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Could It Be Cardiac?

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Although it is very rare for a normal child to have a true cardiac emergency, nonetheless, parents often come to the emergency department because they worry that their child might have a serious cardiac problem. This article will review common emergency department presentations in children that raise the concern for heart disease and clues that may indicate the presence of cardiac-related disorders.
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Although it is very rare for a normal child to have a true cardiac emergency, nonetheless parents often come to the emergency department (ED) because they worry that their child might have a serious cardiac problem.

Chest Pain

Because chest pain in adults is emphasized in the lay literature as a sign of possible life-threatening problems such as myocardial infarction or pulmonary embolism, many adults reasonably assume that children with chest pain are likely to have these same conditions. In fact, children very rarely have these diseases, and most chest pain in the pediatric age group is benign. However, there are a few cardiac entities that do cause chest pain in children. These can be categorized loosely into 3 groups: structural abnormalities, inflammatory reactions, and dysrhythmias. If cardiac, the pain may be caused by myocardial ischemia. A second mechanism for pain is inflammation of the pericardium or myocardium. In other cases, saying his or her "chest hurts" may be a child's way of indicating that something feels abnormal, even if not painful. Potential clues to cardiac causes of chest pain are provided in Table 1.

Structural Abnormalities

There are rare structural abnormalities that increase myocardial oxygen requirements or decrease flow to the coronary arteries (or both). The most common of these are obstructions to left venticular outflow (eg, aortic valve or subvalvular stenosis, obstructive hypertrophic cardiomyopathy). Obstructive right outflow lesions can also cause chest pain on occasion. In addition, coronary artery abnormalities (eg, anomalous origin of the left coronary artery, left coronary ostial stenosis or atresia, coronary artery fistula, right coronary abnormalities) can result in cardiac ischemia.

Unfortunately, most of these conditions are difficult to screen for or diagnose prospectively and remain undetected until the patient develops symptoms of ischemia, which, in some instances, may occur in late childhood or adolescence. Some conditions such as hypertrophic cardiomyopathy may evolve over time, also making screening difficult. Generally, the pain is associated with exercise or physical activity. Characteristically, it is located in the precordial or substernal region and may radiate into the left arm, neck, or jaw. Pain is described as squeezing, dull, or pressurelike in nature. It may be associated with shortness of breath, sweating, nausea, or syncope. Of note, infants cannot express themselves with words and children may not have the language skills to adequately describe their symptoms. In addition, feeding is exertion for an infant, so the baby may cry or have other symptoms during feeds.

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Table 1 Clues to cardiac cause of chest pain.

Characteristics of chest pain
Associated with exercise or exertion
Associated with nausea, shortness of breath, or sweating
Dull
Precordial or substernal in location
Radiates to left arm, jaw, or neck
Past or present history
Arrhythmia
Drug use, including cocaine and other sympathomimetics
Inflammatory disease (eg, Kawasaki disease, polyarteritis, or systemic lupus erythematosus)
Mitral valve prolapse
Recent bacterial, fungal, or viral infection
Structural heart defect
Family history
Arrhythmia or early sudden death
Physical examination
Abnormal vital signs
Arrhythmia
Friction rub
Pathological murmur
Signs of congestive heart failure
ECG
Arrhythmia
Chamber enlargement
Conduction defect
Ischemic changes
Pattern of inflammation such as diffuse low voltages or ST elevation
Prolonged QT interval
Chest x-ray
Abnormal cardiac silhouette
Enlarged heart
Pulmonary vascular congestion

Depending on the entity, physical examination may be completely normal, but sometimes, a murmur, rub, or gallop may be heard. An electrocardiogram (ECG) may suggest a structural abnormality or even ischemic changes but often is normal. Chest radiographs (x-rays) are also usually normal, but they may reveal changes in the cardiac silhouette or pulmonary edema. If myocardial ischemia is suspected, cardiac enzymes and other markers for ischemia (eg, creatine kinase–MB, troponin) should be obtained. Cardiology consultation, echocardiography, coronary catheterization, or other diagnostic studies may be necessary to establish the diagnosis.

Mitral valve prolapse seems to be associated with chest pain in some patients. The mechanism by which it produces pain is unknown, and it is not clear that the prolapse itself is the cause of the pain. (It is worth noting that most patients with mitral valve prolapse do not have chest pain and have no complications.) This diagnosis should be suspected when a midsystolic click and late systolic murmur are heard on auscultation. If the physical examination reveals suggestive findings, cardiology referral is appropriate to confirm the diagnosis.

Patients with Kawasaki disease who develop coronary aneurysms (which may occur after the first several days of the disease) can have cardiac ischemia. The ischemia may occur during the early phases of the illness if obstructive coronary thrombosis occurs. During the later phases, long after the acute symptoms subside, there is also a risk for myocardial ischemia if the regressing coronary aneurysms become stenotic.

Inflammatory Reactions

Many infectious agents (eg, bacteria such as *Borrelia burgdorferi*, *Corynebacterium diphtheriae*, *Haemophilus influenzae*, *Mycobacterium tuberculosis*, and *Staphylococcus aureus*; fungi; and viruses, especially coxsackievirus) can cause pericarditis or myocarditis. However, there are also other inflammatory diseases found in children that cause pericarditis or myocarditis. These include Kawasaki disease, polyarteritis, rheumatic fever, and systemic lupus erythematosus. Typically, pericardial pain is sternal or substernal and is aggravated by deep breathing, coughing, straining, or leaning forward. There may be associated symptoms such as fever, fatigue, and shortness of breath. Infants may feed poorly. Often, a pericardial friction rub can be heard. Chest x-rays may show an enlarged heart if there is a pericardial effusion or heart failure. Electrocardiographic changes may include diffuse ST elevation and/or low QRS voltage. Echocardiography is usually confirmatory. It should be noted that Kawasaki disease can also present with symptoms of ischemia.

Patients with a recent history of cardiac surgery may develop postpericardiotomy syndrome. This typically occurs 2 to 6 weeks after cardiac surgery and results in pericardial inflammation and a pericardial effusion. Pericardial tamponade may occur. The classic symptoms are chest pain, fever, and dyspnea. Poor feeding and stomach upset may also occur. The symptoms are generally vague and nonspecific, so diagnosis can be difficult, even with a history of recent surgery.

Dysrhythmias

Dysrhythmias, especially tachyarrhythmias such as supraventricular tachycardia, can cause chest pain or discomfort. A younger child, knowing that something feels wrong, may use the words *pain* or *hurt* to describe palpitations because of vocabulary limitations. An older child may complain of palpitations or describe an atypical heartbeat. Although children can usually tolerate rapid heart rates for at least several hours, eventually, they will experience symptoms of congestive heart failure, such as weakness, dizziness, hypotension, or cyanosis. The heart rate, duration of tachycardia, and presence of structural abnormalities will all affect the timing of the onset of symptoms. Tachyarrhythmias may be paroxysmal in nature, so the patient may have a normal rate and rhythm when examined in the ED and an ECG may not reveal the arrhythmia. However, even when the patient is