8. CORONARY ARTERY DISEASE - PREVENTION AND TREATMENT

Anthony Steimle, MD

Because treatments for coronary artery disease (CAD) have been particularly well studied, many of the quality indicators for this chapter are directly supported by randomized controlled trials (RCTs). RCTs have shown that several medications - including lipid lowering drugs, aspirin, beta-blockers, ACE inhibitors, and thrombolytic agents - prolong survival for a broad spectrum of CAD patients. Other studies have found that coronary artery bypass surgery (CABS) benefits subgroups of patients with the most extensive disease. To develop our quality indicators for CAD treatment, we performed MEDLINE searches to identify English language articles published since 1992 on treatment for each of the following: coronary disease, myocardial ischemia, myocardial infarction (MI), angina pectoris, stable angina, and unstable angina. We also searched for articles on coronary artery bypass surgery and percutaneous transluminal coronary angioplasty (PTCA). We supplemented these searches with key references from the bibliographies of review articles. Our proposed quality indicators draw heavily from several particularly well-done overviews (Braunwald et al., 1994; Ryan et al., 1996; Hennekens et al., 1996; and Yusuf et al., 1988).

IMPORTANCE

The public health importance of CAD was described in the preceding chapter on screening and diagnosis. Although it remains the leading cause of death in the United States, mortality from coronary heart disease decreased 34 percent between 1980 and 1990. Models estimate that 43 percent of this reduction is due to improvements in the treatment of patients with known CAD (as opposed to primary prevention or lifestyle changes) (Hunick et al., 1997). Despite this progress, surveys reveal that the management of CAD in the United States does not yet conform with ideal practices as suggested by clinical trials (Rogers et al., 1994) and that the quality of treatment can be improved further.
PREVENTION

Randomized trials in people without known CAD have examined the effects of both aspirin and lipid-lowering drugs on cardiovascular outcomes. However, the use of these agents for primary prevention remains controversial. In two trials of U.S. and British physicians, aspirin reduced the risk of nonfatal myocardial infarction, slightly increased the risk of hemorrhagic stroke, and had no impact on total vascular mortality (Yusuf et al., 1988). Thus, aspirin has not been routinely recommended for people without clinical CAD, although it may be appropriate for those at particularly high risk for myocardial infarction. The role of lipid-lowering drugs in primary prevention is discussed in Chapter 10.

TREATMENT

Stable Angina and Known CAD

This category comprises patients with known CAD not currently suffering from one of the two acute ischemic syndromes, acute myocardial infarction or unstable angina. These patients have a history of angina, MI, CABS, PTCA, or angiographically proven CAD. Several medications have been shown to be beneficial in these patients.

Clinical trials have found that aspirin benefits most patients with clinically apparent vascular disease, including patients with acute MI, prior MI, prior stroke or transient ischemic attack (TIA), prior CABS or PTCA, and prior unstable angina. In these patients, aspirin reduces nonfatal MI by about 30 percent, nonfatal stroke by 30 percent, and death by 17 percent (Ryan et al., 1996). Thus, practice guidelines recommend aspirin for all people with known CAD as well those with other vascular disease (Braunwald et al., 1994; Ryan et al., 1996; NESAGDG, 1996) (Indicators 1 and 2).

Beta-blockers have been shown to prolong survival in patients with stable angina and either silent ischemia or recent MI (Braunwald et al., 1994). The role of beta-blockers in asymptomatic CAD patients who have never had an infarction is less clear. However, the North of England expert panel recommends beta-blockers as first line agents (over nitrates and calcium channel blockers) for all patients with CAD who
require chronic antianginal medications (NESAGDG, 1996). It is also reasonable to use beta-blockers as first-line antihypertensives in this population. Unfortunately, it is difficult to identify through chart review those patients who need antianginal treatment or who might have already failed a trial of beta-blockade for hypertension or angina.

Cholesterol reduction in patients with CAD is discussed in Chapter 10.

Cigarette smoking is an important modifiable risk factor for CAD (USDHHS, 1989). Persons who stop smoking reduce their risk of myocardial infarction and death from coronary artery disease (USPSTF, 1996) and patients who have had an MI who stop smoking reduce their risk of mortality (Ryan, 1996) (Indicator 3). Smoking cessation counseling is discussed in Chapter 5.

**Unstable Angina**

Four RCTs in over 3000 patients with unstable angina have shown that aspirin reduces both death and MI by about 70 percent at seven days and by about 50 percent between three and 18 months (Braunwald et al., 1994; Theroux et al., 1988). In a trial of 479 patients meeting strict criteria for unstable angina (> 20 minutes rest pain with ischemic ECG changes), heparin has been shown to reduce fatal and nonfatal MIs by 88 to 96 percent at one week (Theroux et al., 1988). In this trial, the addition of aspirin to heparin resulted in no additional benefit. However, because heparin is beneficial early while aspirin has long-term benefits, the AHCPR unstable angina clinical practice guideline (Braunwald et al., 1994) recommends using both drugs (Indicators 4 and 5).

Beta-blockers have been shown to reduce the progression of unstable angina to MI. Although they have never been proven to reduce mortality in unstable angina, they have been shown to do so for acute MI, recent MI, and in stable angina with silent ischemia (Braunwald et al., 1994). Thus, the weight of evidence supports treating unstable angina with beta-blockers in addition to heparin. However, patients admitted with the diagnosis “unstable angina” include many at low risk who are unlikely to have acutely unstable CAD and do not require intensive
heparin and beta-blocker therapy. In order to separate these lower risk patients, often called “soft rule-outs”, from those with true unstable angina, we have adapted criteria from the TIMI IIIB study (> 5 minutes of rest pain associated with ST-segment depression or T-wave inversion) (TIMI IIIB Investigators, 1994). Unfortunately, these strict criteria exclude many patients with bona fide unstable angina (Indicator 6).

Nitroglycerin has no proven effect on mortality in unstable angina but is indicated for the relief of symptoms (Braunwald et al., 1994). Since symptoms are difficult to assess retrospectively through chart review, our quality indicators do not specify indications for nitroglycerin.

The TIMI IIIB trial (TIMI IIIB Investigators, 1994) of 1473 patients found no benefit from thrombolytic therapy in patients with unstable angina who do not have ST elevation or LBBB, the ECG criteria for acute infarction (Ryan et al., 1996; TIMI IIIB Investigators, 1994). Our quality indicators do not specify that thrombolytics are contraindicated for unstable angina because surveys suggest that thrombolytics are underused for MI rather than overused for unstable angina (Rogers et al., 1994), and MI and unstable angina can be difficult to distinguish at presentation. In the future, new enzyme markers may allow for the rapid identification of subsets of patients with unstable angina who would benefit from thrombolytic therapy.

The AHCPR unstable angina guideline (Braunwald et al., 1994) recommends acute revascularization for patients with ongoing and refractory angina who are found on coronary angiography to have either a greater than 95 percent stenosis of a “culprit” vessel or multi-vessel disease with depressed LV function. Early revascularization has been studied in patients with unstable angina in the TIMI IIIB trial (TIMI IIIB Investigators, 1994). However, both arms of this study managed patients with refractory ischemia invasively, so revascularization was not compared to medical therapy. Because the decision to revascularize acutely is complex and the benefits unproven, we have not developed quality indicators for revascularization specific to unstable angina. Rather, we have developed indicators for catheterization specific to
unstable angina (see Chapter 7), and revascularization indicators that apply to all patients with CAD (see “Revascularization”, below).

**Myocardial Infarction**

RCTs in over 40,000 patients have demonstrated that thrombolytic agents given early in acute MI reduce mortality. Mortality at 35 days is reduced by about 26 percent when a thrombolytic agent is given within six hours after symptom onset and by about 18 percent when given within 12 hours (Indicator 8) (Ryan et al., 1996; Yusuf et al., 1988). The mortality benefit persists at least four years (Ryan et al., 1996) and results in about 20 lives saved per 1000 treated. Over age 75, the relative reduction in mortality is less and the complications of thrombolytic agents greater so that only ten lives are saved per 1000 treated (Ryan et al., 1996). For this reason, the ACC/AHA MI practice guidelines cautiously recommend thrombolytic therapy in the elderly but acknowledge that the supporting evidence is weaker (Ryan et al., 1996).

Recently, RCTs have compared coronary angioplasty to thrombolytic therapy for acute MI and have found that in expert hands angioplasty can reduce mortality, reinfarction, strokes, and length of hospital stay (Grines et al., 1993). However, most hospitals are not equipped to perform primary angioplasty, and observational data suggest that, when performed in the community setting, primary angioplasty may be equivalent to thrombolysis (Every et al., 1996). For these reasons, our indicator for reperfusion in acute MI allows for either thrombolytic therapy or angioplasty (Indicator 8).

Randomized trials have tested the effects of aspirin in approximately 20,000 post-MI patients. In patients with MI, aspirin reduces the risk of vascular death by approximately 15 percent, of nonfatal MI by 30 percent, and of nonfatal stroke by 40 percent. Benefit is seen both during an infarction, whether thrombolysis was given or not, and following an MI as part of secondary prevention (Indicators 7 and 14) (Ryan et al., 1996; Antman et al., 1996; Yusuf et al., 1990).

The benefits of heparin for patients not receiving thrombolytic therapy have not been tested since routine therapy with aspirin, beta -
blockers, nitrates, and ACE inhibitors became available. Nonetheless, an overview of randomized trials from the pre-thrombolytic era in which patients did not receive these other therapies found a 17 percent reduction in mortality and a 22 percent reduction in reinfarction. In patients who do receive thrombolytic therapy, recommendations for heparin depend on the agent used. For patients treated with tissue plasminogen activator, an overview of randomized trials found an 18 percent reduction in mortality. In contrast, when agents which result in systemic anticoagulation are used, an added benefit for heparin has not been demonstrated in randomized trials (Ryan et al., 1996) (Indicator 9).

In trials of over 50,000 patients with acute MI, beta-blockers have reduced mortality by 13 percent in the first week (with a 25 percent reduction in the first two days) and by 23 percent over the following months to years (Hennekens et al., 1996; Yusuf et al., 1988; Yusuf et al., 1990). Early treatment with beta-blockers has also been shown to reduce nonfatal reinfarction by 19 percent and nonfatal cardiac arrests by 16 percent (Yusuf et al., 1990). In trials of over 100,000 MI patients, ACE inhibitors have reduced mortality by six percent in unselected patients and by 22 percent in patients with LV dysfunction (Hennekens et al., 1996). For most patients with MI, recent reviews recommend beginning beta-blockers within 12 hours and adding ACE inhibitors within 24 hours for in the absence of contraindications (e.g., if blood pressure is adequate) (Ryan et al., 1996; Hennekens et al., 1996). Experts recommend ACE inhibitors most strongly for patients with LV dysfunction, clinical CHF, and large anterior infarctions, because these patients derive the greatest benefit (Ryan et al., 1996) (Indicators 11 and 16). Whether some MI patients should receive beta-blockers and others ACE inhibitors, or all whether patients should receive both is unknown. Because of these uncertainties, our indicators accept either beta-blockers or ACE inhibitors as first-line therapy after MI (Indicators 10, 11 and 15).

In numerous randomized trials, calcium channel blockers have not reduced mortality during or after acute MI, and in certain subgroups, they may have increased mortality (Ryan et al., 1996 and Yusuf et al.,
1990). Thus, calcium channel blockers are not recommended for the routine treatment of MI. A meta-analysis of 16 trials found that short-acting nifedipine increased mortality 16 percent during and after myocardial infarction (Hennekens et al., 1996). In the Multicenter Diltiazem Postinfarction Trial (MDPIT), post-hoc subgroup analysis found a 41 percent increase in death and nonfatal reinfarction in patients with pulmonary congestion (MDPIT, 1988). Thus, the American College of Cardiology and American Heart Association recommend that short-acting nifedipine be avoided in all post-MI patients (Indicator 12) and diltiazem and verapamil be avoided in those with LV dysfunction or CHF (Ryan et al., 1996) (Indicator 13).

Prior to the advent of thrombolytics, early trials suggested that nitrates reduced mortality after MI by 20 to 35 percent (Ryan et al., 1996). However, in very large recent trials (ISIS-4 and GISSI-3), nitroglycerin had only small, statistically insignificant effects on mortality (Ryan et al., 1996). Thus, we have not included an indicator for nitrates, although most experts still recommend them for the treatment of MI (Ryan et al., 1996).

Treatment of elevated cholesterol in patients following MI is discussed in Chapter 10.

Revascularization

Seven trials between 1972 and 1984 randomized 2649 patients with one, two, and three-vessel CAD to either CABS or medical therapy. A meta-analysis of these trials (Yusuf et al., 1994) found that surgery significantly reduced mortality in all patients by 39 percent, in patients with three-vessel disease by 40 percent, and in patients with left main disease by 70 percent. Other patients may also benefit from revascularization, particularly those with severe angina or with proximal LAD stenosis. However, it is difficult to retrospectively assess many of the subjective factors such as symptom severity which can make surgery necessary for less extensive CAD. Thus, we have confined our quality indicators to patients with left main disease or three-vessel disease plus low left ventricular ejection fraction (LVEF) (Indicators 17 and 18). These patients’ mortality benefit is so great
that revascularization should almost always be offered regardless of other factors.

More recently, six trials have compared CABS to multivessel PTCA in 4200 patients. Meta-analyses of these trials (Pocock et al., 1995; BARI Investigators, 1996) found comparable mortality with both procedures. However, only a minority of subjects screened with multivessel CAD were candidates for angioplasty while nearly all were eligible for CABS. In addition, CABS relieved angina better, improved functional status more, led to fewer repeat procedures, and was equally cost-effective compared to PTCA (Hlatky et al., 1997). Finally, the mortality benefit of multivessel PTCA has never been directly compared to medical therapy. Despite these caveats, our quality indicator accepts either PTCA or CABS for three-vessel CAD. Because mortality may be similar for selected patients, their choice of procedure often rightly depends on individual and physician preferences.
REFERENCES


RECOMMENDED QUALITY INDICATORS FOR CORONARY ARTERY DISEASE – PREVENTION AND TREATMENT

The following criteria apply to men and women age 18 and older.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of Evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Stable Angina or known CAD</td>
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<tr>
<td>1. Patients newly diagnosed with CAD should be offered aspirin (at a dose of at least 81 mg/day continued indefinitely) within one week of the diagnosis of CAD unless they have a contraindication to aspirin.</td>
<td>I</td>
<td>Braunwald, 1994; NESAGDG, 1996; Ryan et al., 1996; Yusuf et al., 1988</td>
<td>Reduce mortality, recurrent MIs, strokes, bypass graft closure.</td>
<td>Aspirin reduces mortality in patients with CAD.</td>
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<tr>
<td>2. Patients with a prior diagnosis of CAD who are not on aspirin and do not have contraindications to aspirin should be offered aspirin (at a dose of at least 81 mg/day continued indefinitely) within one week of any visit to a provider in which CAD was addressed.</td>
<td>I</td>
<td>Braunwald, 1994; NESAGDG, 1996; Ryan et al., 1996; Yusuf et al., 1988</td>
<td>Reduce mortality, recurrent MIs, strokes, bypass graft closure.</td>
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<tr>
<td>3. Patients newly diagnosed with CAD who smoke should have documentation of counseling on smoking cessation within 3 months of the diagnosis of CAD.</td>
<td>I</td>
<td>Braunwald, 1994; NESAGDG, 1996; Ryan et al., 1996; Yusuf et al., 1988</td>
<td>Reduce mortality, reinfarction.</td>
<td>Smoking cessation reduces mortality post MI, but relapse is rate is high.</td>
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<tr>
<td>Unstable Angina</td>
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<td>Indicator</td>
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<td>5. Patients admitted with the diagnosis of definite unstable angina&lt;sup&gt;3&lt;/sup&gt; who do not have contraindications to heparin&lt;sup&gt;4&lt;/sup&gt; should receive: a. heparin within 2 hours of the initial ECG that demonstrates ischemic changes; and b. continuous heparin infusion for at least 24 hours (or until 26 hours after the ECG with ischemic changes).</td>
<td>I</td>
<td>Braunwald et al., 1994; Theroux et al., 1988</td>
<td>Reduce mortality.</td>
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<td>6. Patients &lt; 75 years old admitted with the diagnosis of unstable angina who have angina &gt; 5 minutes at rest associated with ischemic ST segment changes should receive beta-blockers within 4 hours (unless they have contraindications to beta-blockers&lt;sup&gt;5&lt;/sup&gt;).</td>
<td>I</td>
<td>Braunwald et al., 1994; Yusuf et al., 1988</td>
<td>Reduce progression to MI.</td>
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<td><strong>Myocardial Infarction</strong></td>
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<td>7. Patients presenting with acute myocardial infarction should receive at least 160 mg of aspirin within 12 hours of presentation unless they have contraindications to aspirin.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>I</td>
<td>Ryan et al., 1996; Yusuf et al., 1988</td>
<td>Reduce mortality, recurrent MIs and ischemia, strokes.</td>
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<tr>
<td>8. Patients &lt; 75 years old presenting with an acute myocardial infarction who are within 12 hours of the onset of MI symptoms&lt;sup&gt;2&lt;/sup&gt; and who do not have contraindications to thrombolysis&lt;sup&gt;6&lt;/sup&gt; or revascularization&lt;sup&gt;7&lt;/sup&gt; should receive a thrombolytic agent within 1 hour of the time their ECG initially shows either of the following findings: a. ST elevation &gt; 0.1 mV in 2 or more contiguous leads, or b. a LBBB not known to be old</td>
<td>I</td>
<td>Ryan et al., 1996; Yusuf et al., 1988</td>
<td>Reduce mortality, reinfarction, infarct size, improve LVEF. Under age 75, 18 lives saved per 1000 treated; over age 75, 10 lives saved per 1000 treated.</td>
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<td>Indicator</td>
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<tr>
<td>9. Patients admitted within 12 hours of the onset of acute myocardial infarction who do not have contraindications to heparin should receive heparin (subcutaneously or IV) for at least 24 hours unless they have received streptokinase, APSAC, or urokinase.</td>
<td>III</td>
<td>Ryan et al., 1996</td>
<td>Reduce reinfarction and mortality.</td>
<td>The ACC/AHA MI guidelines recommend heparin for all patients with MI (except those receiving certain thrombolytic agents) while noting that the evidence supporting this recommendation is not definitive. The majority of experts also make this recommendation.</td>
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<td>10. Patients admitted with acute myocardial infarction whose LVEF is either unknown at admission or &gt;= 45%, should receive either a beta-blocker or an ACE inhibitor or both within 12 hours of admission (unless they have contraindications to both beta-blockers and ACE inhibitors).</td>
<td>I</td>
<td>Ryan et al., 1996; Hennekens et al., 1996</td>
<td>Reduce mortality, infarct size, reinfarction.</td>
<td>It is unclear which patients should receive beta-blockers and which should receive ACE inhibitors. Subgroup data from trials suggest benefits are additive and that some patients should receive both.</td>
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<tr>
<td>11. Patients admitted with acute myocardial infarction and are known to have a LVEF &lt;= 45% at admission should receive an ACE inhibitor within the first 24 hours of admission (unless they have contraindications to ACE inhibitors).</td>
<td>I</td>
<td>Ryan et al., 1996; Hennekens et al., 1996</td>
<td>Reduce mortality, reinfarction.</td>
<td>ACE inhibitors may be used in place of beta-blockers in any MI patient; however, their benefit appears to be greatest in patients with LV dysfunction or large anterior infarctions.</td>
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<td>12. Patients admitted with acute myocardial infarction should NOT receive short-acting nifedipine during the hospitalization.</td>
<td>I</td>
<td>Ryan et al., 1996; Hennekens et al., 1996</td>
<td>Avoid increased mortality.</td>
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<tr>
<td>13. Patients admitted with acute myocardial infarction should NOT receive any calcium channel blocker if they have a reduced LVEF (&lt; 45%) or heart failure during the hospitalization.</td>
<td>I</td>
<td>Ryan et al., 1996; Hennekens et al., 1996</td>
<td>Avoid increased mortality.</td>
<td>In very rare cases, diltiazem or verapamil may be indicated in these patients for relief of ongoing ischemia or control of rapid atrial fibrillation when all other agents have failed.</td>
</tr>
<tr>
<td>14. Patients discharged after an acute myocardial infarction who do not have contraindications to aspirin should be discharged on aspirin at a dose of at least 81 mg/day.</td>
<td>I</td>
<td>Ryan et al., 1996</td>
<td>Reduce mortality.</td>
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<td>Indicator</td>
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<td>15. Patients discharged after an acute myocardial infarction who have either an LVEF &gt;= 45% documented during hospitalization or an unknown LVEF, should be discharged on a beta-blocker or an ACE inhibitor or both (unless they have contraindications to both beta-blockers and ACE inhibitors).</td>
<td>I</td>
<td>Ryan et al., 1996; Hennekens et al., 1996</td>
<td>Reduce mortality.</td>
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<tr>
<td>16. Patients discharged after an acute myocardial infarction who have an LVEF &lt;= 45% documented at any time during the hospitalization should receive ACE inhibitors at discharge (unless they have contraindications to ACE inhibitors).</td>
<td>I</td>
<td>Ryan et al., 1996; Hennekens et al., 1996</td>
<td>Reduce mortality.</td>
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Revascularization

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<tr>
<th>Indicator</th>
<th>Quality of Evidence</th>
<th>Literature</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>17. Patients &lt; 75 years old with CAD who do not have contraindications to revascularization should be offered PTCA or CABS within 1 month of coronary angiography if they have 3 vessel CAD and an LVEF &lt; 45%.</td>
<td>I</td>
<td>Yusuf et al., 1994</td>
<td>Reduce mortality, relieve angina.</td>
<td>Most patients with 3 vessel CAD are more appropriately treated with CABS than with PTCA. PTCA/CABS also benefits many patients with less severe CAD by relieving angina.</td>
</tr>
<tr>
<td>18. Patients &lt; 75 years old with CAD who do not have contraindications to revascularization should be offered CABS within 1 month of coronary angiography if they have left main stenosis &gt; 50%.</td>
<td>I</td>
<td>Yusuf et al., 1994</td>
<td>Reduce mortality, relieve angina.</td>
<td>Most patients with 3 vessel CAD are more appropriately treated with CABS than with PTCA. PTCA/CABS also benefits many patients with less severe CAD by relieving angina.</td>
</tr>
</tbody>
</table>

Definitions And Examples

1 Contraindications to aspirin:
   a. Hypersensitivity/allergy to salicylate (rare)
   b. Bleeding within the past 4 weeks (including gastrointestinal bleeding, melena, epistaxis, any bleeding requiring transfusion; excluding occult hemoglobin in stools and menses).

2 Angina: Any symptom resulting from myocardial ischemia. Most often manifest as chest discomfort or dyspnea but numerous other symptoms have been described. Whether a symptom is “angina”, that is, due to myocardial ischemia, is a subjective judgment on the part of the clinicians caring for a patient.

3 Definite Unstable Angina: angina > 5 minutes at rest associated with ischemic ECG changes (either dynamic T wave inversions or = 1 mm ST-segment depression or elevation in two contiguous leads).
Potential contraindications to heparin:

a. Previous hemorrhagic stroke at any time or non-hemorrhagic stroke within 1 month
b. Known intracranial neoplasm, mass, or other intracerebral pathology (e.g., aneurysm, abscess)
c. Bleeding within the past 4 weeks (including gastrointestinal bleeding, melena, epistaxis, any bleeding requiring transfusion; excluding occult hemoglobin in stools and menses)
d. Suspected aortic dissection
e. Current use of anticoagulants in therapeutic doses (e.g., coumadin with INR = 2)
f. Bleeding diathesis (e.g., dysfunctional platelets, Von Willebrand's disease, thrombocytopenia, clotting factor deficiency, hemophilia

Potential contraindications to thrombolytics:

a. Previous hemorrhagic stroke at any time; other strokes or cerebrovascular events within one year.
b. Known intracranial neoplasm, mass, or other intracerebral pathology (e.g., aneurysm, abscess)
c. Bleeding within the past 4 weeks (including gastrointestinal bleeding, melena, epistaxis, any bleeding requiring transfusion; excluding occult hemoglobin in stools and menses).
d. Suspected aortic dissection
e. Blood pressure >180/110
f. Current use of anticoagulants in therapeutic doses (e.g., coumadin with INR = 2).
g. Bleeding diathesis (e.g., dysfunctional platelets, Von Willebrand's disease, thrombocytopenia, clotting factor deficiency, hemophilia.
h. Trauma within 4 weeks (head trauma, concussion, bone fracture)
i. CPR within 4 weeks
j. Surgery with 4 weeks (excluding cataract surgery)
k. Pregnancy.

Relative Contraindications to Beta Blockers:

a. Heart rate < 60 bpm.
b. Systolic blood pressure < 100 mm Hg
c. Heart failure
d. PR interval (on ECG) > 0.24 seconds
e. Second or third-degree AV block
f. Bifascicular block
g. Chronic obstructive pulmonary disease
h. History of asthma

Potential contraindications to revascularization and catheterization:

a. Terminal illness (malignancy, severe COPD, AIDS, hepatic cirrhosis).
b. Intracranial pathology contraindicating systemic anticoagulation (e.g., stroke within 1 month)
c. Advanced dementia
d. Bedbound (i.e. severe impairment in ability to perform basic activities of daily living)
e. Anaphylaxis to contrast material
f. Digitalis intoxication
g. Progressive renal insufficiency
h. Severe anemia (HCT < 30) or active gastrointestinal bleeding
i. Ejection fraction less than 25% or left ventricular end-diastolic dimension > 7.5 cm
j. Active infection, sepsis, or fever which may be due to infection
k. Patient refusal of catheterization or of both PTCA and CABS
l. Coronary anatomy documented in the medical record not to favor revascularization - often evidenced by a prior coronary angiogram which revealed multivessel coronary disease but did not result in revascularization
m. In unstable patients, lack of a cardiac catheterization laboratory or a cardiac surgical team in the hospital. Attempts should be made to stabilize such patients with medical therapy so that they may be transferred
n. Two or more prior CABS operations
o. Stress imaging which reveals fixed radionuclide defects or echocardiographic wall motion abnormalities with only small areas of reversibility.

8 LVEF: left ventricular ejection fraction, also termed “left ventricular function”; may be described as a percentage or qualitatively (e.g. normal, mildly reduced, moderately reduced, severely reduced). An LVEF < 0.45 is equivalent to moderately reduced (or if not qualified, “reduced”).

9 Contraindication to angiotensin converting enzyme (ACE) inhibitors:
   a. Systolic blood pressure < 100 mm Hg
   b. Creatinine > 2.0
   c. Bilateral renal artery stenosis
   d. Allergy to ACE inhibitors
   e. Serum potassium > 5.5.

10 CABS: coronary artery bypass surgery.

11 Three vessel CAD: 70% narrowing of all three major coronary arteries or one of their first order branches (left anterior descending or one its branches the diagonals, the circumflex or one of its branches to obtuse marginals, and the right coronary artery or its branch the posterior descending artery). Three vessel CAD will also be defined by the catheterization report stating “three vessel” CAD.
   (NOTE: any patient described in the medical record as not a candidate for CABS or PTCA should be considered to have a contraindication to revascularization).

12 Patients who receive cardiac catheterization within 90 minutes of these findings are not eligible for this indicator.

Quality of Evidence Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Randomized controlled trials</td>
</tr>
<tr>
<td>II-1</td>
<td>Nonrandomized controlled trials</td>
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<tr>
<td>II-2</td>
<td>Cohort or case analysis</td>
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<tr>
<td>II-3</td>
<td>Multiple time series</td>
</tr>
<tr>
<td>III</td>
<td>Opinions or descriptive studies</td>
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