## DGAFMS MEDICAL MEMORANDUM NO –174

## CARDIAC MURMURS

1. Cardiac murmurs in young asymptomatic patient population pose a diagnostic dilemma. On one hand, missing the significance of a pathological murmur may prove to be dangerous omission but on the other ordering expensive and unnecessary tests for innocent / benign murmurs may add to the cost of treatment besides causing avoidable anxiety to an otherwise healthy patient. Fortunately systematic clinical evaluation can differentiate reliably between the two and obviate the need for echocardiography and cardiologist referral.

2. A basic understanding of the classification of cardiac murmurs is essential for their proper clinical appraisal (Box 1).

3. **Holosystolic pansystolic.** These murmurs are generated when there is flow between chambers that have widely different pressures throughout systole, such as the left ventricle and the left atrium (causing mitral regurgitation) or right ventricle and the right atrium (causing tricuspid regurgitation) or the left and right ventricle (causing a ventricular septal defect). With an abnormal regurgitant orifice, the pressure gradient and regurgitant jet begin early in contraction and last until relaxation is almost complete. Hence the murmur starts with the onset of $S_1$ partially or completely masking it and continues till the $S_2$ with the same intensity thus occupying the entire systole.

4. **Midsystolic (systolic ejection)**. These murmurs often crescendo de-crescendo in configuration; occur when blood is ejected across the aortic or pulmonic outflow tracts. The murmur starts shortly after $S_1$, when the ventricular pressure rises sufficiently to open the semilunar valve. As ejection increases, the murmur is augmented, and as ejection declines it diminishes and ends before the corresponding second heart sound. The murmurs of aortic or pulmonic stenosis are the classic examples of midsystolic murmurs. In the presence of normal semilunar valves, this murmur may be caused by an increased flow rate such as that which occurs with elevated cardiac output (e.g., pregnancy, thyrotoxicosis, anemia, arteriovenous fistula, anxiety), ejection of blood into a dilated vessel beyond the valve, or increased transmission of sound through a thin chest wall. **Most benign innocent murmurs occurring in children and young adults are midsystolic and originate either from the aortic or pulmonic outflow tracts**. These murmurs are fortunately much more common than their more sinister counterparts, the pathological murmurs.

5. **Diastolic Murmurs.** These murmurs start after the $S_2$ and continue for a variable time into the diastole while continuous murmurs start in systole and continue uninterrupted through the $S_2$ to end in diastole.

6. It must be emphasized that **holosystolic, late systolic and continuous murmurs and all diastolic murmurs are never benign and require detailed assessment** including echocardiography.

## CARDIAC AUSCULTATION

7. Cardiac auscultation forms the cornerstone of evaluation of cardiac murmurs. Though it is a clinical skill that can only be acquired with adequate training yet there are certain

prerequisites for a satisfactory auscultation to ensure that subtle findings are not overlooked.

(a) The patient must be made comfortable and relaxed in a quiet room as undue tachycardia due to anxiety can make the interpretation of murmurs very difficult.

(b) It should be done with the patient lying supine but in case of some murmurs it may be beneficial to do dynamic maneuvers like standing, squatting exercise, handgrip or valsalva maneuver ( box 2).

(c) Each area of the heart including the apex, left and right parasternal area interspace by interspace and subxiphoid should be auscultated systematically. In addition the stethoscope should be routinely applied to the axillae, the back and above the clavicles.

(d) Attention should be paid to all phases of the cardiac cycle in a methodical manner.

(e) In case a murmur is heard careful note should be made of its location, timing in the cardiac cycle, intensity, duration, pitch, configuration and direction of radiation (box 3).

(f) Any additional sounds like $S_3$, $S_4$, clicks and rub and additional features suggestive of an organic murmur etc should also be noted (box 4).

## SYSTEMATIC ASSESSMENT OF CARDIAC MURMUR

8. A stepwise and comprehensive clinical assessment as outlined below will aid in distinguishing the benign from the pathological murmurs.

(a) **History.** Though the absence of symptoms is no guarantee that a murmur is benign but the presence of following symptoms are reliable clinical markers of pathological murmurs:-

(i) Typical pain chest

(ii) Breathlessness on accustomed exertion

(iii) Recurrent loss of consciousness

(iv) Palpitations

(v) Limb claudication

(vi) Recurrent respiratory tract infection

(vii) Undue fatigue

A thorough history taking with special emphasis on these symptoms is an essential step at arriving at the correct diagnosis. Many asymptomatic children and young adults with grade 2/6 midsystolic murmurs and no other cardiac physical findings need no further cardiac workup after the initial history and physical examination.

(b) **Gen Physical Exam.** A meticulous physical examination is the cornerstone of clinical diagnosis of cardiac murmurs. The presence of following abnormal findings are clues to significant cardiac disorder that needs further evaluation:-

(i) Pallor

(ii) Edema

(iii) Cyanosis

(iv) Jugular venous distension

(v) Asymmetry of the chest or abnormal curvature of the spine

(vi) Prominent suprasternal / precordial pulsations

(vii) Limb deformities / abnormal facies

(c) **Cardiovascular Exam.** The following findings are indicators of significant cardiac disorder and should be carefully lookd for :-

(i) Asymmetry of pulses or asymmetry of blood pressure between right and left upper limb/upper and lower limbs

(ii) Hypertension

(iii) Palpable thrill especially of the carotids / over the precordium

(iv) Abnormal position of the heart in the chest (dextrocardia)

(v) Displacement of the apical impulse outside and downwards

(vi) Abnormally prominent apical impulse

During cardiac auscultation the following indicate significant cardiac disease:-

(i) All murmurs which are palpable.

(ii) Holosystolic, diastolic or continuous murmurs.

(iii) Presence of additional sounds like $S_3/S_4$/clicks.

(iv) Fixed or paradoxical splitting of S2. In case of doubt it is recommended that dynamic auscultation with hand grip, Valsalva maneuver, sudden standing from squatting position may be done. Any murmur which shows a significant change in intensity or length during these maneuvers should be presumed to be pathological and referred for further evaluation.

(d) **Investigations.**

(i) **ECG.** Though a normal ECG is not synonymous with a benign murmur but the finding of an abnormal ECG is an important clue for cardiac pathology. The presence of QRS axis deviation / atrial or ventricular hypertrophy / any rhythm other than sinus rhythm, conduction abnormalities like RBBB / LBBB, grossly inverted T waves, evidence of old myocardial infarction in the form of abnormal Q waves needs evaluation.

(ii) **X-ray**. The presence of cardiomegaly, dextrocardia, dilated aortic/ pulmonary artery shadow, any cardiac calcification, notching of the ribs, pulmonary vascular redistribution are strong markers of cardiac disease.

It must be emphasized that most asymptomatic young adults do not need either an ECG or an X-ray if the clinical examination suggests just a grade 2 or less midsystolic murmur with no other associated findings.

(iii) **Echocardiography.** It remains the most definitive test in the evaluation and complete characterization of a cardiac murmur but should be used with discretion as it adds to the cost and causes avoidable delay in patient evaluation. It should only be ordered in the following cases in asymptomatic young adults:-

(aa) Diastolic or continuous murmurs

(ab) Holosystolic or late systolic murmurs

(ac) Grade 3 or more midsystolic murmurs

(ad) Murmurs associated with abnormal physical findings

(ae) Murmurs associated with abnormal X-Ray/ECG

A simple algorithm for evaluation of cardiac murmurs is outlined in Fig 2.

**Evaluation at the BRO level**

9. All candidates with a suspected significant cardiac murmur should be made unfit and given the option of appeal medical board at the nearest MH where facilities of medical specialist are available. A checklist to determine if a murmur indicates underlying cardiac disease is given below. (See box 5 also)

(a) History of cardiac symptoms present.

(b) Presence of hypertension / asymmetry of pulses.

(c) Presence of cyanosis / edema / raised JVP.

(d) Cardiomegaly or thrill over the precordium.

(e) Grade 4 or more systolic murmur.

(f) Any diastolic or continuous murmur.

(g) Abnormal second heart sound.

(h) Abnormal ECG/CXR.

**Evaluation at the Medical Specialist level**

10. It should be as per Fig 2. In case in the opinion of the medical specialist the candidate has an organic murmur he should be made permanent unfit while the candidates with functional murmurs may be considered fit for recruitment. The medical specialist may choose to take the help of an ECG / X-ray to arrive at a decision in case he so desires. A referral to the service cardiologist / senior advisor should be made only in the instances where the medical specialist has difficulty in classifying a murmur as either innocent or organic and should be resorted to only in genuinely doubtful cases.

**Box 1 : Classification of Cardiac Murmurs**

1. Systolic murmurs
   (a) Holosystolic (pansystolic) murmurs
   (b) Midsystolic (ejection systolic) murmurs
   (c) Early systolic murmurs
   (d) Mid to late systolic murmurs
2. Diastolic murmurs
   (a) Early high- pitched or low-pitched diastolic murmurs
   (b) Middiastolic murmurs
   (c) Presystolic murmurs
3. Continuous murmurs

**Box 2 : Optimising Auscultation**

- Optimise acoustics
  - O Ear pieces should fit perfectly
  - O Experiment with different degrees of pressure on the head of stethoscope
- Time the sound by feeling carotid pulse
- Use bell to examine low pitched sounds e.g. third heart sound, mid diastolic murmur
- Use diaphragm for high pitched murmur e.g. pan systolic murmur, ESM
- Analyse each event separately
- Augment the murmur
  - O Inspiration for right sided murmur
  - O Expiration for pulmonary ejection click
  - O Hand grip and roll patient to left for MS
  - O Leaning forward and breath held in expiration for AR
  - O Valsalva and standing for MVP & HOCM

**Box 3 : Auscultatory evaluation of cardiac murmurs**

**When does it occur ?**

Time the murmur using carotid pulse, apex beat and heart sounds.

NB: (All diastolic, pansystolic, continuous murmurs are organic; midsystolic murmurs can be organic / physiological)

**How loud it is ? (Intensity)**

Grade 1 : Very soft

Grade 2 : Soft

Grade 3 : Moderate

Grade 4 : Loud, associated with thrill

Grade 5 : Very loud

Grade 6 : Heard with stethoscope away from chest

NB: 1. Diastolic murmurs are sometimes graded 1-4.

2. Thrill suggests organic heart disease

**Where is it heard best? (Location)**

**Where does it radiate?**

Listen over apex, base of the heart

Evaluate radiation to neck, axillae and back

NB : Radiation is due to high velocity jet and suggests an organic murmur

**How does it sound like ? (Pitch and Quality)**

Pitch is determined by the flow

(High pitch indicates high velocity flow as in AS, PS, MR, AR, VSD, low pitch indicates low velocity flow as in MS.)

**Box 4: Associated features in Organic Heart Murmurs**

- Abnormal Arterial Pulses
  - Collapsing pulse in AR, PDA
  - Slow rising carotid pulse in AS
  - Radio femoral delay in Coarctation of Aorta (CoA)
  - Prominent suprasternal and intercostals pulsations in CoA
- Abnormal Jugular Pulse
  - Exaggerated 'A' wave in PS, PAH
  - Giant 'V' wave in TR
- Abnormal Precordial Pulse
  - Hyperdynamic and displaced (MR, AR)
  - Thrusting and sustained (AS)
  - Tapping apex (MS)
  - Parasternal heave in RVH (PS, PAH)
  - Hepatic pulsation in TR, TS
- Abnormal Heart Sounds
  - Ejection clicks of valvular AS, PS
  - Opening snap of MS, TS
  - Wide and fixed S2 in ASD
  - Reversed S2 split in AS
  - S3 in MR, AR, VSD
  - S4 in AS
- Associated flow murmur
  - MDM at apex in MR, VSD
  - MDM at left sternal border in ASD, TR
  - ESM at right upper sternal border in AR

**Box 5: Features of a benign or innocent heart murmur**

1. Soft
2. Mid-systolic
3. Heard at left sternal edge
4. No radiation
5. No other cardiac abnormality (Associated features)

**Figure 1 : Time the sound and murmur with carotid pulse and apex beat**

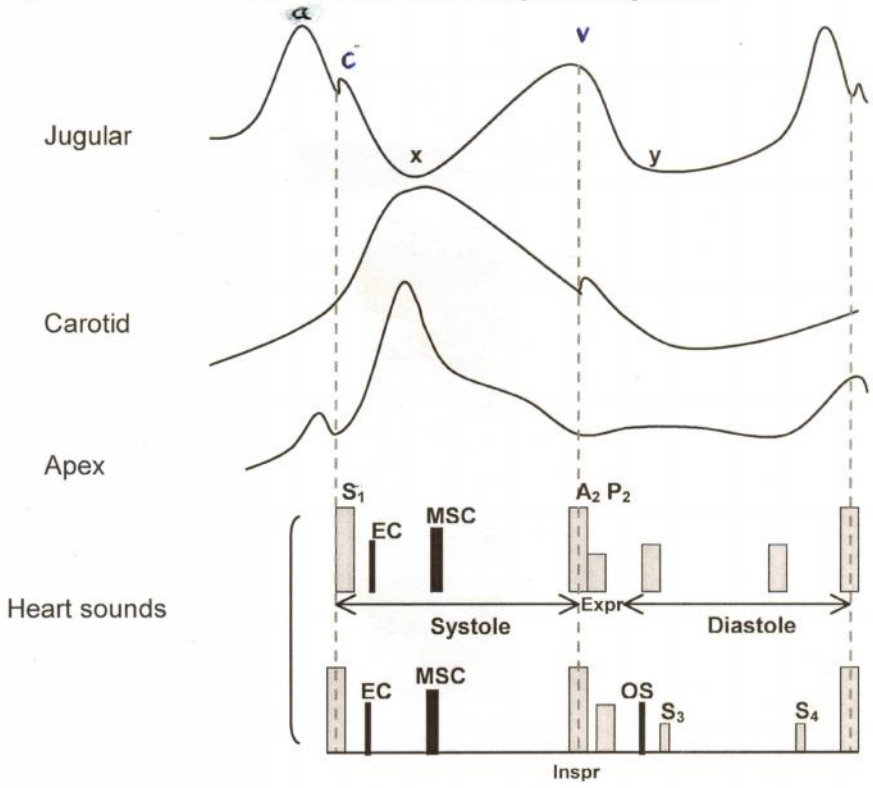

**Figure 2. Evaluation of Cardiac Murmurs**