Acute Myocardial Infarction: How Well Do Emergency Physicians in Community Hospitals Follow Clinical Guidelines?

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Abstract

• **Objective:** To evaluate physicians’ adherence to the American College of Cardiology (ACC) and American Heart Association (AHA) guidelines regarding care of patients with acute myocardial infarction (MI) who present to the emergency department (ED).
• **Design:** Retrospective analysis of ED charts.
• **Setting and participants:** A consecutive sample of 936 patients with an ED diagnosis of acute MI (ICD-9-CM 410) who presented between June and September 2001 to 40 U.S. community hospitals.
• **Methods:** Compliance with guidelines for acute MI per chart documentation was analyzed for 905 of the sample patients. The data source was a proprietary template documentation system used by all emergency physicians at the 40 hospitals.
• **Measurements:** Percentage of patients with documentation of cardiac monitoring, oxygen administration, and aspirin and β-blocker treatment as well as time to administration of thrombolytic therapy.
• **Results:** 94.4% of patients received cardiac monitoring, 87.4% of patients received supplemental oxygen administration, 75.4% of patients were administered aspirin, and 31.9% of patients were administered β blockers while in the ED. In the 201 patients with sufficient data to permit calculation of the door-to-drug interval, the mean time was 51 minutes and the median time was 35 minutes.
• **Conclusion:** Emergency physicians achieved a moderate to high level of compliance for oxygen administration and cardiac monitoring, and a low to moderate level for β blocker and aspirin administration. Results compared favorably with previous studies that examined compliance during the first 24 hours after arrival.

Chest pain is one of the most common patient presentations in U.S. emergency departments (EDs), with nearly 6 million visits made to EDs for the evaluation of chest pain and related symptoms each year [1,2]. Care decisions regarding the patient with chest pain should reflect the patient’s underlying risk for acute myocardial infarction (MI). Approximately 1 in 5 deaths in the United States in 1999 was caused by acute MI. It is estimated that in 2003 approximately 1 million Americans will experience an acute MI, and nearly half will die from it [2]. At least half of these deaths will occur within 1 hour of onset of symptoms, before the person reaches a hospital ED [3,4].

Management of the acute MI patient in the ED continues to be challenging. Timely and appropriate intervention has been shown to reduce mortality, decrease infarct size, and improve functional outcomes [5–8]. However, despite advances in diagnosis and treatment, 2% to 4% of acute MI patients are misdiagnosed and discharged from the ED, and for those admitted, in-hospital mortality rates range from 5% to 15% [9–11]. Acute MI is the single largest source of malpractice lawsuits in emergency medicine, accounting for the most total dollars awarded in malpractice claims [12,13].

Authoritative guidelines for the management of MI patients are available [14–17]. In particular, the American College of Cardiology/American Heart Association (ACC/AHA) [14,15] guidelines provide evidence-based direction to physicians and other health care providers regarding best practices in the treatment of acute MI patients. We found no previously published studies specifically examining compliance with ACC/AHA guidelines for acute MI in the ED setting. Studies looking at compliance with other clinical guidelines have demonstrated variable and sometimes disappointing results [18–21]. A study that evaluated compliance with the 1990 American College of Emergency Physicians (ACEP) chest pain guidelines found that only 78% of the study physicians documented having taken a history,
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88% documented performing a physical examination, and 64% followed action rules [20]. Another study demonstrated that 35% of physicians were not compliant with advanced cardiac life support (ACLS) guidelines and that ACLS certification was not correlated with compliance [21]. Computerized decision support systems may improve physician guideline compliance through prompting and reminders [22,23].

Measuring compliance with guidelines is important because it provides information about the actual impact of published guidelines on clinical practice. Furthermore, aggregate compliance data provide realistic comparative benchmarking data for EDs interested in performing their own quality assurance studies. Without such data, it is easy for ED physicians to misinterpret their own quality results and wrongly conclude that they are performing well or poorly. The objective of this study was to evaluate physicians’ adherence to ACC/AHA guideline recommendations regarding evaluation and management of acute MI in patients who present to the ED.

ACC/AHA Guideline Recommendations

This study focused on 5 aspects of acute MI management addressed by the ACC/AHA guidelines: use of cardiac monitoring, use of supplemental oxygen, administration of aspirin and β blockers, and time from patient arrival to administration of thrombolytic therapy. Each of the recommendations in the ACC/AHA guidelines is based on the weight of evidence and expert opinion.

Current ACC/AHA guidelines recommend placing all suspected acute MI patients on continuous cardiac monitoring (class I) during the ED evaluation period because ventricular fibrillation is the major preventable cause of death in the early part of an acute MI [14,24]. The use of supplemental oxygen is recommended as a class I intervention in patients with pulmonary edema and an oxygen saturation less than 90% and as a class IIa intervention for all patients with uncomplicated acute MI during the first 2 to 6 hours [14]. There is some evidence that suggests breathing supplemental oxygen may limit infarct size [25] and reduce ST-segment elevation [26]. Acute MI patients may be mildly hypoxemic initially because of excessive lung water as well as ventilation-perfusion mismatches; thus, there is a rationale for the use of supplemental oxygen [27].

An aspirin dose of 160 mg to 325 mg is recommended as a class I intervention and should be given on day 1 of an acute MI and then continued indefinitely on a daily basis [14,24]. The International Study of Infarct Survival (ISIS-2) trial showed conclusively that using aspirin alone in the treatment of an evolving acute MI reduces the 35-day mortality by 23% [8]. Some research data show added benefit from giving aspirin early, either by paramedics prior to arrival at hospital or in the ED [28].

β-Blocker treatment is recommended for acute MI patients because these medications reduce cardiac work and myocardial oxygen demand [14,24]. Research has demonstrated resultant decreased infarct size, re-infarction, and short-term and long-term mortality [14,29,30]. ACC/AHA guidelines recommend β-blocker administration within 12 hours of the onset of infarction in acute MI patients (class I), regardless of whether angioplasty or thrombolytic therapy is pursued, in the absence of contraindications [14]. ACC/AHA guidelines also recommend β-blocker therapy for the treatment of ongoing chest pain and tachyarrhythmias (class I). Some relative contraindications to β-blocker therapy include hypotension, left ventricular dysfunction, heart rate less than 60 bpm, and second- or third-degree heart block.

Thrombolytic therapy has been proven to reduce infarct size and decrease mortality. The earlier therapy begins, the better the outcome, with the greatest benefit decidedly occurring when therapy is given within the first 3 hours of symptom onset. However, proven benefit occurs up to at least 12 hours after the onset of symptoms [24,31]. ACC/AHA guidelines recommend a door-to-drug time (the time from patient arrival in the ED until intravenous thrombolytic infusion) goal of less than 30 minutes.

Methods

Design
This was a retrospective study using administrative claims data for the period 1 June 2001 through 30 September 2001.

Setting
We studied patients seen in the EDs of 40 community hospitals in the United States. The hospitals were located in 11 states, with 44% in an urban setting. The hospitals had an annual ED volume ranging from 9000 to 63,000 patients and varied in size from 75 to 750 beds.

Data Source
Apollo Information Services, Inc. (Fort Myers, FL) provides physician billing services for all of the EDs included in the study. ED physicians at 39 of the study hospitals document professional services using proprietary template-generated paper forms (QualChart, ECI). Documentation at the remaining hospital is performed using voice-recognition software and computerized templates (Clinical Reporter, Dictaphone). All patient documentation is collected and collated at the originating hospital and then forwarded to the billing company for coding and billing.

Demographic information, ICD-9-CM codes, and procedure codes for each patient record are manually entered into computers by billing company staff. Demographic data are entered into the system via direct computer download. All patient records are scanned and a picture image of each is stored electronically.
Patient Selection
A total of 936 patients with an ED diagnosis of acute MI (ICD-9-CM 410.00 through 410.99) were seen during the 4-month study period, as identified from a query of billing software. Thirty-one patients from this group were excluded for the following reasons: patient arrived in cardiac arrest (4), patient dead on arrival in the ED (2), illegible scanned record (6), incorrect diagnosis coding (15), or other (4). Thus, there were 905 patients available for the final analysis.

Chart Review and Measures
A quality management analyst at Apollo Information Services reviewed all 905 patient charts. The analyst is a certified professional coder with 2 years’ experience reviewing and coding ED charts from the study hospitals. The analyst was trained for this study using a sample of acute MI records from among the 905 study charts; one of the authors reviewed the charts with the analyst to assure that the analyst understood the study indicators and where to look for them. The analyst and authors had periodic phone meetings and e-mail contact to review the data abstraction rules and resolve any questions.

The following descriptive variables were recorded for each patient: age, gender, disposition, arrival time, physician exam time, discharge time, and physician identifier code. Using specifically defined criteria, the analyst then reviewed each scanned chart to determine whether care adhered to ACC/AHA clinical guidelines and recorded the following clinical variables for each patient: use of cardiac monitoring, use of oxygen supplementation, use of aspirin and β blockers, use of special interventions (angioplasty, thrombolytics), and time from arrival to administration of thrombolytics. All data were recorded using a customized Access database and a standardized electronic data abstraction form (Figure 1). A compliance/performance score was generated and recorded for each of the clinical variables by calculating the percentage of total charts reviewed for which the variable was documented. If a variable could not be determined because a part of the patient record was missing (eg, nursing notes), then the variable was assumed to have not been performed and was recorded as such.

Analysis
Analyses were performed using SPSS software (release 11.0, SPSS, Chicago, IL). Review by the institutional review board at the principal institution determined that the study was exempt from full review.

Results
The mean age of the study patients was 65.5 years (range, 26 to 98 years). 534 were male (59%) (Table 1). Intravenous thrombolysis was performed in 274 patients (30%). 98 patients (11%) were sent directly to the cardiac catheterization laboratory from the ED for either coronary angiography or angioplasty. The number of acute MI patients treated at each of the 40 participating hospitals ranged from 2 to 62. The median number of patients treated per hospital was 17.5, and the mean number was 22.6. There were 285 participating attending emergency physicians, who each treated between 1 and 12 patients.

Table 2 shows the rates of physician compliance with the selected guideline recommendations based on documentation in clinical charts. A total of 854 (94.4%) patients were
placed on a cardiac monitor, 791 (87.4%) received oxygen supplementation, 682 (75.4%) were treated with aspirin while in the ED, at home, or during paramedic transport, and 289 (31.9%) received β-blockers while in the ED or were currently on β-blocker therapy. Scores describing each of the 40 hospitals’ performance of each indicator were calculated. Figure 2 shows the 25th, 50th (median), and 75th quartiles for the 40 hospitals participating in the study.

A total of 274 (30%) study patients received thrombolytic therapy. Of these patients, 201 had sufficient date-time data documented to permit calculation of the door-to-drug interval. The mean time was 51.0 minutes (95% CI, 42.5–59.5), with a median value of 35 minutes.

**Discussion**

In this study of 40 community hospitals, the median hospital data demonstrated that 99% of patients were placed on a monitor, 96% received oxygen, 80% received aspirin, and 33% received a β blocker prior to departure from the ED. Thus, guideline compliance was moderate to high for oxygen administration and cardiac monitoring, and low to moderate for β blocker and aspirin administration.

In the current study, the mean rate of aspirin administration prior to departure from the ED was 75.4%, a rate that compares favorably to previous studies that have measured aspirin administration during the first 24 hours of hospitalization. In the 1999 National Registry of Myocardial Infarction (NRMI) study, nearly 85% of all patients received aspirin within 24 hours of acute MI diagnosis [32]. In 1999, the ACC led a 10-hospital project (ACC-GAP) involving 735 acute MI patients and found that 81% of all patients received aspirin within 24 hours of acute MI diagnosis [33]. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has included aspirin therapy as one of its core hospital measures and has suggested that 95% of patients without contraindications should receive it within 24 hours before or after arrival [34].

Despite the ACC/AHA guidelines and the many studies that have demonstrated benefit from β-blocker therapy, these medications reportedly are not used frequently in the ED [35]. According to 1999 NRMI results, 53% of all patients received oral or intravenous β blockers within 24 hours of acute MI diagnosis [32]. And in the ACC-GAP study, β blockers were given within 24 hours of acute MI diagnosis in 65% [33]. In the current study there was documentation of β-blocker administration prior to departure from the ED in 31.9% of all patient records. JCAHO has also included β-blocker therapy as one of its core hospital measures.
and has suggested that 85% of patients without contraindications should receive it within 24 hours of arrival [34].

In the GUSTO I and GUSTO III trials, the median door-to-drug time for thrombolytics fell from 66 minutes in 1990 to 48 minutes in 1997 [36]. Results from the NRMI demonstrated a reduction in median door-to-drug times from 61.8 minutes to 37.8 minutes during the last 10 years of NRMI data collection [32,37]. In our study, the median door-to-drug time for acute MI patients was 35 minutes.

While numerous studies in the medical literature support the recommendations in the ACC/AHA acute MI guidelines, few studies have examined compliance with these guidelines. There is little data specific to ED care [32,37–40]. Thus, the results of the current study provide comparative benchmarking data for EDs interested in performing similarly structured quality assurance studies.

There are limitations to the current study. The hospitals were not randomly selected but rather 40 participating EDs that all used a common billing company were studied. In addition, the emergency physician charting in this study was performed using proprietary template-based documentation. This may limit the generalization of these results to other hospitals as templates have been shown to improve information capture and overall documentation [41,42]. Interestingly, the results of this study indicate areas of potential improvement in the templated document system. For example, either the emergency physician history and physical exam sheet or a complaint-specific order sheet should have a prompt for aspirin and β-blocker administration.

A number of the patients in the study likely had contraindications for the recommended interventions aspirin, β-blockade, and thrombolysis. Thus, the percentage of eligible patients who received these interventions would certainly be higher than the percentages reported in this study.

Another limitation of the current study was that physician awareness of acute MI clinical guidelines was not measured. Wigder et al. surveyed emergency physicians in 1993 and 1994 and found that only 48% were aware of the 1990 ACEP chest pain policy [43].

Finally, missing and illegible portions of patient records likely led to underestimates of compliance with the clinical practice guidelines. For example, it is difficult to imagine that anything less than 100% of patients with an ED diagnosis of acute MI were monitored. In some cases, patient records were illegible because of the quality of the duplicated record. In other cases, patient records were missing key accompanying documentation, such as nursing notes, respiratory therapy notes, and order sheets.

The results of this study underscore the importance of good medical documentation and challenge emergency care providers to discover effective ways to teach and promote best clinical practices.

The results of the current study were reported to the participating EDs and a focused educational component has subsequently been developed and distributed. This study will be repeated in the future to determine the impact of these quality improvement interventions. We are hopeful that the dual quality improvement interventions of feedback and education will result in improvements in medical care and documentation for acute MI patients at our partner hospitals [26].

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