
بسم الله الرحمن الرحيم


DR ALIREZA AHMADI
Professor of Medical Science University of Isfahan

Common Outpatient Pediatric Heart Disease

ALIREZA AHMADI MD

PROFESSOR OF MEDICAL SCIENCE
UNIVERSITY OF ISFAHAN

- Innocent Heart Murmurs
- Syncope
- Chest pain
- Palpitation

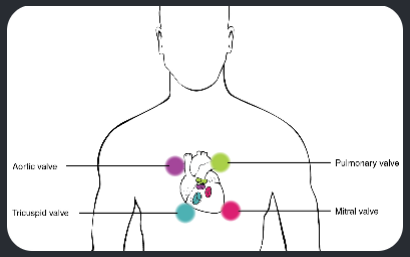
Heart Murmurs in Children: A Guide for Physicians

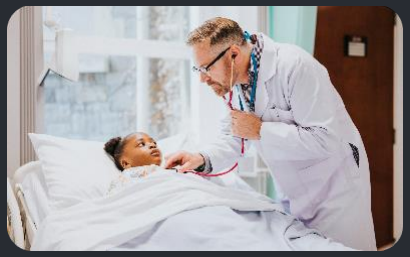
Asymptomatic children with heart murmurs are common, but correct assessment of the significance of a heart murmur is crucial to ensure appropriate treatment.

Learn about the significance of heart murmurs, clinical presentation, evaluation, workup and referral, consequences of misdiagnosis, and more.

What are Heart Murmurs?

Heart murmurs can result from a variety of factors. Some murmurs are innocent and have no serious consequence, while others are the result of structural heart abnormalities, such as congenital heart defects. Learn about the different types of heart murmurs and their causes.





Types of Heart Murmurs

Heart murmurs can be innocent or caused by structural defects. Understanding the differences between types of murmurs is key to proper diagnosis.

Causes of Heart Murmurs

Some murmurs are harmless and others are the result of structural heart abnormalities, such as congenital heart defects. Knowing the cause of the murmur is crucial to proper diagnosis and treatment.

Auscultatory Skills

Developing and maintaining auscultatory skills is essential for identifying the patient who requires cardiology referral. Learn about the importance of good stethoscope quality and sizing.

Significance of Heart Murmurs

Heart murmurs are what doctors call “findings” rather than medical symptoms or signs because they are detected incidentally at an examination conducted for something else. In this section, we discuss the significance of heart murmurs and how to assess them correctly.

Innocent vs Organic Murmurs

An estimated 50% of healthy children have heart murmurs. However, not all murmurs are the result of heart disease. Learn how to differentiate between innocent and organic murmurs.

History and Symptoms

The history and physical examination of a patient can provide helpful clues in assessing the presence and significance of a heart murmur. Find out what to look for and how to identify patients who require cardiology referral.

Misdiagnosis and Consequences

Heart murmurs can be misinterpreted, leading to unnecessary restrictions, parental anxiety, and adult job discrimination. Discover why misdiagnosis is costly and how to avoid it.

Clinical Presentation of Heart Murmurs

Heart murmurs are typically detected during routine examinations or in response to another issue. When the heart murmur is innocent, there are generally no signs or symptoms. In this section, we explore the clinical presentation of heart murmurs, from infancy through adulthood.

1 **Infancy**

Easy fatigability during infancy may be reported as poor or slow feeding. A history of rapid breathing, excessive sweating, and other symptoms referable to CHF is suggestive of organic heart disease.

2 **Childhood**

Most symptoms associated with organic murmurs are related to CHF and usually become evident during infancy. Chest pain is rarely cardiac in origin in children, but it's important to monitor the history of the patient closely.

3 **Adulthood**

Adults with heart murmurs can exhibit symptoms that are often nonspecific, such as dyspnea, syncope, palpitations, and chest pain. Additionally, adults with valvular heart disease may develop heart failure or have an embolic event.

Innocent Heart Murmurs

- **Innocent** heart murmurs, also called ***functional*** *murmurs, arise from cardiovascular* structures in the absence of anatomic abnormalities.

- Innocent heart murmurs are common in children.

- More than **80%** of children have innocent murmurs of one type or another sometime during childhood.

- All innocent heart murmurs (as well as pathologic murmurs) are **accentuated** or brought out in a **high-output** state, usually during a **febrile** illness.

- They have also been called ***benign***, ***functional, vibratory, and flow*** *murmurs*.

- These normal murmurs are heard most often during the **first 6 months** of life, from **3 to 6 years of age**, and in **early adolescence**.

- Characteristic findings of innocent murmurs include
- the **quality of the sound**,
- lack of significant **radiation**, and
- significant alteration in the intensity of the murmur with **positional** changes.

- Most importantly, the cardiovascular history and examination are otherwise normal.

- The presence of symptoms, including **failure to thrive or dysmorphic features**, should make one more cautious about diagnosing a "normal" murmur.

- **Diastolic**, **holosystolic**, **late systolic**, and **continuous** (except for the venous hum) murmurs and the presence of a **thrill** are not normal.

FIGURE 26.2 Turner syndrome. Eleven-year-old girl with hypertelorism, facial nevi, and dysplastic right pinnae. She has short stature, normal intelligence, thyroiditis, and no CHDs (Courtesy of Angela E. Lin, MD.)

- All innocent heart murmurs are associated with normal ECG and
- x-ray findings.

- When one or more of the following are present,

the murmur is more likely pathologic and

requires cardiac consultation:

- **1. Symptoms,**
- **2. Abnormal cardiac size or silhouette or abnormal pulmonary vascularity on** chest roentgenograms

- **3. Abnormal ECG**
- **4. Diastolic murmur**
- **5. A systolic murmur that is loud (i.e., grade 3/6 or with a thrill), long in duration,**

  and transmits well to other parts of the body
- **6. Cyanosis**
- **7. Abnormally strong or weak pulses**
- **8. Abnormal heart sounds**

Table 2-9 -- Common Innocent Heart Murmurs

Type (Timing)	Description of Murmur	Age Group
Classic vibratory murmur (Still's murmur) (systolic)	Maximal at MLSB or between LLSB and apex	3–6 yr
	Grade 2 to 3/6	Occasionally in infancy
	Low-frequency vibratory, “twanging string,” groaning, squeaking, or	

Type (Timing)	Description of Murmur	Age Group
	musical	
Pulmonary ejection murmur (systolic)	Maximal at ULSB	8–14 yr
	Early to midsystolic	
	Grade 1 to 3/6 in intensity	
	Blowing in quality	
Pulmonary flow murmur of newborn (systolic)	Maximal at ULSB	Prematures and full-term newborns
	Transmits well to the left and right chest, axilla, and back	
	Grade 1 to 2/6 in intensity	Usually disappears by 3–6 mo of age
Venous hum (continuous)	Maximal at right (or left) supraclavicular and infraclavicular areas	3–6 yr
	Grade 1 to 3/6 in intensity	
	Inaudible in the supine position	
	Intensity changes with rotation of the head and compression of the jugular vein	
Carotid bruit (systolic)	Right supraclavicular area and over the carotids	Any age
	Grade 2 to 3/6 in intensity	
	Occasional thrill over a carotid	

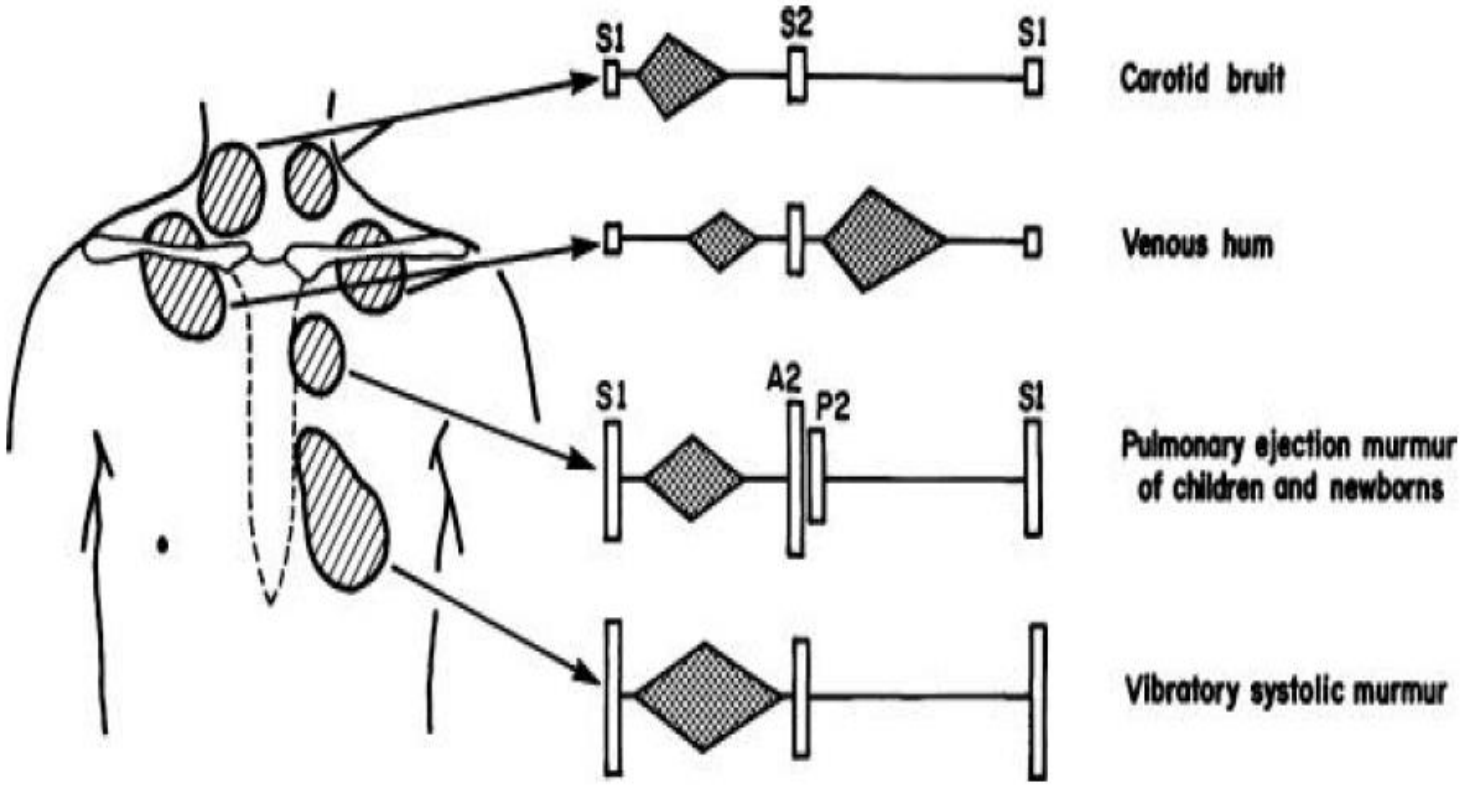
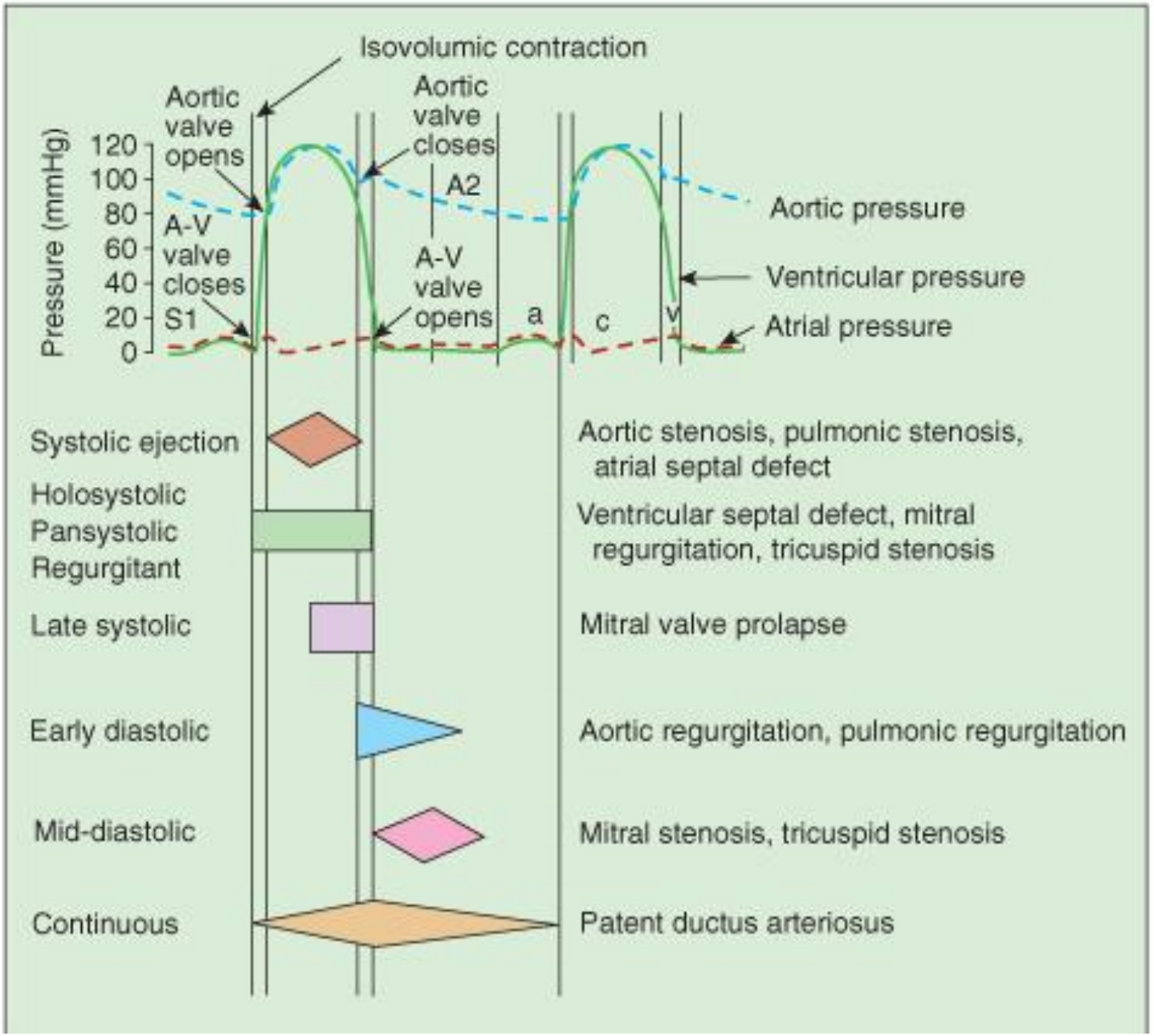


Figure 2-14 Diagram of innocent heart murmurs in children.


Isovolumic contraction
Aortic valve opens
Aortic valve closes
A2
A-V valve closes
S1
A-V valve opens
a
c
v
Pressure (mmHg)
120
100
80
60
40
20
0
Aortic pressure
Ventricular pressure
Atrial pressure
Systolic ejection
Aortic stenosis, pulmonic stenosis, atrial septal defect
Holosystolic
Pansystolic
Regurgitant
Ventricular septal defect, mitral regurgitation, tricuspid stenosis
Late systolic
Mitral valve prolapse
Early diastolic
Aortic regurgitation, pulmonic regurgitation
Mid-diastolic
Mitral stenosis, tricuspid stenosis
Continuous
Patent ductus arteriosus

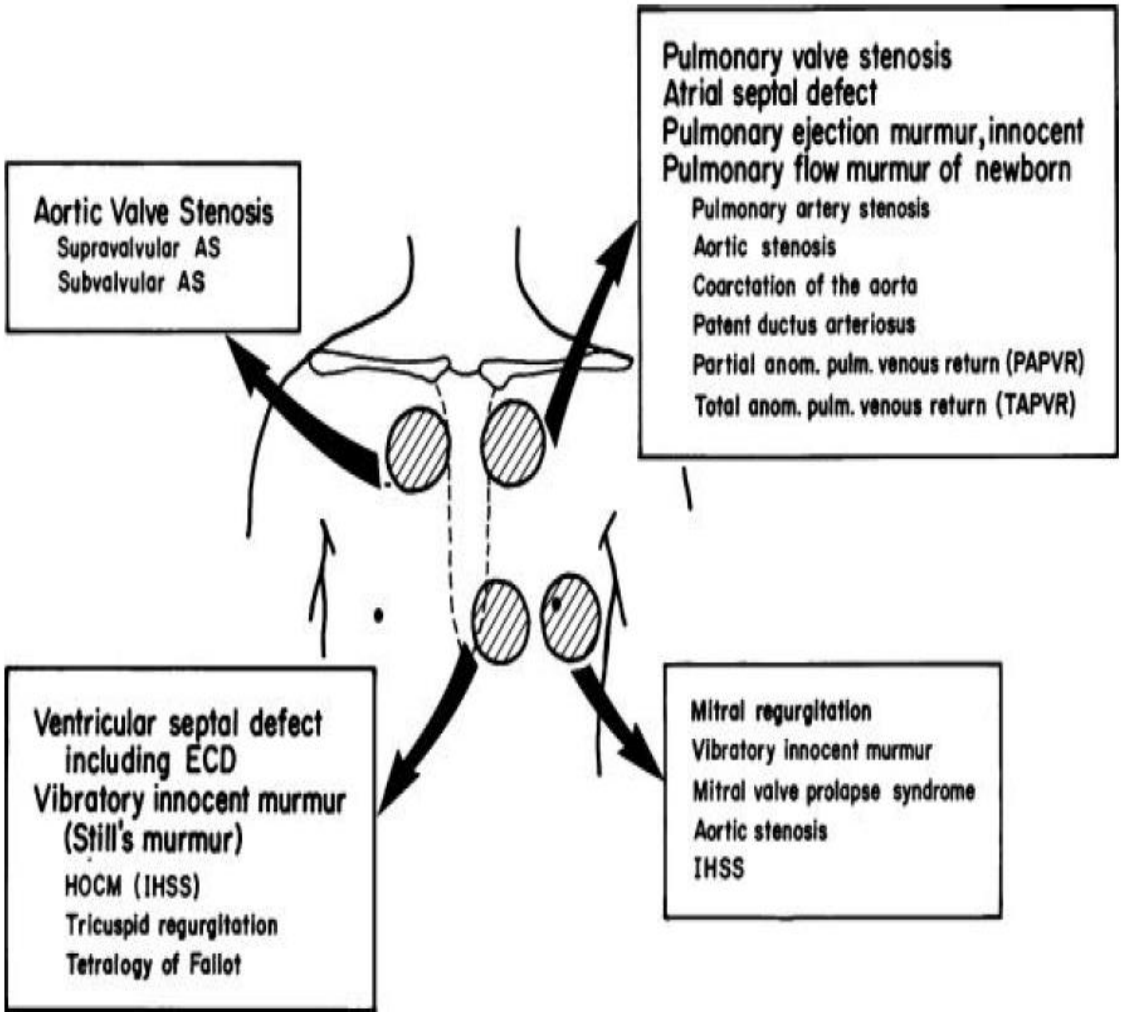
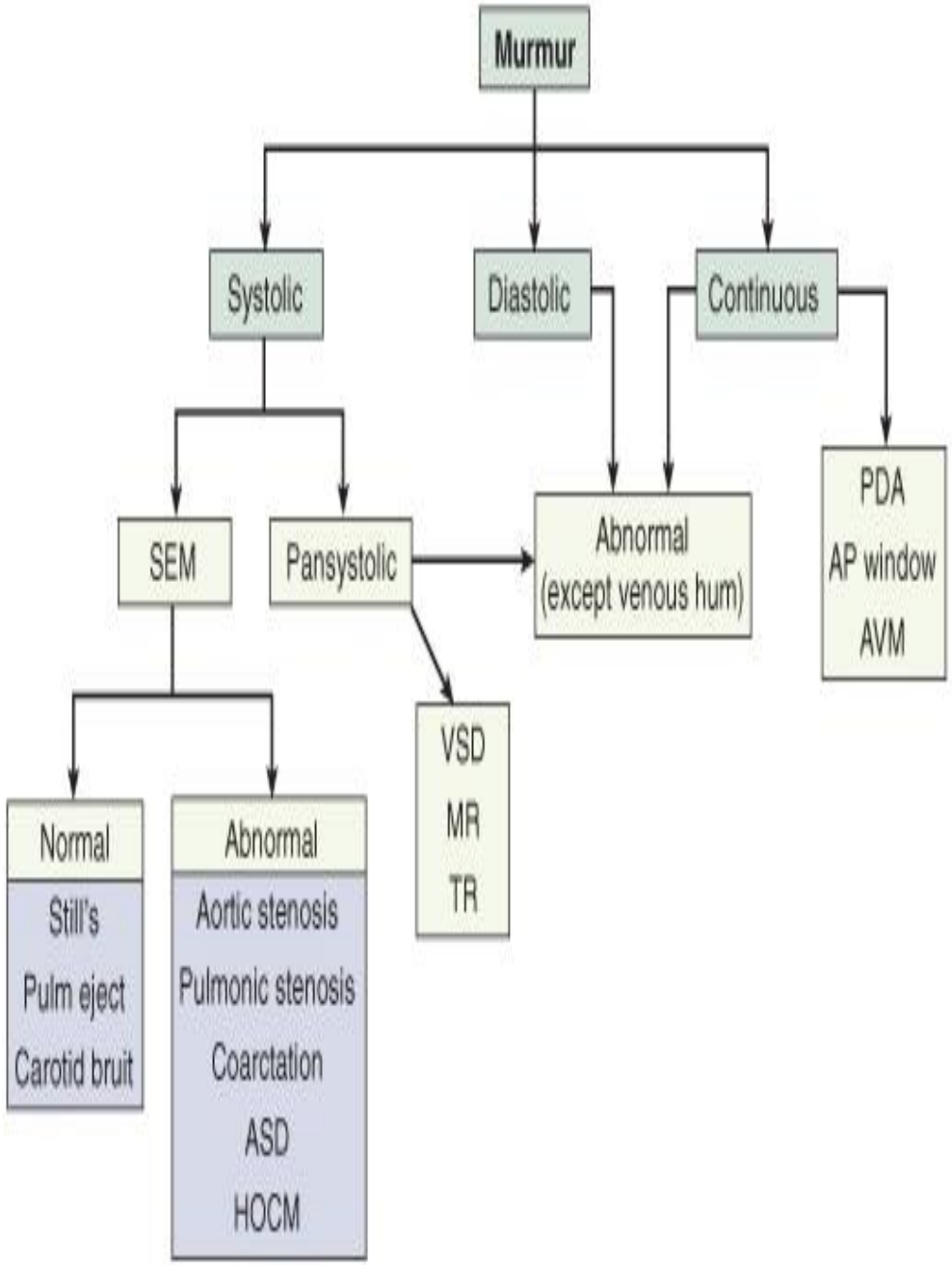

Aortic Valve Stenosis
Supravalvular AS
Subvalvular AS
Pulmonary valve stenosis
Atrial septal defect
Pulmonary ejection murmur, innocent
Pulmonary flow murmur of newborn
Pulmonary artery stenosis
Aortic stenosis
Coarctation of the aorta
Patent ductus arteriosus
Partial anom. pulm. venous return (PAPVR)
Total anom. pulm. venous return (TAPVR)
Ventricular septal defect including ECD
Vibratory innocent murmur (Still's murmur)
HOCM (IHSS)
Tricuspid regurgitation
Tetralogy of Fallot
Mitral regurgitation
Vibratory innocent murmur
Mitral valve prolapse syndrome
Aortic stenosis
IHSS

TABLE 139-5 Normal or Innocent Heart Murmurs

Murmur	Timing/Location/Quality	Usual Age at Diagnosis
Still's murmur/vibratory murmur	Systolic ejection murmur LLSB or between LLSB and apex Grades I–III/VI Vibratory, musical quality Intensity decreases in upright position	3–6 yr
Venous hum	Continuous murmur Infraclavicular region (right > left) Grades I–III/VI Louder with patient in upright position Changes with compression of jugular vein or turning head	3–6 yr
Carotid bruit	Systolic ejection murmur Neck, over carotid artery Grade Is–III/VI	Any age
Adolescent ejection murmur	Systolic ejection murmur LUSB Grades I–III/VI Usually softer in upright position Does not radiate to back	8–14 yr
Peripheral pulmonary stenosis	Systolic ejection murmur Axilla and back, LUSB/RUSB Grades I–II/VI Harsh, short, high-frequency	Newborn–6 mo


Murmur
Systolic
Diastolic
Continuous
SEM
Pansystolic
Abnormal
(except venous hum)
PDA
AP window
AVM
VSD
MR
TR
Normal
Still's
Pulm eject
Carotid bruit
Abnormal
Aortic stenosis
Pulmonic stenosis
Coarctation
ASD
HOCM

Heart Murmur Physical Examination

When examining for heart murmurs, doctors often look for vital signs and other clues beyond the murmur itself to determine a cardiac diagnosis. Find out what to look for in the physical examination and how to identify extra sounds and some signs of long-standing cardiomegaly.

Vital Signs

- Tachypnea and tachycardia are present in heart failure.
- Blood pressure is normal in most patients with CHD.

Complete Examination

- Assess the patient for chest asymmetry, which is a sign of long-standing cardiomegaly.
- Note any extra sounds.
- Determine if the second heart sound is normal in intensity and in width and motion of splitting.

Pertinent Findings

- Lethargy, dysmorphic features suggestive of a genetic syndrome, and noncardiac anomalies commonly associated with CHD should be noted.
- Central cyanosis and clubbing may be present.

Diagnostic Studies for Heart Murmurs

When a heart murmur is suspected of being organic in origin, some diagnostic studies may be necessary to properly diagnose and treat the patient..

1 Laboratory Studies

In most murmurs, routine laboratory studies are not warranted. Doctors typically rely on history, examination, and diagnostic studies rather than lab results to diagnose the cause of heart murmurs.

2 Electrocardiography

When heart disease is known or strongly suspected, electrocardiograpy may be indicated to aid in diagnosis. However, a normal eclectrocardiogram may not rule out significant CHD, so a careful diagnosis is required.

3 Chest Radiography

A chest radiograph may be helpful in some cases but is typically weighed down by the discomfort and risk of radiation exposure.

Heart Murmur Management

When a heart murmur is suspected of being organic in origin, a referral to a pediatric cardiologist is required in most cases.

Management	Description
Medical therapy	Medical therapy may be used to treat heart murmurs depending on the type and severity of the condition.
Invasive procedures	Invasive procedures may be required for patients with severe conditions that have not responded to medical therapy.
Surgery	Some types of heart disease can be treated by surgery.

Syncope

DEFINITION

- **Syncope** is the transient loss of consciousness and muscle tone that result from inadequate cerebral perfusion.
- **Presyncope** or near-syncope has many or all of the prodromal symptoms without loss of consciousness.

- Cerebral blood flow is maintained by autoregulation over a wide range of perfusion pressures.
- With a critical reduction in PO_2, or an elevation of PCO_2, reflexive cerebral vasodilation occurs.
- Syncope may occur with a transient failure in this reflexive mechanism, which protects the cerebral blood perfusion for some 8 to 10 seconds.

- Also, other factors such as **dehydration** may induce syncope .
- Syncope typically is characterized by a sudden fall in arterial **blood pressure**, which is associated with **light-headedness, dizziness, and loss of consciousness**.
- A common explanation is the sudden **pooling of blood in the splanchnic system** or in the **peripheral blood vessels**, which leads to a dramatic reduction of the venous return to the heart.

- The most common cause is a functional disturbance in the **baroreflex** control of the arterial blood pressure.
- The abnormal reflex activity is characterized by a sympathetic withdrawal and excessive vagal tone.
- This leads to a critical impairment of cerebral blood flow.
- Other types of syncope, owing to **structural heart disease**.

- Syncope is relatively common and has many causes.
- The **frequency of episodes** and amount of **stress** and **functional impairment** caused by syncope vary.
- **Most** syncopal events are relatively **benign**, but can represent a serious cardiac condition that may lead to **sudden death**.

- The resulting hemodynamic abnormalities can be classified according to a
- **cardioinhibitory,**
- **a vasodilatory**, or
- a **mixed type** of response for heart rate and blood pressure as has been defined above.

- During **neurally mediated** syncope,

  afferent signals initiate a series of autonomic events in the medullary control areas that induce inappropriate **vasodilatory**, **bradycardic**, and in some instances, even **asystolic** responses.

- Dizziness is the most common prodromal symptom of syncope.
- They may also be due to noncardiac causes (such as benign vasovagal syncope), neuropsychiatric conditions, and metabolic disorders.
- A history of exertional syncope may suggest arrhythmias (particularly ventricular arrhythmias, such as seen in long QT syndrome) or severe obstructive lesions (such as severe AS or hypertrophic cardiomyopathy [HCM]).

- Syncope provoked by exercise, that accompanied by chest pain, or a history of unoperated or operated heart disease suggests a potential cardiac cause of syncope.
- Syncope while sitting down suggests arrhythmias or seizure disorders.
- Syncope while standing for a long time suggests vasovagal syncope without underlying cardiac disease, which is the most common syncope in children.

- Hypoglycemia is a rare cause of syncope occurring in the morning.
- Syncopal duration less than 1 minute suggests vasovagal syncope, hyperventilation, or syncope related to another orthostatic mechanism.
- A longer duration of syncope suggests convulsive disorders, migraine, or arrhythmias.

TABLE 140-1 Syncope and Dizziness: Etiology

Diagnosis	History	Signs/Symptoms	Description	Heart Rate/ Blood Pressure	Duration	Postsyncope	Recurrence
Neurocardiogenic (vasodepressor)	At rest	Pallor, nausea, visual changes	Brief ± convulsion	↓/↓	<1 min	Residual pallor, sweaty, hot; recurs if child stands	Common
Other vagal							
Vasovagal	Needle stick	Pallor, nausea	Brief ± convulsion	↓/↓	<1 min	Residual pallor; may recur if child stands	Situational
Micturition	Postvoiding	Pallor, nausea	Brief; convulsions rare	↓/↓	<1 min		(+)
Cough (deglutition)	Paroxysmal cough	Cough	Abrupt onset	May not change	<5 min	Fatigue or baseline	(+)
Carotid sinus	Tight collar, turnedhead	Vague, visual changes	Sudden onset, pallor	Usually ↓/↓	<5 min	Fatigue or baseline	(+)
Metabolic							
Hypoglycemia	Fasting, insulin use	Gradual hunger	Pallor, sweating; loss of consciousness rare	No change or mild tachycardia	Variable	Relieved only by eating	(+)
Neuropsychiatric							
Hyperventilation	Anxiety	SOB, fear, claustrophobia	Agitated, hyperpneic	Mild ↓/↓	<5 min	Fatigue or baseline	(+)
Syncopal migraine	Headache	Aura, migraine, nausea	± Pallor	No change	<10 min	Headache, often occipital	(+)
Seizure disorder	Anytime	± Aura	Convulsion ± incontinence	No change or mild tachycardia	Any duration	Postictal lethargy + confusion	(+)
Hysterical	Always an "audience" present	Psychological distress	Gentle, graceful swoon	No change	Any duration	Normal baseline	(+)
Breath holding (hypoxic)	Agitation or injury	Crying	Cyanosis ± brief convulsion	↓/↓ Frequent	<10 min	Fatigue, residual pallor	(+)

TABLE 140-1 Syncope and Dizziness: Etiology—cont'd

Diagnosis	History	Signs/Symptoms	Description	Heart Rate/ Blood Pressure	Duration	Postsyncope	Recurrence
Cardiac syncope							
LVOT obstruction	Exercise	± Chest pain, SOB	Abrupt during or after exertion, pallor	↑/↓	Any duration	Fatigue, residual pallor, and sweating	(+)
Pulmonary hypertension	Any time, especially exercise	SOB	Cyanosis and pallor	↑/↓	Any duration	Fatigue, residual cyanosis	(+)
Myocarditis	Post-viral infection exercise	SOB, chest pain, palpitations	Pallor	↑/↓	Any duration	Fatigue	(+)
Tumor or mass	Recumbent, paroxysmal	SOB ± chest pain	Pallor	↑/↓	Any duration	Baseline	(+)
Coronary artery disease	Exercise	SOB ± chest pain	Pallor	↑/↓	Any duration	Fatigue, chest pain	(+)
Dysrhythmia	Any time	Palpitations ± chest pain	Pallor	↑ or ↑/↓	Usually <10 min	Fatigue or baseline	(+)

LVOT, left ventricular outflow tract; SOB, shortness of breath; ±, with or without; (+), yes but not consistent or predictable.

From Lewis DA: Syncope and dizziness. In Kliegman RM (ed): Practical Strategies in Pediatric Diagnosis and Therapy. Philadelphia, *WB Saunders*, 1996.

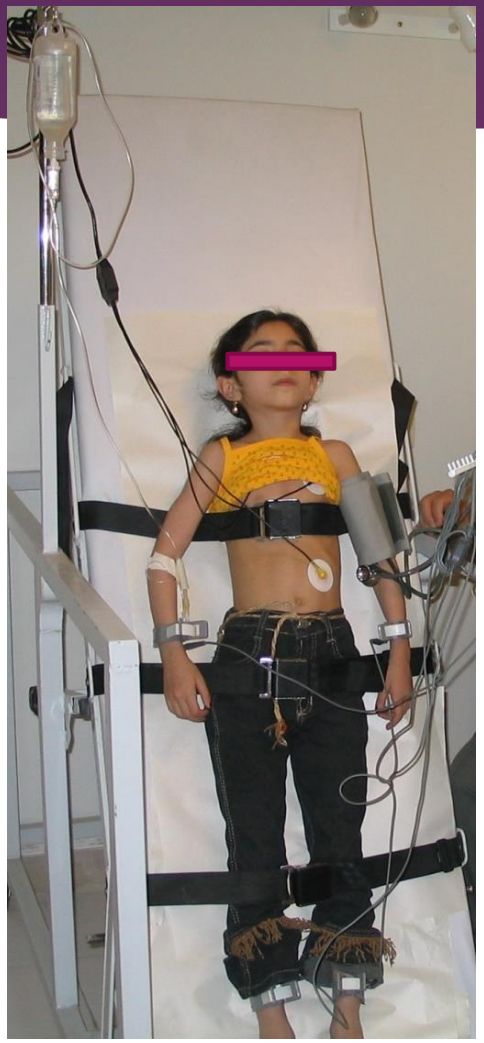
DIAGNOSTIC STUDIES

- Depending on the **number**, **frequency**, and amount of **functional impairment**, syncopal episodes may require no more than reassurance to the patient and family.

- If the episodes have a significant impact on **daily activities**, further evaluation may be indicated.

- It is appropriate to do an **ECG** on any patient presenting with a chief complaint of syncope with attention to the **Q-Tc** and **P-R** intervals.

- Additional testing may include **tilt table testing** before considering medical therapy.



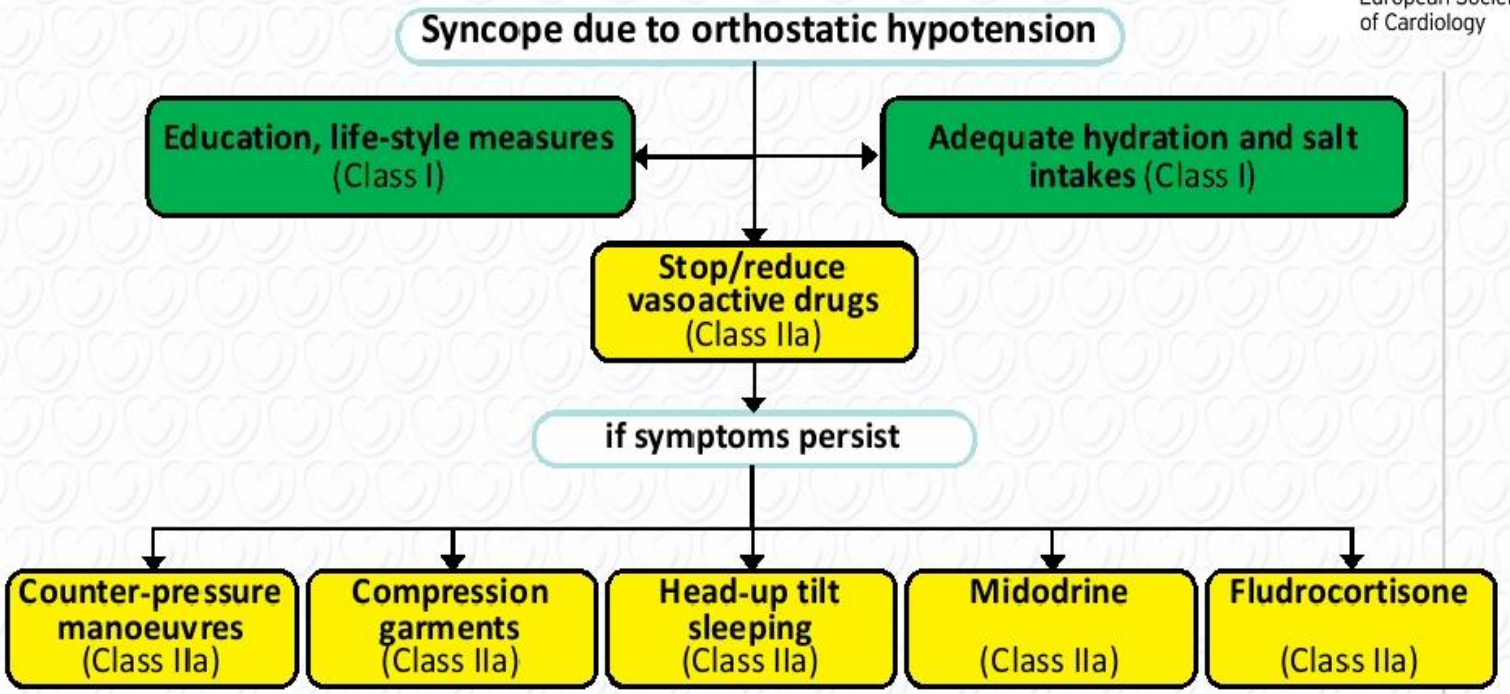
Treatment syncope: **Counterpressure manoeuvres**

ESC
European Society of Cardiology

2018 ESC Guidelines on Syncope – Michele Brignole & Angel Moya
European Heart Journal 2018;39:1883–1948 - Doi:10.1093/eurheartj/ehy037

Treatment of syncope: **Orthostatic hypotension**

ESC European Society of Cardiology



2018 ESC Guidelines on Syncope – Michele Brignole & Angel Moya
European Heart Journal 2018;39:1883–1948 - Doi:10.1093/eurheartj/ehy037

Chest pain

- Chest pain is a common chief complaint in pediatric patients, often generating a significant amount of patient and parental concern.
- Although chest pain is **rarely cardiac** in origin in children, common knowledge about atherosclerotic heart disease raises concerns about a child experiencing chest pain.

- Most chest pain in childhood is musculoskeletal in origin.
- A significant amount remains **idiopathic**, however.
- Knowledge of the complete differential diagnosis is necessary to make an accurate assessment.

TABLE 141-1 Differential Diagnosis of Pediatric Chest Pain

COMMON

Musculoskeletal
- Costochondritis
- Trauma or muscle overuse/strain

Pulmonary
- Asthma (often exercise-induced)
- Severe cough
- Pneumonia

Gastrointestinal
- Reflux esophagitis

Psychogenic
- Anxiety, hyperventilation

Miscellaneous
- Precordial catch syndrome (Texidor's twinge)
- Sickle cell vaso-occlusive crisis
- Idiopathic

UNCOMMON/RARE
Cardiac
Ischemia (coronary artery abnormalities, severe AS or PS, HOCM, cocaine)
Infection/inflammation (myocarditis, pericarditis, Kawasaki disease)
Dysrhythmia
Mitral valve prolapse
Musculoskeletal
Abnormalities of rib cage/thoracic spine
Tietze syndrome
Slipping rib
Tumor
Pulmonary
Pleurisy
Pneumothorax, pneumomediastinum
Pleural effusion
Pulmonary embolism
Gastrointestinal
Esophageal foreign body
Esophageal spasm
Psychogenic
Conversion symptoms
Somatization disorders
Depression

AS, aortic stenosis; HOCM, hypertrophic obstructive cardiomyopathy; PS, pulmonary stenosis.

Assessment

- Assessment of a patient with chest pain must include a thorough history to determine
- what the child is doing at the **onset**;
- the **location**,
- **radiation,**
- **quality**, and
- **duration** of the pain;
- what makes the pain **better** and
- **worse** during the time that it is present; and
- any **associated symptoms**.

- A good **family history** and assessment of how much anxiety the symptom is causing are important and often revealing.
- Although the history alone often determines the etiology, a careful **general physical examination** should focus on
- the **chest wall**,
- **heart**,
- **lungs**, and
- **abdomen**.

- A history of chest pain associated with **exertion**, **syncope**, or **palpitations**, or **acute onset associated with fever** suggests a **cardiac** etiology.
- Cardiac causes of chest pain are generally **ischemic**,

inflammatory, or

arrhythmic in origin.

DIAGNOSTIC STUDIES

- Tests rarely may be indicated based on the **history** or the need to supplement clinical findings and reassure the patient and family.
- A **chest x-ray**,
- **ECG**,
- **24-hour Holter monitoring**,
- **echocardiogram**, and
- **exercise stress testing** may be obtained based on history and examination.

- Referral to a pediatric cardiologist is based on the **history**,

  physical examination findings,

  family history, and

  frequently the high **level of anxiety** in the patient or family members regarding the pain.

Pediatric Palpitations: A Comprehensive Guide

Learn about the significance, causes, evaluation, and diagnosis of palpitations in healthy children.

Significance of Palpitations in a Healthy Child Child

1

Assessing Cardiac Function

Understand the implications of palpitations and their their potential impact impact on the child's child's cardiac health. health.

2

Differentiating Cardiac vs Non-Cardiac Causes

Explore the likelihood likelihood of heart-related issues compared to other potential causes.

3

Recognizing Life-Threatening Scenarios

Gain insights into the the severity of palpitation symptoms symptoms and their their potential implications.

Causes and Evaluation

1

Cardiac Arrhythmias

Understanding the role of cardiac arrhythmias in pediatric palpitations.

2

Psychogenic Factors

Exploring the impact of anxiety and heightened somatic awareness on palpitation palpitation episodes.

3

Differential Diagnosis

Examining other potential causes and their relevance in the evaluation process.

Clinical Presentation

1

Sudden Onset and Alarm

Unpacking how palpitations take children by surprise and the accompanying accompanying emotional response. response.

2

Parental Concerns

Understanding the discrepancy between between the child's demeanor and the anxiety experienced experienced by their their parents.

3

Isolated Episodes

Exploring the absence absence of concurrent concurrent medical issues during reported reported episodes of of palpitations.

Pathophysiology

1 **Cardiac-Related Causes**

Delving into the impact of cardiac arrhythmias on cardiac function and and overall health.

2 **Potential Complications**

Understanding the the range of physiological changes that can occur due to arrhythmias.

3 **Sustained Arrhythmias**

Highlighting the prevalence and significance of supraventricular tachycardia in pediatric patients with palpitations.

Physical Examination and Laboratory Studies

Physical Examination

Exploring the limited diagnostic potential of potential of physical examinations in isolating isolating palpitation causes.

Laboratory Studies

Understanding the role of laboratory studies in informing the need for referrals and guiding diagnosis.

Documenting Cardiac Rhythm and Diagnostic Tests

1

Importance of Rhythm Documentation

Unpacking the necessity necessity of capturing the the cardiac rhythm during during symptomatic episodes for accurate diagnosis.

2

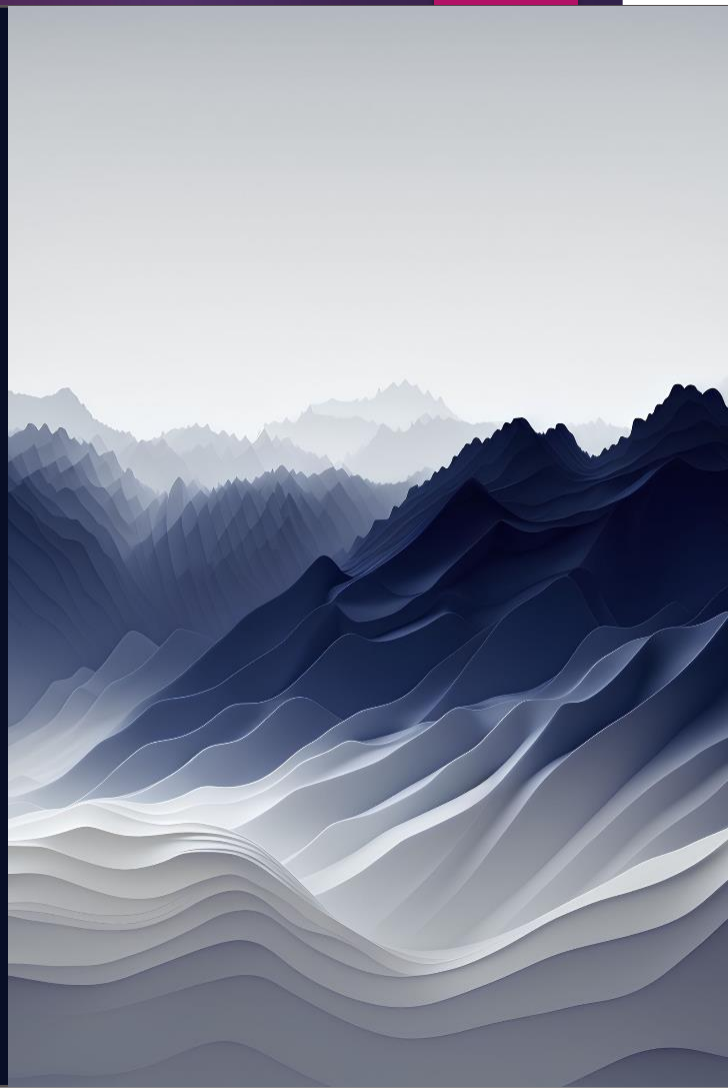
Diagnostic Techniques

Examining various diagnostic tests available, available, including ECG, ECG, holter monitor, and and implantable monitoring options.

3

Additional Diagnostic Tests

Highlighting other complementary tests that may aid in establishing a definitive diagnosis.



Key Questions to Ask

1

Patient's Experience

Explore specific questions to elicit relevant information information about the the nature and frequency of palpitations.

2

Associated Symptoms

Understanding the potential symptoms symptoms accompanying palpitations for better better diagnostic insight.

3

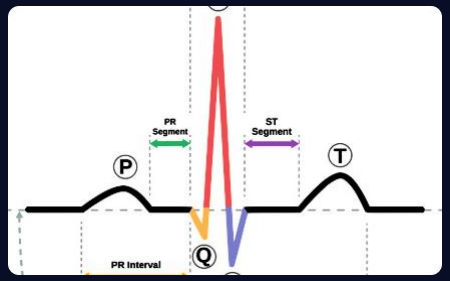
Family History and Triggers

Identifying the role of of genetic factors and and triggering events events in assessing pediatric palpitations. palpitations.

Concluding Remarks

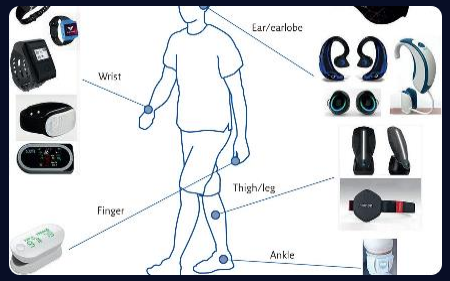
Collaboration with Cardiologists

Insights into the primary care care physician's role in referring referring children with palpitations to cardiologists.



Early Intervention and Treatment

Highlighting the significance of timely diagnosis and its impact on treatment options.



Long-Term Monitoring

Understanding the potential need for long-term monitoring monitoring for accurate assessment and management of management of palpitations. palpitations.

palpitation

- Palpitations describe perception of the heartbeat that is usually concerning to the patient.
- In adults, palpitations occasionally herald serious underlying cardiac events.

- However, palpitations in children typically arise from physiologic stimuli, such as
- fever,
- exercise,
- anxiety, or
- anemia,
- rather than life-threatening causes (eg, cardiac arrhythmia).
- In addition, children with serious arrhythmias may report no palpitations.

- **Life-threatening causes** —
- Children with a serious underlying cause for their palpitations often have a history of
- syncope,
- congenital heart disease, or
- cardiac surgery.

Causes

- Myocarditis
- Hypoglycemia
- HCM
- Increased metabolic rate
- PAC
- PVC
- Pheochromocytoma
- Hyperthyroidism
- Drug induced
- Poisioning
- ARF, MVP

- History
- Physical exam
- ECG
- Holter monitoring
- Echocardiography

Palpitations Diagnosis and and Management

If child experiences palpitations, it's important to understand the underlying cause and how to manage it.

Normal Sinus Rhythm

1

No Further Intervention Intervention

When palpitations have no no evidence of cardiac arrhythmia and upon monitoring have normal sinus rhythm, no further treatment is needed.

2

Minor Dysrhythmias

Isolated low-grade PVCs do do not require treatment. Reassurance of the patient patient and parents is sufficient management.

3

Significant Dysrhythmias

Antiarrhythmic medication, beta blockers, or implantable cardioverter-cardioverter-defibrillator might be necessary for severe ventricular ventricular arrhythmias. Supraventricular tachycardia can usually be usually be managed using pharmacotherapy, cryoablation, or radiofrequency ablation.

SVT - Supraventricular Tachycardia

1

Pharmacologic Management

Treatment with medication is usually well-tolerated and highly highly effective in preventing recurrences.

2

Ablation

Cryoablation or radiofrequency ablation of accessory pathways lead lead to great results in patients not not only of the arrhythmia but also also of the need to take daily medications.

3

Interrupting Recurrences

SVT recurrences can be interrupted interrupted with vagal maneuvers maneuvers or the application of of cold water or ice to the face.

Prognosis

Low or No Concern for Heart Disease

The prognosis is the same as for other other children.

Paroxysmal SVT

Patients usually respond well to pharmacologic management.

Ablative Procedures for SVT

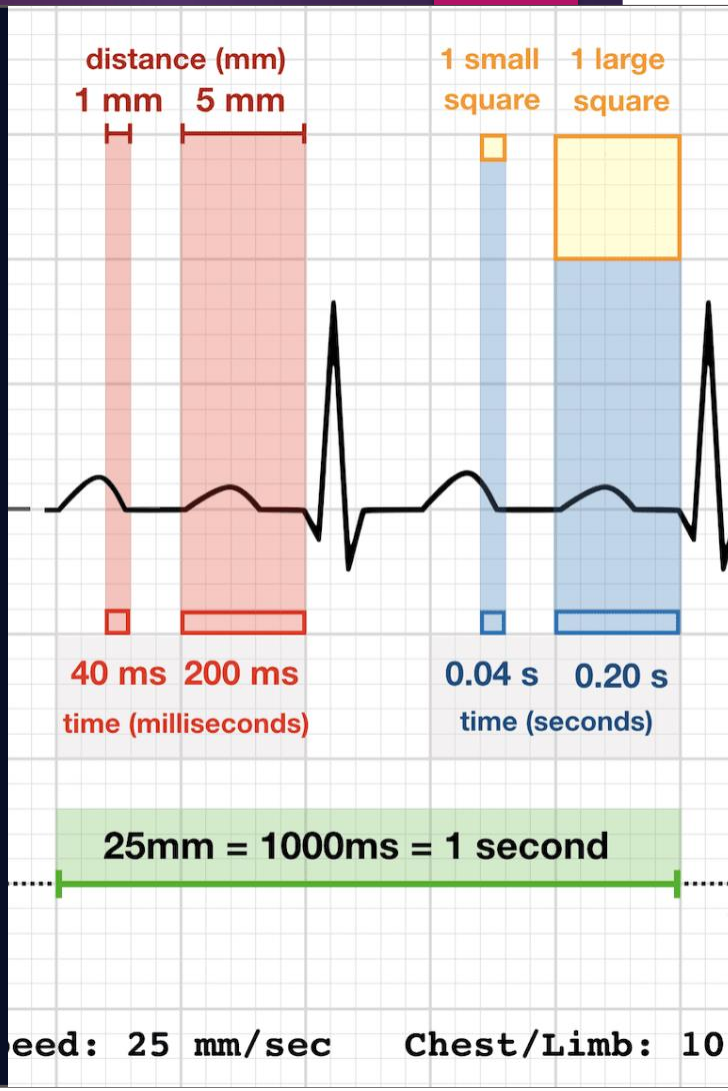
Yield an excellent prognosis and are often often curative in the absence of complete complete heart block rare complication. complication.

Serious Ventricular Arrhythmias

Prognosis varies depending on the underlying condition but implantable implantable cardioverter-defibrillators can defibrillators can greatly improve the quality of life.

Case Resolution

After a Holter monitor, an event detector revealed SVT at a rate of 250 beats per minute that was successfully ablated through an electrophysiology study without complications. The patient was free of palpitations, on no medications, and doing well at the 1-year follow-up.



Pediatric Patients with Palpitations

Reassure Parents

The palpitations of most pediatric patients are harmless, and parents usually feel less anxious when they understand what's happening.

Initial Consultation

Evaluation, diagnosis, and and management should be be individualized and ages ages and concurrent medical medical and psychological psychological conditions should be taken into consideration.

Encourage Activities

Physical activity is important important for kids with palpitations as it helps control heart rates and improves heart conditions. conditions.

Tips for Managing Palpitations

1

Lifestyle Changes

Help child maintain a healthy body weight, eat a balanced diet, get enough sleep, and manage stress levels.

2

Inform Teachers and Coaches

If child has palpitations, make sure sure that their coaches and teachers teachers are aware of the condition condition and emergency plans are are in place.

3

Emergency Plan

Have a clearly defined emergency emergency plan to provide immediate care in case of urgent urgent worsening palpitations and and involving child's cardiologist in cardiologist in this process.

When to Seek Medical Advice

1 **When Palpitations Become Frequent or Severe**

If the palpitations become more frequent, last longer than than normal, or become more more severe and your child experiences symptoms like chest pain, dizziness, fainting, fainting, or difficulty breathing breathing when he or she has has palpitations, then you should seek medical help right right away.

2 **During Physical Activity**

If child experiences palpitations during physical physical activity, you should should consult pediatric cardiologists they can indicate underlying heart heart problems.

3 **Family History of Cardiac Disease**

If there is a family history of cardiac disease, it is worth seeking seeking medical advice even if the symptoms only occur occasionally.

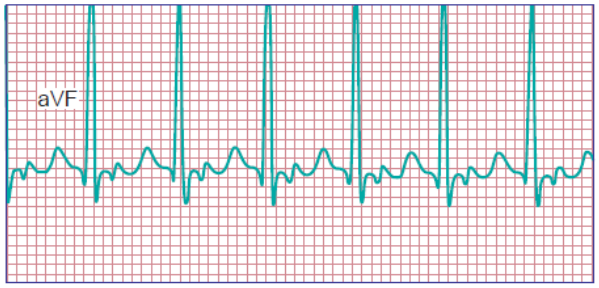
CLINICAL MANIFESTATIONS

- SVT is characterized by an abrupt onset and cessation;
- It may occur when the patient is at rest or exercising, and in infants it may be precipitated by an acute infection.
- Attacks may last only a few seconds or may persist for hours.
- The heart rate usually exceeds 180 beats/min and may occasionally be as rapid as 300 beats/min.
- The only complaint may be awareness of the rapid heart rate.

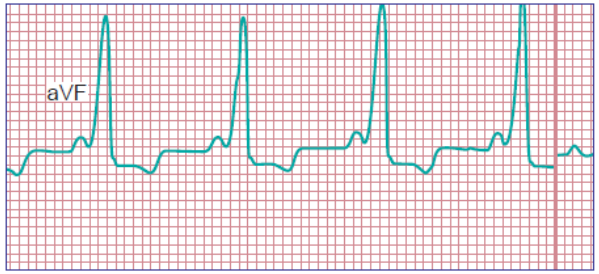
- Many children tolerate these episodes extremely well,
- and it is unlikely that short paroxysms are a danger to life.
- If the rate is exceptionally rapid or if the attack is prolonged, precordial discomfort and heart failure may occur.
- In children, SVT may be exacerbated by exposure to nonprescription decongestants or by bronchodilators.

young infants

- In young infants, the diagnosis may be more obscure because of the inability to communicate their symptoms.
- The heart rate at this age is normally higher than in older children and it increases greatly with
- crying.
- Infants with SVT on occasion initially present with heart failure, because the tachycardia may go unrecognized for a long time.
- The heart rate during episodes is frequently in the range of 240-300 beats/min.
- If the attack lasts 6-24 hr or more, heart failure may be recognized, and the infant will have an ashen color, and be restless and irritable, with tachypnea, poor pulses and hepatomegaly.
- When tachycardia occurs in the fetus, it can cause hydrops fetalis, which is the in utero manifestation of heart failure.



A



B

Figure 435-5 **A,** Supraventricular tachycardia in a child with Wolff-Parkinson-White (WPW) syndrome. Note the normal QRS complexes during the tachycardia, as well as clear retrograde P waves seen on the upstroke of the T waves. **B,** Later, the typical features of WPW syndrome are apparent (short P-R interval, delta wave, and wide QRS).

TREATMENT

- Vagal stimulation by placing of the face in ice water (in older children) or by placing an ice bag over the face (in infants) may abort the attack.
- To terminate the attack, older children may be taught vagal maneuvers such as the Valsalva maneuver, straining, breath holding, or standing on their head.
- Ocular pressure must never be performed, and carotid sinus massage is very rarely effective.

- In **stable patients**, **adenosine** by rapid intravenous push is the **treatment of choice** because of its rapid onset of action and minimal effects on cardiac contractility.
- The dose may need to be increased if no effect on the tachycardia is seen.
- Because of the potential for adenosine to initiate atrial fibrillation, it should never be administered without a means for direct current (DC) cardioversion near at hand.
- **Calcium channel blockers such as verapamil** have also been used in the initial treatment of SVT in older children.
- Verapamil may reduce cardiac output and produce hypotension and cardiac arrest in infants younger than 1 yr;
- it is, therefore, contraindicated in this age group.
- In **urgent situations** when symptoms of severe heart failure have already occurred, synchronized DC cardioversion (0.5-2 J/kg) is recommended as the initial management

- Once the patient has been converted to sinus rhythm, a longer acting agent may is selected for maintenance therapy.
- In patients without an antegrade accessory pathway (non-WPW), the β-blockers are the mainstay of drug therapy.
- Digoxin is also popular and may be effective in infants, but less so in older children.
- In children with WPW, digoxin or calcium channel blockers may increase the rate of antegrade conduction of impulses through the bypass tract, with the possibility of ventricular fibrillation, and are therefore contraindicated.

- Some centers use **transesophageal pacing** to evaluate the effects of therapy in infants.
- More detailed electrophysiologic studies performed in the cardiac catheterization laboratory are often indicated in patients with refractory SVTs who are candidates for **catheter ablation**.
- During an electrophysiologic study, multiple electrode catheters are placed transvenously in different locations in the heart.
- Pacing is performed to evaluate the conduction characteristics of the accessory pathway and to initiate the tachyarrhythmia, and mapping is performed to locate the accessory pathway.
- **Catheter ablation** of an accessory pathway is frequently used in children and teenagers, as well as in patients who require multiple agents or find drug side effects intolerable or for whom arrhythmia control is poor


The End