

APPROACH TO CARDIAC HISTORY TAKING

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General Presentation**BACKGROUND**

Cardiac pathologies are always in consideration when a child presents to their primary care physician or in the emergency room with undiagnosed chest pain, shortness of breath, **cyanosis or syncope**. While it is important to consider other organs in the thorax (ie. lungs) when taking a medical history, a focused cardiac history is also necessary to rule-in and rule-out cardiac pathology.

BASIC ANATOMY AND PHYSIOLOGY

To provide an accurate differential diagnosis, it is important to understand the basic anatomy and physiology of the heart. The direction of blood flow starts from the systemic venous circulation, to the right atrium, then right ventricle, oxygenated at the lungs, and then passes through the left atrium and ventricle to the systemic arterial circulation.

Understanding the fetal circulation and the circulatory shunts can also form a framework for approaching congenital heart diseases. The foramen ovale shunts blood from the right atrium to the left atrium. A **patent foramen ovale** presents as an atrial septal defect, resulting in a left-to-right shunt of blood. The ductus arteriosus shunts blood from lungs to the aorta. A **patent ductus arteriosus** also leads to a left-to-right shunt and pulmonary hypertension. A prolonged left-to-right shunt can significantly increase pressure in the right side of the heart, leading to a reverse right-to-left shunt known as **Eisenmenger's syndrome**.

PRESENTATION AND EMERGENT CONSIDERATIONS

When taking a history, it is important to consider the etiology of presenting concerns. For example, chest pain may have a somatic musculoskeletal origin as opposed to a cardiac origin. Similarly, shortness of breath and cyanosis may be of pulmonary origin. Important to note is that cyanosis is a medically important finding and demonstrates decreased oxygen saturation in the blood – this is possible in a right-to-left shunt. Other considerations include murmurs heard on physical exam, which may or may not be clinically significant. (See Table 1)

Table 1 Congenital Heart Conditions

Heart Conditions			
Septal	Valvular	Vascular	Ventricular
Atrial septal defect (ASD)	Aortic valve stenosis (ie. Bicuspid)	Truncus arteriosus	Tetralogy of Fallot
Atrioventricular septal defect	Ebstein's anomaly	Coarctation of aorta	Hypoplastic left heart syndrome
Ventricular septal defect (VSD)	Pulmonary valve stenosis	Transposition of the great arteries	
	Pulmonary atresia	Patent ductus arteriosus (PDA)	
	Tricuspid atresia	Total anomalous pulmonary venous return	

Questions to Ask

HISTORICAL INVESTIGATION

- **Ask about pregnancy history and prenatal testing:** this includes the use of medications, gestational diabetes mellitus, maternal systemic lupus erythematosus, and exposure to infectious (ie. Rubella, Coxsackie virus). Also ask about prenatal ultrasounds which often identify structural heart disease before birth
- **Ask about perinatal history and birth defects:** this includes premature rupture of membranes, fever, sedatives or anesthetics, antibiotics, cyanosis at birth, gestational age and APGAR score, asphyxia, hypertension, pneumonia, and any birth defects (ie. heart-related or not) diagnosed at birth
- **Ask about family history of congenital or childhood heart disease, or sudden death**
- **If the child has a murmur,** inquire about the initial detection and diagnosis of the murmur (Relevant findings: valve regurgitation murmur detected in the first 6 hours after birth (ie. tricuspid or mitral), shunt lesions also diagnosed as pulmonary resistance drops – **usually first 12-24 hours** (ie. ASD, VSD, PDA, pulmonary stenosis, Tetralogy of Fallot).
- **Ask about the growth and development of the child:** height and weight gain can be affected by poor cardiac function, pulmonary edema, or a left-to-right shunt. Large shunts, particularly ventricular shunting, become symptomatic in 2 to 8 weeks as pulmonary resistance drops, and presents with tachypnea, diaphoresis, and feeding

difficulties.

- **If the child is cyanotic**, determine a cardiac, pulmonary, central nervous system, or hematologic basis for the condition by asking about onset, course and duration. Tetralogy of Fallot can present as cyanotic spells, or squatting in older infants. Transient cyanosis can also be a normal finding in infants.
- **Ask about Endurance and exercise tolerance**: this screens for cardiac diseases involving obstructive lesions such as aortic or pulmonic stenosis
- **Ask about chest pain**: this can screen for left ventricular outflow obstruction, aortic dissection, pericarditis, myocarditis, and arrhythmias
 - Follow the PQRSTAAA mnemonic in the history of a child with cardiac symptoms (Place/Location, Quality/Type, Radiation, Severity, Timing/Onset, Alleviating, Aggravating, Associated Symptoms)(See Table 2)

Table 2 PQRSTAAA Mnemonic Approach to Chest Pain

PQRSTAAA	What to Ask and Relevant Findings
Place and Location	The child may identify a specific location of the pain (Relevant findings: localization to a small area suggests chest wall or pleural origin, while cardiac ischemic pain is diffuse)
Quality	Pain can be a sharp stabbing pain (ie. trauma) or diffuse poorly-localized pain (ie. chronic or visceral pain) (Relevant findings: sharp midsternal pain at rest can be costochondritis, a “popping sensation” may suggest slipping rib syndrome, squeezing or pressure on the chest may suggest ischemic cardiac pain, sharp retrosternal pain suggests pericarditis). However, note that many young children may have difficulty with describing pain.
Radiation	Pain can radiate from its point of origin in any direction (Relevant findings: radiation to the neck, throat, jaw, teeth, arm or shoulder can suggest ischemic cardiac pain, radiation to the left arm or shoulder can suggest pericarditis, radiation to the back or scapula can suggest aortic dissection, epigastric pain radiating to right shoulder can suggest acute cholecystitis)
Severity	Degree of pain on a scale of 10 (Relevant findings: children can respond differently to extreme pain with some acting out and crying while others are shy)
Timing and Onset	Onset of the pain, duration of pain during the day, and the frequency of episodes (Relevant findings: acute onset pain can suggest a pulmonary or vascular condition such as pulmonary embolism or aortic dissection, gradual onset pain can suggest ischemic cardiac pain, chronic pain may be musculoskeletal or psychogenic)
Alleviating Factors	Anything that helps reduce the pain and can include a certain body position and/or lack of movement (Relevant findings: lack of exertion may suggest child is fatigued)
Aggravating Factors	Anything that aggravates or precipitates the pain (Relevant findings: body position and shallow breathing suggests musculoskeletal pain, exacerbation with swallowing suggests esophageal or upper gastrointestinal, discomfort on exertion suggests cardiac or respiratory, pain when lying down may have pleuritic origin)
Associated Symptoms	Fever, dyspnea, vomiting, headache or pain in another region, lightheadedness, syncope, palpitations

- **Ask about syncopal episodes:** this can suggest right or left obstructive heart disease, pulmonary hypertension, and arrhythmia (such as prolonged QT). Ask about related symptoms to low cardiac output, including dizziness, blurring of vision, oliguria, easy fatigability, and cold extremities
- **Ask about palpitations:** this can suggest sinus tachycardia, supraventricular tachycardia, ventricular tachycardia, and other irregular rhythms (prolonged arrhythmia can cause dizziness or episodes of syncope)
- **Ask about symptoms of Right- and Left-sided Heart Failure:** left-sided heart failure may be due to left-sided obstructive disease (ie. aortic stenosis, coarctation of the aorta). Right-sided heart failure may be due to right-sided obstructive disease (ie. pulmonic stenosis)(See Table 3)

Table 3 Signs and Symptoms of Right- and Left- sided Heart Failure

Right-sided Heart Failure	Left-sided Heart Failure
Systemic venous congestion	Pulmonary venous congestion
Hepatosplenomegaly	Tachypnea
Edema	Respiratory distress (retractions)
Ascites	Wheezing (cardiac asthma)
Pleural effusion	Nasal flaring or grunting
Jugular venous distension	Crackles and pulmonary edema
Shared Signs and Symptoms of Congestive Heart Failure	
Tachycardia	Fatigue and low energy
Pallor	Cool extremities
Sweating	Feeding difficulties
Failure to thrive	Hepatic and/or renal failure
Dizziness, syncope	Altered consciousness

Common Differential Diagnoses

Determining the differential diagnosis requires a sufficient cardiac history, and the list of differentials can change significantly based on the patient's age

- Note that this summary focuses on Cardiac History Taking

Table 4 Differential Diagnosis based on Cardiac History

Medical Condition	Relevant Findings on Cardiac History
Aortic valve stenosis	Often asymptomatic; heart failure in severe stenosis, along with chest pain, lightheadedness, syncope with exercise
Atrial septal defect	Often asymptomatic; heart failure in large defect, along with shortness of breath, easy fatigability, poor growth
Atrioventricular septal defect	Cyanosis (right-to-left shunt), heart failure, sweating, tiring while feeding, poor growth, weight loss
Coarctation of aorta	Heart failure, signs of ischemia to organs and extremities
Ebstein's anomaly	Often asymptomatic; cyanosis (right-to-left shunt), heart races (due to supraventricular tachycardia), irregular beats and palpitations, easy fatigability, shortness of breath
Hypoplastic left heart syndrome	Cyanosis (right-to-left shunt), respiratory distress, lethargy,

	poor feeding, leads to shock, seizures, renal & liver failure
Interrupted aortic arch with ventricular septal defect	Weakness, fatigue, poor feeding, rapid breathing, fast heart rate, leads to shock, pale, mottled, and cool
Patent ductus arteriosus	Fast or increased work of breathing, respiratory infections, easy fatigability, poor growth, asymptomatic if small PDA
Pulmonary valve stenosis	Often asymptomatic; cyanosis (right-to-left shunt), easy fatigability and shortness of breath with exertion
Pulmonary atresia	Rapid breathing, difficulty breathing, irritability, lethargy, pale/cool/clammy skin, cyanosis
Tetralogy of Fallot	Cyanosis (right-to-left shunt), rapid breathing, tet spell (cyanosis usually accompanying a crying fit)
Total anomalous pulmonary venous return	Severe cyanosis at birth, respiratory distress, rapid breathing, grunting and retraction of rib cage muscles
Transposition of the great arteries	Cyanosis as ductus arteriosus closes, rapid breathing, 'comfortably tachypneic', congestive heart failure
Tricuspid atresia	Cyanosis at birth or as ductus arteriosus closes, fast breathing and heart rate, poor feeding, difficulty breathing (pulmonary edema), heart failure, sweating, poor growth
Truncus arteriosus	Cyanosis in first week of life, heart failure, rapid breathing, shortness of breath, wheezing, grunting, noisy breathing, nasal flaring, retractions, restlessness, hepatomegaly (due to congestion), poor feeding, swelling
Ventricular septal defect	Heart failure, poor growth and failure to thrive

Physical Exam, Investigations, and Complications

PHYSICAL EXAM AND COMPLICATIONS

A complete general physical exam with vitals, with a special focus on the cardiac examination and a focus on your differential diagnosis.

- Inspection: look for cyanosis
- Percussion: percuss lungs for **consolidation or fluid**
- Palpation: palpate for thrills, right ventricular heave, **displaced apical beat**
- Auscultation: auscultate for heart sounds, splitting, and murmurs
- Note that this summary focuses on Cardiac History Taking

Table 5 Physical Exam Findings and Complications for Congenital Heart Diseases

Medical Condition	Physical Exam Findings, Complications
Aortic valve stenosis	Murmur; lightheadedness, fainting spells, or sudden death during strenuous activities
Atrial septal defect	Murmur, S2 splitting; poor growth
Atrioventricular septal defect	Murmur, cyanosis; congestive heart failure and poor growth
Coarctation of aorta	Difference in pulse between upper and lower extremities, hypertension in upper extremities, congestive heart failure
Ebstein's anomaly	Murmur, cyanosis; heart failure
Hypoplastic left heart syndrome	Cyanosis, weak pulses in extremities; shock with seizures, renal and liver failure, and heart failure
Patent ductus arteriosus	Murmur; heart failure, endocarditis

Pulmonary valve stenosis	Murmur, cyanosis; right ventricular failure, sudden death
Pulmonary atresia	Cyanosis, possible murmur; cyanosis
Tetralogy of Fallot	Murmur, cyanosis; severe cyanosis and unresponsive
Total anomalous pulmonary venous return	Murmur, cyanosis; severe cyanosis and hemodynamic instability
Transposition of the great arteries	Cyanosis; congestive heart failure, 90% die in first year if unrepaired
Tricuspid atresia	Cyanosis; congestive heart failure, fast heart rate, sweating with feeds, poor weight gain
Truncus arteriosus	Cyanosis; congestive heart failure in first two weeks
Ventricular septal defect	Murmur; congestive heart failure and poor growth

INVESTIGATIONS

- Most common investigations carried out to diagnose congenital heart conditions include the echocardiogram, electrocardiogram, exercise stress test, and chest x-ray

References

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Acknowledgements

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