NORTH EAST AND NORTH CUMBRIA
Congenital Heart Disease Network

Chest Pain in Children

Document History

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Contents

Summary

Chest pain is a relatively common complaint in children, seen both acutely and in routine outpatient clinics. Chest pain can cause a great deal of anxiety to children, young people and their carers, however an underlying cardiac cause in people with normal heart structure is exceptionally unusual.

Aims

This guideline aims to give Paediatricians and Paediatricians with Expertise in Cardiology (PEC) some guidance regarding the investigation and management of chest pain in children. In particular to focus on reducing unnecessary investigations and anxiety for children and their families, and also to reduce the number of referrals to tertiary centres.

Objectives

1. to review the causes of chest pain in children, with a focus on cardiac causes
2. to reinforce the role of the PEC
3. to review the possible investigations and summarize when these will be appropriate - focussing on those available in a Level 3 Local Children's Cardiology Centre
4. to review treatment options available when a cardiac cause is identified
5. to highlight red flags requiring tertiary cardiology referral

Background

Chest pain is a relatively common complaint in children, seen both acutely and chronically. Chest pain can cause a great deal of anxiety to children, young people and their carers, however an underlying cardiac cause is unusual. (0.6-1% of paediatric cardiological referrals) [1][3]

Good history taking, including the family history and early identification of risk factors are key in identifying patients at the most risk. First line investigations can be completed by the General Paediatrician or the Paediatrician with Expertise in Cardiology and will aid the risk stratification and inform any need for onwards referral.

Causes of chest pain

Chest pain is seen frequently in paediatrics and generally the cause is unlikely to be cardiac. Younger children in particular report a wide range of symptoms as ‘chest pain’. Adolescents may localise the features better, but are more likely to have musculoskeletal or psychological causes. [1]

The most common cause of chest pain is musculoskeletal, characterised by reproducible pain or tenderness on palpation and worsening on movement or coughing. Respiratory causes such as bronchospasm and pleuritic pain from lower respiratory tract infection or inflammation are also commonly reported. Gastro-oesophageal symptoms, due to reflux and constipation for example, typically cause retrosternal and epigastric pain respectively. Other causes to consider include herpes zoster, sickle cell, trauma and psychological causes such as anxiety and hyperventilation. Chest pain coming on at rest or sitting watching television or playing computer games between the ages of 6- early 20s should raise the possibility of precordial catch.

The general paediatrician might be the first port of call and identifying red flags for referral direct to cardiology is key. In other instances referral to the local PEC is the most appropriate pathway and reduces unnecessary worry and travel for families. We propose a triage ‘traffic light system’ to help identify the most at risk groups.

RED	Requires referral to the Level 1 or 2 Specialist Congenital Heart Centre
AMBER	Initial assessment & baseline screen to be done by PEC or Paediatrician
GREEN	Can be seen by General Paediatrician

Categories

Red patients:

These patients are higher risk for a cardiac cause of their chest pain and therefore early discussion and review at the Level 1 or 2 Specialist Centre is preferable.

Condition	**Reasons for concern**
Post cardiac surgery < 2 weeks	• Pericarditis/Post pericardotomy syndrome • Pericardial or pleural effusion • Repair site complication • Infection/endocarditis • Pneumothorax
Connective tissue disorder eg. Marfan	• Dissection or rupture • Mitral valve prolapse
Known Kawasaki patients with known coronary pathology	• Coronary artery thrombus
Family history of Cardiomyopathy or conduction disorders NB can be seen by PEC but if any concerns needs referral to Level 1	• Risk factor for sudden death

Heart Transplant patients should be referred to their Transplant Centre.
Kawasaki patients with Coronary Aneurysms should carry a Patient Specific Passport (PSP) or alert.

Amber Patients

These patients would benefit from assessment by a Paediatrician with Expertise in Cardiology locally, if available, to reduce the travel and time burden for families and to reduce the demand on Level 1 & 2 centres.

Signs & Symptoms	**Reasons for concern**
Chest pain associated with exercise	Consider left heart obstruction or myocardial ischaemia
Radiation to the jaw or left arm	Consider coronary ischaemia
Radiation to the left shoulder tip	Consider pericarditis or other chest pathology
Associated with palpitations	Consider pathological arrhythmia (see palpitation guideline)
Associated with syncope, especially if during swimming or diving	Consider left heart obstruction or arrhythmia
Family history of Cardiomyopathy or conduction disorders ***NB any concern should be referred for Level 1 review***	• Risk factor for sudden death

A good working relationship with your regional Cardiology service is essential. In some cases a case review may be all that is required. However, in view of limited investigations available for the paediatric age group in a DGH, referral for further review at the tertiary centre may be needed.

After initial assessment we suggest consideration of referral for the following:

- Exertional chest pain
- Significant palpitations with chest pain
- Sudden syncope especially during exercise or swimming/diving
- Significant family history in a first degree relative of arrhythmia, sudden death or genetic disorders

Green Patients

Condition	**Possible causes**
Chronic pain (look for long history)	Unlikely to be cardiac
Superficial tenderness, worse on moving	Musculoskeletal
Associated with cough or bronchospasm	Respiratory
Associated with eating or posture	Gastrointestinal
Anxiety and hyperventilation (ask about tetany with hyperventilation)	Psychogenic
Short sharp pain, localised, often at rest	Precordial Catch

The role of the Paediatrician

History taking and examination are the first steps in making the diagnosis. If there is no PEC option locally then many investigations are still possible in the DGH, aside from echocardiogram which may not be essential.

History

- Ascertain if RED features present
- Description of the pain:
    - Duration – acute vs chronic. Chronic pain is less likely to be cardiac
    - Associated complaints, and precipitating, aggravating and relieving factors. When associated with exercise consider a cardiac cause.
    - Localisation of the pain - musculoskeletal pain is usually well localised and reproducible
    - Radiation – myocardial ischaemia radiates to the neck, jaw and left arm. Pericarditis may radiate to the left shoulder and be aggravated when the patient is supine, radiates to the left shoulder.
- Other
    - Recent illnesses/surgery /exercise
    - Exercise limitation or intolerance
    - Palpitations and their features
    - Weight loss
    - Drug use
    - Stressors
    - Recent fevers
- Past history
    - Other medical conditions such as asthma, acid reflux, headaches, sickle cell
    - Kawasaki disease
    - Congenital heart disease surgeries/interventions – esp Arterial Switch Operation, Ross Procedure and transcatheter stents or devices
- Family history
    - Sudden death
    - Connective tissue disorders
    - Genetic abnormalities

    - Arrhythmia
    - Cardiomyopathy

Examination

- Weight and height (plot on chart eg. Marfans)
- Basic observations
- Murmurs – harsh medium pitched systolic murmur may have fixed aortic obstruction or HCM, mitral valve prolapse can give a mid to late systolic murmur and a continuous murmur could be heard in coronary artery fistula or ruptured sinus of Valsalva

Investigations in a DGH

Depending on the history and the clinical examination, all or none of the following investigations might be appropriate. These are discussed when investigating a cardiac cause for chest pain.

ECG

This should be the first line investigation in all cases. It's easy availability makes this an almost essential investigation.
Assessment must include rate, rhythm, hypertrophy determination using normal values for age, and signs of ischaemia and pericarditis. Check for a delta wave (WPW) and assess the QTc (usually best calculated manually).

Role of the PEC

Further assessment by a Paediatrician with Expertise in Cardiology may be helpful if available. The PEC should confirm the above findings and review the examination findings and the ECG. They should also perform an echocardiogram where indicated.

In most cases the echo is likely to be normal, however there is now becoming an expectation for this to be completed. A full sequential segmental analysis is of course advised however there are certain areas to focus on in particular:

- Pericardial effusion
- Cardiomyopathy assessment: dimensions, wall thickness, systolic function and outflow tract obstructions
- Ventricular dysfunction: right and left ventricular systolic and diastolic function
- Left sided obstructive lesions
- Aortic root measurements (with z-score) and assessment for dissection (difficult on transthoracic echo)
- Mitral valve assessment (exclude mitral valve prolapse)
- Coronary artery origins including colour flow Doppler
    - If concerned about any coronary origin anomaly, refer to a cardiologist
- Pulmonary hypertension
- Assessment of cardiac devices eg. Intracardiac devices (septal occluders) for position, dislodgement and flow

The ASE Appropriate Use Criteria [4] for use of echo in children with chest pain can be found in Appendix 1 for reference.

Chest x ray

This is not usually needed unless there is a structural chest abnormality found. However, may be appropriate if there is a history of acute severe pain, pain when awakening from sleep, cough, fever, history of trauma and abnormal examination findings.

Laboratory investigations

These are history dependent and not needed in most cases. However, baseline investigations which could be considered include FBC, ESR, CRP. Blood cultures and viral isolation should be taken only if indicated.

Further investigations that might need to be considered

- 24 hour ambulatory ECG Holter monitor – used in chest pain with palpitations to identify atrial or ventricular arrhythmia or heart block
- Exercise stress test – used for exertional chest pain

Treatment options

These of course depend on the identified cause. Often rest, reassurance and analgesia may be adequate, particularly when no cardiac cause is found. For pericarditis and pericardial effusions ibuprofen can be started with a plan for regular monitoring and review by the Level 1 or Level 2 cardiologist.

References

1. 15-minute consultation: A Structured approach to the assessment of chest pain in a child. Collins SA et al. Archives of Diseases of Childhood Education and Practice Edition 2014;99:122-126
2. Chest Pain in Children and Adolescents. Reddy SR et al. Paediatrics in Review 2010;31:el
3. Chest Pain and Syncope in Children: A Practical Approach to the Diagnosis of Cardiac Disease. Friedman KG et al. J Pediatr 2013;163(3):896-901
4. Appropriate use criteria for initial transthoracic echocardiography in outpatient paediatric cardiology 2014. Journal of the American College of Cardiology 2014;64(19): 2041-2058

Based on PECSIG guidelines

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Appendix

The ASE Appropriate Use Criteria [4] for use of echo in children with chest pain

TABLE 3 Chest Pain

Indication		Appropriate Use Rating
28.	Chest pain with no other symptoms or signs of cardiovascular disease, a benign family history, and a normal ECG	R (2)
29.	Chest pain with other symptoms or signs of cardiovascular disease, a benign family history, and a normal ECG	M (6)
30.	Exertional chest pain	A (8)
31.	Non-exertional chest pain with no recent ECG	R (3)
32.	Non-exertional chest pain with normal ECG	R (1)
33.	Non-exertional chest pain with abnormal ECG	A (7)
34.	Chest pain with family history of sudden unexplained death or cardiomyopathy	A (8)
35.	Chest pain with family history of premature coronary artery disease	M (4)
36.	Chest pain with recent onset of fever	M (6)
37.	Reproducible chest pain with palpation or deep inspiration	R (1)
38.	Chest pain with recent illicit drug use	M (6)

The number in parenthesis next to the rating reflects the median score for that indication.
Abbreviations: A = Appropriate; M = May Be Appropriate; R = Rarely Appropriate; ECG = Electrocardiogram.