American Journal of Emergency Medicine (2010) **28**, 694–702

ELSEVIER

The American Journal of Emergency Medicine

www.elsevier.com/locate/ajem

Original Contribution

ED triage of patients with acute myocardial infarction: predictors of low acuity triage☆

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Received 6 January 2009; revised 11 March 2009; accepted 13 March 2009

Abstract

Objective: Virtually all emergency department (ED) patients receive an ED triage assessment that determines their priority to be seen by a physician. Previous research found that half of patients who are having an acute myocardial infarction (AMI) are given a low priority triage score, which is associated with delays in electrocardiogram (ECG) acquisition and reperfusion therapy. We sought to determine some of the reasons why ED triage is failing in these patients.

Methods: We conducted a retrospective cohort analysis of a population-based cohort of AMI patients admitted to 102 acute care hospitals in Ontario, Canada, from July 2000 to March 2001. We examined 10 potential patient- and hospital-level predictors of low acuity triage: age, sex, number of comorbidities, arrival mode, socioeconomic status, time of day, day of week, ED AMI volume, hospital type, and department use of triage ECGs.

Results: Mean age of the 3088 patients was 67.5 (SD, 14.0), and 65% were men. In adjusted quantile regression analyses, low acuity triage was independently associated with ED AMI volume (odds ratio [OR], 0.44 at very high volume centers), arrival mode (OR, 0.60 for ambulance arrival), sex (OR, 0.80 for males), age (OR, 1.1 per 10 years of age), and a low number of comorbidities (OR, 0.92 for every cardiac co-morbidity).

Conclusions: Low acuity ED triage of AMI patients may be predicted by several patient- and hospital-level characteristics. Focusing future interventions on these factors may improve ED triage and, subsequently, time to initial ECG and reperfusion, in this patient group.

☆ This project was supported in part by a Canadian Insitutes of Health Research (CIHR) Team Grant in Cardiovascular Outcomes Research, an operating grant from the Heart and Stroke Foundation of Ontario (NA5703), and the Department of Medicine Clinician-Scientist Program at the University of Toronto. Dr Atzema was supported by a Fellowship Award from CIHR, and Dr Schull was supported by a New Investigator Award from CIHR. Dr Tu was supported by a Canada Research Chair in Health Services Research and by a Career Investigator award from the Heart and Stroke Foundation of Ontario. This study was also supported by the ICES, which is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care.

The opinions, results and conclusions reported in this article are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario Ministry of Health and Long-Term Care is intended or should be inferred.

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doi:10.1016/j.ajem.2009.03.010

1. Introduction

Acute myocardial infarction (AMI) remains a leading cause of mortality [1] despite a large amount of research that has produced numerous therapies known to increase survival [2-6]. Despite improvements in the last decade [7,8], performance on key AMI quality measures such as time to reperfusion still exceeds the recommended benchmark time in about half of all AMI patients [7-11]. Six million patients with chest pain are evaluated in American emergency departments (EDs) each year [12], and virtually all of them are subject to the process of ED triage when they first arrive, whereby a triage officer (usually a nurse) does a brief assessment to assign a triage score that may determine both when and where in the department the patient will be seen by an emergency physician. Previous population-based research revealed that approximately half of all patients who were ultimately diagnosed as having an AMI received a low acuity triage score, which was associated with delays in diagnostic tests and reperfusion therapy [13]. To establish further reductions in quality-of-care measures like reperfusion times, we need to refine and improve the ED triage process in AMI patients, a topic that has received relatively little research attention.

In Canada, virtually all EDs use the five-level Canadian Triage and Acuity Scale (CTAS) (Fig. 1) [14] to perform ED triage [15], whereas in the United States various triage tools, ranging from 3 to 5 levels, are used [16]. The use of a single triage tool afforded us the opportunity to look at predictors of triage score at a population-level. Based on previous work [17-28] we chose 10 potential predictors of low acuity ED triage in AMI patients for evaluation in this study. Our objective was to identify some of the factors that cause the triage process to fail in half of AMI patients [13]. We anticipate that knowledge of these factors will facilitate improved ED triage and, subsequently, quality-of-care measures in AMI patients. Our hypothesis was that the following potential predictor variables would be independently associated with low acuity triage: younger age, female sex, a low number of comorbidities, ambulatory arrival mode, low socioeconomic status (SES), low ED AMI volumes, overnight arrival, weekend arrival, hospital type, and no department use of triage ECGs.

2. Methods

2.1. Study design

This retrospective cohort study linked a population-based sample of AMI patients to an administrative database of all ED records in the province of Ontario, Canada, from July 2000 to March 2001, the period when the 2 databases overlapped. We obtained ethics approval from the Institute for Clinical Evaluative Sciences (ICES).

2.2. Data sources

The Enhanced Feedback for Effective Cardiac Treatment (EFFECT) study contains a population-based sample of AMI patients from the province of Ontario. It has been described in detail elsewhere [29,30]. Briefly, it includes clinical data

Triage Score	Recommended Time to Physician	Example Presentation	Sentinal Diagnosis
1	Immediate	▪ Code arrest ▪ Major shock ▪ Altered mental state	○ ***AMI with complications*** ○ Facial burns with airway compromise ○ Status epilepticus
2	15 minutes	▪ Nontraumatic visceral chest pain ▪ Fever in a child, with lethargy ▪ Overdose	○ ***AMI***, unstable angina or CHF ○ Anaphylaxis
3	30 minutes	▪ Chest pain - no visceral symptoms (sharp or MSK, no previous heart disease) ▪ Mild-moderate asthma exacerbation ▪ GI bleed, no active bleeding	○ ***Unspecified chest pain NOS (MSK, GI, respiratory)*** ○ Tibia or fibula fracture ○ Pneumonia
4	60 minutes	▪ Chest pain, minor trauma or MSK injury: no distress ▪ Vomiting &/or diarrhea, age >2, no dehydration ▪ Chronic back pain	○ ***Chest pain not-otherwise-specified (MSK, GI, respiratory)*** ○ Otitis media ○ Gastroesophageal reflux
5	120 minutes	▪ Abrasion/contusion ▪ Sore throat, no respiratory compromise ▪ Overuse syndrome (tendonitis)	○ Constipation ○ laceration

AMI: acute myocardial infarction; CHF: congestive heart failure; MSK: musculoskeletal; NOS: not otherwise specified; GI: gastrointestinal

Fig. 1 The CTAS, example of presentations and sentinel diagnoses by score.

from retrospective chart reviews of 11 510 AMI patients discharged from 102 acute care hospitals in Ontario from April 1999 to March 2001. All but one of the 85 eligible hospital corporations in Ontario that treated 30 or more AMI patients per year agreed to participate. Chart reviews were performed by trained nurse abstractors on a random sample of 125 AMI patients per hospital (or all AMI patients at that hospital if there was less than 125), according to prespecified chart review rules. Interrater reliability demonstrated high reliability for all of the indicators assessed by EFFECT.

The National Ambulatory Care Reporting System (NACRS) began in April 2000 and is an administrative database that contains abstracted data on *all* ED patient visits in Ontario, Canada. The AMI patients in EFFECT were linked to the ED visit that prompted the admission via the unique encrypted Ontario health care number for that patient. Because reporting of ED visits in NACRS only began in 2000 and became mandatory by 2002, participation in NACRS by all Ontario hospitals was not complete until 2002 because of technical and implementation delays at some sites. During our study period, 87 (85%) of the 102 acute care hospitals in EFFECT were participating in NACRS, resulting in 26.7% of EFFECT patients who were not able to be linked (this was the sole reason that these subjects were missing).

The CTAS implementation guidelines were published in 1998 and were disseminated over the next several years by the training of educators from each Ontario ED. These educators in turn taught CTAS to the nursing staff at their hospitals, usually with a course that was suggested to be 8 hours in length, but this could vary according to site resources. CTAS training could also take the form of a self-learning package, a Web-based package/CD, or video- or teleconference [15]. In a 2005 report on triage training in Ontario, it was noted that although most hospitals reported median percentages of triage nurses trained in adult CTAS of between 90% and 100%, some hospitals reported medians in the low 60% range [15], indicating that even in 2005 (and likely today), not all triage nurses were CTAS trained. New triage nurses are trained by the site educator as necessary: this continues today as it did during the study period.

Data on the use of triage ECGs were provided by the emergency department (ED) Structures and Services Questionnaire, a 7-page survey sent to all Ontario ED directors in 2004 on various resources and techniques used in their EDs (data kept at the ICES).

2.3. Selection of participants

The inclusion and exclusion criteria of EFFECT are described in detail elsewhere [31]. Briefly, EFFECT includes Ontario residents between the ages of 20 and 105 with a valid Ontario Health Care number who were admitted to an acute care hospital with a most responsible diagnosis of AMI. The discharge (final) diagnosis of AMI was confirmed using the European Society of Cardiology/American College of Cardiology clinical criteria of AMI, which include presence of any two of the following: ECG changes, symptoms, and positive cardiac markers [32]. Patients were excluded if the AMI was an in-hospital complication or if initial therapy was percutaneous coronary intervention (PCI). Patients who were transferred to a second site were counted only once based on their first admission.

2.4. Outcome measures

Ten potential predictor variables of interest were defined a priori: 5 patient-level and 5 hospital-level characteristics. Patient-level predictors were (1) age, (2) sex, (3) number of comorbidities, (4) arrival mode, and (5) SES. Hospital-level predictors included (1) time of day, (2) day of week, (3) ED AMI volumes, (4) hospital type, and (5) ED use of triage ECGs. Cardiac comorbidities were counted as a continuous variable out of 7 and included diabetes mellitus, hypertension, smoking, hypercholesterolemia, coronary artery disease, previous PCI or cardiac bypass graft, and congestive heart failure. Mode of arrival was either by ambulance or ambulatory, and SES was defined as neighborhood-level median household income from census data (based on postal code) and categorized in quintiles. Day of week was dichotomized as either weekday or weekend, and time of day was analyzed in 4-hour increments, starting at 08:01. The yearly ED AMI volumes were categorized as follows: less than 50 (very low), 51 to 100 (low), 101 to 200 (moderate), 201 to 300 (high), and above 300 (very high). Hospital type was teaching or not.

2.5. Data analysis

The independent effect of each of the 10 predictor variables on low acuity triage was assessed using logistic regression modeling [33]. The dependent variable of low acuity triage was defined as a CTAS score of 3, 4, or 5 (corresponding to urgent, less urgent, and non-urgent, respectively) as CTAS stipulates that patients who could be experiencing an AMI should receive a CTAS score of 1 or 2 (corresponding to resuscitation or emergent, respectively) [14]. The primary analysis included the entire AMI cohort, as all patients who are ultimately found to be having an AMI should be given a high priority triage score, according to CTAS guidelines [14]. We also performed a secondary analysis on ST-elevation myocardial infarction (STEMI) patients alone, as evidence demonstrating a mortality benefit to AMI therapy given minutes earlier is largely limited to the STEMI group. Nine additional potential confounders were included in the model as covariates: blood pressure, heart rate, respiratory rate, presence of chest pain, presence of shortness of breath, presenting cardiac arrest or shock, presenting in pulmonary edema, number of outpatient cardiac medications out of 7, and presence of a catheterization laboratory on site. Vital signs were included as continuous variables, as was the number of cardiac medications the patient was taking in the 2 weeks before ED arrival, out of a possible 7: aspirin, β-blockers, ACE inhibitors, statins, angiotensin receptor blockers, nitroglyerin, and clopidogrel. Parameter estimates were presented per comorbidity (ie, if the patient had 4 comorbidities, the parameter estimate was a multiple of 4). Other covariates were binary, including presenting with cardiac arrest or shock (defined as occurring in the 6 hours before or 10 minutes after arrival in the ED, as documented by a physician). Generalized Estimating Equations were used in all models to account for clustering of the data by hospital site. We tested for an age and sex interaction and examined both collinearity and goodness-of-fit characteristics.

Because 26.7% of the original EFFECT cohort (n = 4210) could not be linked to NACRS (because some hospitals did not submit data until NACRS became mandatory in 2002), several analyses were performed to assess whether study patients were systematically different from those excluded. In a univariate analysis, subjects were compared with those who were not captured on 6 characteristics selected a priori: age, sex, door-to-ECG time, mortality at 30 days, hospital length of stay, and Global Registry of Acute Coronary Events score [34]. Next logistic regression modeling was used to determine if receipt of a triage score could be predicted, using the same list of covariates from the predictor regression model, as well as Global Registry of Acute Coronary Events score and presence of STEMI. All analyses were performed with SAS software (Version 9.1, SAS Institute Inc, Cary, NC).

Table 1 Baseline characteristics of the study cohort by type of AMI

Characteristic		STEMI patients (n = 1418), n (%)	NSTEMI patients (n = 1563), n (%)
CTAS triage score, n (%)	I	80 (5.6)	52 (3.3)
	II	723 (51.0)	629 (40.2)
	III	526 (37.1)	759 (48.6)
	IV	68 (4.8)	83 (5.3)
	V	21 (1.5)	40 (2.6)
Mean age ± SD		65.2 ± 14.2	69.4 ± 13.6
Male, n (%) (3 patients with missing data)		941 (66.4)	991 (63.4)
Income quintile, n (%)	Quintile 1	298 (21.6)	339 (22.5)
(102 patients missing data)	Quintile 2	316 (22.9)	320 (21.3)
	Quintile 3	274 (19.9)	298 (19.8)
	Quintile 4	257 (18.6)	264 (17.6)
	Quintile 5	234 (17.0)	283 (18.8)
Medical history			
≥1 risk factor(s)*, n (%)		1164 (82.1)	1275 (81.6)
≥2 risk factor(s) *, n (%)		588 (41.5)	664 (42.5)
ED visit details			
Arrival by ambulance, n (%)		629 (44.4)	654 (41.8)
Time of day, n (%)	Morning (08:01	632 (44.6)	673 (43.0)
	Evening (16:01	445 (31.4)	531 (34.0)
	Night (00:01-08:00)	341 (24.0)	359 (23.0)
Day of week, n (%)	Sunday	210 (14.8)	246 (15.8)
	Monday	220 (15.5)	260 (16.6)
	Tuesday	205 (14.5)	210 (13.4)
	Wednesday	190 (13.4)	214 (13.7)
	Thursday	200 (14.1)	216 (13.8)
	Friday	190 (13.4)	219 (14.0)
	Saturday	203 (14.3)	198 (12.7)
Hospital-level characteristics			
Hospital type, n (%)	Teaching (7 sites)	142 (10.0)	149 (9.5)
	Community (69 sites)	1188 (83.8)	1312 (84.0)
	Small (11 sites)	88 (6.2)	102 (6.5)
ED AMI volume, n (%)	Very Low (7 sites)	48 (3.4)	62 (4.0)
	Low (17 sites)	228 (16.1)	186 (11.9)
	Moderate (14 sites)	229 (16.1)	255 (16.3)
	High (14 sites)	234 (16.5)	251 (16.0)
	Very high (35 sites)	679 (47.9)	809 (51.8)

107 patients missing (AMI type not classified).
NSTEMI indicates non–ST-elevation myocardial infarction.
* Diabetes mellitus, hypertension, smoker, dyslipidemia.

3. Results

The EFFECT AMI patients were able to be linked to ED visits for 3088 (73.3%) of the 4210 patients that were in EFFECT during the study period. Baseline characteristics of the study cohort are provided in Table 1. Of the 3088 AMI patients, 1552 (50.3%) were assigned a low acuity triage score. Of the cohort, 47.6% had criteria for a STEMI, of whom 43.4% were assigned a low acuity triage score. The 30-day mortality rate for the entire cohort was 12.1%, consistent with other large studies of AMI patients [17,18].

Table 2 provides the results of the logistic regression analysis in all AMI patients (n = 3088). Of the 10 potential predictors of interest, the significant independent predictors of appropriate triage were, in order of decreasing effect, being seen at a hospital with high ED AMI volumes (relative to a centre with very low ED AMI volumes), arrival by ambulance, male sex, and a greater number of cardiac comorbidities. Older age had an odds ratio (OR) with a confidence interval that included 1.0 but was statistically significant when more decimal places were included. Income quintile, arrival time of day and day or week, hospital type, and department use of triage ECGs were not significant predictors of triage.

The results were similar when performed in STEMI patients only, although several variables were no longer statistically significant due to a smaller sample size. The OR for age was unchanged but it was no longer statistically significant, male sex remained protective against a low acuity triage score (OR, 0.72), and the odds of receiving a low acuity triage score were 0.96 per comorbidity (also no longer statistically significant), similar to the OR of 0.92 in the whole AMI cohort. Arrival by ambulance was protective against a low acuity triage score (OR, 0.55), as was being seen at a centre with very high ED AMI volumes (OR, 0.68, but no longer statistically significant). Similarly, the model covariates were comparable to those in the whole AMI cohort but some were no longer statistically significant.

In the univariate analysis comparing the study cohort to the 26.7% who could not be linked to NACRS, there was no difference between the groups. Logistic regression modeling revealed a *c*-statistic (the model's ability to discriminate between patients who did and did not receive a triage score) of 0.54, similar to chance. We concluded that there was no evidence of selection bias in our cohort.

4. Discussion

Low-priority triage, which occurs to half of all AMI patients when they arrive in the ED [13], may occur secondary to one of three general causes: a flaw in the triage system itself, inappropriate assignment of scores by the

Table 2 Predictors of low acuity triage (CTAS score of 3, 4, or 5) in logistic regression model of 3088 acute myocardial infarction patients

Potential predictor variables		Parameter estimate	Odds Ratio	95% Confidence intervals	*P*
1. Age		0.01	**1.01**	**1.00-1.01**	**.023**
2. Male		−0.22	**0.80**	**0.69-0.93**	**.003**
3. Income quintile:	2	−0.08	0.92	0.72-1.17	.49
	3	0.08	1.08	0.87-1.34	.48
	4	0.00	1.00	0.80-1.26	.98
	5	0.04	1.04	0.79-1.36	.79
4. Number of comorbidities * (/7)		−0.08	**0.92**	**0.86-0.98**	**.012**
5. Arrived by ambulance		−0.51	**0.60**	**0.52-0.70**	**<.0001**
6. Arrival time of day:	12:01-16:00	−0.11	0.90	0.73-1.10	.30
	16:01-20:00	−0.03	0.97	0.76-1.23	.78
	20:01-00:00	−0.07	0.93	0.75-1.16	.53
	00:01-04:00	−0.19	0.83	0.63-1.08	.16
	04:01-08:00	−0.23	0.80	0.60-1.06	.12
7. Day of week: weekend		0.02	1.02	0.89-1.18	.77
8. ED AMI Volume:	Low (50-99/year)	−0.31	0.74	0.41-1.31	.30
	Moderate (100-199)	−0.24	0.79	0.40-1.55	.49
	High (200-299)	−0.35	0.71	0.35-1.44	.34
	Very high (≥300)	−0.82	**0.44**	**0.26-0.74**	**.002**
9. Hospital type (teaching)		0.26	1.30	0.67-2.53	.45
10. Use of triage ECGs		−0.02	0.98	0.69-1.39	.91

Boldface indicates statistical significance.

* Comorbidities included (1) diabetes mellitus, (2) hypertension, (3) smoking, (4) hypercholesterolemia, (5) coronary artery disease, (6) previous percutaneous coronary intervention or cardiac bypass graft, and (7) congestive heart failure.

triage officer, or simply from the inherent difficulty in identifying an AMI patient, particularly on very limited clinical information. In this study, we identified several specific factors that are associated with low priority ED triage in AMI patients, factors which may stem from all three of these etiologies. We found that centres with very high ED AMI volumes (more than 300 AMI patients seen per year) were less likely to assign low acuity triage scores to their AMI patients than at sites that saw very few AMI patients. Presumably, this is because staff at these centers have more experience with AMI patients, which suggests that part of inappropriate triage is due to errors in the assignment of scores. More importantly, it suggests that triage of these patients can be improved with experience, rather than being solely an inherent difficulty in recognizing the signs and symptoms of these patients. The AMI volume association mirrors findings in many other areas (including a variety of surgeries and cardiovascular procedures) that show an association between higher patient volumes and better outcomes [35-39]. While EDs cannot redirect chest pain patients to higher AMI volume sites, we could consider cross-training triage nurses from smaller centres at high volume centers.

Not surprisingly, some predictors of low ED triage were the same as those that predict a higher likelihood of being discharged home with a missed AMI after a full ED evaluation [18], and with delays to thrombolysis, such as female sex [22,25,40]. This may be secondary to atypical clinical presentations among females [17,41], and the same factor may also explain why older age was associated with low acuity triage, in contrast to our a priori hypothesis. The effect was small, with an OR of 1.07 for every 10 year increase in age. Both older age and female sex highlight the inherent difficulty in recognizing an AMI patient with atypical symptomatology, and although standardized, AMI-specific training of triage nurses may improve recognition of such atypical patients during the triage process, these presentations suggest that gains in appropriate triage of these patients has a ceiling, after which it cannot be further improved.

Ambulatory arrival was also a significant predictor of low triage, consistent with previous research that shows shorter door-to-needle times for patients who arrive by ambulance [20-22]. Unfortunately, previous efforts to improve the proportion of AMI patients who call for an ambulance have not been successful [42-44]. The suggestion of illness severity when a patient arrives by ambulance clearly influences the triage assessment. We are unaware of any studies on the number of patient comorbidities and either missed AMIs or delays to treatment; we found that as a patient's number of comorbidities increases, he or she is less likely to be mistriaged, probably because the triage nurse is less likely to give a low acuity score to a patient with multiple related health problems.

It was reassuring to find that several potential predictor variables that should be unrelated to triage, such as time of day, day of week, and income quintile, did not affect an AMI patient's triage score. In a previous study, time of day and day of week affected door-to-balloon time but not door-to-needle times [19]; it likely does not affect ED triage for similar reasons, namely, the staff required for the task of triage are all in-house regardless of the day of week or time of day. A recent study of SES and 2-year mortality found that the inverse relationship between income and mortality was greatly attenuated once adjustment was made for age and other risk factors [45]. Our study accounted for a large number of covariates, which could explain why we did not find an association between income and triage. Alternatively, it is quite possible that wealth does not affect triage, which consists of a very brief interaction upon arrival in the ED, regardless of its effects on later areas of AMI management. Lastly, the universal Canadian health care system may have mitigated the effects of SES: the results could be different in an American cohort.

After controlling for ED volume, being seen at a nonteaching site did not predict low triage, in contrast to our hypothesis. In a previous study conducted in 1990, urban teaching sites were associated with faster door-to-needle times [26]. Our finding could be related to increased ED crowding at teaching centres [46], which may lead to some "down-triage" of AMI patients or giving lower acuity scores according to when patients *can* be seen instead of when they *should* be seen, as was noted in a previous report on ED triage [15]. Although we accounted for time of day and day of week, we did not specifically account for ED crowding. As well, our study lost some teaching hospitals from analysis because they did not participate in NACRS in 2000/01, so it is possible that our finding on teaching hospitals is biased.

We did not find an association between low-acuity triage and triage ECGs, which is disappointing given that an ECG performed during the triage assessment is one solution to shorten door-to-ECG times and, presumably, time to reperfusion as well [47]. We did not collect data on whether the ECGs were shown to a physician; this is one possible explanation why triage ECGs did not affect the triage score. A previous study looked at triage ECGs by hospital and had a similar finding: hospitals that had a dedicated space in the ED for immediate ECG, and dedicated ECG technicians always on site, did not have significantly shorter median door-to-balloon times [48].

Based on the results of this study, to improve ED triage, triage nurses need to be selective and identify who among the women and older patients may be experiencing an AMI. Although it is difficult for health care professionals to recognize certain AMI patients, efforts at improving ED triage training, which is not standardized after the initial eight hour training session [43], may result in some improvement in ED triage sensitivity and specificity; future studies could assess the effectiveness of improved training. Cross-training at high-volume AMI centres would strengthen the principles learned in standardized training, as well as address gaps in the training. A heightened awareness of the atypical AMI patient, such as females, ambulatory patients, and older patients, may improve ED triage accuracy, particularly if this was combined with triage ECGs and expected symptom "clusters" in atypical patients such as females and the elderly. Computerized triage or "e-triage" [49] could guide the identification of acute coronary syndrome (ACS) in atypical symptom groups by asking about chest pain-equivalent symptoms, such as weakness in the elderly, and by the use of second-order modifiers [50]. This represents a change to the triage system itself. Future studies could use factor analysis to identify symptom clusters in certain AMI patients with atypical presenting symptoms, such as elderly or diabetic patients, which might improve triage if incorporated into a standardized triage training process and e-triage.

4.1. Limitations

In this study, we included only admitted AMI patients. It would be helpful to analyze the characteristics of AMI patients who not only received a low priority triage score but were missed entirely during their ED visit, although this is only about 2% [18] to 5% [51] of AMI patients. Another limitation was retrospective data collection, with some of the inherent limitations of chart review. However, rigorous training of nurse chart abstractors, standardized data collection instruments, and evaluation of interrater reliability should limit possible bias [52]. We did not collect triage nurse experience or the specific training format they used to learn CTAS, nor did we collect information on patient race, both of which could potentially affect triage assignment; this should be assessed in future studies. As well, we did not attempt to determine accuracy of triage in all patients with potential cardiac ischemia, as our study cohort included only AMI patients; we focused only on triage scores given to AMI patients. A future study could assess the proportion of potential ACS patients who receive high acuity triage scores and who are not found to have ACS, as well as their predictor characteristics, to provide a full picture of triage in potential ACS patients.

Patients were excluded from this study if initial therapy was PCI because there were relatively few patients (n = 48) who underwent primary PCI in EFFECT [29,30]. However, regardless of the reperfusion modality, the ED steps preceding it are the same, including triage and acquisition of an ECG. Patients who present to a site that performs PCI are unlikely to look substantially different at triage than those who present to a centre without PCI capability; thus, we believe the results of this study likely apply to AMI patients who receive PCI as well.

The data in our study is from 2000/01 and CTAS training in Ontario may have improved in terms of dissemination since the guidelines were released in 1998 [14], but training was in place then as it is now (and some triage nurses still do not have CTAS training) [15] so is unlikely to have changed enough to alter our results.

5. Conclusions

ED patients who are ultimately determined to be experiencing an AMI are more likely to receive an inappropriately low acuity triage score if they present at a hospital with low ED AMI volumes, if they are elderly, female, have few comorbidities, or do not arrive by ambulance. These results provide some opportunity to decrease the frequency of inappropriate triage that occurs in half of these patients when they first arrive at an ED and, subsequently, to decrease the associated delays in diagnosis and treatment of these high-risk patients.

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