Continuous Quality Improvement: Adherence to Performance Measures - Implementation of Antiplatelet, Statin, Beta-Blocker and Angiotensin System Blockade Therapy Post Myocardial Infarction, Compliance with ACC/AHA Guidelines

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Abstract

Introduction: With improvements in diagnosis and management of acute myocardial infarction (MI) more patients suffering MI are surviving to discharge. Patients with known coronary heart disease are at high risk for recurrent MI, stroke, and death. Thus interventions aimed at secondary prevention are critically important. We assessed compliance with secondary prevention guidelines and describe a strategy for improvement that was recently implemented at our institution.

Methods: We performed a retrospective chart review of 737 consecutive patients who presented to our institution from 2008 to 2010. Data was collected on patient demographics, medications prescribed at the time of discharge, and contraindications to each of the following classes of medications: aspirin, statin, beta blockers, and angiotensin system antagonists.

Results: The average age was 62 years, 67% were male, 74.8% had hypertension, 61.9% had diabetes, 42% were tobacco users, and 59.3% had dyslipidemia. Aspirin was prescribed to 721 (99.4%) patients, 3 (0.4%) had a contraindication. Beta blockers were prescribed to 692 (95.5%) patients, 27 (3.7%) had a contraindication. Angiotensin system inhibitors were prescribed to 587 (81.0%) patients, 61 (8.4%) had a contraindication. A statin was prescribed to 698 (96.6%), 10 (1.3%) had a contraindication.

Discussion: Therapeutic lifestyle changes remain the mainstay for secondary prevention after MI. Several adjunctive medications have demonstrated survival benefit. Given the proven
survival benefit, the American Heart Association/American College of Cardiology recommend all patients, in the absence of contraindications, receive these four classes of medications. Our hospital has instituted an electronic prompt that requires the discharging clinician to either order each of these medications or place an order stating the reason why the medication is not prescribed.

**Conclusion:** As we strive to deliver excellent health care we must strive for 100% compliance with these recommendations. An electronic prompt when discharging patients after a myocardial infarction will likely improve compliance.

**Key words:** Acute Coronary Syndrome, Secondary Prevention

**Introduction**

In the United States heart disease is the leading cause of death in both men and women. Coronary heart disease claims more lives annually than cancer, accidents, and diabetes combined.\(^1\) Based on hospital discharge data, 1,680,000 hospital discharges for acute coronary syndrome (ACS) occurred in 2001, with an estimated 30 percent of all ACS cases manifesting as ST-segment elevation myocardial infarction.\(^2\) Aging of the population as a whole has resulted in an increase in the number of people living with cardiovascular disease, particularly coronary heart disease (now estimated to be 16.3 million).\(^3\) With an increasing emphasis on early reperfusion therapy (both percutaneous coronary interventions and fibrinolysis) more patients presenting with acute coronary syndromes are surviving to discharge.

Patients with coronary heart disease are at high risk of subsequent cardiovascular events, including myocardial infarction, stroke, and death.\(^4\) Thus, interventions aimed at secondary prevention are critically important. Therapeutic lifestyle changes including increased physical activity, dietary modifications/weight loss, and smoking cessation should be promoted. Adjunctive pharmacotherapeutics of proven benefit include aspirin (or other antiplatelet medication), statins, beta blockers, and angiotensin converting enzyme inhibitors (or angiotensin receptor blockers).\(^5\) In the absence of contraindications, these medications should be initiated upon discharge and continued indefinitely. These recommendations are supported by multiple medical societies, including the American Heart Association and American College of Cardiology.

We performed a retrospective analysis of 737 consecutive patients who presented to the Providence Hospital and Medical Center Heart Institute with myocardial infarction in order to identify the proportion of patients who did receive the recommended aspirin, statin, beta blocker and angiotensin system inhibition prior to or upon discharge. Given the mortality benefit of the above therapies, we will utilize the data obtained from this analysis as a measure of the quality of clinical care.
Methods

We performed a retrospective chart review of 737 consecutive patients who presented to the Heart Institute at Providence Hospital in Southfield Michigan and Providence Park Hospital in Novi Michigan between April 2006 and December 2010. Inclusion criteria were patients presenting with either ST-segment or non ST-segment elevation myocardial infarction diagnosed by the presence of EKG changes and elevated cardiac biomarkers. We excluded patients who did not survive to discharge or were transferred to another facility prior to discharge (12 patients total). All eligible patients were included in this analysis. Demographic data including age and gender was collected. Information regarding past medical history, including history of diabetes mellitus, hypertension, dyslipidemia, and tobacco use was collected. Charts were reviewed in order to identify the patients who received each medication on discharge and those patients who had documentation of a contraindication to one or more medications. If the medication was prescribed or a contraindication was documented somewhere on the patient's chart there were considered to have met our discharge goal. Data was analyzed in order to determine the percentage of patients who upon discharge received antiplatelet therapy, lipid-lowering therapy with a statin, angiotensin pathway blockade, and beta-adrenergic blockade, consistent with current ACC/AHA guidelines and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) core measures for acute myocardial infarction.

Results

Patient demographics are displayed in table 1. In our study population 74.8% had hypertension, 61.9% had diabetes mellitus, 42% used tobacco products, and 59.3% had hypercholesterolemia, 67.1% were male. Mean age was 61.8 years. Our data was analyzed in order to identify the proportion of patients who met our goal for each of the four medications described above (table 2) (Figure 1). Of 725 total patients included 724 (99.8%) met our goal for aspirin prescribed at discharge, 3 of these patients (0.4%) had a contraindication to aspirin, 1 patient (0.2%) was not prescribed aspirin and did not have a documented contraindication. For ACE inhibitors, 648 (89.4%) met our goal, 61 (8.4%) of those had a contraindication, 77 (10.6%) did not receive ACE inhibitor and did not have a documented contraindication. For Beta blockers, 719 (99.2%) met our goal, of those 27 (3.7%) had a contraindication, and 6 (0.8%) did not receive a beta blocker and did not have documentation of a contraindication. For statins, 708 (97.7%) met our goal, of those 10 (1.3%) had a contraindication and 17 (2.3%) did not receive a statin and did not have a documented contraindication.

The data was also analyzed by year in order to identify prescription trends (table 3) (Figure 2). In 2006, 104 patients were included, 104 (100%) met our goal for aspirin, 103 (99.0%) met our goal for beta blockers, 91 (77.8%) met our goal for ACE inhibitors, and 99 (95.1%) met our goal for statin use. In 2007, 168 patients were included, 168 (100%) met our goal for aspirin, 168 (100%) met our goal for beta blockers, 143 (85.1%) met our goal for ACE inhibitors, and 162 (96.4%) met our goal for statins. In 2008, 139 patients were included, 139 (100%) met our goal for aspirin, 137 (98.5%) met our goal for beta blockers, 131 (94.2%) met our goal for ACE inhibitors, and 134 (96.4%) met our goal for statins. In 2009, 148 patients were included, 147 (99.3%) met our goal for aspirin, 145 (98.6%) met our goal for beta blockers, 131 (88.5%) met
our goal for ACE inhibitors, and 148 (100%) met our goal for statins. In 2010, 166 patients were included, 166 (100%) met our goal for aspirin, 166 (100%) met our goal for beta blockers, 152 (91.5%) met our goal for ACE inhibitors, and 166 (100%) met our goal for statins.

Discussion

With improved diagnostic and therapeutic modalities many more patients presenting with myocardial infarctions are surviving to discharge. Once the acute treatment phase is complete and the patient is stabilized the focus of medical therapy turns to secondary prevention. Given the increased cardiovascular risk after a primary event, long term preventative therapies should be initiated as soon as possible. Ideally prior to or at the time of discharge. The cornerstone of secondary prevention lies in therapeutic lifestyle changes as clinically important effects on both cardiovascular and all-cause mortality can be appreciated within as short a time as six months. The OASIS-5 trial examined over 18,000 patients found a 43% decrease in the risk of MI in patients who quit smoking compared to persistent smokers at six month follow up. Patients who adhered to a diet and exercise program had a 48% decrease in the risk of MI at six months. Considering both the short and long-term benefits, the focus of therapeutic lifestyle modifications should be on smoking cessation, weight reduction, increased physical activity, and control of chronic medical conditions (particularly hypertension and diabetes). In addition to lifestyle modifications several adjuvant medications have been shown to improve mortality following MI, these include statins, aspirin, beta-blockers, and angiotensin converting enzyme inhibitors.

According to the 2011 update of the AHA/ACC guidelines on the secondary prevention and risk reduction for patients with atherosclerotic vascular disease all patients should have a lipid profile checked and lipid lowering therapy initiated prior to discharge. In the absence of contraindications all patients should be prescribed a statin with the dose adjusted to achieve an low density lipoprotein cholesterol (LDL) concentration <100 mg/dL and at least a 30% reduction from baseline. An optional LDL goal of <70 is recommended for very high risk patients. Additionally, the prescribing of statins upon discharge has recently been added to the Center for Medicare and Medicaid Services (CMS) core measure checklist for acute myocardial infarction.

The AHA/ACC guidelines also state that in the absence of contraindications all patients suffering from acute MI should be offered aspirin as first line antiplatelet monotherapy. Patients intolerant of aspirin may use clopidogrel as an alternative. Patients at moderate to high risk of MI or death may be placed on both aspirin and clopidogrel (dual antiplatelet therapy). The Antithrombotic Trialists' Collaborative overview examined 195 randomized controlled trials, involving more than 135,000 high risk patients, demonstrated a 22% relative reduction in the risk of subsequent cardiovascular events. The beneficial effects of aspirin extend beyond the heart with significant reductions in stroke and other vascular events.

In the absence of contraindications, blockade of the angiotensin pathway (with either ACEi or angiotensin II receptor blocker) should begin as soon as possible following an acute MI. The benefit of ACEi is particularly apparent in the setting of heart failure or reduced left ventricular ejection fraction (LVEF). Beneficial effects on left ventricular remodeling are thought to be the
primary mechanism accounting for the survival benefit associated with ACEi\textsuperscript{10}. Angiotensin converting enzyme inhibitor therapy has been shown to improve left ventricular function, and survival at both 30 days and one year\textsuperscript{11}.

Blockade of the beta adrenergic pathway (with beta blockers) has also been shown to improve survival following a myocardial infarction. Beta blockers have several beneficial effects including (but not limited to) decreased myocardial oxygen demand, suppression of arrhythmias, improved coronary perfusion, attenuation of ventricular remodeling, and slowing atherosclerotic progression\textsuperscript{12}. A meta-analysis including 25,000 patients on long-term beta blocker therapy demonstrated a 10.1% decrease in overall mortality in patients prescribed beta blockers compared to placebo\textsuperscript{13}. Long term beta blocker therapy has been shown to improve survival in both high\textsuperscript{14} (LVEF < 40%) and low\textsuperscript{15} risk patients.

We recognize several limitations to our current study. Our retrospective design relies on chart review and therefore proper and detailed documentation within the medical record. With the recent transition to an electronic medical record several records of potential interest were not available (particularly daily progress notes). We are unable to assess patient compliance with the recommended therapies post discharge and are thus unable to assess clinical outcomes.

Given the proven benefit of the four classes of medications discussed above the goal for practitioners, hospitals, and the nation as a whole should be 100% compliance with current AHA/ACC recommendations. Our data indicate 89% to 99% institutional compliance over the five year study period. It is certainly possible and even likely that several patients among the small percentage of who were discharged without a medication did in fact have a contraindication that was not documented in the discharge paperwork. Regardless, as we strive to deliver excellent health care we must strive for 100% compliance with these recommendations.

**Conclusion**

Interventions such as standard discharge order-sets and check lists will likely improve both the number of patients who receive these necessary medications and improve the documentation of contraindications. Our hospital recently instituted an electronic prompt that requires clinicians to either prescribe the indicated medication or enter an electronic order stating the reason the medication was not prescribed. Documentation of contraindications is critical as certain contraindications may resolve overtime (acute kidney injury precluding ACEi therapy for example). Therefore patients should constantly be reassessed in the outpatient setting and indicated therapy initiated once contraindications have resolved. Additionally it is important to monitor patient compliance with this medical regimen at all office follow-up appointments. In the future we will evaluate the effectiveness of this simple intervention.

**Conflict of Interest:** None declared.
References


**TABLE 1: Demographics**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>74.8 (%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>61.9 (%)</td>
</tr>
<tr>
<td>Tobaccouse</td>
<td>42 (%)</td>
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<tr>
<td>Dyslipidemia</td>
<td>59.3 (%)</td>
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<tr>
<td>Male</td>
<td>67.1 (%)</td>
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<tr>
<td>Female</td>
<td>32.9 (%)</td>
</tr>
<tr>
<td>Age – 20-49</td>
<td>19 (%)</td>
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<tr>
<td>50-69</td>
<td>69.3 (%)</td>
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<tr>
<td>70-99</td>
<td>28.9 (%)</td>
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TABLE 2: Proportion of Patients Who Received, Had a Contraindication to, and Did Not Receive Each Medication

<table>
<thead>
<tr>
<th>DRUG</th>
<th>RECEIVED no.</th>
<th>RECEIVED %</th>
<th>NOT RECEIVED no.</th>
<th>NOT RECEIVED %</th>
<th>CONTRAINDED no.</th>
<th>CONTRAINDED %</th>
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<tbody>
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<td>ASPIRIN</td>
<td>721</td>
<td>99.4</td>
<td>1</td>
<td>0.1</td>
<td>3</td>
<td>0.4</td>
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<td>B-BLOCKER</td>
<td>692</td>
<td>95.5</td>
<td>6</td>
<td>0.8</td>
<td>27</td>
<td>3.7</td>
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<td>ACE-INHIBITOR</td>
<td>587</td>
<td>81.0</td>
<td>77</td>
<td>10.6</td>
<td>61</td>
<td>8.4</td>
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<tr>
<td>STATIN</td>
<td>698</td>
<td>93.6</td>
<td>17</td>
<td>2.3</td>
<td>10</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Patients Who Received, Did Not Receive, and Had a Contraindication to Each Medication

Figure 1: Proportion of patients who received each medication, had a contraindication to each medication, and did not receive and did not have a documented contraindication to each medication.
TABLE 3: Proportion of Patients Meeting Goal For Each Medication By Year

<table>
<thead>
<tr>
<th>YEAR</th>
<th>N (725)</th>
<th>ASPIRIN no.</th>
<th>ASPIRIN %</th>
<th>B-BLOCKER no.</th>
<th>B-BLOCKER %</th>
<th>ACE-INHIBITOR no.</th>
<th>ACE-INHIBITOR %</th>
<th>STATIN no.</th>
<th>STATIN %</th>
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<tbody>
<tr>
<td>2006</td>
<td>104</td>
<td>104</td>
<td>100</td>
<td>103</td>
<td>99</td>
<td>91</td>
<td>77.8</td>
<td>99</td>
<td>95.1</td>
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<td>168</td>
<td>168</td>
<td>100</td>
<td>168</td>
<td>100</td>
<td>143</td>
<td>85.1</td>
<td>162</td>
<td>96.4</td>
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<tr>
<td>2008</td>
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<td>139</td>
<td>100</td>
<td>137</td>
<td>98.5</td>
<td>131</td>
<td>94.2</td>
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<td>98.6</td>
<td>131</td>
<td>88.5</td>
<td>148</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>166</td>
<td>166</td>
<td>100</td>
<td>166</td>
<td>100</td>
<td>152</td>
<td>91.5</td>
<td>166</td>
<td>100</td>
</tr>
</tbody>
</table>

Patients Meeting Goal By Year

Figure 2: Percentage of patients meeting goal (either prescribed medication or had documentation of contraindication) by year.