

JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

# Chest Pain Clinical Pathway

Johns Hopkins All Children's Hospital

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Owners: Charles Eldridge, MD

*This pathway is intended as a guide for physicians, physician assistants, nurse practitioners and other healthcare providers. It should be adapted to the care of specific patient based on the patient's individualized circumstances and the practitioner's professional judgment.*

Johns Hopkins All Children's Hospital  
**Chest Pain Clinical Pathway**

**Rationale**

This protocol was developed by a consensus group of JHACH emergency medicine physicians, cardiologists, hospitalists and intensivists to standardize the management of patients ages 7-21 years of life presenting with chest pain without a known cardiac condition. It addresses the following clinical questions or problems:

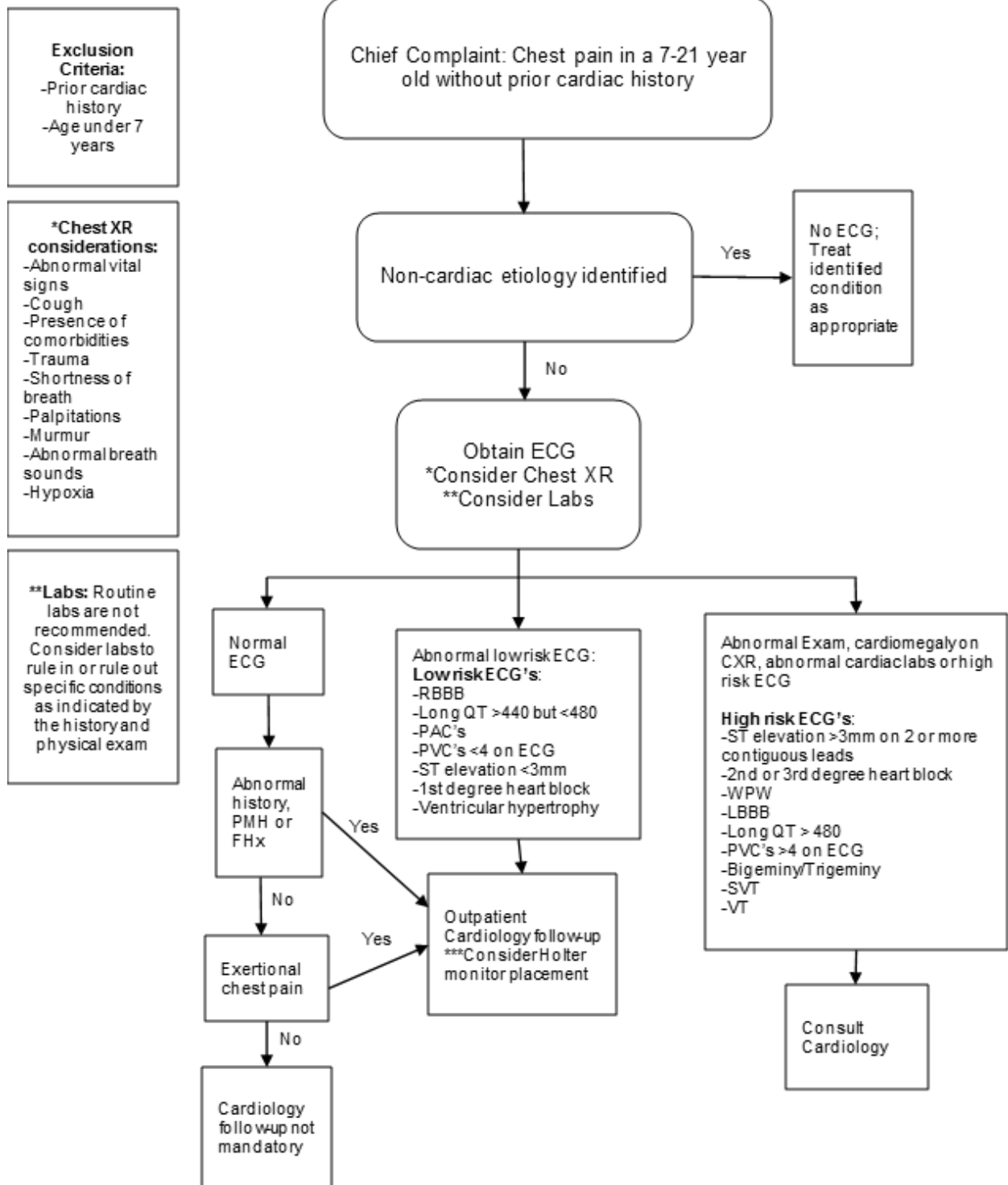
1. How to evaluate a pediatric patient without underlying cardiac disease presenting with chest pain?
2. When to consider the use of electrocardiograms (ECG), chest radiographs, or labs?
3. When to consult cardiology?
4. When to consider echocardiogram or holter monitoring for further evaluation?
5. When to consider admission for further evaluation?
6. When to provide cardiology outpatient follow-up?

**Background**

Chest pain is a common pediatric emergency department (PED) complaint. There are numerous conditions that can cause chest pain in the pediatric patient, many of which are relatively benign, such as musculoskeletal pain, gastroesophageal reflux, anxiety, etc. Although it is rare to have a significant cardiac cause for chest pain, cardiac conditions are often the greatest concern for patients and family members. Chest pain evaluations are often inconsistent and can be very expensive and time consuming.

This guideline provides a standardized, evidence-based algorithm for the management of pediatric chest pain. The goal of this algorithm is to tailor the chest pain evaluations to the individual patient, limiting unnecessary testing, including reducing unnecessary chest radiographs and radiation exposure, reducing the patient's length of stay in the emergency department and reducing the patient's healthcare cost. The guideline includes patient ages from 7 years to 21 years as these are the included ages in the largest studies providing the best evidence.

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## Emergency Center Management

ECG: Electrocardiograms are reasonable to perform on patients when a cardiac cause of chest pain cannot be ruled out by the history or physical exam. Concerning elements of history include chest pain that is not reproducible to palpation, chest pain that is worse with exertion, palpitations, syncope, near-syncope, crushing chest pain, chest pain that awakens patient from sleep, chest pain that radiates to the neck, shoulder or left arm, dyspnea or orthopnea, significant chest trauma (i.e. steering wheel trauma in motor vehicle accident), history of fevers with intravenous drug abuse (IVDA). Physical exam findings include but are not limited to a new or changing murmur, significant tachycardia or bradycardia, muffled heart sounds, abnormal heart sounds, friction rub, gallop, click, poor perfusion, weak pulses. Outpatient cardiology clinic follow-up is recommended for low-risk ECG's which include but are not limited to: Right Bundle Branch Block (RBBB), Long QT >440ms but <480ms, Premature Atrial Contractions (PACs), Infrequent Premature Ventricular Contractions (PVCs) 4 or less on an ECG, ST elevation < 3mm, 1st degree Heart Block, Ventricular Hypertrophy. Cardiology consultation in the PED is recommended for high-risk ECG's which include, but are not limited to: Left Bundle Branch Block (LBBB), Long QT >480ms, 2nd or 3rd degree Heart Block, Wolff-Parkinson-White (WPW), Frequent PVC's >4 on an ECG, Ventricular Bigeminy/Trigeminy, ST elevation >3mm in 2 or more contiguous leads.

Chest XR: Chest radiographs are not mandatory for the evaluation of pediatric chest pain and do not need to be routinely performed. Possible indications for chest XR include fever, cough, shortness of breath, hypoxia, abnormal breath sounds, asymmetric breath sounds, trauma, concerning or worsening murmur, abnormal heart sounds such as muffled heart sounds or friction rub.

Labs: Troponin, BNP, CBC, ESR, CRP, blood culture, D-dimer. Routine lab testing is not recommended. Labs testing should be performed if history, physical exam, ECG or chest XR are suggestive of certain etiologies that can cause chest pain. Troponins may be sent to evaluate for myocardial ischemia, myocarditis, etc. This typically presents with an abnormal ECG, crushing substernal chest pain which may radiate to the back or neck. CBC, ESR, CRP's may aid in the diagnosis of an infectious or post-infectious etiology such as myocarditis and pericarditis. Blood cultures are recommended for the evaluation of infectious endocarditis, although this is an uncommon condition in the pediatric population without a concerning history of IVDA or other causes of significant bacteremia. D-dimers would help the evaluation of pulmonary embolus (PE), however, a D-dimer can be elevated for numerous reasons. Conditions that increase the suspicion of PE are a history of prior PE or deep vein thrombosis (DVT), a history of a coagulopathy, medication use that can cause coagulopathies such as oral contraceptive pills (OCP), medical conditions that can cause coagulopathies such as systemic lupus erythematosus (SLE) or other rheumatological conditions or connective tissue such as Marfan's disease. BNP testing should be considered for the evaluation of congestive heart failure, however, if there is a suspicion for heart failure, consult cardiology.

Cardiology consultation: Cardiology should be consulted for patients who are ill appearing with a concern for a cardiac cause of the patient's condition. Cardiology should be consulted for abnormal cardiac labs, such as elevated troponins and/or BNP's. ECG's with significant abnormality also warrant cardiology consultation. Some significant ECG findings include diffuse ST elevation greater than 3mm, heart block, Wolff-Parkinson-White, long QT greater than 480, frequent PVC's, Bigeminy or Trigeminy.

Echocardiogram: Echocardiograms can be performed to help evaluate for significant cardiac conditions, however, discussion with cardiology is warranted prior to the order of the echocardiogram if the patient is stable.

Holter monitoring: Holter monitor placement is not recommend for routine cardiac evaluation. Holter monitor placement can be considered for episodic chest pain with associated palpitations or chest pain which caused syncope or near-syncope in the otherwise well appearing patient with a normal ECG or an ECG representative of a low suspicion for cardiac disease.

Cardiology follow-up: Cardiology follow-up is warranted for any abnormal cardiac related physical exam finding, abnormal ECG, concerning past medical history, concerning family history, or for further parental concerns.

## **Admission**

Admission criteria includes abnormal ECG or abnormal cardiac labs (i.e. troponin, BNP) with cardiology consultation and recommendation for admission. Admission location depends on patient's condition and expectation of declining condition and monitoring capabilities. The PICU IMCU, or CVICU can admit myocarditis, pericarditis, cardiomyopathy, CHF, decreased function, etc. Discussion should occur between cardiology and the PICU and CVICU attendings to determine the best suitable location for patient observation and management. The CVICU should admit ill appearing patients with myocarditis or structural lesions that would potentially need surgery in the next 24 hours or cardiomyopathy patients ill-enough to warrant ECMO consideration. Floor telemetry is a consideration for patients with a normal initial cardiac work-up (i.e. ECG, labs), and is stable as per cardiology, but needs admission for an echocardiogram. Patients may need admission with chest pain that is not cardiac in origin, which may include pain that is severe and uncontrollable, unstable vital signs or unstable patient condition, along with other possible etiologies depending on the results of the evaluation (i.e. pneumothorax). Non-cardiac chest pain could be admitted under "pain of unknown origin" under observation status. Patients with abnormal cardiac labs would meet inpatient criteria.

### Additional Considerations

The following diagnostic codes should be considered: intercostal pain, precordial pain, pleurodynia, painful respiration, for other chest pain, chest pain unspecified

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**Outcome Measures:**

1. Length of Stay in EC
2. % EKG
3. % Chest Xray
4. % Labs
5. % Cardiology consult
6. % Cardiology follow-up
7. Admission rate

Clinical Pathway Team  
Chest Pain Clinical Pathway  
*Johns Hopkins All Children's Hospital*

Owner: Charles Eldridge, MD

Also Reviewed by:

Cardiology: Jeremy Ramey, MD

Intensive Care: Tom Nakagawa, MD

Clinical Pathway Management Team: Joseph Perno, MD; Courtney Titus, PA-C

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**Disclaimer**

*Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.*

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