A. Acute Reperfusion Therapy: MI with ST ↑ or new bundle branch block

On presentation with cardiac chest discomfort or other possibly ischemic symptoms such as dyspnea, patients should be considered for acute reperfusion if:

- Chest pain or symptoms of acute myocardial infarction are of at least 30 minutes in duration and began within 12 hours of presentation to the ED. Patients presenting with symptoms which began greater than 12 hours prior to presentation should be considered if these symptoms are ongoing or recurrent or if the patient presents with cardiogenic shock.
- The ECG shows ST elevation > 1 mm in 2 contiguous leads or a new bundle branch block pattern.
- The ECG changes do not resolve after administration of sublingual nitroglycerin.
- The patient presents with sudden cardiac death of suspected cardiac etiology.

IF PATIENTS MEET THE ABOVE CRITERIA IN THE ED:

PAGE 719-PTCA AND NOTIFY THE CATHETERIZATION LABORATORY TEAM

In order to prepare the patient for emergent percutaneous coronary intervention (PCI):

1. Establish large bore IV access (preferably two lines), and condom catheterization or Foley catheterization. IV access should be with extension tubing.
2. Administer chewable aspirin 325 mg.
3. Administer clopidogrel (Plavix®) 300 mg orally if patient not taking already. This is in anticipation of stent placement. If the patient receives a stent, clopidogrel 75 mg daily should be administered for at least 30 days following stent implantation. Clopidogrel therapy is contraindicated in patients at high risk of GI bleeding, known allergy to the drug, and thrombocytopenia.
4. Administer standard unfractionated heparin, 5,000 units intravenousous bolus. Do not begin a continuous infusion at this time.
5. Administer eptifibatide (Integrilin®) Dosing: 180 mcg/kg IV bolus over 1-2 minutes followed by a continuous infusion of 2 mcg/kg/min for patients with a serum creatinine < 2 mg/dL. For patients with a serum creatinine between 2 and 4 mg/dL, the continuous infusion dose should be decreased to 1 mcg/kg/min. All patients should receive a second 180 mcg/kg bolus 10 minutes following the first bolus. For patients with a serum
creatinine > 4 mg/dL, abciximab (Reopro®) should be considered since it is not dependent upon the kidneys for elimination.

CONTRAINDICATIONS TO EPTIFIBATIDE:
- Any active abnormal bleeding within the previous 30 days
- History of CVA or head trauma within 30 days or any history of hemorrhagic stroke
- Presence or history of bleeding diathesis
- INR > 2.0
- Thrombocytopenia < 100,000
- Uncontrolled hypertension, SBP > 200 mm Hg, DBP > 110 mm Hg
- Major surgery or trauma within 6 weeks
- Known hypersensitivity to any component of the product
- Serum creatinine > 4.0 mg/dL or dependency on renal dialysis
- Age > 75 is a relative contraindication and clinical judgement about the risks and benefits of eptifibatide must be applied.

The maximum dosing weight for patients receiving eptifibatide is 120 kg. (For patients > 120 kg calculate dose based upon a maximum weight of 120 kg.)

Post PCI management of eptifibatide and heparin will be directed by the Cardiac Catheterization Laboratory. In cases where a rapid door to balloon time is anticipated (e.g. when the interventional team is already in the hospital), the interventional cardiology team may request that eptifibatide be held. In other cases, the interventional team may use abciximab instead of eptifibatide. Abciximab must be brought to the ED from the catheterization laboratory or the pharmacy.

All antithrombotic agents should be ordered on the ANTITHROMBOTIC THERAPY ORDER FORM.

6. Administer beta-blockers to achieve a target heart rate of less than 60 bpm. Metoprolol 5 mg IV q 5 min x 3 is recommended if the hemodynamics and Killip classification upon presentation are acceptable and no contraindications exist.

7. The ICC cardiology fellow or catheterization laboratory team member will discuss the procedure and conscious sedation with the patient and family and obtain informed consent.

8. Consider beginning IV amiodarone for patients with resuscitated sudden cardiac death. Give 150 mg IV over 10 minutes followed by 1 mg/min IV drip for the next 6 hours, then 0.5 mg/min for the next 18 hours. Further dosing will be dictated by the patient's clinical course.

9. Prepare the patient for transportation with portable oxygen, IV pumps, and portable defibrillator.

10. The goal is to perform coronary angiography within 90 minutes of presentation.

11. After angioplasty, inpatient management should include:
   a. Treatment with an ACE inhibitor. If CHF or LV dysfunction is present, the dose should be titrated to the maximal tolerated dose. Contraindications to ACE inhibitors are known history of cough, angioedema and severe renal failure.
b. Continued anticoagulation with heparin or enoxaparin and warfarin (Coumadin®) should be considered in patients who are at high risk for systemic emboli (large or anterior MI, AF, previous embolus, known LV thrombus).

c. Patients who are not being treated with full dose heparin or enoxaparin and who are not ambulatory should receive DVT prophylaxis with enoxaparin 40 mg SQ once daily. Risk factor assessment for VTE prophylaxis can be reviewed with the Comprehensive Hemostasis and Antithrombotic Service (719-4023)

d. Cardiac Risk factor assessment and modification (see section D).

e. Consideration for cardiac rehabilitation (see section E).

B. UNSTABLE ANGINA (UA) / NON ST ↑ MI (NSTEMI)

Patients with unstable angina and non-ST elevation MI are a heterogeneous group and appropriate management critically depends on proper patient triage. Chest discomfort is often the presenting symptom but dyspnea or other ischemic symptoms may be the primary manifestation. Patients should be classified into one of three categories: critically unstable, high risk, and low risk.

1. Critically Unstable Patients
   a. Definition: Patients who have clinically evident ACS with uncontrollable symptoms, hemodynamic compromise, or cardiogenic shock.
   b. Recommendations for Management:
      i. Urgent referral for cardiac catheterization, following the Acute Reperfusion protocol described above
         • After catheterization and stabilization, inpatient management should include the measures described in section A.11 above.

2. High Risk Patients
   a. Definition: patients who have clinically evident ACS with one or more of the following high risk features:
      ➢ Ongoing ischemic symptoms despite initial medical therapy
      ➢ High risk ECG findings:
         • ST depression > 1 mm in two contiguous leads
         • Minimal ST elevation < 1 mm in two contiguous leads lasting less than 20 minutes
         • Deep T-wave inversions in contiguous leads of > 3 mm or more in three or more limb leads or four or more precordial leads excluding lead V1
      ➢ Elevation of troponin I (> 0.3)
      ➢ TIMI risk score > 2 with one point scored for each of the following:
         • Age > 65
         • > 3 cardiac risk factors
         • Prior coronary stenosis > 50%
         • ST segment depression
• > 2 anginal episodes in last 24 hours
• Received aspirin within the last 7 days
• Elevated troponin I

b. Recommendations for Management:
   i. Administer chewable aspirin (325 mg).
   ii. Clomipogrel (Plavix®) 300 mg orally if patient not taking already. Clopidogrel should then be continued at a dose of 75 mg qd for a period of 9 months or longer. Patients who are likely to derive the most benefit from long-term clopidogrel therapy are those with a history of recurrent ACS despite appropriate modification of risk factors and appropriate medical therapy. Clopidogrel therapy is contraindicated in patients at high risk of GI bleeding, known allergy to the drug, and thrombocytopenia.
   iii. Enoxaparin 1 mg/kg subcutaneously every 12 hours. Enoxaparin should be avoided in patients with underlying renal insufficiency (serum creatinine > 2.5 mg/dl or CrCl < 30 ml/min) or body weight over 150 kg. If enoxaparin is contraindicated due to renal insufficiency or obesity, initiate unfractionated heparin with a bolus of 60 units/kg intravenously (maximum 5000 units) followed by a continuous infusion of 12 units/kg/h (maximum 1000 units/h). Follow guidelines according to the ANTITHROMBOTIC THERAPY ORDER FORM with therapy initiated in the Emergency Department. On the day of catheterization, the morning dose of enoxaparin should be held if the patient has been stable overnight without clinical or electrocardiographic evidence of recurrent ischemia. In unstable patients, however, enoxaparin should be continued up to the time of cardiac catheterization, at the discretion of the cath lab fellow. After percutaneous coronary intervention (PCI), enoxaparin or IV heparin will generally be discontinued at the discretion of the Interventional Cardiology team.
   iv. Eptifibatide (Integrilin®) 180 mcg/kg IV single-bolus over 1-2 minutes followed by a continuous infusion of 2 mcg/kg/min for patients with a serum creatinine < 2 mg/dL. For patients with a serum creatinine between 2 and 4 mg/dL, the bolus dose should be 180 mcg/kg followed by a continuous infusion dose of 1 mcg/kg/min up to 72 hours. The maximum dosing weight for patients receiving eptifibatide is 120 kg. For patients > 120 kg, calculate dose based upon a maximum weight of 120 kg. For patients with a serum creatinine > 4 mg/dL in whom a glycoprotein 2b3a platelet receptor inhibitor is indicated, abciximab should be considered since it is not dependent upon the kidneys for elimination. Eptifibatide must be dosed in the Emergency Department ASAP after presentation (using the ANTITHROMBOTIC THERAPY ORDER FORM) for the patients to derive benefit. Prior to dosing eptifibatide, notify the ICC Cardiology Fellow on call (during nights or on weekends @ 719-PTCA). Eptifibatide should generally be continued up to the time of cardiac catheterization, at the discretion of the cath lab fellow.
   CONTRAINDICATIONS TO EPTIFIBATIDE: see section A.5

2B/3A BLOCKERS AFTER PCI:
• After percutaneous coronary intervention (PCI), eptifibatide treatment will be directed by the Interventional Cardiology team.
Following uncomplicated PCI, eptifibatide (Integrilin®) 2 mcg/kg/min in patients with a serum creatinine of <2 mg/dL, or 1 mcg/kg/min in patients with a serum creatinine > 2.0 but < 4.0 mg/dL will be administered for 18 hours.

v. For patients transferred from cath lab to the inpatient unit on abciximab (Reopro®), it will be continued at a dose of 0.125 mcg/kg/min (maximum dose 10 mcg/min) for 12 hours.

vi. Medical therapy with **beta-blockers** is indicated to achieve a target heart rate of less than 60 bpm. May use metoprolol 5 mg IV q 5 min x 3 or 25-50 mg po if patient hemodynamics and Killip classification upon presentation are acceptable and no contraindications exist to their use.

vii. Treatment with an **ACE inhibitor**. If CHF or LV dysfunction is present, the dose should be titrated to the maximal tolerated dose. Contraindications to ACE inhibitors are known history of cough or angioedema and severe renal failure.

viii. Patients who are not being treated with full dose heparin or enoxaparin who are not ambulatory should receive DVT prophylaxis with enoxaparin 40 mg SQ once daily. Risk factor assessment for VTE prophylaxis can be reviewed with the Comprehensive Hemostasis and Antithrombotic Service (719-4023)

ix. **An early interventional approach** is recommended for these patients in the absence of clinical contraindications or patient disinclination. The timing of cardiac catheterization will depend on clinical factors and is generally not emergent.

x. Cardiac risk factor assessment and modification should be performed (see section D).

xi. Referral for cardiac rehabilitation should be considered (see section E).

### 3. Low Risk Patients

a. **Definition**: Patients with “real” unstable angina due to an acute coronary syndrome based on the history, physical exam, and ECG findings but who lack the high-risk features described above.

b. **Recommendations for Management:**

i. **Administer** chewable **aspirin** (325 mg).

ii. **Clopidogrel** 300 mg orally if patient not taking already. Clopidogrel should then be continued at a dose of 75 mcg qd for a period of 9 months or longer. Patients who are likely to derive the most benefit from long-term clopidogrel therapy are those with a history or recurrent ACS despite appropriate modification of risk factors and appropriate medical therapy. Clopidogrel therapy is contraindicated in patients at high risk of GI bleeding, known allergy to the drug, and thrombocytopenia.

iii. **Initiate standard unfractionated heparin** bolus of 60 units/kg intravenously (maximum 5000 units) followed by a continuous infusion of 12 units/kg/h (maximum 1000 units/h) or **enoxaparin** 1 mg/kg subcutaneously every 12 hours. Enoxaparin should be avoided in patients with underlying renal insufficiency (serum creatinine >2.5 mg/dl, CrCl < 30 ml/min, or weight > 150 kg). Follow guidelines according to the ANTITHROMBOTIC THERAPY ORDER FORM.

iv. Platelet IIb/IIIa receptor antagonists are generally not indicated for these patients.
v. Medical therapy with **beta-blockers** is indicated to achieve a target heart rate of less than 60 bpm. May use metoprolol 5 mg IV q 5 min x 3 or 25-50 mg po if patient hemodynamics and Killip classification upon presentation are acceptable and no contraindications exist to their use.

vi. Treatment with an **ACE inhibitor**. If CHF or LV dysfunction is present, the dose should be titrated to the maximal tolerated dose. Contraindications to ACE inhibitors are known history of cough or angioedema and severe renal failure.

vii. Patients who are not being treated with full dose heparin or enoxaparin who are not ambulatory should receive DVT prophylaxis with enoxaparin 40 mg SQ once daily. Risk factor assessment for VTE prophylaxis can be reviewed with the Comprehensive Hemostasis and Antithrombotic Service (719-4023)

viii. **An early conservative approach is generally appropriate** for these patients. If an early conservative approach is chosen, stress testing may be performed during the inpatient stay or as an outpatient, depending on clinical factors such as patient stability. If an early interventional approach is chosen, clopidogrel therapy is recommended prior to cardiac catheterization. **An interventional approach is recommended if any of the following features are present:**

- Persistent or recurrent ischemia
- Positive ETT / nuclear imaging scan (perform cath prior to discharge)
- CHF or LV dysfunction (EF < 50%)
- Prior PTCA or CABG
- Malignant ventricular arrhythmias

ix. Cardiac Risk factor assessment and modification should be performed (see section D).

x. Referral for cardiac rehabilitation should be considered (see section E).

C. **MANAGEMENT OF BLEEDING SECONDARY TO ANTIPLATELET OR ANTITHROMBOTIC THERAPY**

1. Notify Cardiac Catheterization team @ 719-PTCA
2. Treat as medically indicated. For groin bleeding, apply direct pressure and consider FemoStop (a mechanical clamp device to be applied by catheterization laboratory personnel).
3. CBC, platelets, and type and cross STAT to monitor HCT and to rule-out immune mediated thrombocytopenia.
4. Transfuse PRBC, FFP, and platelets as indicated. For abciximab (Reopro®) consider platelet transfusions even if platelet count is normal; for eptifibatide (Integrilin®) consider platelets only if patient thrombocytopenic.
5. Consider hemodialysis if eptifibatide is given.
6. Consider protamine if bleeding is associated with prolonged aPTT secondary to unfractionated heparin. If the patient has received LMWH and is bleeding, although the aPTT may not be prolonged, consider protamine administration. Protamine will reverse approximately 20% of the activity of LMWH.
D. RISK FACTOR MODIFICATION FOR ACS PATIENTS

1. Smoking: All ACS patients who smoke should be counseled to stop. This should be documented in the medical record.

2. Diet: All ACS patients should be advised to eat a diet low in saturated fat and cholesterol. Patient education materials with information about the American Heart Association diet are available on the inpatient cardiology units.

3. Lipid Management:
   a. All ACS patients should have a fasting lipid profile during the hospitalization, preferably within 24 hours of presentation.
   b. Patients with a LDL cholesterol > 100 and a HDL cholesterol > 40 should be started on statin therapy unless known drug allergy to statins is present. Such patients who are already taking a statin should have the dose increased appropriately.
   c. Patients with a LDL > 100 and HDL < 40 who are not taking lipid-lowering drugs should generally be started on a statin as initial therapy.
   d. Patients with a LDL cholesterol < 100 (drawn within 24 hours of presentation) and HDL cholesterol < 40 who are not already taking a statin should be started on gemfibrozil 600 mg bid or niacin. Gemfibrozil and other fibrate drugs should NOT be administered in combination with statins due to an increased risk of myositis. Gemfibrozil is preferred for diabetic patients. Niacin can be used in combination with lower doses of statins but should generally be avoided in diabetic patients. It should be initiated in the outpatient setting when used.
   e. Outpatient physicians should be contacted directly by the inpatient resident or attending to facilitate outpatient monitoring for side effects after a new prescription or up-titration of lipid lowering drugs.
   f. Patient education materials with information about lipid abnormalities and lipid lowering drugs are available on the inpatient cardiology units. Pharmacy is available for consultation with inpatients about lipid lowering drugs.

E. CARDIAC REHABILITATION FOR ACS PATIENTS

Cardiac rehabilitation is a comprehensive, multidisciplinary, long-term services program involving medical evaluation, prescribed exercise, cardiac risk factor modification, patient education and counseling, and behavioral intervention. The program is usually divided into three phases: I – acute inpatient; II – immediate post-discharge (within three months); and III – maintenance.

Phase I
In the inpatient setting, physicians and nurses of the Cardiology Service should provide multidisciplinary counseling, education, and mobilization support to all patients with ACS or CHF. Prior to discharge, patients should receive counseling regarding their medications, disease process and expected recovery course, physical activity, diet, risk factor reduction, smoking cessation, and awareness of the impact of heart disease on psychosocial well-being. The Attending Cardiologist should provide guidance to the house officers and nurses regarding each
patient’s exercise prescription. Key modifiable risk factors should be identified and resources provided (e.g. smoking and referral to a community smoking cessation program). A Nutrition consult should be ordered for all new cardiac patients to discuss a heart healthy diet, review current dietary patterns, and put forth recommended changes. A Physical Therapy consult should be ordered for patients who need inpatient cardiac and/or physical rehabilitation while in hospital. Pharmacy should assist with patient education on medications, especially those newly prescribed. Psychiatry input should be considered for those who live alone or who demonstrate high risk behavior of depression. Counseling and referrals should be documented in the patient charts.

Prior to discharge, each patient should be categorized as follows:

1. Patients capable of an independent exercise program who can also assimilate recommendations for risk factor modification without requiring a supervised, outpatient rehabilitation program.
2. Patients who will benefit from a supervised, outpatient cardiac rehabilitation program including exercise and risk factor modification. Insurance will generally reimburse outpatient rehabilitation for the first presentation of coronary artery disease.
3. Patients requiring inpatient cardiac and/or physical rehabilitation at a skilled nursing facility or rehabilitation hospital.
4. Patients with contraindications to exercise training at the time of discharge.

Phase II
All Patients who would benefit from a supervised, outpatient Cardiac Rehabilitation program must have it ordered by an inpatient or outpatient physician prior to discharge. A physician’s referral is required to enable a patient to enroll. The Cardiology Service’s Discharge Care Coordinator and Clinical Nurse Specialist can facilitate referral of inpatients to outpatient cardiac rehabilitation programs in the San Francisco Bay Area.

F. REFERENCES:


Consensus Panel statement on Cardiac Rehabilitation of the AHA, the U.S. Department of Health and Human Services, and the Agency for Health Care Policy and Research.

Guidelines developed by: Gordon Fung MD, Steven Kayser PharmD, Andrew Michaels MD, Christine Thompson RN, and Jonathan Zaroff MD.