# Problems in Family Practice

# Heart Murmurs in Infants and Children

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A system is presented for evaluation of heart murmurs in infants and children. The system places emphasis on identification of functional murmurs, which the physician encounters so frequently in daily practice. A three-part approach is presented which includes: (1) evaluation of cardiovascular status, (2) assessment of the heart murmur, and (3) decision regarding the need for further evaluation. This approach relieves the physician of the necessity to remember the multiple details of the many congenital cardiac lesions, and requires only the knowledge of a few easily remembered details about functional murmurs. The system enables the physician to confidently distinguish organic and functional murmurs and to decide which children need further evaluation and referral to the pediatric cardiologist.

The physician who cares for infants, children, and adolescents will frequently encounter heart murmurs during the course of a careful physical examination. It has been estimated that a heart murmur may be heard at some time in almost every child.[1] Murmurs may be classified as "functional" (physiologic, normal, benign, or innocent), or "organic" (associated with an anatomic cardiovascular abnormality). The physician needs an approach to evaluation of the child with a murmur which will enable him/her to identify those with heart disease for further evaluation, and those with "normal" murmurs for reassurance to the parents.[2] Using his/her knowledge of the myriad details of the many congenital cardiac malformations, the pediatric cardiologist seeks evidence that the murmur is due to an organic lesion. The family physician cannot expect to retain all of these details, and therefore often feels inadequately prepared to assess the child with a cardiac problem.

In this paper, a system is presented which will enable the physician to evaluate with confidence heart murmurs in children. Since the majority of murmurs encountered in daily practice are functional rather than organic, this system will emphasize recognition of the functional ones. The system consists of a three-part approach in which the physician: (1) assesses the general cardiovascular status, (2) assesses the heart murmur, and (3) decides on the need for further evaluation.

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**Table 1. Assessment of General Cardiovascular Status**

| |
|---|
| **History** |
| Family history of congenital heart disease |
| Maternal history, complicatins of pregnancy |
| Age murmur heard |
| Central cyanosis |
| Feeding difficulties, poor weight gain, respiratory distress, irritability |
| **Physical Examination** |
| Blood pressure |
| Peripheral pulses and capillary filling |
| Respiratory pattern |
| Palpation of liver edge |
| Palpation of precordium |
| Ausculation of heart sounds |
| Assessment of second heart sound |

## Assessment of General Cardiovascular Status

Using those portions of the routine history and physical examination which are related to the cardiovascular system (Table 1), the physician first attempts to answer the specific question: is the cardiovascular system functioning normally or abnormally?

As part of a careful history, the physician should ask about a family background of congenital heart disease, about maternal illnesses, and about medications used during the early weeks of the pregnancy.[3] The age and circumstances under which the murmur was first heard are important. A murmur due to valvular stenosis is frequently heard at birth, while a murmur related to a left-to-right shunt is more frequently encountered at six weeks to three months of age. A functional murmur usually presents between three and nine years of age, often during a febrile illness. Finally, the physician should search for a history of cyanosis or of cardiac dysfunction, including feeding difficulties, respiratory distress, irritability, and poor weight gain, all of which may indicate the presence of congestive failure.

Careful physical examination permits assessment of cardiovascular stability. Elevated blood pressures and increased pulses in the arms, together with decreased blood pressure in the legs, and femoral pulses which are decreased, delayed, or even absent, are indicative of coarctation of the aorta. Central cyanosis, which becomes apparent or increases during crying, suggests a true right-to-left shunt due to cardiac disease.[4] A prominent parasternal lift indicates hypertrophy of the right ventricle, while an increased apical impulse suggests left ventricular hypertrophy. When present at the base of the heart, a systolic thrill suggests stenosis of aortic or pulmonic valves, while a thrill at the left lower sternal border is found with ventricular septal defect. Respiratory distress, hepatomegaly, distant and muffled heart sounds, and a gallop rhythm (accentuated third heart sound), together with decreased peripheral pulses and poor capillary filling, may indicate congestive failure.

The second heart sound must be carefully assessed in every child. Normally, the pulmonary component of the second heart sound occurs later than the aortic component.[5] This splitting is usually increased during inspiration and when the patient is in the recumbent position, and decreased during expiration. Wide, fixed splitting of the second heart sound is encountered in atrial septal defect, and loss of splitting with a single loud second heart sound may be found in pulmonary hypertension.

On the basis of history and physical examination, the physician decides that the cardiovascular system is functioning normally or abnormally.

## Assessment of Heart Murmur

Having completed an evaluation of general cardiovascular status, the physician now turns to assessment of the murmur. Heart murmurs should be described in terms of six basic characteristics (Table 2). As the physician describes the murmur in terms of these characteristics, he/she must decide whether the murmur fits with the general characteristics of a functional or organic murmur (Table 2). Functional murmurs tend to be quiet (Grade I or II), well localized, with poor transmission, and they frequently change with position, respiration, and variations in cardiac output.

**Table 2. Assessment of Heart Murmur**

| Characteristics | Functional Murmur | Organic Murmur |
|---|---|---|
| Timing | early systolic or continuous | systolic, diastolic, or continuous |
| Area of maximum intensity | well-localized | often diffuse |
| Transmission | transmits poorly | often transmits well |
| Intensity | usually Grade I-II | usually Grade III-VI |
| Quality | usually soft | usually harsh, rough, or blowing |

Functional murmurs may appear whenever cardiac output is increased, for example, during a febrile illness, anxiety, exercise, or in the presence of severe anemia. The increased turbulence which results may produce a loud murmur which mimics an organic murmur in its intensity. A cardinal rule in evaluation of a heart murmur is: never make a final decision regarding a heart murmur while the patient is in other than a baseline resting condition.

If the murmur fits the general characteristics of a functional murmur, the physician should attempt to classify it as a specific type of functional murmur. Although five general types of functional murmurs should be listed, only four of these will be encountered with any frequency.

## Specific Types of Functional Murmurs

### *Vibratory Systolic Murmur*

The vibratory systolic murmur (sometimes known as Still's murmur[6]) is a coarse, twangy, low-frequency murmur which is localized to the left lower sternal border in the third to fifth intercostal spaces (Figure 1). The murmur starts after the first heart sound and ends before the second sound. The murmur is thought to be due to vibration of the pulmonary valve[7] or to vibrations of chordae tendinae in the ventricular cavity.[8] This murmur must be differentiated from that of a ventricular septal defect. The latter defect produces a high frequency murmur which starts with and often obliterates the first heart sound. The murmur is of maximal intensity at the left lower sternal border, frequently associated with a systolic thrill, and usually does not vary with position or respiration.

### *Pulmonary Ejection Murmur*

This murmur is a soft, early systolic ejection murmur which is localized to the pulmonary area, transmits poorly, and is often increased in the supine position (Figure 2). The second heart sound is normally split and varies with respiration. There are no associated diastolic murmurs, heaves, or thrills. This murmur is thought to be due to the production of turbulence across a normal outflow tract of the right ventricle.[7,8]

The pulmonary ejection murmur must be differentiated from two organic lesions: atrial septal defect and valvular pulmonic stenosis. Although the systolic murmur of atrial septal defect may be quite similar to the pulmonary ejection murmur, the presence of a widely split and fixed second heart sound, together with a mid-diastolic murmur at the left lower sternal border will identify the child with atrial septal defect. The murmur of valvular pulmonary stenosis is typically rough, loud,

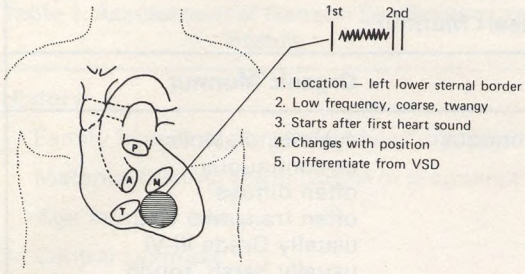


Figure 1. Vibratory Systolic Murmur

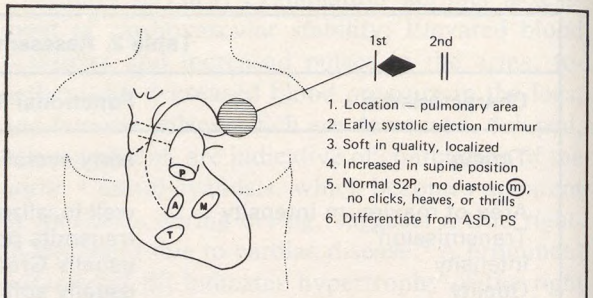


Figure 2. Pulmonary Ejection Murmur

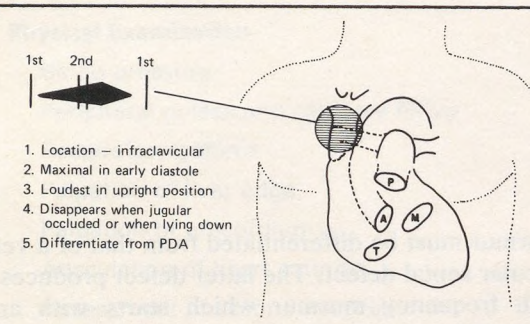


Figure 3. Venous Hum

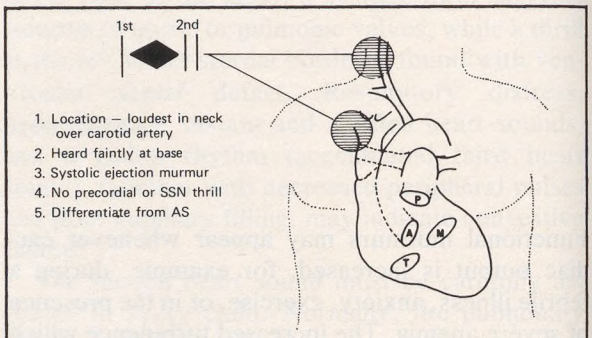


Figure 4. Carotid Bruit

and transmits well toward the left shoulder. In addition, there may be a palpable systolic thrill at the base of the heart, and an associated ejection click.

## *Venous Hum*

The venous hum is a soft, continuous murmur which starts well after the first heart sound, increases in intensity, peaking just after the second heart sound, and then decreases in intensity in early diastole (Figure 3). The murmur is localized to the right infraclavicular area, is loudest when the patient is in an upright position, and often decreases in intensity or disappears when the child assumes a recumbent position. This murmur is produced by the rapid return of cerebral venous blood through the jugular vein and vena cava into the right atrium.[7] The murmur completely disappears when the jugular vein is occluded by manual pressure, and returns immediately upon the release of pressure.

This murmur must be differentiated from patent ductus arteriosus. The murmur of a patent ductus is usually loudest in the left infraclavicular area, and peaks in late systole. The murmur is higher pitched and rougher than a venous hum, and does not change with change in position or occlusion of the jugular vein.

## *Carotid Bruit*

The carotid bruit is a soft, early systolic ejection murmur which is loudest in the neck over the carotid arteries and is heard faintly at the base of the heart (Figure 4). The murmur is produced by turbulence of blood flow through the normally tortuous carotid arteries of the growing infant and child.

This murmur must be differentiated from valvular aortic stenosis. This may be accomplished by careful auscultation in the aortic area and over the carotid vessels. When the murmur is due to a

carotid bruit, the murmur will be loudest in the neck over the carotids and fainter in the aortic area. Conversely, when the murmur is due to aortic stenosis, the loudest intensity will be noted over the aortic area and the murmur will be transmitted into the neck faintly.

### *Cardiorespiratory Murmur*

Rarely, the physician may encounter a soft murmur over the precordium which varies with respiration and changes in position. The murmur sounds close to the stethoscope, and may vary in timing. The murmur disappears when respiration is voluntarily stopped for a brief interval.

## Need for Further Evaluation

If a murmur fits the general characteristics of functional murmurs (Table 2) and can also be categorized as one of the specific types described (Figures 1-4), the diagnosis is established. However, the physician shold take an additional step before completing the evaluation. Reflecting on the specific type of functional murmur encountered, the physician should review his/her findings for evidence of the organic lesion(s) which may be confused with that functional murmur; for example, for a vibratory systolic murmur, consider ventricular septal defect.

Having assessed the general cardiovascular status and determined that the murmur fits best with the characteristics of a functional or organic murmur, the physician then must make a decision regarding the need for further evaluation. If the murmur appears to be organic, the patient should be referred to a pediatric cardiologist for evaluation. In the presence of severe cardiac dysfunction, such as central cyanosis or congestive failure, the referral should be made immediately. If an organic murmur is associated with evidence of minimal cardiovascular dysfunction, the referral can be on an elective basis. Using the system described above, the physician will be able to determine that perhaps 80 percent of the murmurs which he/she hears are functional. For these patients no further evaluation is needed. If the nature of the murmur is uncertain, additional evaluation should include an electrocardiogram and a chest x-ray. Compromised cardiac function will frequently be associated with dilatation of cardiac chambers on x-ray and electrocardiographic evidence of hypertrophy. The roentgenographic appearance of the pulmonary vascularity should be examined for evidence of variation from the normal, ie, increased or decreased pulmonary blood flow. These tests will permit classification of many of the remaining patients into either a functional or an organic status. If a question still remains in the physician's mind, the patient should be referred for evaluation to a pediatric cardiologist.

## Explanation to Parents

It is this writer's strong feeling that parents should always be informed regarding the presence of a functional murmur, and the physician's findings should be carefully recorded in the chart. Not infrequently, at a later time the finding of a murmur may raise the question of an organic malformation. If the physician has informed the parents of the previous presence of a functional murmur, this information will often aid in the evaluation of a murmur which is heard during a febrile illness. Having told the parents of the presence of a murmur, the physician has a most certain responsibility to convince them of the meaning of "functional" or "normal" heart murmurs. It is this writer's experience that the benign nature of the murmur must be explained in several different ways to the parents until the physician is convinced that the parents understand that the child's heart is normal. If the physician feels that the parents are not convinced of the benign nature of the murmur, despite all efforts at explanation, a referral to the pediatric cardiologist for reassurance is indicated.

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