

The
Heart
Of
A Child

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Introduction

Knowing that your child requires a cardiac evaluation may produce anxiety for some parents. Your child may be here for evaluation of one or more of the following reasons: 1) heart murmur; 2) chest pain; 3) arrhythmia (irregular heart beat); 3) syncope or fainting; 5) palpitations (sensation of a racing heart); 4) hypertension; or 5) high cholesterol. This pamphlet was created to explain the reasons your pediatrician or family physician may want further evaluation of these symptoms from a pediatric specialist trained in cardiac disorders. My goal is to provide some type of reassurance that many of these symptoms or findings may not require any treatment. In the cases where treatment is required, most treatment modalities are quite successful. Sometimes, further testing may be required to further evaluate the anatomy and rhythm of the heart. The most common tests performed here in our office are an electrocardiogram (EKG) and echocardiogram (an ultrasound of the heart). I hope that providing you with this information proves to be helpful and informative. If you have any additional questions after your visit here, please feel free to call our office. Your pediatrician or family physician will always receive a written letter from our physicians discussing your evaluation.

Heart Murmurs

The presence of a heart murmur is one of the most frequent reasons for a visit to a pediatric cardiologist. A heart murmur is defined as a blowing sound timed with the heartbeat that can be heard through a stethoscope placed over the chest. There are numerous types of heart murmurs. The most common type of heart murmur is called an "innocent" murmur. This can also be called a "functional" or "benign" murmur. This type of murmur is not associated with any disease or abnormality of the heart. An innocent murmur can be present in up to 50% of normal children and usually disappears before adulthood. This causes no harm to the child and no restrictions in physical activity are required. The main reason why these murmurs are more frequently heard in children rather than adults is due to the thin chest wall in children which readily transmits heart sounds to the chest surface. In addition, the heart of a child is positioned closer to the front wall of the chest and therefore heart sounds are easily heard.

There are four common types of innocent heart murmurs which will be discussed further:

A neonatal pulmonary artery murmur is heard in up to 20% of newborns during the first few weeks of life. This type of murmur can be heard in the sides of the

chest, under the arms, below the collar bones, or in the back between the shoulder blades. This murmur results from the growth of the blood vessels supplying blood to the lungs. These blood vessels are generally small since the lungs do not receive blood flow until an infant takes their first breath immediately after birth. The progressive growth of these vessels causes turbulence of blood flow and leads to the murmur. This phenomenon is usually present throughout the first 6 to 12 months of life. This murmur usually disappears after this period of time. If the murmur persists beyond this period, a follow-up visit to the cardiologist may be needed.

A Still's murmur is the most common heart murmur heard in children between 2 and 8 years of age. This murmur is "vibratory" in nature and originates from the opening of the aortic valve, which is the valve that supplies blood from the left lower pumping chamber of the heart to the body. This murmur is best heard when a child is lying down because more blood is pumped to the body in this position. This murmur also gets louder with fever, exercise, or anxiety because the heart is contracting harder and more rapid during these periods. This type of murmur is not usually heard beyond childhood due the increased thickness of the chest wall.

A pulmonary flow murmur results from the blood flow across the pulmonary valve, which is the valve that

supplies blood from the right lower pumping chamber of the heart to the lungs. Like a Still's murmur, this murmur also gets louder during fever, exercise, anxiety, or pregnancy. This type of murmur can occur at any age but is more often heard later in childhood. It is the most common type of innocent murmur in adolescence.

A venous hum is an innocent murmur originating from the veins in the neck which pump blood back to the heart from the body. The tortuous nature of these vessels causes turbulence of blood flow which results in this type of murmur. It is described as a "whirring" sound. It is heard in the sitting position only. Lifting the chin up can also accentuate the murmur.

A pathologic or "organic" heart murmur is associated with some type of a congenital heart defect. These defects may include a ventricular septal defect, which is a hole between the right and left lower pumping chambers of the heart; an atrial septal defect, which is a hole between the right and left upper pumping chambers of the heart; an abnormality of one of the valves of the heart; or some other type of more complex structural heart defect. This will be discussed in detail with the parent if this pertains to your child.

Chest Pain

Chest pain is a common complaint among children and adolescents. Fortunately, chest pain in children is rarely associated with any cardiac pathology. Sometimes, the pain can be so severe that it causes repeated absences from school. Frequently, the origin of chest pain in this age group is associated with a pulmonary etiology such as pneumonia, asthma, or pneumothorax (air in the lung cavity which is usually associated with chest injury). A gastrointestinal etiology such as gastroesophageal reflux or a foreign body in the esophagus frequently leads to chest pain.

A frequent cause of chest pain in adolescents is inflammation of the chest wall or "costochondritis". This pain can sometimes worsen with exercise. The examination usually elicits tenderness at the area where the ribs connect to the breast bone. This is a benign phenomenon and rarely requires treatment. Sometimes, non-steroidal anti-inflammatory agents are used, i.e. Ibuprofen.

Some of the cardiac origins of chest pain include pericarditis, which is inflammation of the sac around the heart. This can be caused by a virus or bacteria. Bacterial causes can be treated with antibiotics. Usually other

signs of infection are present such as fever or elevation of the white blood cell count.

An arrhythmia or "irregular heart beat" can be associated with chest pain. Usually a very fast rhythm or tachycardia rather than other forms of an arrhythmia lead to chest pain. Other symptoms such as dizziness or palpitations are usually present. This can be diagnosed with an EKG, 24 hour ambulatory monitor, or 30 day ambulatory monitors.

Mitral valve prolapse or "MVP" is caused by a "floppy" mitral valve. This valve separates the left upper pumping chamber from the left lower pumping chamber. The chest pain results from stretching of the muscles in the left lower pumping chamber or left ventricle. This can also lead to dysfunction of the valve. This may lead to fainting spells and rhythm disturbances in severe cases. The majority of people with this disorder do not require any treatment. Hydration, eliminating caffeine intake and over the counter medications which contain ephedrine or epinephrine are beneficial in keeping symptoms under control. Sometimes, beta blockers such as propranolol may be indicated if the symptoms are difficult to control.

An entity described as hypertrophic cardiomyopathy is an abnormal thickening of the muscle which separates the bottom two pumping chambers of the heart. Chest pain can result from a lack of blood flow to the heart

muscles resulting in ischemia. This can lead to sudden death, especially in adolescents. This phenomenon in athletes has been widely publicized in the recent years. This is the most important phenomenon for a pediatric cardiologist to "rule out" in a child with a complaint of chest pain.

Many cases of chest pain are not associated with any cause. This may be concluded after all of the above entities are ruled out. Reassurance should be provided to both the parent and the child in these cases. Medical management and restrictions in activity are not indicated.

Arrhythmia and Palpitations

An abnormal heart rhythm is usually noted by auscultation with a stethoscope. A person's heart rate is variable, i.e. during exercise the heart rate is faster, during sleep the heart rate is slower. The most common type of rhythm abnormality is called sinus arrhythmia. This results from the heart rate speeding up during inspiration and slowing down during expiration. This is a completely normal phenomenon.

Premature or extra beats can cause an irregular heart rhythm. This can produce the sensation of the heart "skipping a beat". The extra beat can either come from the upper or lower pumping chamber of the heart. If the beat comes from the upper pumping chambers it is called a premature atrial contraction or "PAC". If the beat comes from the lower pumping chambers it is called a premature ventricular contraction or "PVC". These beats are common in children and teenagers. They rarely require treatment. Sometimes, a stress test is indicated to determine if the beats disappear with exercise. If this is found, these beats are benign in nature. An echocardiogram may be performed to make certain there is no injury to the heart as a cause for this finding.

Tachycardia is defined as a fast heart beat. This depends on the person's age and activity. Sinus tachycardia is a normal increase in the heart rate associated with fever, excitement, or exercise. This does not require any treatment. Anemia or an overactive thyroid gland can also lead to this phenomenon. Supraventricular tachycardia is an abnormal increase in the heart rate and is usually not associated with activity. If prolonged, this can cause symptoms such as palpitations, dizziness, chest pain, or weakness. Sometimes, procedures such as placing cold H₂O or ice to the face can elicit a reflex which slows the heart rate back down. Admission to the hospital may be required in infants or in older children with a prolonged episode. Short or long term management with medication may be needed to keep the tachycardia under control. A procedure called radiofrequency ablation is performed when one is refractory to medical management. This involves placing numerous catheters in the heart and providing electrical current to the area of the heart which is contributing to the tachycardia. This procedure is usually fairly successful in eliminating the tachycardia.

Tests which are helpful in further evaluating these symptoms are a continuous ambulatory EKG or Holter Monitor. It records the electrical activity of the heart over a 24 hour period. This involves wearing a recorder for 24 hours. The recording is then downloaded over a

computer system and a 24 hour tracing of the electrical activity of the heart is produced.

Another type of monitor is called a transtelephonic monitor or event recorder. This can be sent home for a period of 30 days. This is helpful when the symptoms are infrequent and unpredictable. This is a monitor which is used only when the symptoms are present. The monitor is placed over the chest during the symptom and then the activity is transmitted across the telephone. The recording is downloaded at a central monitoring location and then faxed to the physician's office. The physician is notified immediately if there is an abnormality noted from the technicians at the central monitoring station.

Hypertension

There are blood vessels in our body called arterioles which regulate our blood pressure. They are the smallest arteries carrying blood from the heart to the remainder of our body. When these vessels become narrowed for some reason, the heart has to work harder to pump the blood to our body. This results in an increase in blood pressure. Blood pressure measurements should be monitored at least annually after the age of 3. A person's blood pressure varies throughout the day depending on our activity and environment. Blood pressure increases as the body size increases and with increased age. Normal blood pressure is defined as blood pressure readings below the 90th percentile for age and sex. Elevated blood pressure or hypertension is defined as blood pressure readings above the 95th percentile for age and sex.

In the evaluation of a child with hypertension, documentation of an elevated blood pressure should be confirmed with 3 separate measurements over a period of 3 weeks. Hypertension in children can be caused by family history, obesity, lack of exercise, medications, kidney disease, or a tumor of the adrenal gland which is a small organ above the kidneys. Frequently, there is no cause that can be found and this is called primary or

essential hypertension. Elevated blood pressure is more common in the black population.

An important cardiac cause of hypertension results from an obstruction of the aorta called "coarctation of the aorta". The aorta is a large artery which arises from the left lower pumping chamber of the heart and carries oxygenated blood to our body. This causes an elevated blood pressure in the upper extremities but a lower blood pressure in the lower extremities. This usually requires surgical intervention.

The management of hypertension includes a low salt diet, low fat diet if your child is overweight, and increased physical activity. Medications may be used only if the blood pressure is significantly elevated and non-responsive to the above conservative measures.

Syncope

There are many reasons for syncope or fainting. This is caused by a drop in your blood pressure which results in a lack of blood flow to the brain. Your body responds by losing consciousness for a brief period of time. It usually occurs suddenly. Sometimes you may experience dimmed vision, lightheadedness, or a rapid heartbeat prior to the episode. The duration of syncope is usually very brief, i.e. few seconds.

The most common cause of syncope is called vasovagal syncope. This is a benign phenomenon. This results from prolonged standing, sitting or standing up too fast, stress or anxiety. Many healthy people experience this type of syncope. Emotions such as stress, anxiety, or fear can stimulate a nerve signal in the heart and cause your heart rate and blood pressure to decrease instead of increase. Prolonged standing can cause blood to pool in your legs and therefore cause lack of blood flow to the brain. Standing or sitting up too quickly does not enable your blood pressure to adjust fast enough to the posture changes. As a result, the blood pressure drops too low. Lifestyle changes can help prevent this type of syncope. This includes avoiding prolonged standing, wearing protective stockings to prevent blood from pooling in the lower extremities, or increasing intake of fluids and/or salt.

There are other causes of syncope that are not considered benign. These causes include abnormal rhythm which then leads to ineffective blood flow to the brain or heart failure. These causes require thorough testing for evaluation, such as an electrocardiogram, 24 hour Holter monitoring, Event monitoring, or an Electrophysiology Study performed in the cardiac catheterization laboratory. Another cause of syncope which is not considered benign is an entity called "hypertrophic cardiomyopathy". This is caused by an abnormal thickening in the muscles of the heart which may lead to an abnormal heart rhythm or an inability of the heart to provide adequate blood flow to the body due to obstruction caused by the thickened heart muscle. The diagnosis of this entity is made by an echocardiogram.

A thorough history alone can enable a physician to distinguish which of the above types of syncope one is experiencing.

THE END

Related Web links:

American Heart Association: www.americanheart.org

March of Dimes Birth Defects Foundation: www.marchofdimes.com

