CHEST PAIN IN CHILDREN:

“IS MY CHILD GOING TO DIE?”

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- I have no financial relationships or conflicts in relation to the products or services described in this presentation.
CHEST PAIN IN KIDS

- Chest pain is a common complaint, 7th most common reason for seeing a health care provider.
- Chronic in 1/4 to 1/3 of children, 40% miss some school, 70% have activities restricted.
- Adolescents thought they were having a heart attack (44%), had heart disease (12%) or cancer (12%).
## THE PROBLEM

<table>
<thead>
<tr>
<th>Patient/Parent Suspect Cause</th>
<th>Health Provider Suspect Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Idiopathic</td>
</tr>
<tr>
<td>52-56%</td>
<td>21-45%</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>Musculoskeletal</td>
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<tr>
<td>13%</td>
<td>15-31%</td>
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<tr>
<td>Respiratory</td>
<td>Hyperventilation</td>
</tr>
<tr>
<td>10%</td>
<td>0-30%</td>
</tr>
<tr>
<td>Skin infection</td>
<td>Breast</td>
</tr>
<tr>
<td>3%</td>
<td>1-5%</td>
</tr>
<tr>
<td>Breast</td>
<td>Respiratory</td>
</tr>
<tr>
<td>3%</td>
<td>2-11%</td>
</tr>
<tr>
<td>Cancer</td>
<td>Gastrointestinal</td>
</tr>
<tr>
<td>0-12%</td>
<td>2-8%</td>
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<tr>
<td>Unsure</td>
<td>Cardiac</td>
</tr>
<tr>
<td>10-19%</td>
<td>1-6%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
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<tr>
<td></td>
<td>9%</td>
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</tbody>
</table>
MUSCULOSKELETAL CHEST PAIN

- **Costochondritis**: parasternal tenderness, pleuritic.

- **Slipping Rib Syndrome**: lower ribs slip, pinch nerve.

- **Precordial Catch**: brief, sharp, sudden, 1 intercostal space.

- **Muscular pain**: school bag, weight lifting, new sport.
PSYCHOGENIC CHEST PAIN

- More common after age 12 years.
- **Anxiety/Conversion disorder:** stressful event, other somatic complaints, insomnia.
- **Hyperventilation:** sense of dread, lightheadedness, paresthesias.
- Musculoskeletal pain triggering the above disorders.
BREAST & CHEST PAIN

- **Gynecomastia** in adolescent males result in anxiety, pain.
- **Mastitis, fibrocystic disease** in adolescent women.
- **Thelarche** in preadolescent women.
- **Tenderness** during pregnancy.
- Often cancer worries undely complaints.
RESPIRATORY CHEST PAIN

- **Infections**: pneumonia and bronchitis.
- **Asthma**: exercise induced or undertreated.
- **Pleuritis/Effusion**: pleuritic, positional.
- **Pneumothorax**: trauma or underlying lung disease, Marfan syndrome.
GASTROINTESTINAL CHEST PAIN

- **Esophagitis**: most common GI disorder (70%).
- **Gastritis**: 20% on endoscopy.
- **Esophagageal dysmotility**: spasm or achalasia may be seen with esophagitis.
- **Others**: strictures, foreign body, caustic ingestions.
CARDIAC CHEST PAIN

- **Pulmonary embolus**, pulmonary hypertension, acute chest syndrome (sickle cell).
- **Pericarditis & myocarditis**: infection, autoimmune.
- **Coronary artery anomalies**: congenital or acquired.
- **Aortic root dissection**: Marfan, Ehlers-Danlos IV, Turner syndrome.
CARDIAC CHEST PAIN

- **Left ventricular outflow obstruction**: hypertrophic cardiomyopathy, supra-, sub- or valvar aortic stenosis, coarctation.

- **Coronary artery vasospasm**.

- **Mitral valve prolapse**.

- **Ruptured sinus of Valsalva aneurysm**.

- **Arrhythmias**.
CHEST PAIN WITH A NORMAL PHYSICAL EXAM
CHEST PAIN WITH AN ABNORMAL EXAM

Non-anginal

Pain elicited by
Palpation
Respiration

Acute
Chronic

Chest wall, syndrome, Breast
Pneumonia
Pneumothorax
Pulmonary embolus
Bronchospasm
Allergic

CXR, PFT
Medical therapy

Associated with
Fever
Cough
Friction rub

Peri-myocarditis
Arrhythmia

MVP

Irregular and/or rapid heart beat
Click
Murmur, gallop

Anginal, ἀνγινή, ὀξύνθεσις, palpitations

MVP, mitral regurgitation, LV outflow obstruction, myopathy, coronary anomaly, aortic dissection, sinus of Valsalva rupture

ECG, echocardiogram, Holter monitor

Cardiac catheterization, electrophysiology

Medical/surgical therapy
WHO DIES DURING SPORTS?

- 2 to 4 young athletes per 100,000 per year. African ethnicity higher.
- Hypertrophic cardiomyopathy (2-36%).
- Congenital coronary artery anomalies (12-33%).
- Arrhythmogenic right ventricular hypertrophy (4-22%).
- Myocarditis (6-7%).
WHO DIES DURING SPORTS?

- Mitral valve prolapse (4-6%)
- Aortic root dissection (2-3%).
- Premature coronary disease (2-3%).
- Channelopathy (2-3%).
- Idiopathic dilated cardiomyopathy (2%)
- Drugs, WPW syndrome, commotio cordis.
REASSURANCE AND EXPENSE

- How do we relieve the worry associated with chest pain without doing every test on everybody?
- A quality improvement initiative at Children’s Hospital Boston called Standardized Clinical Assessment and Management Plan (SCAMP) tries to answer this question.
CHEST PAIN & THE HEART

- Records of children over 6 years old with chest pain seen at CHB from 2000 to 2009 were reviewed.

- 3,700 children (7 to 22 yo, m 13 yo) with chest pain (33% exertional) were evaluated.

- 37 (1%) had heart issue, 0 cardiac deaths in nearly 18,000 patient years of follow-up.
CHEST PAIN CHB 2000-09

- **Musculoskeletal**
  - (n = 1345, 36%)

- **Unknown**
  - (n = 1934, 52%)

- **Pulmonary**
  - (n = 242, 7%)

- **Gastrointestinal**
  - (n = 108, 3%)

- **Anxiety**
  - (n = 34, 1%)

- **Cardiac**
  - (n = 37, 1%)
    - Pericarditis (n = 10)
    - Myocarditis (n = 4)
    - Anomalous right coronary artery (n = 3)
    - Hypertrophic cardiomyopathy (n = 1)
    - Dilated cardiomyopathy (n = 1)
    - Supraventricular tachycardia (n = 14)
    - Ectopic atrial tachycardia (n = 1)
    - Nonsustained ventricular tachycardia (n = 1)
    - Cardio-inhibitory syncope (n = 2)
CHEST PAIN EVALUATION

- **History** (medical 21%, family 6% positive) and physical examination (4% abnormal) in 100%.

- **Electrocardiogram** in 100%, 4.5% abnormal.

- **Echocardiogram** in 38%, 11.9% abnormal.

- **Exercise stress tests** in 21%, 0.1% abnormal.

- **Prolonged ECG monitoring** in 30%, 1.1% abnormal.
SIGNIFICANT HISTORY:

- Association with exertion or exertional syncope.
- Radiation to back, jaw, left arm, or left shoulder.
- More pain with supine position.
- Temporal association with fever.
- History of systemic inflammatory disease, malignancy, hypercoagulable state, myopathy or prolonged immobilization.
SIGNIFICANT FAMILY HISTORY:

- Sudden or unexplained death.
- Aborted sudden death.
- Cardiomyopathy.
- Severe familial hyperlipidemia.
- Pulmonary hypertension.
SIGNIFICANT PHYSICAL FINDINGS:

- Pathologic murmur, gallop, rub, abnormal second sound, distant heart sounds, hepatomegaly, decreased peripheral pulses, peripheral edema, tachypnea, fever over 38.4 degrees C.

SIGNIFICANT ECG FINDINGS:

- Ventricular hypertrophy, atrial enlargement, ST-T abnormalities, high grade A-V block, ventricular or supraventricular ectopy, axis deviation, ventricular pre-excitation (IRBBB/early repolarization = normal variants).
406 patients with chest pain in 2009 at CHB had charts reviewed.

5 of 406 (1.2%) had cardiac etiology (2 pericarditis, 3 arrhythmia).

44/406 (11%) had significant medical or family history, an abnormal exam ± an abnormal ECG.

Limiting additional testing to these could save about 20% of costs.
SCAMP CHEST PAIN ALGORITHM

All Patients with CP Code n=417

All chest pain n=406

Primary complaint of palpitations (excluded) n=11

Concerning PMHx=4

Abnormal exam n=16

Abnormal ECG n=20

Positive family history n=4

Negative exam, ECG, history n=362

Nonexertional chest pain n=233

Exertional chest pain n=129

Echo n=145

Alternative diagnosis suspected n=10

No alternative explanation n=119

Chest pain at low level of exertion only n=18

Chest pain at high level of exertion n=101

No Echo n=261
SCAMP & RESOURCE USE: CHEST PAIN  CHB  2010-11

- Echocardiogram (Echocg)
- Exercise Stress Test
- Holter Monitor
- Event Monitor
- ECG

Significant differences (P < 0.001, P < 0.003)

Historical cohort and SCAMP cohort comparison.
SUMMARY

- Careful history, physical exam and ECG can identify most non-cardiac causes of chest pain.
- Chest pain at rest with normal ECG and echocardiogram is nearly always non-cardiac in origin.
- A cardiac cause of chest pain in children is rare (1%).
Exercise stress tests and prolonged ambulatory ECG monitoring do not add yield to assessment of exertional chest pain with normal ECG & echocardiogram.

Use of the chest pain SCAMP algorithm may decrease practice variation, resource utilization and cost without missing life-threatening chest pain in children.
REFERENCES


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