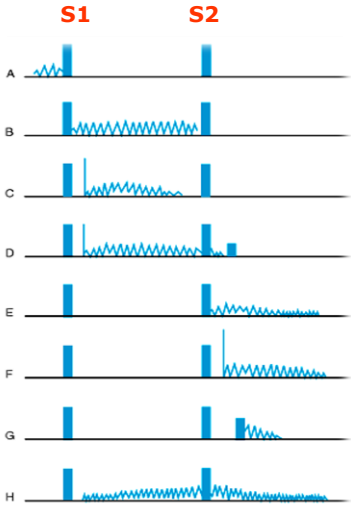
Common Murmurs and Timing ... (Cont.)



A. Presystolic murmur (Mitral/Tricuspid stenosis)

B. Mitral/Tricuspid regurgitation (holosystolic murmur)

C. Aortic stenosis (ejection murmur)

D. Pulmonic stenosis (ejection murmur + spilling S2)

E. Aortic/Pulm. diastolic murmur (early diastole)

F. Mitral stenosis w/ Opening snap (mid diastole)

G. Mid-diastolic inflow murmur

H. Continuous murmur of PDA

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Systolic Murmurs

Early systolic

Mid Systolic (ejection)

Late systolic

Pansystolic (holosystolic)

SYSTOLIC MURMURS

- **Derived from ↑ turbulence**
- **Associated with:**
  1. ↑ flow across normal valve, or into a dilated great vessel
  2. Flow across an abnormal valve, or narrowed ventricular outflow tract - e.g. aortic stenosis
  3. Flow across an incompetent AV valve - e.g. mitral regurgitation
  4. Flow across the interventricular septum

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MIDSYSTOLIC (EJECTION) MURMURS

- The most common kind of heart murmur
- Usually crescendo-decrescendo
- They ? be:

1. **Innocent**
   Common in children & young adults
2. **Physiological**
   Can be detected in hyperdynamic states
   e.g. **anemia**, **pregnancy**, **fever**, & hyperthyroidism
3. **Pathological**
   Secondary to structural CV abnormalities
   e.g. **Aortic stenosis**, Hypertrophic cardiomyopathy, Pulmonary stenosis

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Aortic Stenosis:

Narrowing of aortic outflow tract causing obstruction of flow from LV into ascending aorta

- **T-** mid-systolic (ejection) murmur
- **L-** best heard @ apex- aortic area, radiates to carotids
- **C-** harsh, loud, may have associated thrill, "ejection click"
- **A-** older age, bicuspid aortic valve, rheumatic fever

Note: T- Timing; **L-** Location; **C-** Character; **A-** Association

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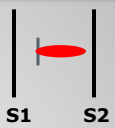
Mitral Prolapse

Bulging of one or both mitral valve leaflets into the left atrium during LV systole



- **T-** mid- late systolic murmur
- **L-** best heard @ apex
- **C-** mid systolic click
- **A-** ~5% normal population, asymptomatic, ? sudden death

Note: T- Timing; **L-** Location; **C-** Character; **A-** Association

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PANSYSTOLIC (HOLOSYSTOLIC) MURMURS

- Pathological murmur
- Begins immediately with S1 & continues up to S2

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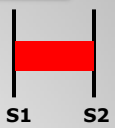
Mitral Regurgitation

Retrograde flow from LV through an incompetent mitral valve into LA

- **T**- holosystolic murmur
- **L**- best heard @ apex, radiates to left axilla
- **C-** soft, high-pitched, blowing
- **A**- MV prolapse, MV myxomatous degeneration, MI, rheumatic heart disease, cardiomyopathy, endocarditis



Note: T- Timing; **L-** Location; **C-** Character; **A-** Association

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Diastolic Murmurs

Early diastolic

Mid diastolic

Late diastolic

DIASTOLIC MURMURS

- Almost always indicate heart disease
- Two basic types:

1. **Early decrescendo diastolic murmurs**
   Signify regurgitant flow through an incompetent semilunar valve
   e.g. **aortic regurgitation**
2. **Rumbling diastolic murmurs in mid- or late diastole**
   Suggest stenosis of an AV valve
   e.g. **mitral stenosis**

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Aortic Regurgitation

Retrograde flow from aorta into LV through incompetent aortic cusps

- **T-** diastolic (early) murmur
- **L-** best heard @2nd-4th left intercostal spaces
- **C-** high-pitched, blowing, decrescendo
- **A-** aortic root degeneration, rheumatic heart disease, VSD w/aortic valve prolapse (kids)

Note: T- Timing; **L-** Location; **C-** Character; **A-** Association

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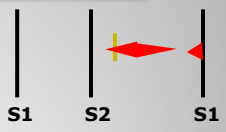
Mitral Stenosis

Obstruction of flow from left atrium to left ventricle because of a narrowed mitral orifice (Valve becomes thickened & calcified)

- **T-** diastolic (mid-diastolic, or pre-systolic) murmur with 'opening snap'
- **L-** best heard @ apex
- **C-** low pitched (heard with bell)
- **A-** rheumatic fever



Note: T- Timing; **L-** Location; **C-** Character; **A-** Association

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Mitral Stenosis … (Cont.)

- First heart sound (S1) is accentuated & snapping
- Opening snap (OS) after aortic valve closure
- Low pitch diastolic rumble at the apex
- Pre-systolic accentuation (esp. if in sinus rhythm)

N.B. Accumulation of blood in LA ? Cause pulmonary HTN

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Continuous Murmurs

Continuous Murmurs

- Begin in systole, ? peak near S2 & continue into all or part of diastole

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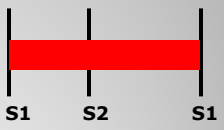
Patent Ductus Arteriosus

Failure of the duct to close between pulmonary artery & aorta

- **T-** continuous murmur
- **L-** best heard @ upper left sternal border
- **C-** machine-like
- **A-** left to right shunt, cyanosis



Note: T- Timing; **L-** Location; **C-** Character; **A-** Association

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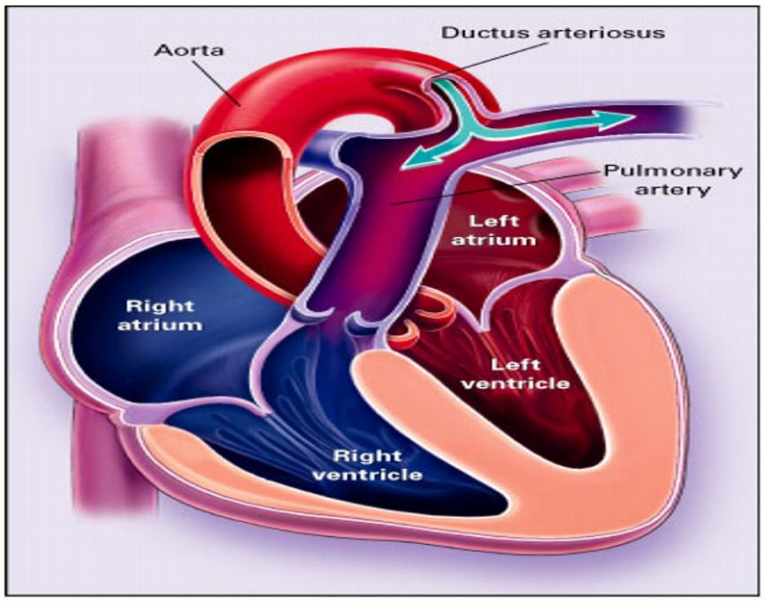

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Thank You