Chest Pain

Purpose

This guideline provides clinical practice advice for clinicians involved in the emergency management of children with chest pain.

Scope

This guideline applies to all staff involved in the care and emergency management of children with chest pain.

Guideline

Introduction

The paediatric presentation of chest pain causes significant anxiety. Clinical extrapolation of adult disease states and the potential of cardiac pathology may lead to inappropriate resource allocation due to investigation and referral (1,2). Contrary to adults, this level of concern is not congruent with the spectrum of disease that occurs in the paediatric population. Less than 1% of paediatric patients with chest pain have a cardiac diagnosis. Less than 2% of patients referred from ED to cardiologist outpatient clinic for chest pain have a cardiac cause (3). The challenge for clinicians is to distinguish cardiac causes from much more likely benign entities.

Chest pain accounts for 0.6% of presentations to paediatric emergency per year in up to 18 year olds (4). The spectrum of illness has a large variation in presentation and cardiac diagnoses form the smallest group by far.
### TABLE AND Figure 1: Causes of chest pain in children

#### NON-CARDIAC CAUSES (COMMON) 98-99%

- **Musculoskeletal**: 50%-68% (Costochondritis, Muscle strain, Trauma)
- **Respiratory**: 3%-12% (Asthma, Pneumonia, Bronchitis, Pleuritis, Pulmonary embolus, Pneumothorax)
- **Gastrointestinal**: 2%-8% (Gastroesophageal reflux, Esophagitis, Gastritis, Pancreatitis, Gastric ulcer, Biliary disease)
- **Psychogenic**: 10%-30% (Anxiety, Panic/anxiety attack, Conversion disorder, Somatisation, Mood Disorder)
- **Other**: <10% (Skin infection, Chest Crisis (Sickle Cell))

#### CARDIAC CAUSES (RARE) 0.6-2%

- **Arrhythmia**: 45%
- **Myocarditis**: 11%
- **Pericarditis**: 28%
- **Arrhythmogenic right ventricular dysplasia**: 8%
- **Anomalous coronary artery**: 13%
- **Acute myocardial infarction**: 17%
- **Coronary artery Stenosis**: 13%
- **Dilated cardiomyopathy**: 7%
- **HCM**: 2%
- **HOCM**: 2%
- **DCM**: 2%
- **Inflammatory cardiomyopathy**: 2%
- **Systolic dysfunction**: 2%
- **Takayasu Arteritis**: 2%
- **Coronary Artery**: 2%
- **Mitral valve prolapse**: 2%
- **Severe LVOTO**: 2%
- **PHT**: 2%
- **Pulmonary Hypertension**: 2%

### DDx for PCP in ED: Aetiology + Epidemiology

**NON-CARDIAC CAUSES (COMMON) 98-99%

**CARDIAC CAUSES (RARE) 0.6-2%

**Abbreviations:**
- SVT = supraventricular tachycardia
- VT = ventricular tachycardia
- ARVD = arrhythmogenic right ventricular dysplasia
- ACM = arrhythmogenic cardiomyopathy
- SCM = hypertrophic cardiomyopathy
- HOCM = hypertrophic obstructive cardiomyopathy
- DCM = dilated cardiomyopathy

**Table adapted from (5,6)**

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CHQ-GDL-00744 – Chest Pain

- 2 -

Children's Health Queensland Hospital and Health Service
Explanatory Counselling as part of Assessment

The paediatric presentation of chest pain causes significant anxiety in both the patient and the clinician group – so reassurance is key from the very beginning. Begin consultation with counselling to set a collaborative environment for the consultation and improve overall satisfaction for all involved in the presentation.

Consider using the following phrases:

- Unlike adults, less than 1% of children with chest pain have a serious cardiac cause/condition
- The chest pain is real for your child, but 99% of the time it is not their heart and it isn’t life-threatening
- There is a large range of causes for chest pain in children, most of them are benign
- A thorough history and examination is most important for us to do together to work out what is going on.
- Further investigation is not often necessary and will not be helpful for their child unless key red flags are identified. I will be thorough in identifying any red-flags.
- Most children have NO clear diagnosis by the time they leave ED, but almost certainly will have critical-life-threatening causes ruled out from a good history and examination.
- Do not recommend exercise restriction or repeated withdrawal from school unless specifically instructed by a medical professional
- Nearly half of children with chest pain have ongoing symptoms 6 months later without evidence of serious organic disease (7)

Assessment

The history of the nature of the pain and associated features is vital in making an accurate diagnosis. Well documented red flags on history increase the likelihood of a cardiac origin for chest pain.

**TABLE 2: Red Flags**

<table>
<thead>
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<th>Examination/ECG</th>
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Adapted from (3,6,8)
Abnormal vital observations are more indicative of underlying pathology (8). The majority of children can be differentiated with a thorough history and examination without need for further investigations (2,9).

**ALERT**

Your initial diagnostic impression of “Non-Cardiac Chest Pain” is adequate and safe for the exclusion of serious cardiac pathology. Your assessment on history and exam will support this if correct.

### Investigations

Few investigations are required for the assessment of chest pain and should be steered by the presenting history.

Potential adjuncts include:

- **ECG** - Electrocardiogram is the most valuable tool to aid in cardiac diagnoses of chest pain (5). Paediatric emergency physicians have good specificity for the evaluation of ECGs of low or high risk patients for an acute cardiac presentation in ED(11). Paediatric emergency demonstrate high PPV (88.3%) and extremely high NPV (96.3%) in interpreting ECGs for cardiac causes of chest pain (12). Be aware that the precardial T-wave configuration changes over time. V1-2 T waves are inverted after the first week of life and usually remain so until around age 8. However, the juvenile T-wave pattern can persist into adolescence and early adulthood (persistent juvenile T waves) and is often shallow asymmetric inversion of V1-3 with no ST changes (13,14). See **Appendix 2: Juvenile T waves**.

- **CXR** - Chest x-ray is indicated for shortness of breath, pleuritic chest pain, palpitations, respiratory or cardiac comorbidities, abnormal vitals, trauma or focal signs are indications for CXR (9).

- **Bloods** - These are of low utility. Serum troponin levels may have some use in patients with myocarditis or myocardial infarct as the cause of their chest pain. However, they are not useful as a screening tool to determine if chest pain is of cardiac origin (15).

- **Echo** - Echocardiography is indicated after discussion with cardiology in those patients with an abnormal cardiac exam, abnormal ECG, significant family history or exertional chest pain (16).

- **Holter** and exercise stress test are rarely useful in determining cause of chest pain and should only be organised on the advice of the cardiologist.

<table>
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<tr>
<th>Indication for test</th>
<th>Usefulness</th>
<th>Conditions diagnosed</th>
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<tr>
<td><strong>ECG</strong> Abnormal physical exam, exertional chest pain, cardiac red flags or palpitations</td>
<td>All patients with concern of cardiac cause of pain</td>
<td>Cardiomyopathy, myocarditis, pericarditis, with or without pulmonary hypertension</td>
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</table>
Management

Management of chest pain in children involves simple analgesics (ibuprofen or paracetamol) for the pain and then focusing on treating the underlying cause.

**ALERT**

There are management plans for Paediatric Myocarditis, Dilated Cardiomyopathy, Hypertrophic Cardiomyopathy being developed to provide rapid guidance on the appropriate screening tests on first presentation. Please be safe. This is a guideline only. Please speak to your senior to get useful advice or call Cardiology Fellow on-call for advice.

Disposition

If the pain is non-specific and the child is discharged, ensure appropriate follow up is arranged with the GP in the next week.

Referral for further cardiology outpatient assessment is only warranted if the pain is assessed as being cardiac in origin after the identification of cardiac red flags. Referrals should be made to the local Cardiology service or if required to the Cardiology team at LCCH with a Specialist outpatient clinic referral form sent to LCCH through the normal processes.

The referral form can be found at:

For patients requiring transfer to access subspecialty teams; urgent critical transfers should be coordinated through RSQ - Retrieval Services Queensland (Tel: 1300 799 127) and non-critical transfers should be arranged through CATCH - Children Advice and Transport Coordination Hub (Tel: 3068 4520).

- **RSQ Activation Flowchart**
- **Children’s Advice and Transport Coordination Hub (CATCH) Information**
• **CATCH Interhospital Transfer Request Form**

A large single centre retrospective decade long review in America of paediatric patients assessed and discharged from cardiology outpatient clinic after referral from ED with chest pain, revealed that there were no deaths from cardiac causes. (3).

The LCCH cardiology department has done extensive follow-up of patients discharged with a diagnosis of non-cardiac chest pain and the audit has shown there has been no subsequent cardiac deaths on median follow-up of 4.4-10 years (17,886 cumulative patient years). Despite this 20% will represent to ED and 10% will be referred for additional cardiac opinion in OPD.

**Consultation**

Key stakeholders who reviewed this version:
- SMO LCCH Emergency Department
- Cardiology Fellow LCCH

**Reference and Suggested Reading**


Guideline revision and approval history

<table>
<thead>
<tr>
<th>Version No.</th>
<th>Modified by</th>
<th>Amendments authorised by</th>
<th>Approved by</th>
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<tr>
<td>1.0</td>
<td>Director Paediatric Emergency Department</td>
<td>Divisional Director, Critical Care</td>
<td>Executive Director, Hospital Services</td>
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</table>

Keywords: Chest, pain, emergency, cardiac, anxiety, 00740

Accreditation references: EQuIP National Standards (11-15): 12
Appendix 1 : Chest Pain Flowchart

Paediatric Patient with chest pain presents to DEM. Determine the nature of the chest pain

- Pleuritic Chest pain
  - CXR
    - Resp signs +/- fever
      - Pneumonia/LRTI signs Pulmonary embolus Foreign body
    - Trauma
      - Precordial Catch Asthma Radiolucent foreign body
      - Rib # Pneumothorax Costochondritis
  - Palpable pain
    - Psychiatric risk factors ie. Mood change, social withdrawal, hyperventilation
      - Discuss with Cardiology regarding OPD referral +/−/− Echo
      - Idiopathic or undifferentiated chest pain. Discuss with GP and possible referral to psychiatry
    - ECG Changes
  - Central or Exertional Chest pain
    - Gastro-oesophageal Reflux Disease
      - Burning retrosternal chest pain with radiation to the epigastrium or pain related to eating
      - Nil cardiac red flags or new signs
    - Cardiac Red Flags or new Cardiac signs
      - CXR and Cardiology review in department +/− ECG

CARDIAC RED FLAGS

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Appendix 2: Juvenile T waves\textsuperscript{14}