Chest pain Evaluation in Athlete
Where to start
Where to finish
Chest pain - how common?

• 1% of ambulatory visits in primary care are for chest pain

• Very few reports of the incidence of chest pain in athletes

• Can be difficult to determine work-up given the rarity of significant cardiac pathology in athletes
History and Physical Examination

• Well documented that history and physical examination have poor sensitivity
  – Red flags
    • Family history of SCD at young age
    • Family history of CAD at young age
  – Both these findings may influence the degree in which you pursue testing with negative findings in the early work up
Results – Etiology of NCAA Deaths
Harmon 2013

- SUD: 33%
- MI: 6%
- Myocarditis: 8%
- Aortic dissection: 8%
- Other: 3%
- Possible HCM/SCT: 3%
- Possible HCM/LVH: 8%
- ARVC: 3%
- Dilated CM: 8%
- Coronary Artery Abnormality: 14%
Age

• Sudden Death
  – < 35 yo
    • HCM
    • Other structural abnormalities
    • Other cardiomyopathies
    • Sudden Unexplained Death
      – ? channelopathies
  – > 35 yo
    • CAD
Other causes

• Non-cardiac causes of chest pain are generally more common in young athletes

• Most common causes
  – Pediatric
    • Exercise induced asthma/bronchospasm
  – Adult
    • Chest wall
    • GERD- up to 36% of adults during vigorous exercise
<table>
<thead>
<tr>
<th>Musculoskeletal</th>
<th>Gastrointestinal</th>
<th>Respiratory</th>
<th>Cardiac</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone/cartilage:</td>
<td>Gastrooesophageal reflux disease</td>
<td>Exercise-induced asthma</td>
<td>Pericarditis</td>
<td>Children/adolescents:</td>
</tr>
<tr>
<td>Rib stress fractures</td>
<td>Esophagitis</td>
<td>Lower respiratory infection</td>
<td>Myocarditis</td>
<td>Psychogenic</td>
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<tr>
<td>Slipping rib syndrome</td>
<td>Hiatus hernia</td>
<td>Spontaneous pneumothorax</td>
<td>Aortic dissection</td>
<td>Precordial catch</td>
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<tr>
<td>Costal cartilage fracture</td>
<td>Peptic ulcer</td>
<td>Pulmonary embolus</td>
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<td>Breast budding</td>
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<tr>
<td>Sternal stress fracture</td>
<td>Biliary colic/cholecystitis</td>
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<td></td>
<td>Malignancy</td>
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<tr>
<td>Joints</td>
<td>Pancreatits</td>
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<td></td>
<td>Drugs</td>
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<tr>
<td>Costochondritis</td>
<td>Oesophageal motility disorders</td>
<td></td>
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<td>Herpes zoster</td>
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<tr>
<td>Tietze's syndrome</td>
<td>Boerhaave's syndrome</td>
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<td></td>
<td>Epidemic myalgia</td>
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<tr>
<td>Stemoclavicular/stemocostal/</td>
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<td></td>
<td></td>
<td>Spontaneous pneumomediastinum</td>
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<tr>
<td>costovertebral subluxation</td>
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<td>Mondor disease</td>
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<td>SAPHO syndrome</td>
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<tr>
<td>Condensing osteitis</td>
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<tr>
<td>Friedrich's syndrome</td>
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<tr>
<td>Xiphodynia</td>
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<tr>
<td>Myofascial:</td>
<td></td>
<td></td>
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<tr>
<td>Intercostal muscle strain</td>
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<tr>
<td>Trigger points</td>
<td></td>
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<tr>
<td>Serratus anterior injury</td>
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</tbody>
</table>

From Sik et al CSMR 2009
Exertional Syncope in Athletes

• Syncope is generally benign in young athletes
• May be a prodrome to Sudden Cardiac Death
  – 17-23% of athletes who died of SCD had a syncopal event. (Kramer 1988, Maron 1980)
  – Reported prodromal symptoms higher (76%)*
  – (Fudge 2009- unpublished)
  • *Retrospective data- subject to significant reporting bias
• Present in 40% of the general population
• Little data on athletes
  – 6.2% in recent literature (Colivicchi 2004)
Other symptoms

• Syncope
  – Syncope/presyncope during exertion almost always indicates a serious cause
  – Exercise- associated collapse or non-exertional syncope are generally not life-threatening cause

• Colivicchi et al -7568 athletes
  – 86% syncope not related to exercise – benign
  – 12% post exertion-workups negative
  – 1.3% during exertion- all had significant disease
Exercise-related

• Exertional chest pain should alert healthcare provider to a potentially serious underlying disorder
Approach to the athlete with chest pain

• Athlete < 35
  – Syncope/presyncope with exercise
    • ECG
      – WPW
      – Long QT
    • Echocardiogram
      – HCM
      – Valve issues
    • Cardiac MRI
      – Anomalous coronary

• Palpitations
  – EKG
  – Stress test
  – Holter/event monitor
  – Electrophysiology consult if cause still unclear
Approach to the athlete with chest pain

• Athlete < 35
  – Exertional Chest pain
    • EKG
    • Stress Test
    • Echocardiogram
    • Role of further testing undefined
    • Consider when suspicion high and/or symptoms cannot be explained by non-cardiac causes
      – Cardiac MRI
      – Angiography
Athlete over 35

• Evaluate risk factors
  – Syncope or presyncope during exercise
    • ECG
    • Stress test
    • Echocardiogram if ECG and stress test negative
    • Angiography if ECG or stress test positive
Athlete over 35

- Evaluate risk factors

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Age/sex: men 55 years or older, women 65 years or older</td>
<td>1</td>
</tr>
<tr>
<td>Known vascular disease (CAD, occlusive vascular disease, cerebrovascular disease)</td>
<td>1</td>
</tr>
<tr>
<td>Pain worse with exercise</td>
<td>1</td>
</tr>
<tr>
<td>Pain not elicited with palpation</td>
<td>1</td>
</tr>
<tr>
<td>Patient assumes pain is of cardiac origin</td>
<td>1</td>
</tr>
</tbody>
</table>

Likelihood of CAD as Cause of Chest Pain

<table>
<thead>
<tr>
<th>Score</th>
<th>Positive likelihood ratio</th>
<th>Negative likelihood ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1 point</td>
<td>1.09</td>
<td>0.00</td>
</tr>
<tr>
<td>2 to 3 points</td>
<td>1.83</td>
<td>0.03</td>
</tr>
<tr>
<td>4 to 5 points</td>
<td>4.52</td>
<td>0.16</td>
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</tbody>
</table>

- 0-1 point
  - 1% chance CAD cause of pain
  - Evaluate for non-CAD related causes

- Moderate/High Risk
  - ECG
  - Stress test
  - Further testing should be based on clinical impression and patient preference

McConaghy et al AFP 2013
Non-exertional chest pain or pain at both rest and with exertion

- Consider atypical causes
- Red flags
  - Fever/Shortness of breath
    - Pericarditis
    - Pneumonia
  - Moderate/High Risk for DVT
    - Wells Criteria
- Recent trauma
  - Cardiac contusion
  - Aortic dissection
    - High energy injuries
  - May have delayed presentation particularly cardiac contusion
Table 3. Wells Clinical Prediction Rule for PE

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical signs of DVT (asymmetric leg swelling, palpable calf pain)</td>
<td>3</td>
</tr>
<tr>
<td>Diagnosis of PE is more likely than an alternative diagnosis</td>
<td>3</td>
</tr>
<tr>
<td>Heart rate greater than 100 beats per minute</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous diagnosis of DVT or PE</td>
<td>1.5</td>
</tr>
<tr>
<td>Bed rest Immobilization or surgery within the past four weeks</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1</td>
</tr>
<tr>
<td>Malignancy within the past six months</td>
<td>1</td>
</tr>
</tbody>
</table>

**Probability of PE**

<table>
<thead>
<tr>
<th>Points</th>
<th>Risk of PE</th>
<th>Probability of PE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1 point</td>
<td>Low</td>
<td>1.3</td>
</tr>
<tr>
<td>2 to 6 points</td>
<td>Moderate</td>
<td>16</td>
</tr>
<tr>
<td>Greater than 6 points</td>
<td>High</td>
<td>41</td>
</tr>
</tbody>
</table>

DVT = deep venous thrombosis; PE = pulmonary embolism.
When to stop?

- Athlete’s with high risk symptoms should likely have complete work up until cause can be determined
  - ? Genetic testing if all else negative
  - Still unknowns with genetic diagnosis versus clinical presentations

- Should cost matter?
  - Patients with high deductible or without insurance
    - Complete work up could cost upwards of $50,000 or more
Selected references