ABSTRACT

Acute coronary syndrome (ACS) is a complex disease state with varying presentations that can considerably complicate treatment decisions. Although a wealth of evidence exists to recommend standard treatments that have been shown to improve outcomes, many institutions do not provide evidence-based ACS care that is supported by the literature. This article will review the evidence-based ACS treatment recommendations from joint panels representing the American Heart Association and the American College of Cardiology. The use of critical pathways in facilitating the adoption of standard, evidence-based treatment protocols will be highlighted, and the role of the hospital pharmacist in providing therapeutic monitoring of required ACS treatments and pharmacologic guidance during discharge planning also will be discussed.

ACLINICAL FEATURES OF ACS AND INITIAL CARE RECOMMENDATIONS

Acute coronary syndrome, including non–ST-segment elevation myocardial infarction (NSTEMI), ST-segment elevation myocardial infarction (STEMI), and unstable angina, presents as a heterogeneous condition that requires varying degrees of intervention and care. Patients with or without a history of coronary artery disease presenting with symptoms of ischemic chest pain should be quickly evaluated with a 12-lead electrocardiogram, which is used to differentiate NSTEMI from STEMI. If ACS is suspected, initial biomarkers of myocardial injury, including troponins and creatinine kinase-MB (CK-MB), should be monitored and followed until a downward trend in these levels is evident.1

At the onset of symptoms, all patients should chew and swallow non–enteric-coated aspirin 162 mg to 325 mg as soon as possible, preferably administered by emergency personnel before hospital arrival, to decrease platelet aggregation and prevent extension of...
the causative thrombus in the infarct-related coronary artery. If the patient is intolerant or allergic to aspirin, then clopidogrel is the recommended antiplatelet agent. Adjunctive therapy with supplemental oxygen and sublingual nitroglycerin followed by intravenous (IV) nitroglycerin also are recommended to control symptoms. Morphine may be administered to patients with refractory chest pain that is not relieved by nitroglycerin. In patients with STEMI, evidence-based guidelines emphasize the importance of a rapid and complete coronary artery reperfusion therapy with either percutaneous coronary intervention (PCI) or fibrinolytic therapy. For patients with non–ST-segment elevation ACS, risk stratification to determine the need for early invasive management (eg, PCI) is used. Regardless of whether or not the early invasive strategy is used, pharmacologic therapy plays an important role in these patients.

**MANAGEMENT OF STEMI**

In the management of patients with STEMI, evidence-based pharmacotherapy should be initiated promptly. As previously noted, aspirin should be administered as soon as possible after symptoms begin and should be continued indefinitely.

In patients presenting to the hospital within 12 hours of symptom onset, rapid reperfusion with primary PCI or fibrinolysis is indicated. The decision of treatment method is dependent on the facility’s access to a cardiac catheterization laboratory with trained cardiac interventionalists. In cases of suspected STEMI, the American College of Cardiology (ACC) and American Heart Association (AHA) guidelines suggest that a planned interventional procedure should begin within 90 minutes of hospital presentation. If it is anticipated that the procedure can occur in a timely fashion, early intervention is the preferred strategy in patients with STEMI. Patients should receive clopidogrel before the primary PCI procedure, but the recommended dosage is a current source of debate.

In the absence of immediate access to PCI facilities, facilitated PCI, or fibrinolytic therapy followed by the PCI procedure, is a viable alternative strategy. However, certain patients with STEMI profiles require early interventional care. The ACC/AHA panel recommends that patients should be transferred to an institution capable of providing immediate interventional care if the individual is younger than 75 years of age and is experiencing cardiogenic shock, or if the individual has a known contraindication to fibrinolytic therapy.

Although primary PCI is preferred, fibrinolysis is generally preferred in patients presenting within 3 hours of symptom onset and the anticipated time to primary PCI is greater than 90 minutes. The fibrinolytic agents commonly used are alteplase, reteplase, or tenecteplase. Fibrinolytic therapy should not be given to asymptomatic patients whose symptoms began more than 24 hours before presentation. It should be stressed that before proceeding with fibrinolytic therapy for STEMI, clinicians must consider the underlying contraindications, which include recent head or facial trauma, uncontrolled hypertension, or ischemic stroke in the past 3 months.

**ANCILLARY PHARMACOTHERAPY IN PATIENTS WITH STEMI**

Supportive pharmacologic management that provides protection against thrombosis is required in medical management and PCI reperfusion strategies. Administration of IV unfractionated heparin (UFH) is recommended in patients undergoing PCI, as well as in those receiving fibrinolytic agents. Low-molecular weight heparin (LMWH) given as an initial 30-mg IV bolus followed by 1 mg/kg subcutaneously every 12 hours is an alternative to UFH in patients who are younger than 75 years, provided that renal dysfunction is not present. In patients with a history of heparin-induced thrombocy-

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Table 1. Factors Determining Reperfusion Strategies in STEMI

<table>
<thead>
<tr>
<th>Fibrinolysis preferred:</th>
<th>Invasive strategy preferred:</th>
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<tbody>
<tr>
<td>• Early presentation (&lt;3 h from symptom onset) and a delay in initiating PCI is anticipated</td>
<td>• Skilled PCI available with surgical backup (for CABG, if necessary)</td>
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<tr>
<td>• Invasive strategy is not an option</td>
<td>• High-risk STEMI presentation</td>
</tr>
<tr>
<td>• Prolonged transport to interventional facilities anticipated</td>
<td>• Contraindications to fibrinolysis (including bleeding risk)</td>
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<tr>
<td></td>
<td>• Late presentation (&gt;3 h after symptom onset)</td>
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<td></td>
<td>• STEMI diagnosis in doubt</td>
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CABG = coronary artery bypass graft; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

Data from Antman et al.
topenia, the direct thrombin inhibitor bivalirudin can be used as an alternative therapy.  

β blockers and lipid-lowering medications should also be initiated within the first 24 hours of hospital admission. Oral β blocker therapy may be initiated when the patient is clinically stable and should be up titrated to maintain a resting heart rate in the range of 50 to 60 beats per minute. Angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers should be added to the medical regimen before discharge to reduce the risk of cardiac remodeling and mortality after the STEMI event.

**MANAGEMENT OF NSTEMI**

Patients with NSTEMI should be risk-stratified to determine the need for early intervention. Although an interventional approach is not always required in NSTEMI, patients with certain high-risk features (Table 2) should be considered for an early invasive strategy. For high-risk patients, including those with continued ischemia or elevated troponins, or when an interventional strategy is planned for the immediate future, pharmacologic therapy is recommended to provide adequate protection before the procedure. The guidelines recommend the administration of a short-acting glycoprotein IIb/IIIa inhibitor, in addition to aspirin and heparin. If intervention is not planned in patients with increased risk, the guidelines suggest the addition of UFH or LMWH only. In low-risk patients with NSTEMI, an early conservative, medications-based strategy or early invasive strategy are both equally appropriate. In patients with a low risk of bleeding, clopidogrel can be started and continued for a period of 1 to 9 months with or without interventional care. However, if a coronary artery bypass graft procedure is planned, clopidogrel therapy should be withheld for 5 to 7 days before the procedure. As in patients with STEMI, patients with NSTEMI should receive β blockers and statins to help improve overall survival.

**STENT PLACEMENT**

Stents are often placed during PCI to prevent reocclusion of the affected vessel. Stent placement requires follow-up dual antiplatelet therapy with aspirin and clopidogrel to reduce the risk of stent thrombosis. The ACC/AHA guidelines recommend that, in addition to indefinite therapy with aspirin, patients receiving a bare metal stent should receive at least 1 month of clopidogrel therapy after stent placement or 3 to 6 months of clopidogrel after drug-eluting stent implantation depending on the type of stent used. The optimal duration of clopidogrel therapy after drug-eluting stent placement remains controversial. However, current guidelines recommend that patients without an increased risk of bleeding should receive clopidogrel therapy for 12 months.

**THE ROLE OF THE HOSPITAL PHARMACIST**

The hospital pharmacist is vital to ensure the delivery of quick, effective, and safe therapies in the treatment of ACS. Hospital pharmacists monitor each therapeutic agent for adequate dosing based on the specific patient parameters of age, weight, renal function, and liver function. These measures ensure the maximum effectiveness of a chosen regimen and a minimal risk of adverse events. Pharmacists are in a unique position to measure quality of care by writing and implementing pharmacotherapeutic guidelines, and measuring institutional adherence to these guidelines. Because many of the drugs used in ACS are associated with a risk of bleeding, following the institution’s bleeding rates, in this patient population, is imperative. Documentation of contraindications to various medications used in the period after an ACS event will help the institution improve compliance with quality measures of performance measured by the Joint Commission and Medicare/Medicaid.

<table>
<thead>
<tr>
<th>Table 2. High-Risk Features in NSTEMI Suggesting the Need for Early Intervention</th>
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<tbody>
<tr>
<td>An early invasive strategy should be planned in patients with NSTEMI in the presence of high-risk features, including:</td>
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<tr>
<td>• Recurrent angina or ischemia at rest</td>
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<td>• Elevated troponins</td>
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<td>• New ST-segment depression</td>
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<tr>
<td>• Recurrent angina or ischemia with symptoms of heart failure (S3 gallop, pulmonary edema, or worsening rales)</td>
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<tr>
<td>• High-risk findings on stress test</td>
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<tr>
<td>• Depressed left ventricular systolic function</td>
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<td>• Hemodynamic instability</td>
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<tr>
<td>• Sustained ventricular tachycardia</td>
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<tr>
<td>• PCI within the past 6 mos</td>
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<tr>
<td>• Prior CABG</td>
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CABG = coronary artery bypass graft; NSTEMI = non–ST-segment elevation myocardial infarction; PCI = percutaneous coronary intervention.
**Discharge Care and the Role of the Hospital Pharmacist**

Discharge planning requires a concerted effort from the entire care team, including the hospital pharmacist. Smoking cessation counseling recommendations are often provided at discharge, and this service has been identified as a critical performance measure of the quality of care received during hospitalization for ACS. Dietary guidelines and exercise recommendations also are provided for patients with ACS at discharge and can be incorporated into standardized care protocols.

The hospital pharmacist plays an important role in discharge care, as patients with ACS require continuing pharmacologic therapy and counseling on the importance of compliance with prescribed regimens. This is particularly critical in patients who have received interventional care with the placement of a stent, as the continued use of aspirin and clopidogrel is necessary to prevent stent thrombosis and the subsequent catastrophic complications of myocardial infarction and death. Furthermore, the hospital pharmacist plays a role in focusing on long-term risk reduction by ensuring that patients receive an ongoing prescription for lipid-lowering therapy at discharge, when warranted.

**Critical Pathways**

Clinical evidence has uncovered the importance of early, standardized treatment for ACS, especially in patients presenting with suspected STEMI. Therefore, the ACC/AHA guidelines stress that a multidisciplinary team should be responsible for the development of institution-specific protocols for triage and management of patients with suspected STEMI. Critical pathways can be used to facilitate the adoption of standard protocols in STEMI and improve overall patient outcomes.

The Strategies and Therapies to Reduce Ischemic and Vascular Events program offers important tools, including a flowchart of ACS management, to help institutions achieve standardized, evidence-based care. The Cardiac Hospitalization Atherosclerosis Management Program likewise instituted a standardized treatment protocol and demonstrated improvements in the use of evidence-based treatment, as well as improved post-hospitalization outcomes for patients with acute myocardial infarction. Similarly, the ACC Guidelines Applied in Practice aimed for quality improvement through the development of standardized protocols and demonstrated improvements in adherence to evidence-based therapies and treatment outcomes in ACS.

A variety of resources are available to help institutions implement critical pathways in ACS. In support of its Get With the Guidelines campaign, the AHA offers smoking cessation resources, disease-specific process documents, team meeting tools, and other materials at http://www.americanheart.org/presenter.jhtml?identifier=1141. Order sets for use in patient admission to an institution’s coronary care unit are available from the Institute for Clinical Systems Improvement at www.icsi.org. The Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of the ACC/AHA Guidelines registry also offers important tools for developing standard treatment protocols at http://www.crusadeqi.com/Main/QTToolbox_OpTools_StandingOrders.shtml.

**Conclusions**

Acute coronary syndrome management is complex and requires standardized treatment protocols to achieve consistent, favorable patient outcomes. Critical pathways represent important tools to achieve best practices in ACS management. Pharmacologic therapy plays an important role in medical management and invasive treatment strategies for ACS. Hospital pharmacists therefore play a prominent role in ACS management and are also responsible for therapeutic monitoring and pharmacotherapy consultations before hospital discharge. As institutions continue to adopt critical pathways for the routine management of complex conditions, such as ACS, hospital pharmacists will play an increasingly prominent role in ACS care.

**References**


