Emergency Medicine Reports
The Practical Journal for Emergency Physicians

Volume 32, Number 1 / January 1, 2011 www.emreports.com

Author:

Preeti Jois, MD, FACEP, Assistant Professor, Department of Emergency Medicine, University of Florida College of Medicine, Gainesville.

Peer Reviewer:

Frank LoVecchio, DO, Director, Banner Poison Center, Department of Emergency Medicine, Maricopa Medical Center, Phoenix, AZ.

Statement of Financial Disclosure

To reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Schneider (editor) serves on the editorial board for Logical Images. Dr. Farel (CME question reviewer) owns stock in Johnson & Johnson. Dr. Stapczynski (editor), Dr. Jois (author), Dr. LoVecchio (peer reviewer), Mr. Underwood (executive editor), and Ms. Mark (specialty editor) report no relationships with companies related to the field of study covered by this CME activity.

AHC Media LLC

NSTEMI and STEMI: Therapeutic Updates 2011

Introduction

Just when you, the emergency physician, think you have the guidelines for treatment of acute coronary syndrome (ACS) figured out, the AHA/ACC releases new revisions and updates. Revision of these guidelines is not done lightly; the timing of these revisions and updates follows closely late-breaking clinical trials, scientific sessions, and other evidence showing improvements in patient outcomes due to certain therapeutic interventions. Over the last 30 years, the paradigm for the diagnosis and treatment of ACS has switched from management of complications of the disease in the critical care unit (CCU) to the detection and reversal of the pathophysiological process starting in the prehospital arena and continuing to the ED with the rapid transfer of selected patients to the cardiac catheterization suite.

In many areas of medicine, we lack enough good evidence to guide our actions. In the management of ACS, we have almost too much evidence, some of which provides conflicting information. The advantage of guidelines and updates is that they critically analyze this extensive amount of evidence and provide recommendations that can be trusted to provide the best care in most circumstances.

Background

The American College of Cardiology (ACC) and the American Heart Association (AHA) have dedicated writing task force committees charged with evaluating the evidence-based literature each year to identify best practices in the management and treatment of acute coronary syndrome.[1,2]

The following article will discuss the revisions and updates, specifically highlighting the changes relevant to the ED recognition, evaluation, and management of patients with ACS. Where applicable, the guideline changes and revisions will reflect the respective class and level of evidence (LOE).

An important principle of evidence-based medicine is that evidence varies in its strength. For example, a recommendation based on opinion is less "strong" and more likely to be in error than one based on controlled clinical trials. A guideline based on many different randomized controlled clinical trials in multiple locations and in multiple patient populations provides the strongest support for a specific course of action. In addition, while a specific approach or treatment may be beneficial, the size of that benefit may be small. Analysis of multiple large clinical trials many find that a specific treatment improves outcome to a highly reliable degree, but the absolute effect is small. So while the benefit is clear in large groups, it is difficult to be sure that it will translate into an improved outcome in an individual patient. The strongest level of evidence is that derived from many different randomized controlled clinical trials in multiple locations and in multiple patient populations and where there is a large beneficial effect. Guidelines based on such evidence are termed "Level IA

Executive Summary

- Both aspirin and clopidogrel should be given to ACS patients in the ED.
- IV beta-blockers and morphine should be used only in selected ACS patients.
- Early invasive strategy is recommended for most NSTEMI patients.
- GP IIB/IIIa inhibitors are beneficial in STEMI patients undergoing PCI.

Recommendations."

Therapeutic Management of UA/NSTEMI: Revision 2007[1]

Prehospital.[1] Thirty years ago, patients with chest pain were told to call their family doctor; now they are told to come to the ED. This concept is stated in the revised guidelines that patients with symptoms representing ACS should not be evaluated solely over the telephone but should be immediately referred to a facility capable of acquiring and interpreting a 12-lead electrocardiogram (ECG), as well as determining biomarkers.[1] The obvious location is the ED that provides those services 24 hours a day, all year-round. Furthermore, the guidelines suggest that patients with symptoms of ACS should call 911 and be transported to the hospital via ambulance rather than with friends or family.

Patient recognition of symptoms is a key factor in timely assessment. It is not unusual for the average patient with non-ST-segment elevation myocardial infarction (NSTEMI) to wait up to two hours before calling for assistance. Reasons cited for this delay include patient uncertainty about requiring help, fear of criticism for a "false alarm," denial of symptoms, and the belief that the symptoms will eventually dissipate.

Nitroglycerin. One of the revisions made in the guidelines involves the dosing regimen of sublingual nitroglycerin (NTG). Patients are now asked to use only *one* dose of sublingual or spray nitroglycerin and *then* call 911 if the pain persists. While the patient is awaiting EMS arrival, he or she can take up to two additional doses of NTG 15 minutes apart. The prior recommendation was to take 3 doses of NTG 15 minutes apart, and if symptoms do not abate, then call 911.

Prehospital ECG. In another effort to reduce the prehospital time of transport in patients with suspected ACS, the 2007 guidelines emphasize acquisition of 12-lead ECG in the field by prehospital providers. In addition, the guidelines suggest preexisting protocols to more quickly determine the receiving facility for patients suspected to have ACS.

Initial Evaluation

Emergency physicians face interesting challenges in the evaluation of acute coronary syndrome. The spectrum of clinical presentations is broad and includes angina, unstable angina, and acute myocardial infarction.

ECG. The guidelines describe pathways to ensure prompt recognition and early treatment of patients presenting with ACS.[1] Of utmost importance is a 12-lead ECG obtained within 10 minutes of patient presentation to the ED (level 1B recommendation). The detailed wording in this guideline recommends that the ECG be performed in those patients who are presenting with chest pain or other symptoms *suggestive of ACS.* Comments were also made that if the initial ECG has non-diagnostic ST-segment or T-wave changes, a repeat ECG in 20-30 minutes should be considered. Likewise, serial ECGs during the ED stay are recommended to detect evolutionary changes that are not initially apparent.

Cardiac Biomarkers. NSTEMI is often not recognized by 12-lead ECG alone. The guidelines give a 1B recommendation to biomarker evaluation in patients who present with chest discomfort consistent with ACS, noting that cardiac troponin is the preferred biomarker.

The question of when to obtain biomarkers is addressed within the 2007 revision. If the patient can provide a time of onset of symptoms consistent with ACS, this time is labeled as "time zero" (T0). If the initial biomarker measurement in the ED is negative within **six hours** of T0, then only **one additional** set of biomarkers needs to be evaluated at T8 to T12, or at 8-12 hours after initial onset of symptoms. This 1B recommendation allows for a more streamlined workup to be performed in the ED because it uses only two measurements within the initial 12 hours. In addition, these guidelines specifically highlight the importance of distinguishing chest pain symptoms as being consistent with ACS.

For patients are not able to provide an accurate time of onset of symptoms, the time when the patient presents to the ED is considered T0, and biomarker evaluation proceeds from this point. This particular scenario then allows for a series of three measurements: a time "0,6,8" or "0,6,10" biomarker evaluation. The revised guidelines give a IIb-B recommendation to CK-MB and to myoglobin as adjunctive biomarkers with serial troponin measurements in the evaluation of NSTEMI. Specifically, serum myoglobin levels can be measured 90 minutes apart with troponin; and serial serum CK-MB values can be obtained at 2-hour intervals.[3,4]

Therapeutic Management: Anti-ischemic Therapy

Beta-Blockers. In 2005, the

COMMIT Collaborative Group published data showing an increased hazard in using early, aggressive intravenous beta-blocker therapy in the treatment of patients with unstable angina and NSTEMI, particularly in those patients with increased risk of cardiogenic shock. This danger was not significantly counterbalanced by the minimal benefit seen with reduction of reinfarction and ventricular fibrillation with administration of IV beta-blocker therapy.[5]

Due to these findings, the revised guidelines issued a 1B recommendation for the use of oral beta-blocker therapy in the first 24 hours of recognition of unstable angina and NSTEMI, and only in non-high-risk patients — those without signs of heart failure or low output state, without increased risk factors for cardiogenic shock, and without relative contraindications to beta-blocker therapy such as PR interval greater than 0.24 seconds, second- or third-degree heart block, asthma, or reactive airway disease. **Intravenous** beta–blocker therapy was downgraded to IIa-B recommendation. This revision represents a major shift in the treatment paradigm of unstable angina and NSTEMI.

Calcium Channel Blockers. In cases where patients have contraindications to beta-blocker therapy, a non-dihydropyridine calcium channel blocker, such as verapamil or diltiazem, should be used as initial therapy for unstable angina and NSTEMI in the absence of clinically significant LV dysfunction or other contraindications to calcium channel blocker use. This guideline received a I-B recommendation.

Angiotensin Converting Enzyme (ACE) Inhibitors. Oral administration of ACE inhibitors is now recommended within the first 24 hours to unstable angina and NSTEMI patients with pulmonary congestion or left ventricular ejection (LVEF) ≤ 40%, in the absence of hypotension (systolic blood pressure < 100 mmHg or < 30 mmHg below the baseline) or known contraindication to the medication. Many readers are likely to think that this particular revision does not apply to the emergency physician in that such therapy can be delayed until the patient arrives on the inpatient unit. However, prolonged ED stays due to lack of inpatient beds may make the patient eligible to receive ACE inhibitor therapy from the emergency physician.

A new guideline earning a IA recommendation concerns those patients with a contraindication or intolerance to ACE inhibitors. In this case, the patient should receive an angiotensin receptor blocker in the setting of unstable angina or NSTEMI and clinical or radiological signs of heart failure or LVEF ≤ 40%.

Nitroglycerin. The major concern posited in the 2007 guideline revision involves the use of nitroglycerin in patients who have received a phosphodiesterase inhibitor for erectile dysfunction. The statement advises **withholding use of** nitrates or nitroglycerin in patients who have used sildenafil (Viagra) or vardenafil (Levitra) within the preceding 24 hours or for patients who have used tadalafil (Cialis) within the preceding 48 hours.

Morphine. Data published in 2005 from the CRUSADE registry led to a major guideline change concerning the use of morphine as an anti-ischemic agent for NSTEMI patients.[6] The registry had enrolled and evaluated patients with acute coronary syndrome treated according to ACC/AHA guidelines published prior to 2005. An analysis of 57,039 high-risk non-ST-segment elevation ACS patients who received morphine sulfate found a higher in-hospital mortality compared to those who did not receive morphine (OR 1.48) or those who received intravenous NTG (OR 1.50).[6]

In the absence of contraindications, intravenous morphine sulfate should be administered in unstable angina or NSTEMI patients for uncontrolled ischemic chest pain refractory to the use of nitroglycerin, and provided that additional therapy is used to manage underlying ischemia. This guideline downgrades the use of IV morphine sulfate from a level IC recommendation to a level IIa-B recommendation.

Therapeutic Management: Antiplatelet and Anticoagulant Therapy

The use of antiplatelet and anticoagulant therapies in the management of unstable angina and NSTEMI patients is complex because it requires a choice between an initial invasive vs. an initial conservative strategy. Since this decision is made by the cardiologist, it is of pivotal importance that the ED physicians and cardiologists create collaborative networks to improve the early treatment of such patients.

Patients with NSTEMI who are selected for an initial invasive approach tend to have an elevated risk for clinical events due to certain factors. (*See Table 1.*) Bavry et al conducted a meta-analysis of studies where patients were randomized to early invasive versus initial conservative strategies and found a long-term survival benefit from initial invasive therapy.[7]

The Class I recommendations for antiplatelet therapy in unstable angina or NSTEMI patients are:

- Aspirin (162-325 mg PO) should be administered to patients as soon as possible after hospital presentation and should be continued indefinitely in patients without intolerance to the medication.
- Clopidogrel (loading dose) should be administered to patients who are unable to take aspirin because of hypersensitivity or other major GI issues. The loading dose of clopidogrel has previously been listed at 300-600 mg PO. However, recent guideline statements suggest that the optimal loading dose of clopidogrel has not been established since there is a paucity of data in randomized clinical trials establishing superior efficacy or safety of loading doses greater than 300 mg PO. The European Society of Cardiology released a level 1A guideline for the administration of clopidogrel 300 mg PO as early as possible for

Table 1: UA/NSTEMI: Invasive vs. Conservative Strategy

Preferred Strategy	Patient Characteristics
Invasive	• Recurrent angina or ischemia at rest or with low-level activities despite intensive medical therapy • Elevated cardiac biomarkers (TnT or TnI) • New or presumably new ST-segment depression • Signs or symptoms of HF or new or worsening mitral regurgitation • High-risk findings from noninvasive testing • Hemodynamic instability • Sustained ventricular tachycardia • PCI within 6 months • Prior CABG • High risk score (e.g., TIMI, GRACE) • Reduced left ventricular function (LVEF less than 40%)
Conservative	• Low risk score (e.g., TIMI, GRACE • Patient or physician preference in the absence of high-risk features

Key:

CABG = coronary artery bypass graft surgery; GRACE = Global Registry of Acute Coronary Events; HF = heart failure; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary intervention; TIMI = Thrombolysis In Myocardial Infarction; TnI = troponin I; TnT = troponin T

Reprinted with permission from: Adams C, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angine/non-ST-elevation myocardial infarction. *J Am Coll Cardiol* 2007;50:678.

patients classified as unstable angina or NSTEMI.

• For patients undergoing an initial **invasive** strategy, an antiplatelet therapy in addition to aspirin should be started before diagnostic angiography. Options for antiplatelet therapy include either clopidogrel or an intravenous glycoprotein IIb/IIIa (GP IIb/IIIa) inhibitor (level of evidence A). Abciximab is recommended as the GP IIb/IIIa inhibitor only if no anticipated delay to angiography and PCI is likely. However, if there is an appreciable delay, then eptifibatide or tirofiban are the preferred GP IIb/IIIa inhibitors (level of evidence: B).

• In unstable angina or NSTEMI patients selected for an initial **conservative** therapy, clopidogrel loading dose should be added to aspirin and anticoagulant therapy as soon as possible after admission. However, if patients in this conservative approach have persistent chest pain/symptoms/ischemia, heart failure, or arrhythmias, then diagnostic angiography should be performed (level of evidence: A). This is particularly relevant for patients who may be in the ED awaiting an inpatient bed.

The Class 1 recommendations for anticoagulant therapy in unstable angina or NSTEMI patients are:

• For patients in whom an **invasive** strategy is selected, regimens with established efficacy (level of evidence: A) include enoxaparin and unfractionated heparin (UFH). Other treatments with established efficacy (level of evidence: B) include bivalirudin and fondaparinux.[8,9]

• For patients in whom a **conservative** strategy is selected, regimens with established efficacy include using either enoxaparin or UFH (level of evidence: A) or fondaparinux (level of evidence: B).

• In patients in whom a **conservative** strategy is selected and who have an increased **risk of bleeding**, fondaparinux is preferable (level of evidence: B).

In summary, the 2007 revision to the unstable angina and NSTEMI treatment guidelines modified the use of IV beta-blocker therapy, cautioned about the use of nitrates with phosphodiesterase inhibitors, highlighted a potential risk to the adjunctive use of morphine sulfate, delineated invasive and conservative pathways for treatment, suggested modified dosing of clopidogrel, and introduced new anticoagulant options with bivalirudin and fondaparinux.

Therapeutic Management of STEMI: Update 2009[2]

This 2009 update to the guidelines focuses on the use of antiplatelet and anticoagulant therapy in ST-segment elevation myocardial infarction (STEMI) as well as the importance of developing prehospital systems of care, triage, and transfer for patients with STEMI.[12]

Once the diagnosis of STEMI is made, the focus is placed on diminishing ischemic burden while arranging for immediate angiography (door-to-balloon).

Antiplatelet Therapy. Thienopyridines work to prevent platelet activation and aggregation. TRITON-TIMI 38 compared prasugrel to clopidogrel.[10] It should be noted that the loading dose of clopidogrel in TRITON-TIMI 38 was 300 mg orally, lower than the current guideline recommendations (300-600 mg PO). The study evaluated more than 13,000 patients with moderate to high-risk ACS, of which 3534 were diagnosed with STEMI, who were all randomized to receiving either prasugrel (60 mg PO) or clopidogrel (300 mg PO) prior to PCI, along with adjunctive aspirin.

Prasugrel was associated with a significant 2.2% absolute reduction and a 19% relative reduction in the primary efficacy endpoint, a composite of the rate of death due

to cardiovascular causes (including arrhythmia, congestive heart failure, shock, and sudden or unwitnessed death), nonfatal MI, or nonfatal stroke during the follow-up period.[10]

The modified class I conclusion drawn from this study for patients undergoing **primary PCI** is that a loading dose of thienopyridine is recommended for STEMI patients. Regimens should be one of the following:

- At least 300 to 600 mg of clopidogrel should be given as early as possible before or at the time of primary or nonprimary PCI (level of evidence: C).
- Prasugrel 60 mg should be given as soon as possible for primary PCI (level of evidence: B).

Furthermore, Class I recommendations for patients **not undergoing primary PCI** are:

- If the patient has received fibrinolytic therapy and has been given clopidogrel, clopidogrel should be continued as the thienopyridine of choice (level of evidence: C).
- If the patient has received fibrinolytic therapy without a thienopyridine, a loading dose of 300 to 600 mg of clopidogrel should be given as the thienopyridine of choice (level of evidence: C).
- If the patient did not receive fibrinolytic therapy, either a loading dose of 300 to 600 mg of clopidogrel should be given or, once the coronary anatomy is known and PCI is planned, a loading dose of 60 mg of prasugrel should be given promptly and no later than 1 hour after the PCI (level of evidence: B).

Glycoprotein IIb/IIIa Inhibitors. Glycoprotein (GP) IIb/IIIa inhibitors work to prevent platelets from aggregating together. The updated guidelines used evidence from several major trials investigating the use of GP IIb/IIa inhibitors as adjuncts to oral therapy in the setting of primary PCI. BRAVE-3 and FINESSE studied exclusively the role of abciximab pre-PCI, ON-TIME 2 evaluated the role of tirofiban pre-PCI, whereas MULTISTRATEGY compared tirofiban with abciximab, and HORIZONS-AMI compared abciximab with eptifibatide.[11-14]

The overall conclusions reached from these studies suggest that adjunctive use of GP IIb/IIa inhibitors at the time of primary PCI is useful in the setting of dual antiplatelet therapy with either UFH or bivalirudin as the anticoagulant, but that routine administration and timing of administration of these agents remains uncertain.

Class IIA: It is reasonable to start treatment with GP IIb/IIIa inhibitors (abciximab (level of evidence: A), tirofiban (level of evidence: B), or eptifibatide (level of evidence: B) at the time of primary PCI (with or without stenting) in selected patients with STEMI.

Class IIB: The usefulness of glycoprotein IIb/IIIa inhibitors (as part of a preparatory pharmacological strategy for patients with STEMI before their arrival in the cardiac catheterization laboratory for angiography and PCI) is uncertain.

Anticoagulant Therapy. Currently available parenteral anticoagulants include bivalirudin, intravenous unfractionated heparin (UFH), enoxaparin, and fondaparinux. The STEMI guideline revision briefly mentioned bivalirudin. However, data published in the HORIZONS-AMI trial led to the new guideline inclusion of bivalirudin use in primary PCI. Specifically, the Class II recommendation suggests the use of bivalirudin in STEMI patients at high risk for bleeding who are proceeding to PCI is reasonable.

The updated Class I guidelines for anticoagulant use in STEMI patients proceeding to primary PCI, and who have received aspirin and a thienopyridine, are:

- For prior treatment with UFH, additional boluses of UFH should be administered as needed to maintain therapeutic activated clotting time levels, taking into account whether GP IIb/IIIa inhibitors have been administered (level of evidence: C).
- Bivalirudin is useful as a supportive measure for primary PCI with or without prior treatment with UFH (level of evidence: B).

Triage and Transfer of STEMI Patients

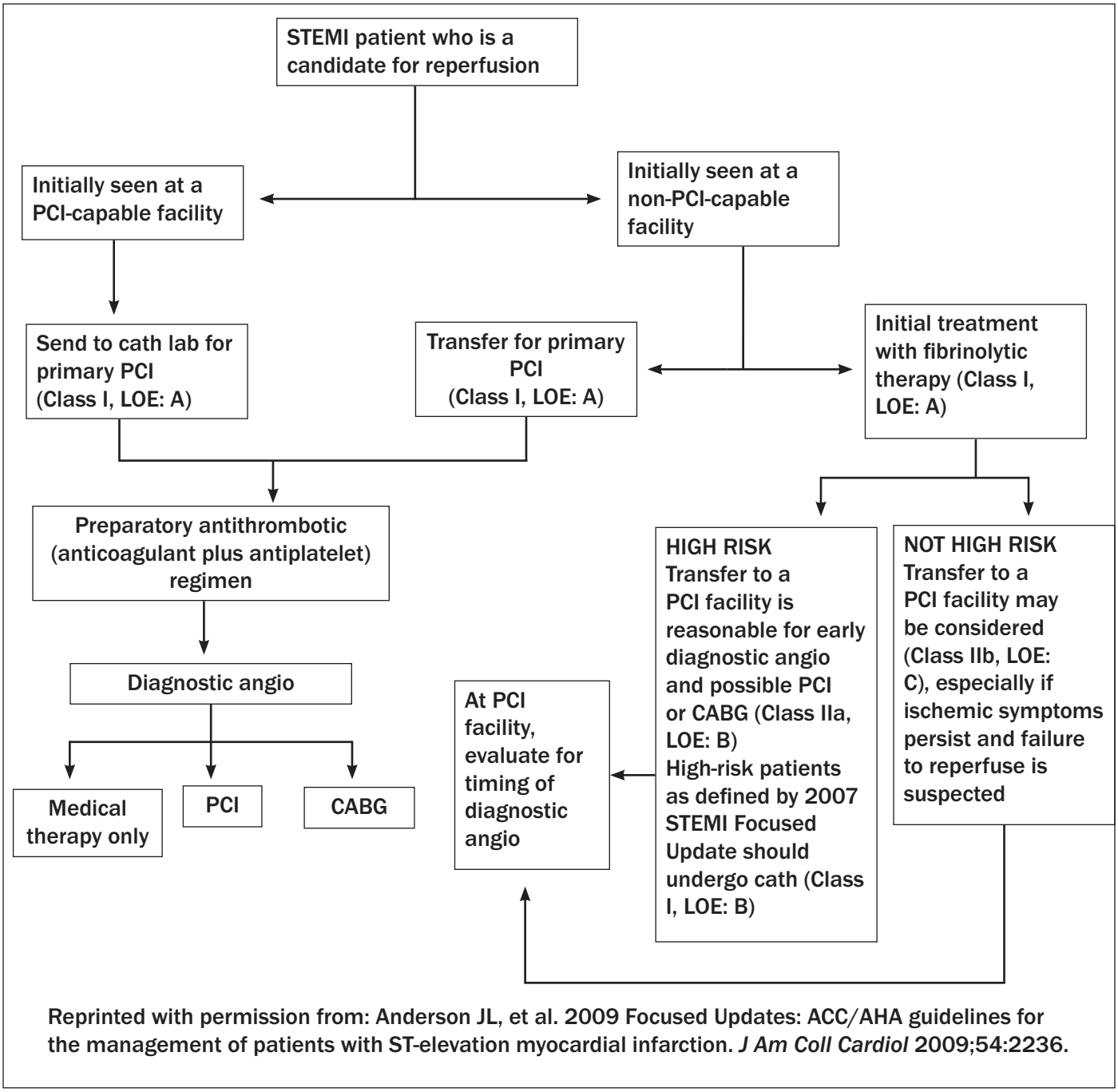
The 2009 guideline update dedicates a large section to new recommendations for the transfer of STEMI patients to a primary PCI hospital. While the 2007 guideline terms "facilitated PCI" and "rescue PCI" have been deleted, the concepts involving transfer and reperfusion treatment of STEMI patients from a non-primary PCI facility still figure prominently in the update. The new, updated recommendations reflect evidence gathered from the ASSENT-4, FINESSE, CARESS-in-AMI, and TRANSFER-AMI studies.[15-18]

The new Class I recommendations propose that each community should develop a STEMI system of care that follows standards at least as stringent as those developed for the AHA's national initiative "Mission: Lifeline," to include the following (level of evidence: C):

- Ongoing multidisciplinary team meetings that include emergency medical services, non–PCI-capable hospitals/STEMI referral centers, and PCI-capable hospitals/STEMI receiving centers to evaluate outcomes and quality improvement data;
- A process for prehospital identification and activation;
- Destination protocols for STEMI receiving centers;
- Transfer protocols for patients who arrive at STEMI referral centers who are primary PCI candidates, are ineligible for fibrinolytic drugs, and/or are in cardiogenic shock.

A new Class II recommendation is that it is reasonable for high-risk (see below) STEMI patients who receive fibrinolytic therapy as primary reperfusion therapy at a non–PCI-capable facility to be transferred as soon as possible to a PCI-capable facility where PCI can be performed either when needed or as a pharmacoinvasive strategy. Consideration should be given to initiating a preparatory antithrombotic (anticoagulant plus antiplatelet) regimen before and during patient transfer to the catheterization

Figure 1: Transfer of STEMI Patients for PCI



Reprinted with permission from: Anderson JL, et al. 2009 Focused Updates: ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction. *J Am Coll Cardiol* 2009;54:2236.

laboratory (level of evidence: B).

"High-risk" patients were defined in the CARESS-in-AMI study as STEMI patients with ≥ 1 high-risk feature: extensive ST-segment elevation, new-onset left bundle-branch block, previous MI, Killip class > II, or left ventricular ejection fraction ≤ 35% for inferior MIs. Anterior MI alone with ≥ 2 mm of ST elevation in ≥ 2 leads also qualified the patient as being at high risk.

"High risk" was defined in TRANSFER-AMI as ≥ 2 mm of ST-segment elevation in two anterior leads or ST elevation of at least 1 mm in inferior leads with at least one of the following: systolic blood pressure < 100 mmHg, heart rate > 100 bpm, Killip class II to III, ≥ 2 mm of ST-segment depression in the anterior leads, or ≥ 1 mm of ST elevation in right-sided lead V4 indicative of right ventricular involvement.

In summary, the 2009 updates to management of STEMI patients introduced bivalirudin as an anticoagulant therapy option, added prasugrel as an antiplatelet therapy strategy, and strongly recommended the establishment of protocols for the triage and transfer of STEMI patients to primary PCI facilities.

Conclusion

The treatment of ACS is an evolving body of concepts, principles, and practices. The ED is at the center of where the initial decisions about assessment, treatment, and disposition occur. It is important for emergency physicians to keep up with the current

recommendations and be leaders within their hospital and community for the development of an organized systems approach to the management of ACS.

References

1. Anderson JL, Adams CD, Antman EM, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angina/non ST elevation MI executive summary: A report of the American College of Cardiology / American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2007;50;652-726.
2. Kushner FG, Hand M, Smith SC, et al. 2009 focused updates: ACC/AHA Guidelines for the management of patients with ST elevation myocardial infarction. *J Am Coll Cardiol* 2009;54:2205-2241.
3. McCord J, Nowak RM, McCullough PA, et al. Ninety-minute exclusion of acute myocardial infarction by use of quantitative point-of-care testing of myoglobin and troponin I. *Circulation* 2001;104:1483–1488.
4. Fesmire FM. Delta CK-MB outperforms delta troponin I at 2 hours during the ED rule out of acute myocardial infarction. *Am J Emerg Med* 2000;18:1–8.
5. Chen ZM, Pan HC, Chen YP, et al. Early intravenous then oral metoprolol in 45,852 patients with acute myocardial infarction: Randomised placebo-controlled trial. *Lancet* 2005;366: 1622–1632.
6. Meine TJ, Roe MT, Chen AY, et al. Association of IV morphine use and outcomes in acute coronary syndromes: Results from the CRUSADE Quality Improvement Initiative. *Am Heart J* 2005;149:1043-1049.
7. Bavry AA et al. Benefits of early invasive therapy in acute coronary syndromes: A meta-analysis of contemporary randomized clinical trials. *J Am Coll Cardiol* 2006;48;1319-1325.
8. Yusuf S, Mehta SR, Chrolavicius S, et al. Comparison of fondaparinux and enoxaparin in acute coronary syndromes. The Fifth Organization to Assess Strategies in Acute Coronary Syndromes Investigators. *N Engl J Med* 2006;354:1464–1476.
9. Stone GW, McLaurin BT, Cox DA et al. Bivalirudin for patients with acute coronary syndrome. *N Engl J Med* 2006; 355:2203-2216.
10. Montalescot G, Wiviott SD, Braunwald E, et al. Prasugrel compared with clopidogrel in patients undergoing percutaneous coronary intervention for ST- elevation myocardial infarction (TRITON-TIMI 38): double-blind, randomised controlled trial. *Lancet* 2009;373:723–731.
11. Valgimigli M, Campo G, Percoco G, et al. Comparison of angioplasty with infusion of tirofiban or abciximab and with implantation of sirolimus-eluting or uncoated stents for acute myocardial infarction: The MULTISTRATEGY randomized trial. *JAMA* 2008;299: 1788–1799.
12. Ellis SG, Armstrong P, Betriu A, et al. Facilitated percutaneous coronary intervention versus primary percutaneous coronary intervention: Design and rationale of the Facilitated Intervention with Enhanced Reperfusion Speed to Stop Events (FINESSE) trial. *Am Heart J* 2004;147:E16.
13. Mehilli J, Kastrati A, Schulz S, et al. Abciximab in patients with acute ST-segment-elevation myocardial infarction undergoing primary percutaneous coronary intervention after clopidogrel loading: A randomized double-blind trial. *Circulation* 2009;119:1933–1940.
14. Stone GW, Witzenbichler B, Guagliumi G, et al. Bivalirudin during primary PCI in acute myocardial infarction. *N Engl J Med* 2008;358:2218–2230.
15. Di Mario C, Dudek D, Piscione F, et al. Immediate angioplasty versus standard therapy with rescue angioplasty after thrombolysis in the Combined Abciximab Reteplase Stent Study in Acute Myocardial Infarction (CARESS-in-AMI): An open, prospective, randomised, multicentre trial. *Lancet* 2008;371:559–568.
16. ASSENT-4 PCI Investigators. Primary versus tenecteplase-facilitated percutaneous coronary intervention in patients with ST-segment elevation acute myocardial infarction (ASSENT-4 PCI): Randomised trial. *Lancet* 2006;367:569–578.
17. Ellis SG, Armstrong P, Betriu A, et al. Facilitated percutaneous coronary intervention versus primary percutaneous coronary intervention: Design and rationale of the Facilitated Intervention with Enhanced Reperfusion Speed to Stop Events (FINESSE) trial. *Am Heart J* 2004;147:E16.
18. Cantor W, Fitchett D, Borgundvaag B, et al, for the TRANSFER-AMI Trial Investigators. Routine early angioplasty after fibrinolysis for acute myocardial infarction. *N Engl J Med* 2009;360: 2705-2718.

Physician CME Questions

1. According to the 2007 guidelines, when should a patient with chest pain call 911?
   A. before taking any NTG
   B. if the pain does not resolve after one NTG dose
   C. if the pain does not resolve after three NTG doses
   D. if the pain persists for longer than 20 minutes

2. What is the recommended combination for the ED assessment of patients with possible ACS?
   A. serial ECGs
   B. serial cardiac biomarkers
   C. serial ECGs and cardiac biomarkers
   D. one initial ECG and then serial cardiac biomarkers

3. For the patient who cannot provide a time of symptom onset, "time zero" is assumed to be:
   A. time of ED arrival
   B. time of EMS call

4. Oral beta-blockers are recommended in all patients with unstable angina or NSTEMI.
   A. true
   B. false

5. Which calcium channel blockers can be used in the treatment of unstable angina or NSTEMI?
   A. verapamil
   B. diltiazem
   C. nifedipine
   D. nimodipine
   E. A and B

6. When should ACE inhibitors be used in the treatment of unstable angina or NSTEMI?
   A. in patients with pulmonary edema
   B. in all patients
   C. in patients with hypotension
   D. in patients with persistent chest pain

7. According to the CRUSADE registry study, patients who received morphine had:
   A. a lower in-hospital mortality than those who did not
   B. the same in-hospital as those who received IV nitroglycerin
   C. a lower in-hospital mortality than those who received IV nitroglycerin
   D. a higher in-hospital mortality than those who did not

8. For NSTEMI patients undergoing an initial invasive strategy, an appropriate antiplatelet therapy would be:
   A. aspirin alone
   B. clopidogrel alone
   C. aspirin plus a GP IIb/IIIa inhibitor
   D. GP IIb/IIIa inhibitor alone

9. Which anticoagulants are recommended in patients with NSTEMI?
   A. unfractionated heparin
   B. bivalirudin
   C. fondaparinux
   D. enoxaparin
   E. all of the above

10. The loading dose of clopidogrel in a STEMI patient slated to undergo PCI is:
    A. 75 mg
    B. 150 mg
    C. 200 mg
    D. 600 mg

CME Answer Key

1. B; 2. C; 3. A; 4. B; 5. E; 6. A; 7. D; 8. C; 9. E; 10. D

Emergency Medicine Reports™ (ISSN 0746-2506) is published biweekly by AHC Media LLC, 3525 Piedmont Road, N.E., Six Piedmont Center, Suite 400, Atlanta, GA 30305. Telephone: (800) 688-2421 or (404) 262-7436.

Executive Editor: Russ Underwood

Specialty Editor: Shelly Morrow Mark

GST Registration No.: R128870672

Periodicals Postage Paid at Atlanta, GA 30304 and at additional mailing offices.

POSTMASTER: Send address changes to Emergency Medicine Reports, P.O. Box 740059, Atlanta, GA 30374.

Back issues: $31. Missing issues will be fulfilled by customer service free of charge when contacted within one month of the missing issue's date.

Multiple copy prices: One to nine additional copies, $359 each; 10 to 20 additional copies, $319 each.

Subscriber Information

Customer Service: 1-800-688-2421

Customer Service E-Mail:
customerservice@ahcmedia.com

Editorial E-Mail:
shelly.mark@ahcmedia.com

World Wide Web page:
http://www.ahcmedia.com

Subscription Prices

1 year *with* 60 ACEP/60 AMA/60 AAFP Category 1/Prescribed credits: $544

1 year *without* credit: $399
Add $17.95 for shipping & handling

Resident's rate $199

Discounts are available for group subscriptions, multiple copies, site-licenses or electronic distribution. For pricing information, call Tria Kreutzer at 404-262-5482.

All prices U.S. only.
U.S. possessions and Canada, add $30 plus applicable GST. Other international orders, add $30.

Accreditation

AHC Media LLC is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

AHC Media LLC designates this educational activity for a maximum of 60 *AMA PRA Category 1 Credits™.* Each issue has been designated for a maximum of 2.30 *AMA PRA Category 1 Credits™.* Physicians should only claim credit commensurate with the extent of their participation in the activity.

Approved by the American College of Emergency Physicians for 60 hours of ACEP Category 1 credit.

Emergency Medicine Reports has been reviewed and is acceptable for up to 39 Prescribed credits by the American Academy of Family Physicians. AAFP accreditation begins 01/01/11. Term of approval is for one year from this date. Each issue is approved for 1.50 Prescribed credits. Credit may be claimed for 1 year from the date of each issue. The AAFP invites comments on any activity that has been approved for AAFP CME credit. Please forward your comments on the quality of this activity to cmecomment@aafp.org.

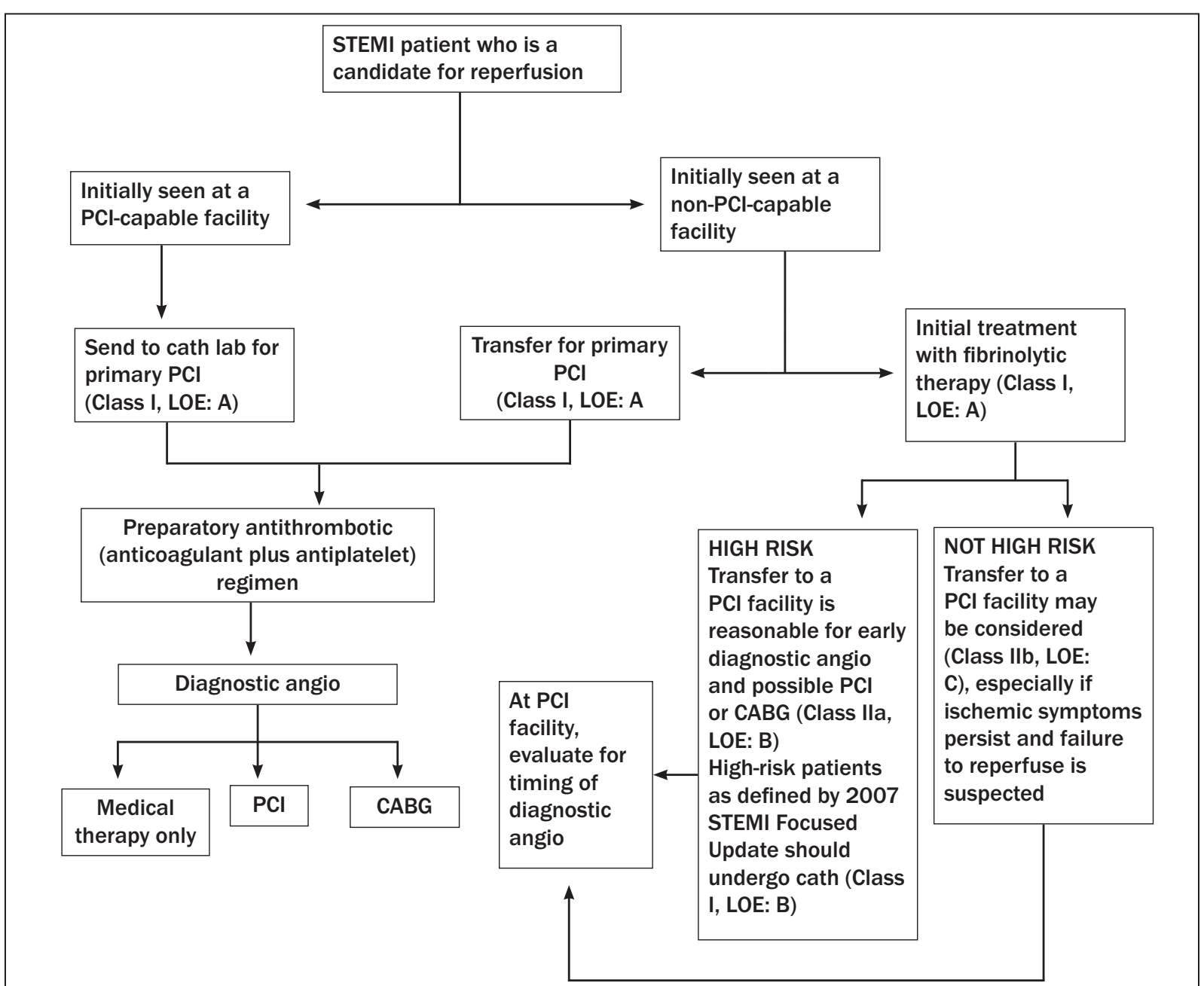
This is an educational publication designed to present scientific information and opinion to health professionals, to stimulate thought, and further investigation. It does not provide advice regarding medical diagnosis or treatment for any individual case. It is not intended for use by the layman. Opinions expressed are not necessarily those of this publication. Mention of products or services does not constitute endorsement. Clinical, legal, tax, and other comments are offered for general guidance only; professional counsel should be sought for specific situations.

This CME activity is intended for emergency and family physicians. It is in effect for 24 months from the date of the publication.

Emergency Medicine Reports
The Practical Journal for Emergency Physicians

NSTEMI and STEMI: Therapeutic Updates 2011

Transfer of STEMI Patients for PCI



Reprinted with permission from: Anderson JL, et al. 2009 Focused Updates: ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction. *J Am Coll Cardiol* 2009;54:2236.

UA/NSTEMI: Invasive vs. Conservative Strategy

Preferred Strategy	Patient Characteristics
Invasive	• Recurrent angina or ischemia at rest or with low-level activities despite intensive medical therapy • Elevated cardiac biomarkers (TnT or TnI) • New or presumably new ST-segment depression • Signs or symptoms of HF or new or worsening mitral regurgitation • High-risk findings from noninvasive testing • Hemodynamic instability • Sustained ventricular tachycardia • PCI within 6 months • Prior CABG • High risk score (e.g., TIMI, GRACE) • Reduced left ventricular function (LVEF less than 40%)
Conservative	• Low risk score (e.g., TIMI, GRACE • Patient or physician preference in the absence of high-risk features

Key:
CABG = coronary artery bypass graft surgery; GRACE = Global Registry of Acute Coronary Events; HF = heart failure; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary intervention; TIMI = Thrombolysis In Myocardial Infarction; TnI = troponin I; TnT = troponin T

Reprinted with permission from: Adams C, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angine/non-ST-elevation myocardial infarction. *J Am Coll Cardiol* 2007;50:678.

Supplement to *Emergency Medicine Reports*, January 1, 2011: "NSTEMI and STEMI: Therapeutic Updates 2011." *Author:* **Preeti Jois, MD, FACEP,** Assistant Professor, Department of Emergency Medicine, University of Florida College of Medicine, Gainesville, FL.