

Guideline

Chest Pain

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Executive sponsor	Executive Director Medical Services			Effective date	28/02/2017
Author/custodian	Director, Paediatric Emergency Department			Review date	28/02/2020
Supersedes	New				
Applicable to	All CHQ staff involved in the care and emergency management of children with chest pain.				
Authorisation	Executive Director Hospital Services				

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

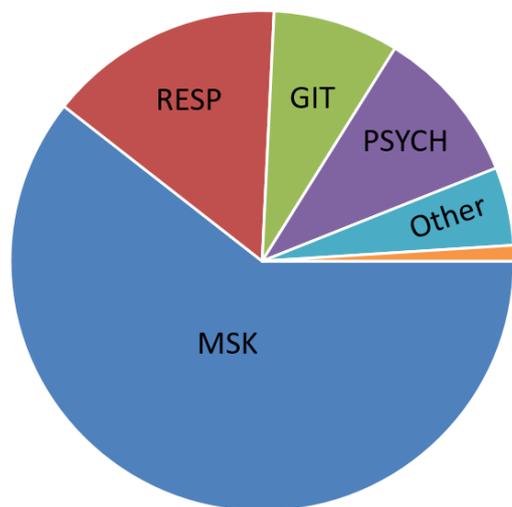
The paediatric presentation of chest pain causes significant anxiety. Clinical extrapolation of adult disease states and the potential of cardiac pathology may lead to inappropriate resource allocation due to investigation and referral (1,2). Contrary to adults, this level of concern is not congruent 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

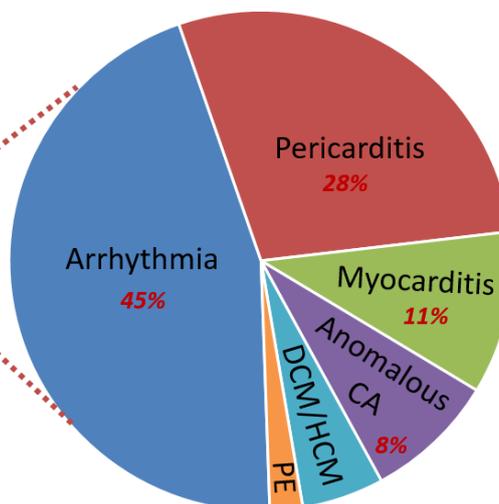
NON-CARDIAC CAUSES

(COMMON) 98-99%



CARDIAC CAUSES

(RARE) 0.6-2%



DDx for PCP in ED: Aetiology + Epidemiology

NON-CARDIAC CAUSES (COMMON) 98-99%

CARDIAC CAUSES (RARE) 0.6-2%

Musculoskeletal	50%-68%	Costochondritis Muscle strain Trauma	ARRHYTHMIA/ CONDUCTION DISTURBANCE	37-48%	SVT/VT LQTC Palpitations ARVD/ACM
Respiratory	3%-12%	Asthma Pneumonia Bronchitis Pleuritis Pulmonary embolus Pneumothorax	INFECTION/ CARDITIS	17%-29%	Myocarditis Pericarditis Perimyocarditis
Gastrointestinal	2%-8%	Gastroesophageal reflux Esophagitis Gastritis Pancreatitis Gastric ulcer Biliary disease	MYOCARDIAL ISCHAEMIA	13%	Anomalous Coronary Artery Kawasaki Disease with Aneurysms Myocardial Infarction Coronary Artery Origin Stenosis
Psychogenic	10%-30%	Anxiety Panic/anxiety attack Conversion disorder Somatisation Mood Disorder	CARDIOMYOPATHY	7%	HCM HOCM DCM
Other	<10%	Skin infection Chest Crisis (Sickle Cell)	INFLAMMATORY	2%-8%	Takayasu Arteritis Coronary Arteritis
			ANATOMICAL	rare	Dissection/Transection/Rupture Mitral Valve Prolapse Severe LVOTO
			PHT	rare	Pulmonary Hypertension

Table adapted from (5,6)

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

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

RED FLAGS OF PAEDIATRIC CHEST PAIN	
History	Examination/ECG
<ul style="list-style-type: none"> • Exertional Syncope • Collapse or chest pain at Maximal Exertion • Previous Cardiac Arrest • Congenital/Acquired Heart Disease/Surgery • Palpitations • First degree relative with Sudden Unexplained Cardiac Death/Cardiomyopathy/Arrhythmia • Recent Surgery • Implantable cardioverter defibrillator Insitu • Connective Tissue Disorder • Systemic Inflammatory Condition (ie Kawasaki) • Hypercoagulable State • Recent or history of cocaine/amphetaime abuse • Haemoptysis (foreign body/infection) 	<ul style="list-style-type: none"> • Pathological Murmur • Signs of Cardiac Failure • Pericardial Rub • Decreased Heart Sounds • Fever > 38.5 with no clear cause • Haemodynamic Instability/compromise • Syndromic appearances • ECG changes/abnormalities

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 precordial 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 3: Utility and Indications for Testing

	Indication for test	Usefulness	Conditions diagnosed
ECG	Abnormal physical exam, exertional chest pain, cardiac red flags or palpitations	All patients with concern of cardiac cause of pain	Cardiomyopathy, myocarditis, pericarditis, with or without pulmonary hypertension

CXR	Abnormal observations, cough, history of choke, haemoptysis, weight loss	All patients with concern of respiratory cause of pain, trauma or signs of cardiac failure	Chest infections, foreign bodies, mediastinal masses, cardiomyopathy
ECHO	Abnormal physical exam, ECG, family history, or exertional chest pain	Selected patients as determined by Cardiology fellow	Anomalous coronary artery origins, cardiomyopathy, myocarditis, pericarditis, pulmonary hypertension, left ventricular outflow obstruction
Troponins	Suspected myocarditis or pericarditis OR high suspicion of myocardial ischaemia	Selected patients	Myocarditis, pericarditis, coronary ischemia

Management

Management of chest pain in children involves simple analgesics (ibuprofen or paracetamol) for the pain and then focussing 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

<http://qhps.health.qld.gov.au/childrenshealth/resources/cliforms/docs/500020.pdf>.

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

1. Verghese GR, Friedman KG, Rathod RH et-al. Resource Utilization Reduction for Evaluation of Chest Pain in Pediatrics Using a Novel Standardized Clinical Assessment and Management Plan (SCAMP). *J Am Heart Assoc.* 2012;1 (2):
2. Kane DA, Fulton DR, Saleeb S et-al. Needles in hay: chest pain as the presenting symptom in children with serious underlying cardiac pathology. *Congenit Heart Dis.* 2010;5 (4): 366-73.
3. Saleeb SF, Li WY, Warren SZ et-al. Effectiveness of screening for life-threatening chest pain in children. *Pediatrics.* 2011;128 (5): e1062-8.
4. Rowe BH, Dulberg CS, Peterson RG et-al. Characteristics of children presenting with chest pain to a pediatric emergency department. *CMAJ.* 1990;143 (5): 388-94.
5. Drossner DM, Hirsh DA, Sturm JJ et-al. Cardiac disease in pediatric patients presenting to a pediatric ED with chest pain. *Am J Emerg Med.* 2011;29 (6): 632-8.
6. Collins SA, Griksaitis MJ, Legg JP. 15-minute consultation: a structured approach to the assessment of chest pain in a child. *Arch Dis Child Educ Pract Ed.* 2014;99 (4): 122-6.
7. Selbst SM, Ruddy R, Clark BJ. Chest pain in children. Follow-up of patients previously reported. *Clin Pediatr (Phila).* 1990;29 (7): 374-7.
8. Yeh TK, Yeh J. Chest Pain in Pediatrics. *Pediatr Ann.* 2015;44 (12): e274-8.
9. Neff J, Anderson M, Stephenson T et-al. REDUCE-PCP study: radiographs in the emergency department utilization criteria evaluation-pediatric chest pain. *Pediatr Emerg Care.* 2012;28 (5): 451-4.
10. Sert A, Aypar E, Odabas D et-al. Clinical characteristics and causes of chest pain in 380 children referred to a paediatric cardiology unit. *Cardiol Young.* 2013;23 (03): 361-7.

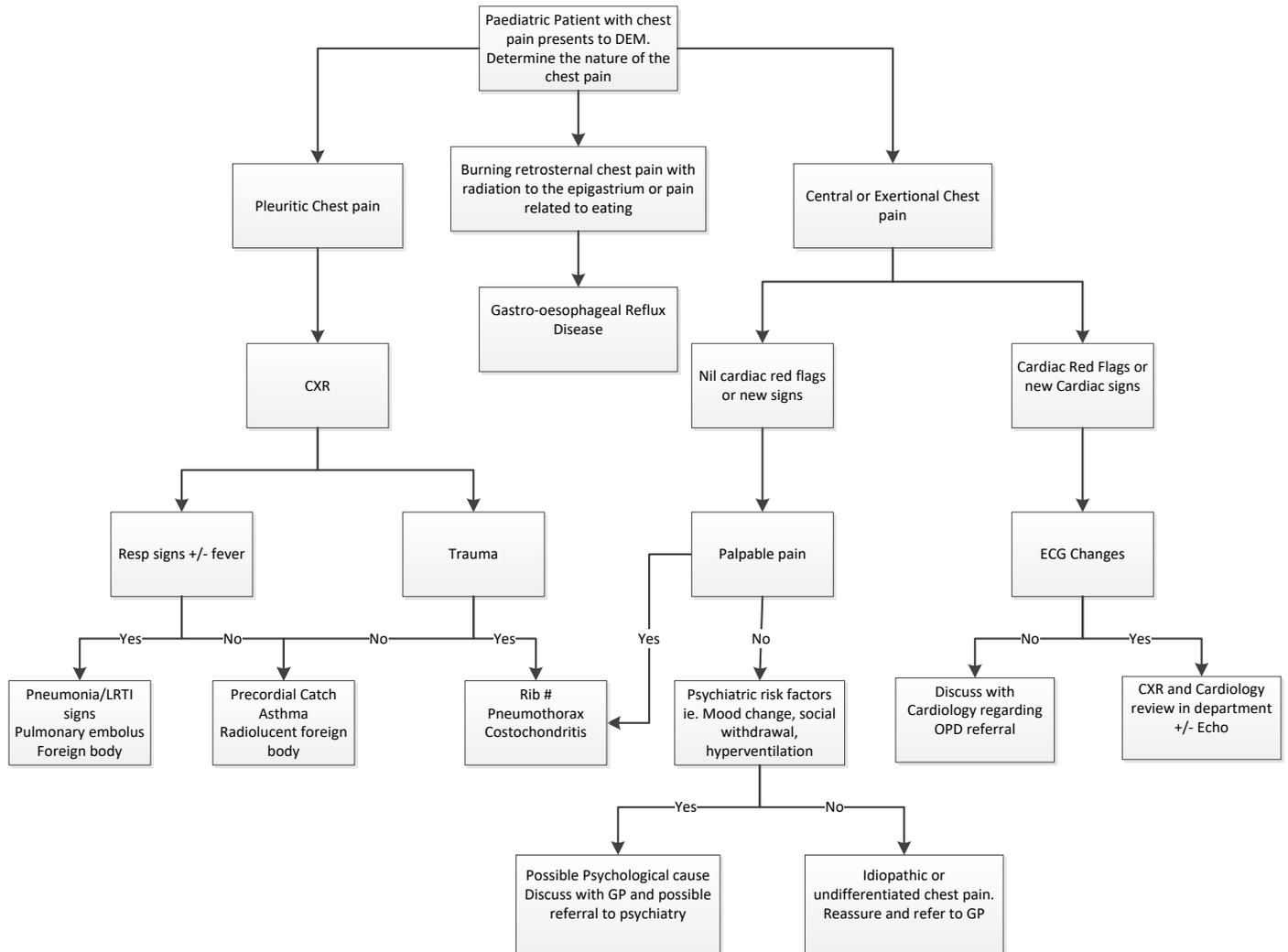
11. Horeczko T, Park JK, Mann C et-al. Pediatric Emergency Department Study of Cardiac Risk in the Novel Patient (PED SCReeN). *Pediatr Emerg Care*. 2016; .
12. Wathen JE, Rewers AB, Yetman AT et-al. Accuracy of ECG interpretation in the pediatric emergency department. *Ann Emerg Med*. 2005;46 (6): 507-11.
13. Dickinson DF. The normal ECG in childhood and adolescence. *Heart*. 2005;91(12):1626-1630.
14. Sharieff GQ, Rao SO. The Pediatric ECG. *Emerg. Med. Clin. North Am*. 2006;24(1):195-208
15. Brown JL, Hirsh DA, Mahle WT. Use of troponin as a screen for chest pain in the pediatric emergency department. *Pediatr Cardiol*. 2012;33 (2): 337-42.
16. Friedman KG, Kane DA, Rathod RH et-al. Management of pediatric chest pain using a standardized assessment and management plan. *Pediatrics*. 2011;128 (2): 239-45.

Guideline revision and approval history

Version No.	Modified by	Amendments authorised by	Approved by
1.0	Director Paediatric Emergency Department	Divisional Director, Critical Care	Executive Director Hospital Services

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Accreditation references	EQulPNational Standards (11-15): 12

Appendix 1 : Chest Pain Flowchart



CARDIAC RED FLAGS	
History	Examination/ECG
<ul style="list-style-type: none"> • Exertional Syncope • Collapse or chest pain at Maximal Exertion • History of Cardiac Arrest • Congenital/Acquired Heart Disease/Surgery • Palpitations • First degree relative with Sudden Unexplained Cardiac Death • First degree relative with Cardiomyopathy • First degree relative with Arrhythmia • Recent Surgery • Implantable cardioverter defibrillator Insitu • Connective Tissue Disorder • Systemic Inflammatory Condition (Ie Kawasaki) • Hypercoagulable State • Recent or history of cocaine/amphetaime abuse • Haemoptysis 	<ul style="list-style-type: none"> • Pathological Murmur • Signs of Cardiac Failure • Pericardial Rub • Decreased Heart Sounds • Fever > 38.5 with no clear cause • Haemodynamic Instability/compromise • Syndromic appearances • ECG changes/abnormalities

Appendix 2: Juvenile T waves¹⁴

