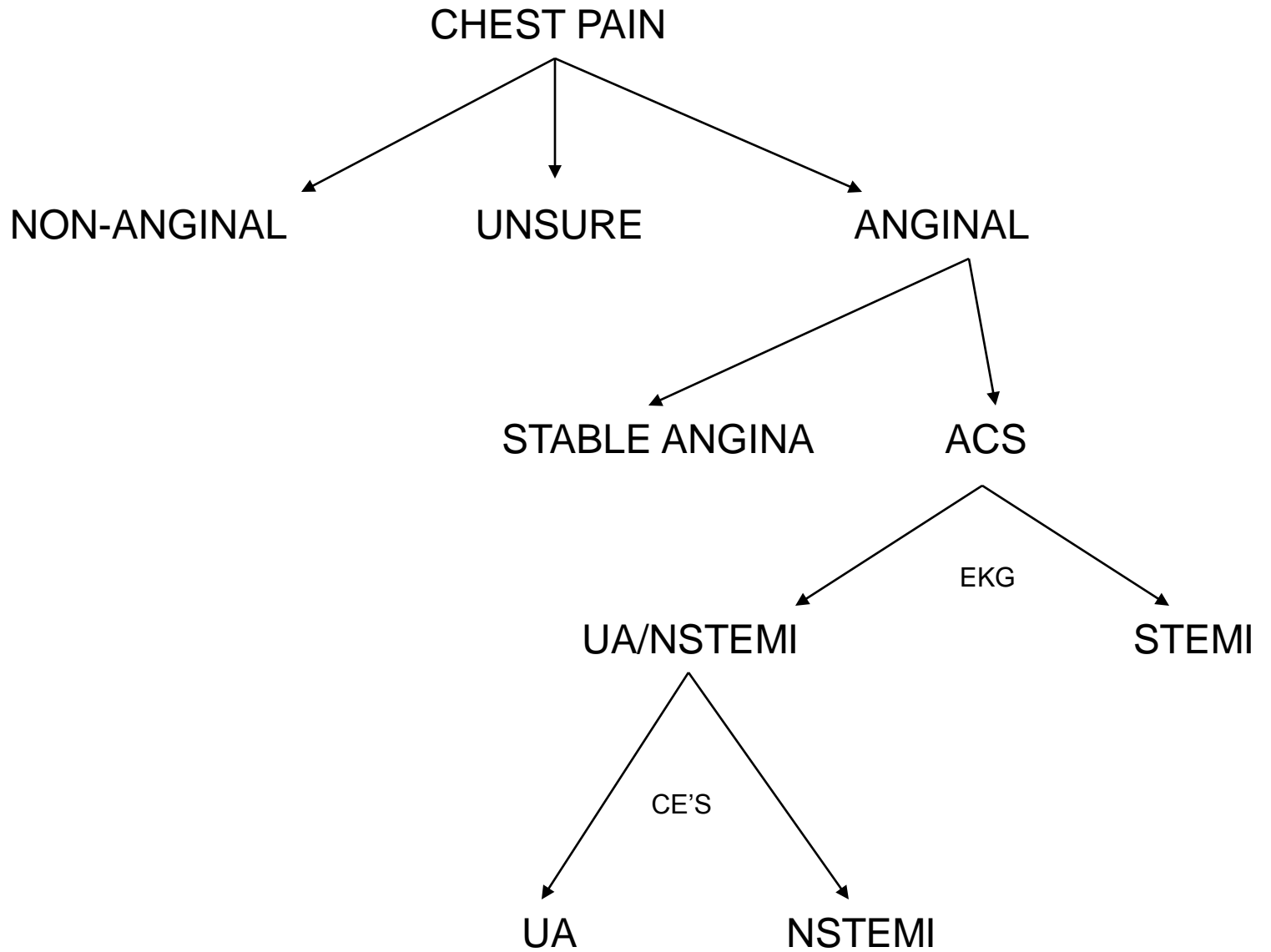# Postoperative Myocardial Infarction: Diagnosis and Management
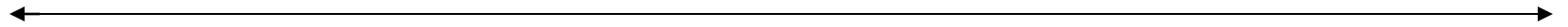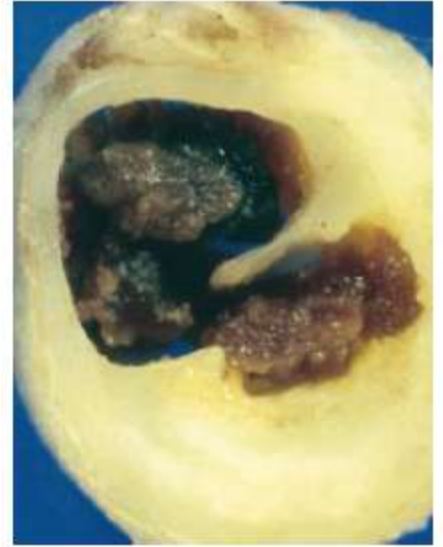
Todd M. Brown, MD, MSPH
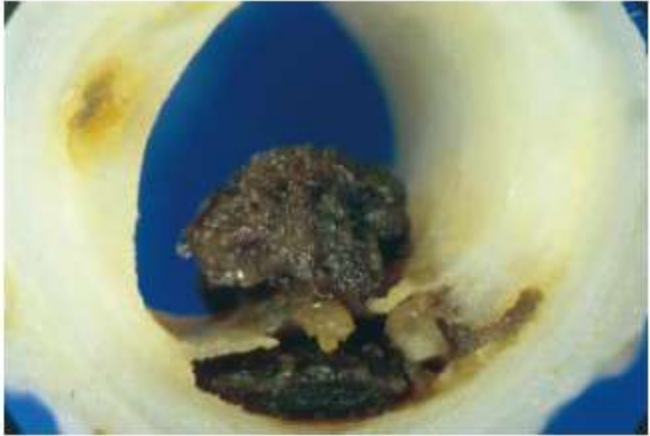Chief Fellow
Division of Cardiovascular Diseases

December 9, 2008

UA   NSTEMI   STEMI

 Ischemic Discomfort

Acute Coronary Syndrome

Presentation
↓
Working Dx

ECG

Cardiac
Biomarker
↓
Final Dx

No ST Elevation

ST Elevation

UA   NSTEMI

Unstable
Angina

Myocardial Infarction

NQMI   Qw MI

2004 ACC/AHA STEMI Guidelines
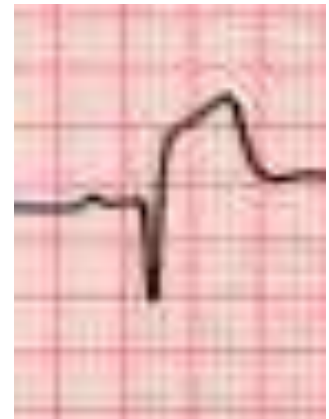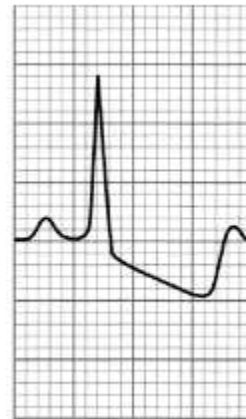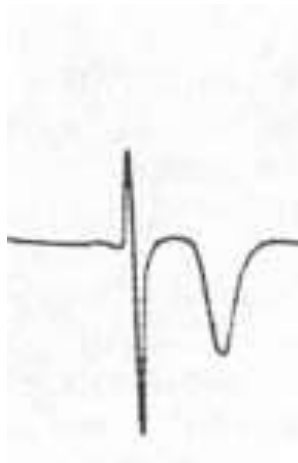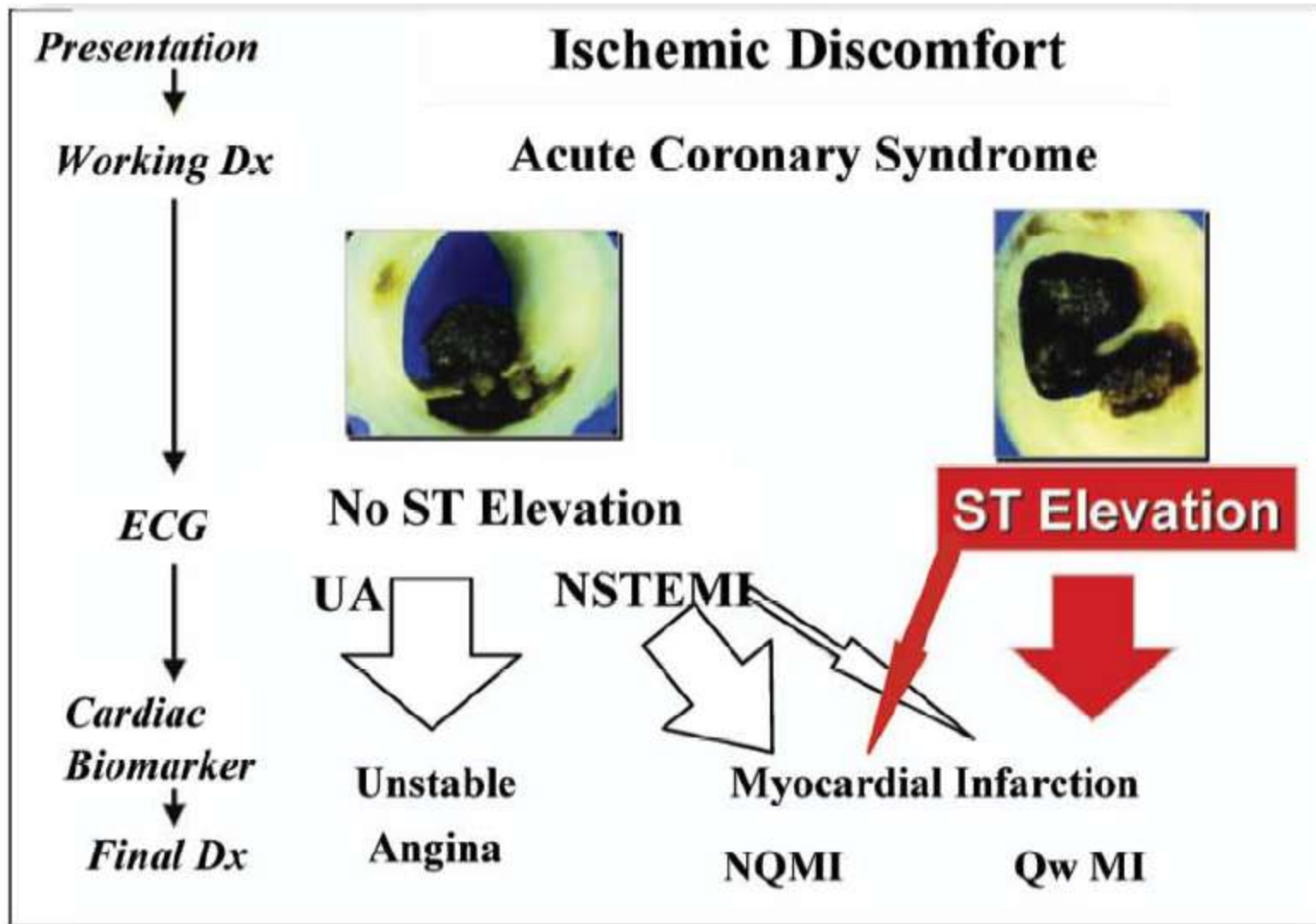
Pathophysiology

Table 3. Causes of UA/NSTEMI*

Thrombus or thromboembolism, usually arising on disrupted or eroded plaque

- Occlusive thrombus, usually with collateral vessels†
- Subtotally occlusive thrombus on pre-existing plaque
- Distal microvascular thromboembolism from plaque-associated thrombus

Thromboembolism from plaque erosion

- Non–plaque-associated coronary thromboembolism

Dynamic obstruction (coronary spasm‡ or vasoconstriction) of epicardial and/or microvascular vessels

Progressive mechanical obstruction to coronary flow

Coronary arterial inflammation

Secondary UA

Coronary artery dissection§

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

Mauck, et al. Clin Geriatr Med 2008;24:585-605.

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

Procedural Risk

Table 4. Cardiac Risk* Stratification for Noncardiac Surgical Procedures

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

*Combined incidence of cardiac death and nonfatal myocardial infarction.

†These procedures do not generally require further preoperative cardiac testing.

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

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

Mauck, et al. Clin Geriatr Med 2008;24:585-605.

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

Mauck, et al. Clin Geriatr Med 2008;24:585-605.

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

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 <u>without</u>: HF symptoms, low-output state, increased risk of cardiogenic shock, and those with relative contraindications to BB (AV interval >240 msec, 2nd/3rd 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

Mauck, et al. Clin Geriatr Med 2008;24:585-605.

STEMI

Hemodynamic Instability/ Shock

Hemodynamically stable

Aspirin
Vasopressors as
needed
+/- IABP

Aspirin, Beta-blockers
IV Nitroglycerin
Morphine Sulfate

Able to anticoagulate with
Heparin

Absolute CONTRAINDICATION to
Heparin anticoagulation

Cardiac Catheterization and
Primary PCI
+/- IABP
+/- CABG+

Medical Management++

Beta Blocker
Aspirin +/- Clopidrogel
+/- ACE Inhibitor
HMG-CoA reductase
inhibitors (Statins)

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