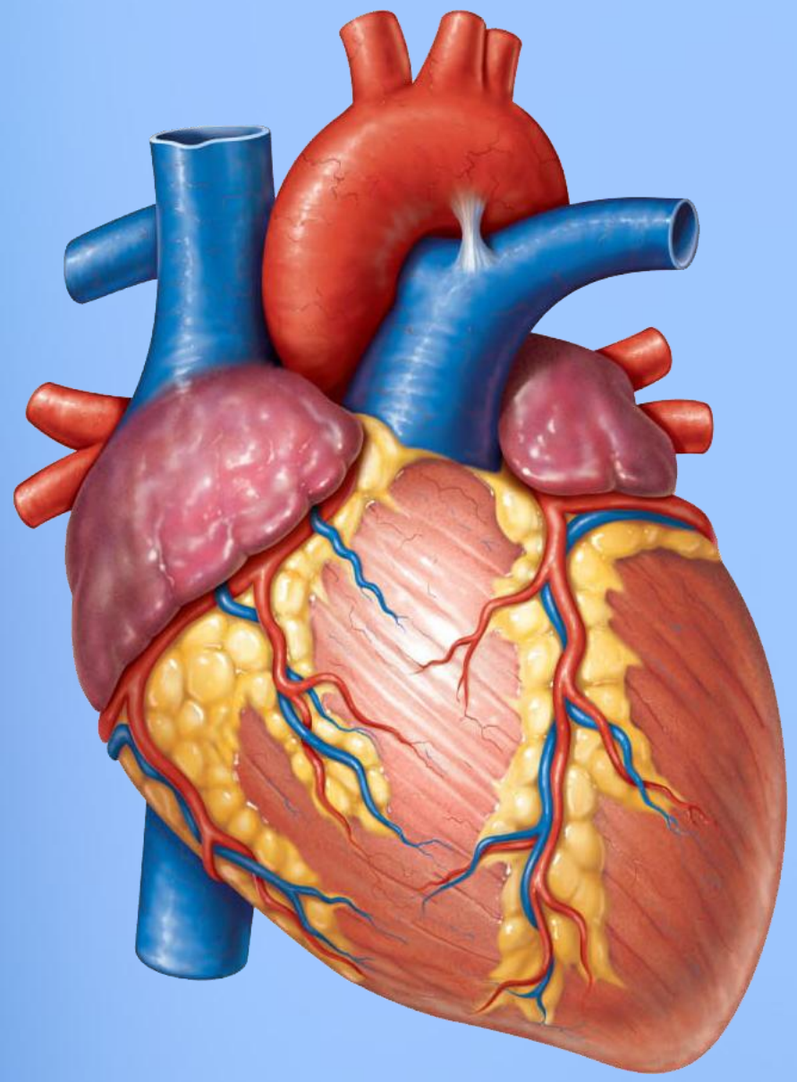
8

HEART SOUNDS & MURMURS



Cardiovascular Block

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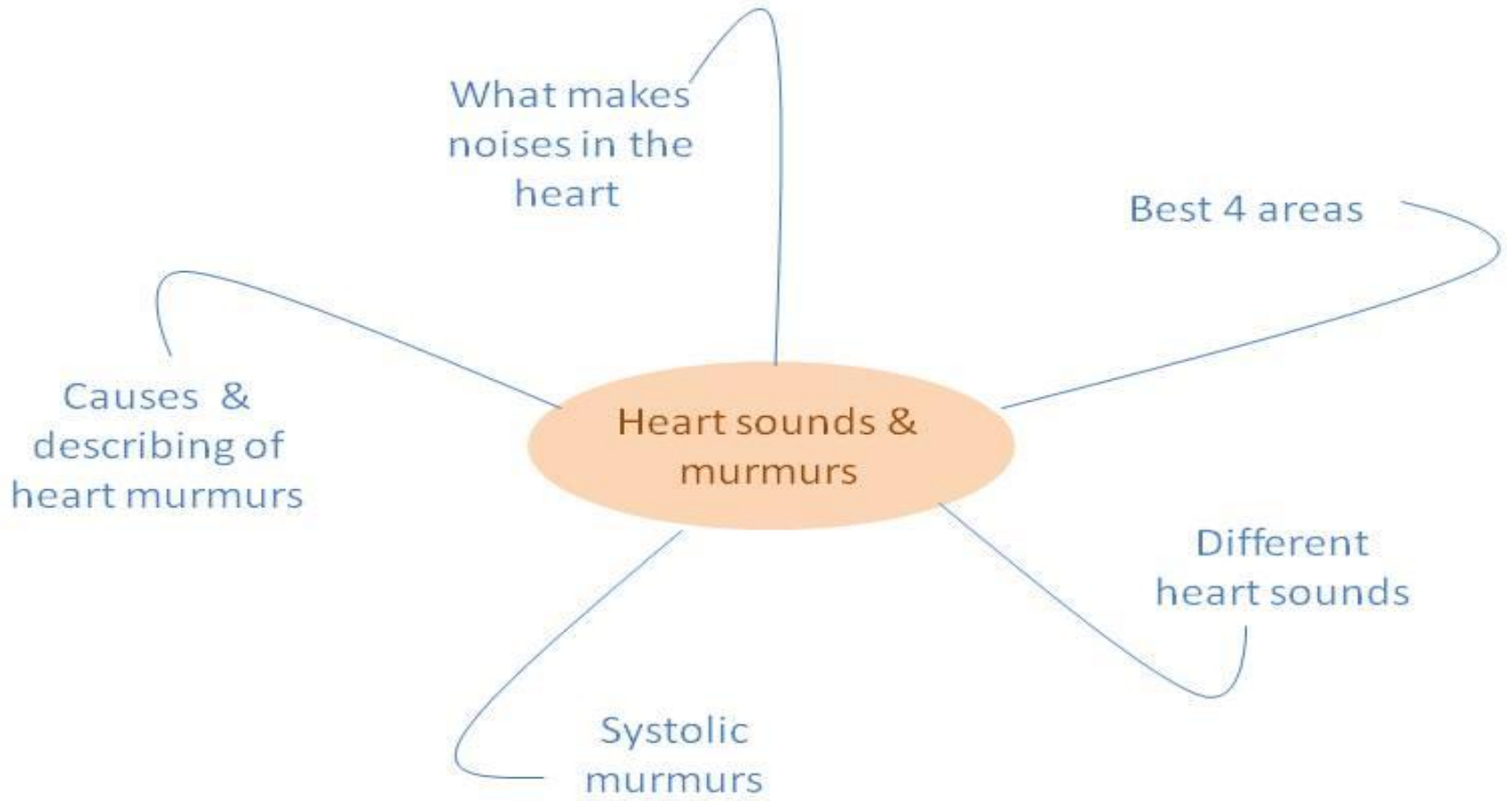

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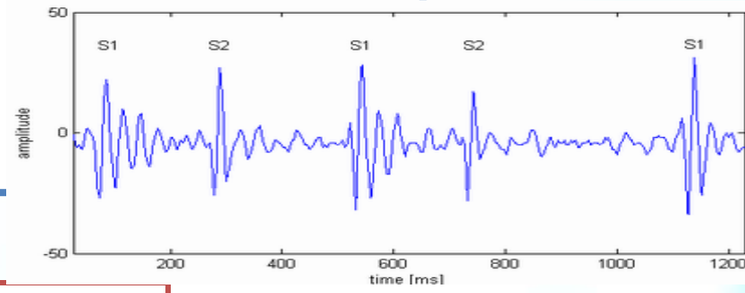
Heart Sounds (HS)

Detected over the anterior chest wall by:

Auscultation: Stethoscope (via hearing)

Phonocardiography: Sound recorder device (HS is recorded on a piece of paper)



There are 4 HS:

- 1st and 2nd HS : very clear and are heard easily
- 3rd and 4th HS : sometimes detected

HS are BEST heard at 4 certain areas:

- **Pulmonary area:**

2nd LEFT intercostal space

- **Aortic area:**

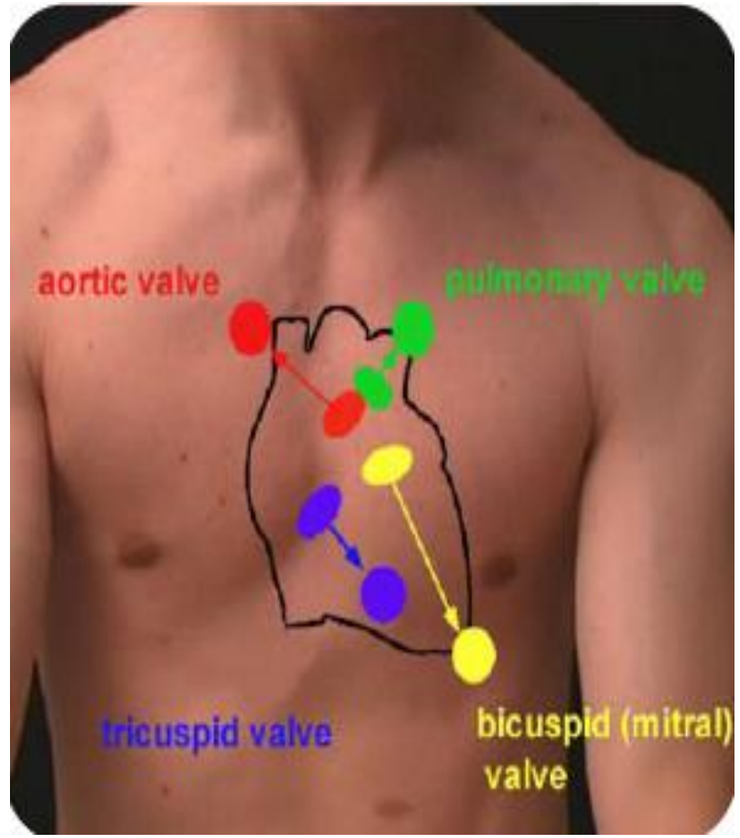
2nd Right costal cartilage

- **Mitral area:**

5th LEFT intercostal space, crossing midclavicular line OR 9cm from sternum

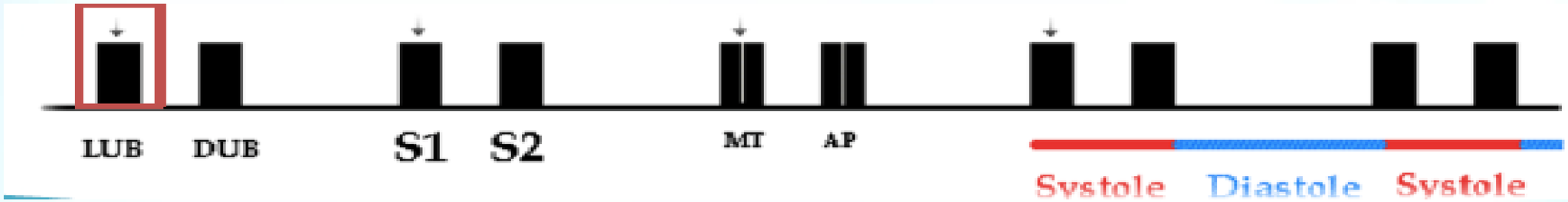
- **Tricuspid area:**

LOWER part of sternum

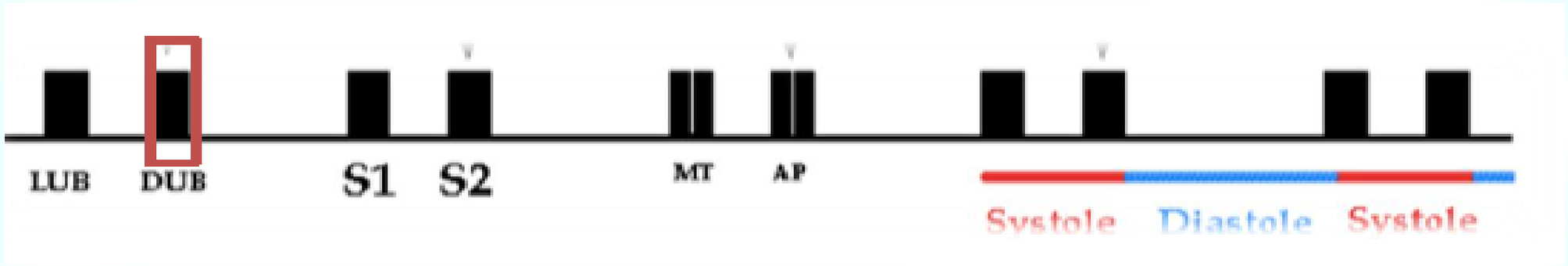


	S1	S2	S3	S4
Cause	Sudden closure of AV valves	Sudden closure of SEMILUNAR valves	Rush of blood to the vent. during the rapid ventricular filling	Contraction of the atrial muscles
Cardiac Cycle	Beginning of vent. Systole (Isovolumetric contraction)	Beginning of vent. Diastole (Isovolumetric relaxation)	Rapid (max) vent. filling phase of diastole	Atrial Systole
Duration	0.15 sec	0.11-0.125 sec	0.05 sec	0.04 sec
Frequency	25-35 Hz	50 Hz	----------	----------
Characteristics	•Low bitch •LUB •Loudest HS	•High bitch •DUB •Softer and sharper •Split into 2 sounds during inspiration (due to delay closure of pulmonary v).	•Very low bitch •**Heard in children**	•Very low pitch •**Heard in elderly**
Best heard	Mitral & Tricuspid	Aortic & Pulmonary	Mitral	Mitral

S1



S2

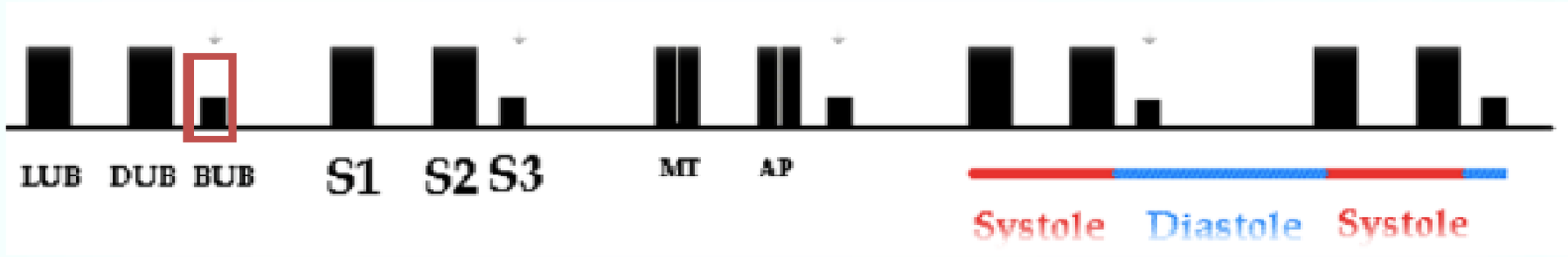


Physiological split

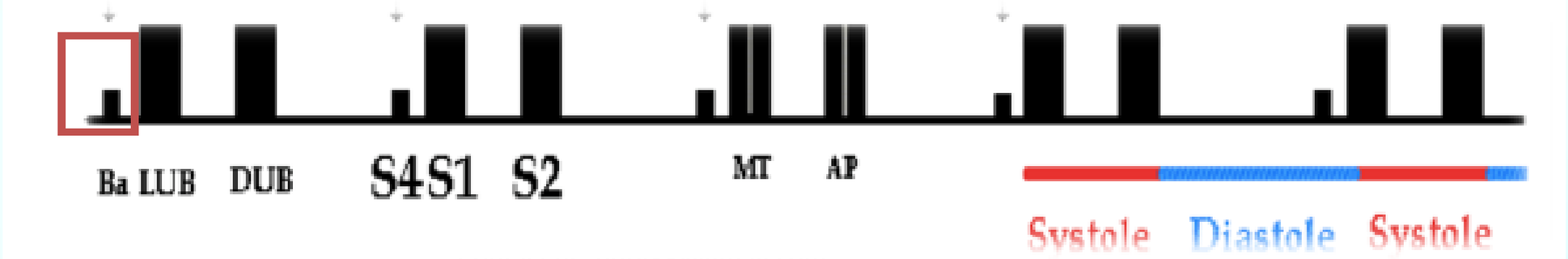
due to the closure of the PULMONARY valves

NB It is in S2 phase

S3



S4



WHAT MAKES NOISES IN THE HEART?

Valves closing :

- Atrio-ventricular (AV valve) == **S1**
- Semilunar valves == **S2**

} **Normal**

Increased intra-cardiac hemodynamic:

- Blood striking the left ventricle:== **S3 & S4**
- Increased flow across normal valves

} **Normal**

- Turbulent flow through an abnormal valve
- Turbulent flow through septal defect

} **Pathological**

SIGNIFICANCE OF HS ?

Important for the diagnosis of abnormal HS **(Murmurs)**

Murmurs are **longer** than HS

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CAUSES OF HEART MURMURS

Physiological Murmurs

↑ blood flow across normal valves:

eg.

- pregnancy
- anemia
- fever
- children

Pathological Murmurs

1- Congenital

2- Turbulent blood flow through abnormal valves or septal defect:

eg.

- tight valves (stenosis)
- leaky valves (regurgitation)

MURMURS ARE DESCRIBED ACCORDING TO

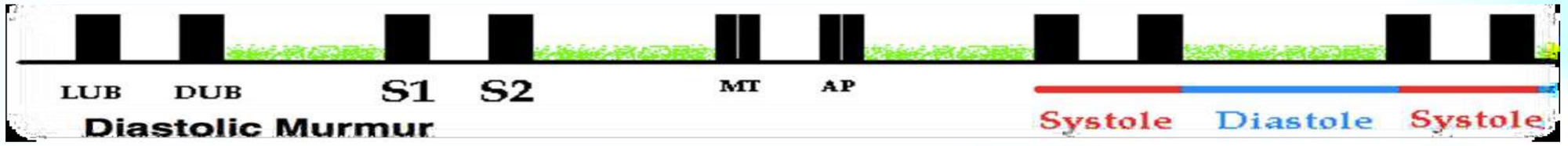
- ❖Timing
- ❖Shape
- ❖Location
- ❖Radiation
- ❖Intensity
- ❖Pitch
- ❖Quality

1. Timing

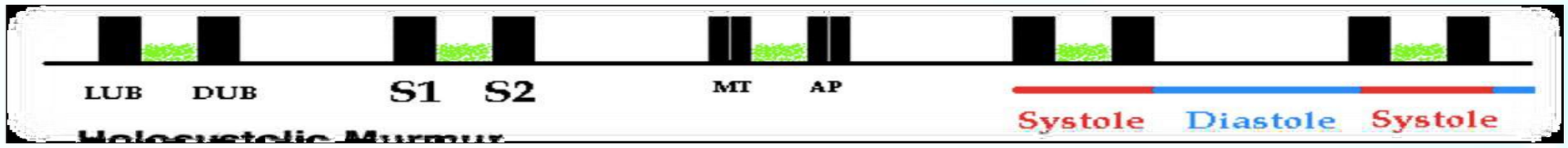
Murmurs are described according to their position in the cardiac cycle

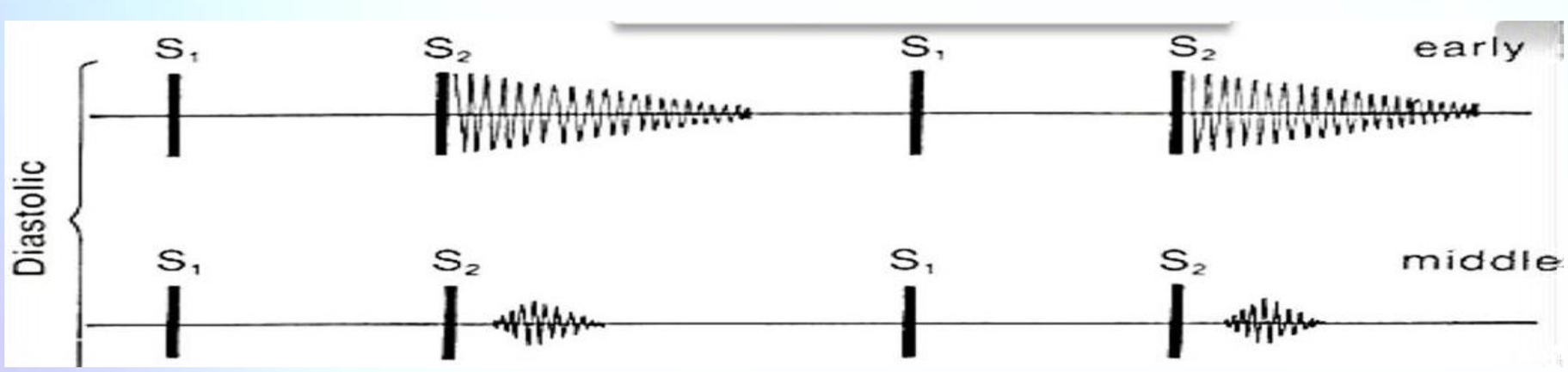
Systolic **Diastolic** **Continuous**

Diastolic murmur



Holosystolic "Pansystolic" murmur





Diastolic murmurs

- Between **S2 & S1**
- Classified as early, mid &late

Systolic murmurs

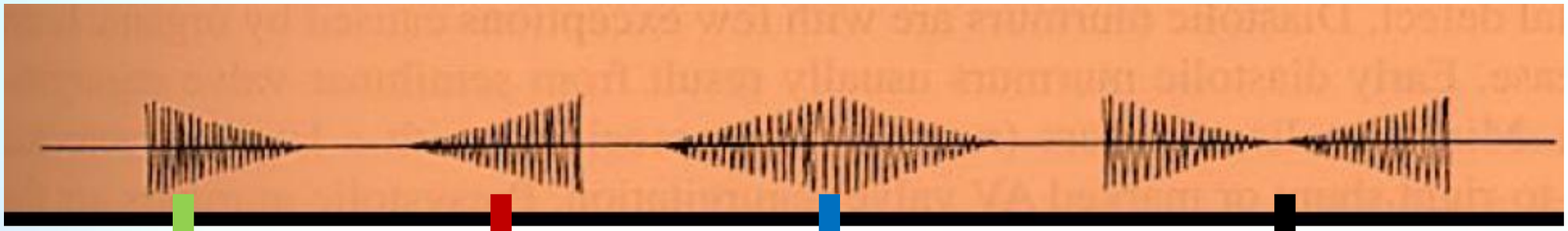
- Between **S1 & S2**
- Classified as early, mid, late & holosystolic

Valve	Abnormality	Time of murmur
Semilunar valves (aortic and pulmonary valves)	Stenosis	Systolic
	Regurgitation	Diastolic
Mitral valves	Stenosis	Diastolic
	Regurgitation	Systolic

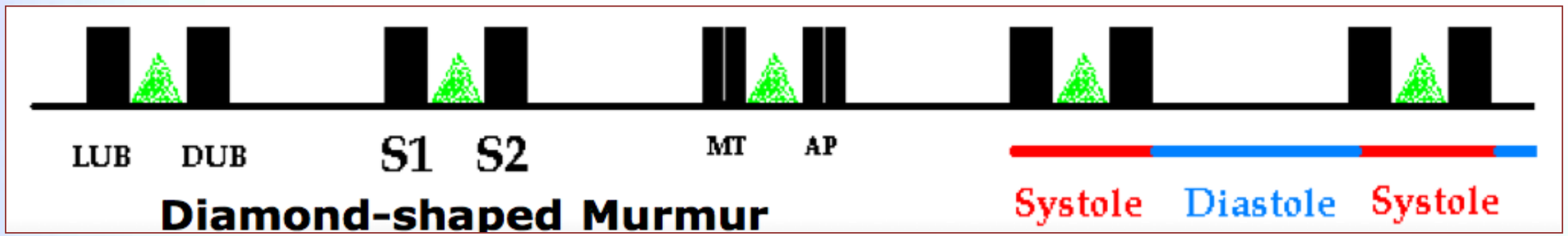
2.Shape

Murmurs are described according to the waxing and waning of the sound

Crescendo	Decrescendo	Crescendo-decrescendo	Plateau
Grows louder	يبدأعالي ثم ينخفض تدريجياً حتى يختفي الصوت	Diamond shaped يبدأمنخفض ثم يعلو تدريجياً ثم ينخفض تدريجياً	الصوت على نبرة واحدة فلا يعلو و لا ينخفض



Decrescendo	Crescendo	Crescendo-decrescendo	Decrescendo-crescendo-



Diamond-shaped Murmur

3.Location of the maximum intensity

Determined by the site from where the murmur originates from the listening areas

Aortic area **Mitral area** **Pulmonary area** **Tricuspid area**

4.Radiation

Reflects the intensity of the murmur & direction of blood flow

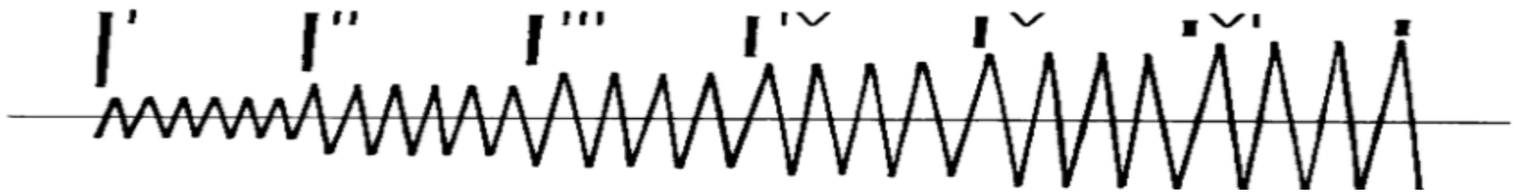
The HS moves from its original location in the heart to the other surrounding areas of the thorax ..

Eg. radiation of the murmur from the mitral area to the axillary area .

NB >> The murmur radiates in the direction of the blood flow

5.Intensity

Graded on a 6 point scale according to the Levine Scale



Classification of murmurs by loudness

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
• Lowest intensity • Very faint	• Low intensity • Quiet but heard immediately	• Medium intensity • Moderately loud	• Medium intensity • Loud • Thrills	• Loud intensity • Heard with stethoscope partly off the chest • Thrills	• Loudest intensity • No stethoscope needed • Thrills

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

Describing a heart murmur

Pitch	Quality	Others
• High, medium, low	• Blowing, harsh, rumbling & musical	• **Variation with respiration** • **Right sided murmurs change > left sided** • **ii. Variation with position of patient** • **iii. Variation with special maneuvers** • **Valsalva ? Murmurs ? in length & intensity**

Systolic Murmurs

Derived from harsh & increase in turbulence in flow

- Early systolic
- Mid systolic(ejection)
- Late systolic
- Pansystolic (holosystolic)

Associated with:

*flow across normal valve
*flow into a dilated great vessel
*flow across an abnormal valve, or narrowed ventricular outflow tract - e.g. aortic /pulmonary stenosis
*flow across an incompetent AV valve - e.g. mitral/tricuspid regurgitation
*flow across the inter-ventricular septum - e.g. VSD

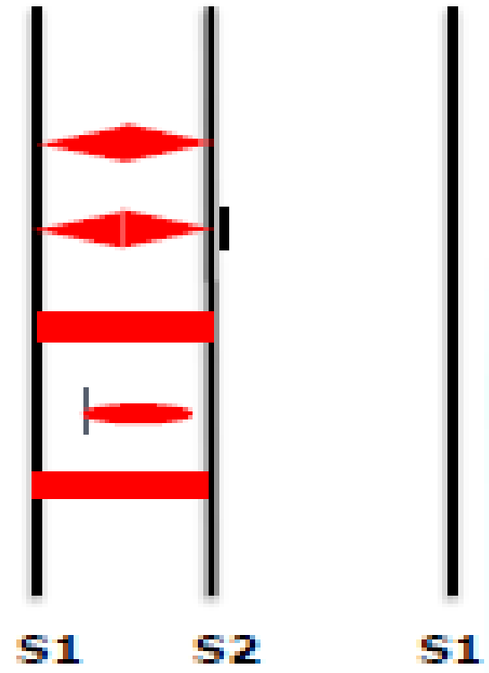
Mid systolic(ejection) murmurs

Most common kind of heart murmur
Usually crescendo-decrescendo
It could be →

1. Innocent	2. Physiological	3. Pathological
Common in children & young adults	Can be detected in hyper-dynamic states. e.g. anemia, pregnancy, fever & hyperthyroidism	Secondary to structural CV abnormalities. e.g. Aortic/pulmonary stenosis, Hypertrophic cardiomyopathy & mitral prolapse

Common systolic murmurs and timing

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) – holosystolic

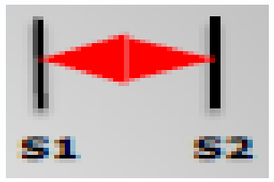


Common systolic murmurs and timing

1. Aortic stenosis – ejection murmur

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

T- mid-systolic (ejection) murmur
L- best heard @ aortic area, radiates along carotid arteries
C- harsh, loud, may have associated thrill, “ejection click”
A- older age, bicuspid aortic valve, rheumatic fever

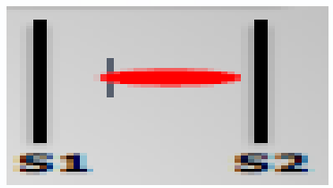


Note: T- Timing; L- Location; C- Character; A- Association

2-Mitral valve prolapse – mid-late systole

Bulging of one or both mitral valve leaflets into LA during LV systole

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



3-Pan – systolic (holosytolic) murmurs

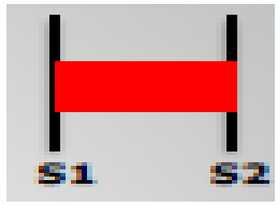
Pathological murmur
Begins immediately with S1 & continues up to S2

Heard with:
- Mitral/tricuspid regurgitation
- Ventricular septal defect (VSD)

4-Mitral regurgitation

Retrograde flow from LV into LA through an incompetent mitral valve

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

diastolic murmurs

Almost always indicate heart disease

Two basic types:

Early diastolic
Mid diastolic
Late diastolic

1. Early decrescendo diastolic murmurs
Signify regurgitant flow through an incompetent semilunar valve
e.g. aortic/pulmonary regurgitation

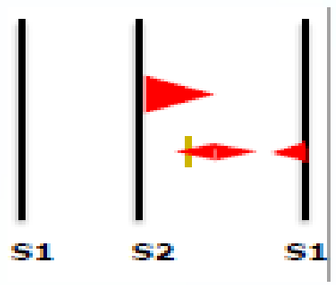
2. Rumbling diastolic murmurs in mid- or late diastole

Suggest stenosis of an AV valve
e.g. mitral/tricuspid stenosis

Common diastolic murmurs and timing

Softer, blowing, gurgle

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



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

Mitral stenosis

Obstruction of flow from LA to LV because of a narrowed mitral orifice (Valve becomes thickened & calcified)

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

Continuous murmurs

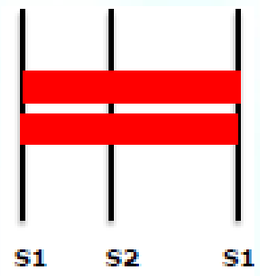
Begin in systole

peak near S2 & continue into all or part of diastole
Heard with:
- Patent ductus arteriosus (PDA)
- Ventricular septal defect (VSD)

Common Continuous murmurs and timing

1. Patent ductus arteriosus (PDA)

Failure of closure of the duct 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

2. Ventricular septal defect (VSD)

MCQs

1/The duration of S1 is :

A. 0.13
B. 0.14
C. 0.15

2/the second heart sound occur soon :

A. before the T-wave
B. after the T-wave
C. at QRS complex

3/Murmurs is longer than heart sounds :

A. T
B. F

4/Mitral Stenosis best hear in :

A. 2nd intercostal space
B. upper left sternal border
C. apex

1- c
2-a
3-a
4-c

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Good Luck

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