Cardiovascular System II

EMC 420: Maternal & Child Emergency Care

D. Trigg, MD

Objectives

- Present the clinical features and emergency management of cardiovascular disorders, including:
  - Recognize congenital and acquired heart disease.
  - Identify patients with myocarditis.

Critical Concepts

- Dysrhythmias can cause serious cardiovascular compromise.
- Structural congenital heart disease can present in many different ways at many different ages.
- Acquired heart disease can be subtle yet life-threatening.

Case Study : "Chest Pain, SOB"

- 10-year-old boy presents with chief complaint of chest pain and shortness of breath.
- 5 days of cold and cough symptoms
- He has been lying around a lot and has missed 1 week of school.
  - Usually a very active child but complains that he is "just too tired" to play

Initial Assessment

PAT:

- Abnormal appearance, abnormal breathing, abnormal circulation

Vital signs:

- HR 130, RR 44, BP 90/65,
- T 37.8°C (100.4 F),
- O_2 sat 90% on room air, increases to 100% on blow-by O_2

Initial Assessment

A: Patent

B: Intermittently shallow and deep; rapid respiratory rate

C: Pale; pulse rapid, thready, and weak

D: No focal deficits, GCS 15

E: No signs of injury

Focused History

O: Chest hurts for several days.
P: Provoked by cough and exertion; short of breath whenever he gets up and walks
Q: Burning, pressure
R: Substernal, some radiation to shoulders
S: 3 to 8 out of 10
T: Pressure and SOB last almost all day, exacerbations with exertion last 15 to 30 min.

Detailed Physical Exam

- Neck: Jugular venous distention supine
- Lungs: Diminished breath sounds with occasional end expiratory wheeze with deep breaths
- Cardiac: Distant heart sounds, no murmurs, S_3 gallop rhythm
- Abdomen: Distended with palpable spleen and liver
- Neuro: No focal deficits

Question

What is your general impression of this patient?

What are your initial management priorities?

General Impression

- Child is in respiratory distress and in cardiogenic shock.
  - Demonstrates abnormal appearance with increased work of breathing and signs of shock.

Management Priorities

- ABCs
- Give O_2 by nonrebreather mask.
- Obtain IV access.
- Check rhythm on cardiac monitor.
- Obtain blood glucose, lab studies.
- Consider reducing preload and afterload with nitrates.
- Consider diuretic therapy.
- May need inotropic support.

Case Discussion: Differential Diagnosis

- Acquired cardiac problem:
  - Respiratory illness during winter months causing secondary myocarditis
- Congenital heart lesion that had been asymptomatic until this illness:
  - Anomalous coronary artery or valvular disease
- Pericarditis

Clinical Features: Your First Clue

- Consider myocarditis in any child with:
  - Weakness
  - SOB
  - Chest pain
  - Especially if associated with preceding prodromal viral illness
  - Distant heart sounds: “Silent Chest”
  - Enlarged heart on CXR

Diagnostic Studies: Myocarditis

- Radiology:
  - CXR will reveal cardiomegaly and prominent vasculature, perhaps even pulmonary edema
  - Laboratory:
    - May not add much
    - Not specific

Prehospital Differential Diagnosis

- Pericarditis
- Hypertensive crisis
- Congenital coronary artery anomaly and myocardial ischemia/infarction
- Valvular disease
- Structural cardiac disease (e.g., VSD, ASD)
- Renal failure (e.g., glomerulonephritis)
- Rheumatic fever

Management: Myocarditis

- Gentle diuretic therapy
  - Furosemide 1mg/kg
- Afterload reduction
- Possibly inotropic support
  - Dopamine 5 mic/kg/min

Modified from APLS

Case Progression: Version 1

- Myocarditis : global infection/inflammation of myocardium
- Poor cardiac contractility (Echocardiogram)
- Maintained on inotropes and pressor agents
- Recovered to a point that he could be discharged 2 weeks later
- Will be followed closely (for yr.s) to assess the degree to which he regains cardiac function

Case Progression: Version 2

- CC: chest pain; SOB
- Suspected diagnosis: Myocarditis
- Deteriorates enroute to the hospital:
  - Progressive shock
  - Requires inotropic support
  - Develops V-tach and V-fib

Modified from APLS

Pediatric Congestive Heart Failure

Etiologies

- Toxins (cocaine,…)
- Extracardiac (sepsis, electrolyte,…)
- Congenital (LV outflow obstruction: AS)
- Acquired
  - Inflammatory
    - Myocarditis
    - Endocarditis
    - Kawasaki Disease
    - Rheumatic fever
  - Obstructive (pericarditis)

Modified ; not part of APLS presentation. But I was unable to insert a non-APLS design

Myocarditis

- Inflammatory disease of the myocardium:
  - Direct infection of the myocardium (e.g., viral myocarditis)
  - Toxin production (e.g., diphtheria)
  - Immune response as a delayed sequela of an infection (postviral or postinfectious myocarditis)
  - A common type of myocarditis is acute rheumatic fever (ARF).

Kawasaki Disease

- Vasculitis: propensity for coronary aneurysms
  - AKA : mucocutaneous lymph node syndrome [MLNS]
- Etiology : unknown
- Age : less than 5
- Aneurysms may subsequently scar, resulting in coronary stenosis (early onset coronary artery disease). 15% to 20% of children with Kawasaki disease will develop coronary artery aneurysms within 1 to 3 wks from the onset of illness
- Coronary artery thrombosis and myocardial infarction
- Myocarditis, dysrhythmia

Kawasaki Disease

Clinical presentation

- may present with a MI
- may have more nonspecific findings than an adult
- can present with nausea, vomiting, and abdominal pain
- may be diaphoretic and crying, or asymptomatic.

Kawasaki Disease: Clinical Features

- High fever for 5 days or more
- Diagnostic criteria
  - Conjunctivitis
  - Cervical lymphadenopathy
  - Gingivostomatitis
  - Polymorphous rash [many different patterns]
  - Swelling of hands with erythema of palms

Acute Rheumatic Fever: Jones Criteria

- Major criteria:
  - (J) Migratory polyarthritis
  - (O) Carditis: Most commonly valvulitis
  - (N) subcutaneous nodules
  - (E) erythema marginatum,
  - (S) Sydenham"s chorea
- Minor criteria:
  - High (H) CRP or ESR (E), arthralgia,(A), prolonged PR (R), fever (T)

Endocarditis

- An infection of the endothelial surface of the heart, with a propensity for the valves
- Increased risk in children with artificial valves and patches, and patients with central lines
- 90% of cases are caused by gram-positive cocci.
  - Alpha strep, *Staph aureus*, pneumococcus, group A ß hemolytic streptococci

Endocarditis Clinical Features

- Fever
- Tachycardia, CHF, dysrhythmia, cardiogenic shock
- History of recent cardiac surgery or indwelling vascular catheter
- Heart murmur
- Petechiae, septic emboli, or splenomegaly

Pericarditis

- Pericardial inflammation
- Viral versus bacterial
- Bacterial causes include pneumococcus, *S. aureus, H. influenzae* type B
- Cardiac tamponade possibly requiring pericardiocentesis

Pericarditis: Clinical Features

- Chest pain
- Respiratory distress, CHF, or tamponade
- Precordial "knock" or rub (like the sound of shoes walking on snow)
- The classic signs include exercise intolerance, fatigue, jugular distension, lower extremity edema, hepatomegaly, poor distal pulses, diminished heart tones, and pulsus paradoxus.

Summary

- Assessment of pediatric heart disease can be challenging; however, applying assessment skills with an understanding of normal physiology as well as pathophysiology of cardiovascular disorders in children will assist the clinician in management.