Postoperative Myocardial Infarction: Diagnosis and Management

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Adapted from Davies. Heart 2000;83:361
Ischemic Discomfort

Acute Coronary Syndrome

Presentation

Working Dx

ECG

Cardiac Biomarker

Final Dx

ST Elevation

No ST Elevation

UA

NSTE MI

Unstable Angina

Myocardial Infarction

NQMI

Qw MI

2004 ACC/AHA STEMI Guidelines
Pathophysiology

Table 3. Causes of UA/NSTEMI

<table>
<thead>
<tr>
<th>Thrombus or thromboembolism, usually arising on disrupted or eroded plaque</th>
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<tbody>
<tr>
<td>Occlusive thrombus, usually with collateral vessels†</td>
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<tr>
<td>Subtotally occlusive thrombus on pre-existing plaque</td>
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<tr>
<td>Distal microvascular thromboembolism from plaque-associated thrombus</td>
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<table>
<thead>
<tr>
<th>Thromboembolism from plaque erosion</th>
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<tbody>
<tr>
<td>Non-plaque-associated coronary thromboembolism</td>
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<table>
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<tr>
<th>Dynamic obstruction (coronary spasm‡ or vasoconstriction) of epicardial and/or microvascular vessels</th>
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<tbody>
<tr>
<td>Progressive mechanical obstruction to coronary flow</td>
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<tr>
<td>Coronary arterial inflammation</td>
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<tr>
<td>Secondary UA</td>
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<tr>
<td>Coronary artery dissection§</td>
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</table>

2007 ACC/AHA UA/NSTEMI Guidelines
Pathophysiology

• Other mechanisms of myocardial ischemia in the postoperative patient
  – Fluid mobilization which increases strain on vulnerable myocardium
    • Coronary perfusion pressure = DBP – LVEDP
  – Pro-thrombotic state associated with surgery
  – Catecholamine surges
  – Post-operative pain
    • Tachycardia and hypertension

Patients at Greatest Risk

- High Risk Clinical Features
  - Unstable coronary syndromes
    - Unstable or severe angina
    - Recent MI
  - Decompensated CHF
  - Significant arrhythmias
  - Severe valvular heart disease

- Other Clinical Risk Factors
  - History of ischemic heart disease
  - History of CHF
  - History of cerebrovascular disease
  - Diabetes mellitus
  - Renal insufficiency

2007 ACC/AHA Guidelines on Perioperative CV Evaluation and Care for Noncardiac Surgery
# Procedural Risk

## Table 4. Cardiac Risk* Stratification for Noncardiac Surgical Procedures

<table>
<thead>
<tr>
<th>Risk Stratification</th>
<th>Procedure Examples</th>
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<tbody>
<tr>
<td>Vascular (reported cardiac risk often more than 5%)</td>
<td>Aortic and other major vascular surgery</td>
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<tr>
<td></td>
<td>Peripheral vascular surgery</td>
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<tr>
<td>Intermediate (reported cardiac risk generally 1% to 5%)</td>
<td>Intraperitoneal and intrathoracic surgery</td>
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<tr>
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<td>Carotid endarterectomy</td>
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<td>Head and neck surgery</td>
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<td></td>
<td>Orthopedic surgery</td>
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<td></td>
<td>Prostate surgery</td>
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<tr>
<td>Low† (reported cardiac risk generally less than 1%)</td>
<td>Endoscopic procedures</td>
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<tr>
<td></td>
<td>Superficial procedure</td>
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<tr>
<td></td>
<td>Cataract surgery</td>
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<td></td>
<td>Breast surgery</td>
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<tr>
<td></td>
<td>Ambulatory surgery</td>
</tr>
</tbody>
</table>

*Combined incidence of cardiac death and nonfatal myocardial infarction.
†These procedures do not generally require further preoperative cardiac testing.
Pathophysiology

• Surgical procedures at greatest risk
  – Vascular procedures
  – Major abdominal, thoracic, and head and neck surgeries

• Patients at greatest risk
  – History of CAD or CHF

• Circumstances associated with increased risk of postoperative MI
  – Postoperative hypotension, new intraoperative ST changes, intraoperative blood loss requiring transfusion

Pathophysiology

• Post-operative myocardial ischemia
  – the strongest predictor of perioperative cardiac morbidity
  – is rarely accompanied by pain
  – may go untreated until overt symptoms of cardiac failure develop
    • Clinical heart failure, arrhythmias, hypotension, confusion
Pathophysiology

• Time course of myocardial infarction
  – 94% occur by postoperative day 2
    • 44% on the day of surgery
    • 34% on postoperative day 1
    • 16% on postoperative day 2
Surveillance

- Clinically low-risk patients undergoing low-risk surgery
  - Only if symptoms warrant
- Intermediate of high risk patients undergoing intermediate or high risk surgery
  - EKG's should be done at baseline, immediately after the procedure and daily for 2 days
  - Routine troponin measurements should also be done

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Diagnostic and Therapeutic Approach to ACS

• Initial stabilization and inpatient management

• Risk Stratification
  – Early identification of those patients who are likely to benefit from revascularization (PCI, CABG)

• Risk factor management and secondary prevention

• Symptom control

PCI = percutaneous coronary intervention, CABG = coronary artery bypass graft surgery
Initial Stabilization

• Initial therapies in patients with ACS
  – Antiplatelet agents
    • Aspirin, clopidogrel, glycoprotein IIb/IIIa inhibitors
  – Anticoagulation
    • Heparin, LMWH, Fondaparinux, Bivalirudin
  – Anti-Ischemic Therapy
    • Beta-blockers, Nitrates, CCB
  – Statins
  – Ace Inhibitors
  – Oxygen
  – Blood
General Anti-Ischemic Measures for all Patients with UA/NSTEMI

1. Oxygen
   - if sat <90% (Class I)
   - all patients (Class IIa)

2. Nitroglycerin
   - SL PRN for chest pain (Class I)
   - IV for persistent ischemia, HF symptoms, or hypertension (Class I)
   - IV NTG should not preclude the use of mortality reducing therapies (BB, Ace I) (Class I)
   - Nitrates contraindicated with recent use of sildenafil (24 hours), tadalafil (48%), or vardenafil (unknown time duration) (Class III)

3. Morphine
   - for chest pain despite NTG administration (Class IIa)

4. Beta Blockers
   - PO in those without: HF symptoms, low-output state, increased risk of cardiogenic shock, and those with relative contraindications to BB (AV interval >240 msec, 2\textsuperscript{nd}/3\textsuperscript{rd} degree AV Block, asthma/RAD) (Class I)
   - IV for the treatment of hypertension or tachycardia in the absence of above listed contraindications (Class IIa)
General Anti-Ischemic Measures for all Patients with UA/NSTEMI

5. Calcium Channel Blockers
   - non-dihydropyridine CCB’s in those intolerant of BB (Class I)

6. Ace Inhibitors
   - PO in those with: EF <40 or pulmonary congestion (Class I)
   - PO in everyone (Class IIa)
   - IV ace inhibitors are contraindicated (Class III)

7. Angiotensin Receptor Antagonists
   - PO in those intolerant of ace inhibitors (Class I)
Risk Stratification

• You have a choice between invasive and non-invasive testing
• Invasive testing (Coronary Angiography) is generally preferred in the following situations:
  – STEMI
  – Positive cardiac enzymes (NSTEMI)
  – Refractory angina
  – Hemodynamic or electrical instability
  – Recent stents
  – Prior CABG
  – Those who initially are managed conservatively and have a high risk non-invasive study