EM Advances

Sex differences in clinical presentation, management and outcome in emergency department patients with chest pain

Erik P. Hess, MD, MSc;[*] Jeffrey J. Perry, MD, MSc;[†‡] Lisa A. Calder, MD, MSc;[†‡] Venkatesh Thiruganasambandamoorthy, MD;[†‡] Veronique L. Roger, MD, MPH;[§] George A. Wells, PhD;[‡] Ian G. Stiell, MD, MSc[†‡]

ABSTRACT

Objective: We sought to assess sex differences in clinical presentation, management and outcome in emergency department (ED) patients with chest pain, and to measure the association between female sex and coronary angiography within 30 days.

Methods: We conducted a prospective cohort study in an urban academic ED between Jul. 1, 2007, and Apr. 1, 2008. We enrolled patients over 24 years of age with chest pain and possible acute coronary syndrome (ACS).

Results: Among the 970 included patients, 386 (39.8%) were female. Compared with men, women had a lower prevalence of known coronary artery disease (21.0% v. 34.2%, $p < 0.001$) and a lower frequency of typical pain (37.1% v. 45.7%, $p = 0.01$). Clinicians classified a greater proportion of women as having a low (< 10%) pretest probability for ACS (85.0% v. 76.4%, $p = 0.001$). Despite similar rates of electrocardiography, troponin T and stress testing between sexes, there was a lower rate of acute myocardial infarction (AMI) (4.7% v. 8.4%, $p = 0.03$) and positive stress test results (4.4% v. 7.9%, $p = 0.03$) in women. Women were less frequently referred for coronary angiography (9.3% v. 18.9%, $p < 0.001$). The adjusted association between female sex and coronary angiography was not significant (odds ratio 0.63, 95% confidence interval 0.37–1.10).

Conclusion: Women had a lower rate of AMI and a lower rate of positive stress test results despite similar rates of testing between sexes. Although women were less frequently referred for coronary angiography, these data suggest that sex differences in management were likely appropriate for the probability of disease.

Keywords: sex differences, acute coronary syndrome, myocardial infarction, unstable angina, diagnosis

RÉSUMÉ

Objectif : Nous avons cherché à évaluer les différences entre les sexes dans la présentation clinique, la prise en charge et les résultats chez des patients se présentant à l'urgence avec des douleurs thoraciques et à mesurer le lien (corrélation) entre le sexe féminin et la coronarographie dans les 30 jours.

Méthodes : Nous avons réalisé une étude de cohorte prospective dans l'urgence d'un centre hospitalier universitaire urbain entre le 1 juillet 2007 et 1 avril 2008. Nous avons recruté des patients de plus de 24 ans souffrant de douleurs thoraciques et probablement d'un syndrome coronarien aigu (SCA).

Résultats : Parmi les 970 patients inclus dans l'étude, 386 (39,8 %) étaient des femmes. Comparativement aux hommes, les femmes avaient une prévalence plus faible de coronaropathie connue (21,0 % c. 34,2 %, $p < 0,001$) et une fréquence inférieure de douleurs typiques (37,1 % c. 45,7 %, $p = 0,01$). Les cliniciens ont accordé une probabilité pré-test faible (< 10 %) de SCA à un pourcentage plus élevé de femmes que d'hommes (85,0 % c. 76,4 %, $p = 0,001$). Malgré des taux similaires d'électrocardiographie, de troponine T et des résultats semblables à l'épreuve d'effort cardio-respiratoire pour les deux sexes, ils ont noté un taux plus faible d'infarctus aigu du myocarde (IAM) (4,7 % c. 8,4 %, $p = 0,03$) et de résultats positifs à l'épreuve d'effort cardio-respiratoire (4,4 % c. 7,9 %, $p = 0,03$) chez les femmes. Elles étaient référées moins souvent pour une coronarographie (9,3 % c. 18,9 %, $p < 0,001$). L'association ajustée entre les femmes et la coronarographie n'était pas significative (risque relatif approché de 0,63, intervalle de confiance à 95 %, de 0,37 à 1,10).

Conclusion : Les femmes affichaient un taux plus faible d'IAM et de résultats positifs à l'épreuve d'effort cardio-respiratoire, malgré des taux similaires de tests réalisés auprès des deux sexes. Les femmes étaient référées moins souvent pour une coronarographie, mais les données suggèrent que les différences attribuables au sexe au regard de la prise en charge étaient probablement appropriées compte tenu de la probabilité de maladie.

From the *Department of Emergency Medicine, Division of Emergency Medicine Research, Mayo Clinic College of Medicine, Rochester, Minn., the Departments of †Emergency Medicine and ‡Epidemiology and Community Medicine, University of Ottawa, Ottawa, Ont., and the §Department of Internal Medicine, Division of Cardiology, Mayo Clinic College of Medicine, Rochester, Minn.

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INTRODUCTION

Chest pain is the second most common chief complaint in emergency departments (EDs) in North America, accounting for more than 6 million patient visits annually.[1] When evaluating a patient with acute chest pain, clinicians use readily available information obtained from the history, physical examination, electrocardiogram (ECG) and basic laboratory tests to identify noncardiac etiologies and determine the likelihood of acute coronary syndrome (ACS). Clinicians often base their decision on whether to pursue additional cardiac testing such as stress testing or coronary angiography on an unstructured assessment of the pretest probability of disease.

Previous studies have documented sex differences in the evaluation and management of acute chest pain. Other investigators have reported lower rates of cardiac catheterization in women, even after adjusting for baseline risk and other potential confounding factors.[2–5] Silbergleit and McNamara[6] reported lower rates of hospital admission in women with nontraumatic chest pain. Kaul and colleagues,[7] in a large administrative database study of more than 54 000 patients, reported that women presenting to the ED with ACS were less likely than men to be admitted and to undergo coronary revascularization. Despite receiving less aggressive management, women in this study had similar outcomes compared with men at 1 year.

Most prior studies on sex differences in ACS have been conducted in the inpatient setting or have used large administrative databases to assess potential sex differences in management and outcome. Relatively few ED-based studies have been published. We hypothesized that sex differences in clinical presentation and pretest probability for ACS would account for management differences in ED patients with chest pain.

METHODS

Study design and setting

We conducted a prospective cohort study enrolling consecutive eligible patients presenting with chest pain to the ED of a university-affiliated urban medical centre, with an annual ED census of 60 000 patient visits. The institution's research ethics board approved the study without the need for written informed consent. Patients provided verbal consent during a telephone interview conducted by a study nurse.

Population

We designed the study to include patients at low to moderate risk for ACS, whose care often poses the greatest diagnostic challenge for clinicians. The study population consisted of patients over 24 years of age who presented to the ED with a primary complaint of chest pain. Exclusion criteria were as follows: acute ST-segment elevation in at least 2 contiguous leads, hemodynamic instability or tachycardia (systolic blood pressure < 90 mm Hg; heart rate < 50 or > 100 beats/min), a history of cocaine use or positive test for cocaine, communication or language problems such that a reliable history could not be obtained, a clear traumatic etiology of pain, a terminal noncardiac illness or prior enrolment within 30 days.

Data collection

We identified variables to be collected based on literature review and consensus agreement from the investigation committee, comprised of the study authors. We designed standardized data collection forms to prospectively collect data on cardiac risk factors, cardiovascular history, characteristics of the chest pain history and physical examination, and outcomes according to standardized reporting guidelines for studies evaluating ED patients with potential ACS.[8] Before data collection began, the primary investigator trained physician assessors to ensure unambiguous interpretation of data collection forms and uniform collection of data. We conducted a 2-month run-in phase during which the data collection forms and variable definitions were refined as necessary.

On patient arrival, registration clerks or triage nurses attached a standardized data collection form to the ED record of treatment for all patients with chest pain. On-duty attending emergency physicians certified in emergency medicine or supervised emergency medicine residents assessed patient eligibility, completed data collection forms and ordered diagnostic investigations as appropriate. Physicians completed data collection forms immediately after patient evaluation and before ordering diagnostic investigations to ensure that assessment of the clinical variables was not biased by knowledge of the outcome. We specifically instructed physicians to assess patients' pretest probability for ACS after the ECG was performed but before obtaining the results of cardiac troponin T testing. Cardiac troponin T levels were measured on patients' arrival at the ED and 6 hours or

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longer after the onset of pain, with at least 4 hours between samples. We used the Elecsys troponin T assay by Roche Diagnostics. The 99th percentile of the reference range for this assay is less than 0.01 μg/L and the 10% coefficient of variation is 0.035 μg/L.

After patient discharge, a study nurse attached the ED record of treatment to the standardized data collection form along with a copy of the first interpretable ECG and results of laboratory testing, cardiac stress testing and coronary angiography, when available. The study nurse collected additional data from the medical record of eligible enrolled patients and recorded it on a designated case record form. To determine the number of eligible patients who were missed, a study nurse reviewed the log of ED patients for all visits with a primary complaint of chest pain, and completed a separate case record form for missed eligible patients. The primary investigator, unaware of both predictor variables and patient outcome, interpreted ECGs of all enrolled patients according to current standardized reporting guidelines.[8] We also reviewed the medical record for all patients starting at 1 month for the occurrence of outcomes. The electronic medical record at our institution contains information from both inpatient visits to the 4 major hospitals in our area and outpatient visits to clinics affiliated with the Ottawa Hospital. A study nurse conducted structured telephone follow-up 1 month from the ED visit for all enrolled patients to obtain information on any outcomes not documented in the medical record.

Outcome measures

We defined ACS as acute myocardial infarction (AMI), revascularization (percutaneous or surgical), death from cardiac or unknown cause, a new perfusion defect on radionuclide stress imaging, or a stenosis of 70% or greater in at least 1 of the major epicardial coronary arteries.[9,10] We included all outcomes that occurred after patient assessment, whether in the ED, in the hospital or after ED discharge.

We defined AMI as either of the following: a cardiac troponin T level of 0.01 μg/L or greater with a rising or falling pattern (defined as a change of ≥ 0.03 μg/L for values that were initially < 0.20 μg/L; for levels ≥ 0.20 μg/L, a positive cardiac troponin T was defined as a change of ≥ 20% between samples);[11,12] or development of pathologic Q waves on the ECG or ECG evolution consistent with AMI. We defined revascularization as re-establishment of coronary artery patency by percutaneous coronary intervention or coronary artery bypass graft surgery. We defined significant coronary disease as stenosis of 70% or greater in any of the major epicardial coronary arteries.[9]

All positive and 10% of randomly selected negative outcomes were confirmed by a second co-investigator blinded to the standardized data collection forms. Disagreements were resolved by consensus. If a consensus could not be reached between 2 co-investigators, a third co-investigator resolved discordances.

Statistical analysis

Univariate analysis techniques were used to determine the statistical significance of differences observed between men and women appropriate for the type of data: for nominal data, the χ^2 test with continuity correction; for ordinal variables, the Mann–Whitney *U* test; for continuous variables, the unpaired 2-tailed *t* test, using pooled or separate variance estimates, as appropriate. Receiver operating characteristic curve analysis was performed to determine the diagnostic accuracy of physicians' pretest probability assessment for ACS by sex. Multiple logistic regression was performed to measure the association between female sex and coronary angiography within 30 days while controlling for predetermined confounders. To ensure stability of the regression coefficients, the number of variables entered into the multiple logistic regression model was restricted to maintain an event-per-variable ratio of at least 10:1.[13] MedCalc version 10.4.0.0 (MedCalc Software) was used for receiver operating characteristic curve analysis and SAS software (SAS Institute, Inc.) version 9.1 TS Level 1M3 for all other analyses.

RESULTS

The total ED census from Jul. 1, 2007, to Apr. 1, 2008, was 45 874 patient visits. During this period, 1527 (3.3%) patients were assessed for eligibility (Fig. 1). Of the 1415 patients eligible for enrolment, physicians prospectively completed data collection forms for 1017 (71.9%). We were unable to contact 47 patients by telephone at 30 days; the remaining 970 (95.4%) patients were contacted and included in the final analysis. Baseline characteristics of patients eligible for inclusion who were enrolled and missed were similar in all respects (Table 1).

The mean age of the patients was 59.5 (standard deviation 13.8) years (Table 2). Compared with male patients, a lower proportion of female patients were admitted to

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the hospital, had a history of previous myocardial infarction or had known coronary artery disease.

A lower proportion of women described their pain as worse with exertion or similar to previously diagnosed ischemia (Table 3). Clinicians considered the chest pain syndrome to be typical for ACS less frequently in women. Physicians classified a greater proportion of women as having a low (< 10%) pretest probability for ACS.

Figure 2 shows the results of physicians' pretest probability assessments, by sex. On the whole, a greater proportion of women were classified in the lower pretest probability categories and a greater proportion of men were classified in the higher pretest probability categories.

Figure 3 shows the diagnostic accuracy of pretest probability assessments by sex. There was no significant difference in the area under the receiver operating characteristic curve (AUC) between women and men, respectively (AUC = 0.82, 95% confidence interval [CI] 0.76–0.83; AUC = 0.80, 95% CI 0.78–0.86; $p = 0.73$ for difference).

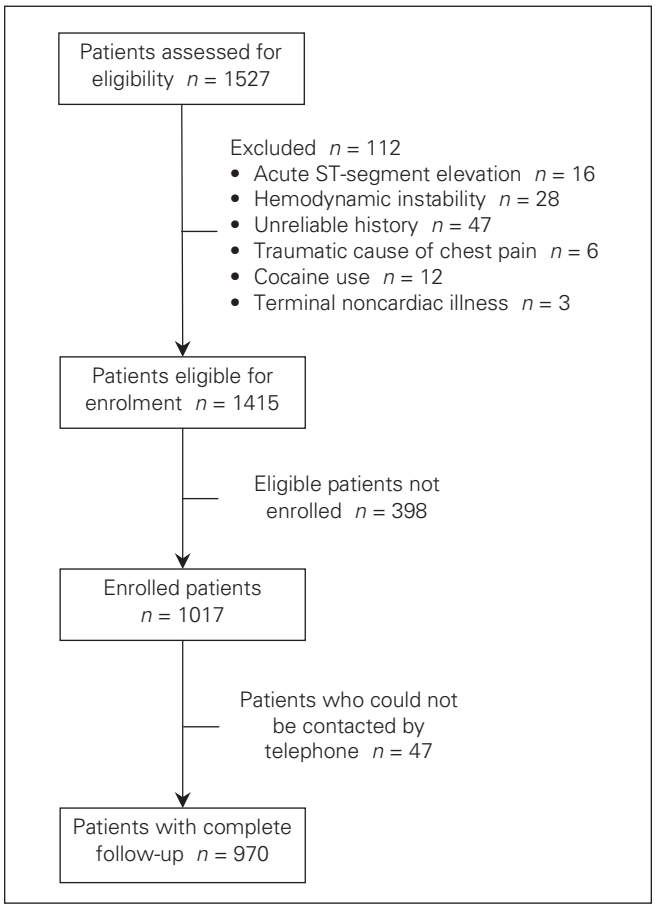

Fig. 1. Flow diagram of 9-month prospective cohort study of emergency department patients with chest pain.

Physicians referred similar proportions of men and women for cardiac stress testing (Table 4); however, a lower proportion of stress tests were positive for ischemia in women. Women were subsequently referred for coronary angiography less frequently and had a lower rate of significant coronary artery disease. Among those referred for coronary angiography, the rate of significant coronary disease (80.6% v. 81.8%, $p = 0.87$) and the rate of revascularization (58.3% v. 63.6%, $p = 0.57$) were similar between sexes. The rate of revascularization among those with significant coronary disease on angiography was also similar (72.4% v. 77.8%, $p = 0.55$). There was a lower rate of AMI and no deaths in women within 30 days of the ED visit.

The unadjusted odds ratio (OR) for coronary angiography in women was 0.44 (95% CI 0.30–0.66). After controlling for predetermined confounders (e.g., age, thrombolysis in myocardial infarction risk score, elevated cardiac troponin T level, new ischemic changes on ECG, total number of cardiac risk factors, pretest probability for ACS and typical pain), the association between female sex and coronary angiography was no longer significant (OR 0.63, 95% CI 0.37–1.10). Table 5 shows the ORs and respective 95% CIs for each predictor in the adjusted multiple logistic regression model.

DISCUSSION

In this prospective cohort study we observed that, compared with men, women had a lower prevalence of

Table 1. Characteristics of patients eligible for inclusion who were enrolled and missed

Characteristic	No. (%) of patients*	
	Enrolled, $n = 1017$†	Missed,‡ $n = 398$
Mean age (SD), yr	59.3 (13.8)	62.1 (12.9)
Range, yr	25–99	27–91
Male sex	616 (60.6)	238 (59.8)
Previous myocardial infarction	228 (22.4)	81 (20.1)
Known coronary artery disease	287 (28.2)	126 (31.7)
Congestive heart failure	39 (3.8)	14 (3.5)
Atrial fibrillation	53 (5.2)	18 (4.5)

SD = standard deviation.
*Unless otherwise indicated.
†Of the 1017 eligible enrolled patients, 47 (4.6%) could not be reached by telephone, leaving 970 patients in the final analysis. On review of the provincial coroner's database, none of the patients who could not be reached by telephone had a recorded death within 30 days of the emergency department visit.
‡Data were abstracted from the medical record for missed eligible patients. There were 3.8% of cases that were missing data regarding a history of atrial fibrillation. The remaining variables had missing rates less than 3.8%.

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known coronary artery disease and less frequently presented with typical chest pain. Physicians classified a greater proportion of women as having a low (< 10%) pretest probability for ACS. Despite similar rates of ECG, troponin T and stress testing between sexes, there was a lower rate of AMI and positive stress tests in women. Although a lower proportion of women were referred for coronary angiography, the adjusted association between female sex and coronary angiography was not significant. These data suggest that sex differences in clinical presentation and pretest probability likely account for the lower rate of coronary angiography in women and that care was appropriate for the probability of disease.

Our findings differ from another ED-based study in patients with potential ACS. Chang and coauthors[3] observed that men received more cardiac catheterizations and more stress tests than women, even after adjusting for potential confounding factors. We similarly found that men received more cardiac catheterizations then women; however, after adjusting for potential confounders, the association between female sex and coronary angiography was not significant. What are some potential explanations for these differences? One possibility is that our study collected data on physicians' assessment of pretest probability for ACS and adjusted for it in the multiple logistic regression model. It is also possible that socio-cultural differences between Ottawa, Ont., and Pittsburgh, Pa., may be associated with different patterns of the management of patient care. Finally, residual confounding may be present in both investigations. One potentially important confounder that was not assessed in either study was the impact of patient preference. It is possible that women, in concert with their

Table 2. Baseline characteristics of 970 emergency department patients with chest pain, by the total cohort and sex

	No. (%) of patients*			
Characteristic	Total cohort, *n* = 970	Female sex, *n* = 386	Male sex, *n* = 584	*p* value
Demographics				
Mean (SD) age, yr	59.5 (13.8)	61.0 (13.9)	58.5 (13.6)	0.006
Range	26–99	26–99	26–96	
Arrival by ambulance	195 (20.1)	96 (24.9)	99 (17.0)	0.003
Admitted to hospital	179 (18.5)	47 (12.2)	132 (22.6)	< 0.001
Cardiac risk factors				
Hypertension	493 (50.8)	209 (54.1)	284 (48.6)	0.09
Diabetes mellitus	171 (17.6)	68 (17.6)	103 (17.6)	0.99
Hypercholesterolemia	459 (47.3)	160 (41.5)	299 (51.2)	0.003
Family history of cardiac disease	330 (34.0)	147 (38.1)	183 (31.3)	0.03
History of smoking	583 (60.1)	193 (50.0)	390 (66.8)	< 0.001
Cardiovascular history				
Previous myocardial infarction	222 (22.9)	55 (14.2)	167 (28.6)	< 0.001
Angina (chest pain on exertion)	200 (20.6)	74 (19.2)	126 (21.6)	0.36
Known coronary artery disease	281 (29.0)	81 (21.0)	200 (34.2)	< 0.001
Congestive heart failure	39 (4.0)	13 (3.4)	26 (4.5)	0.40
Atrial fibrillation	51 (5.3)	23 (6.0)	28 (4.8)	0.43
ECG — specific findings				
ST-segment depression > 0.5 mm	34 (3.5)	11 (2.9)	23 (3.9)	0.37
T-wave inversion	60 (6.2)	20 (5.2)	40 (6.9)	0.29
Left bundle branch block	38 (3.9)	10 (2.6)	28 (4.8)	0.08
Right bundle branch block	33 (3.4)	12 (3.1)	21 (3.6)	0.70
Q waves	128 (13.2)	44 (11.4)	84 (14.4)	0.18
ECG — overall interpretation				0.26
Normal	258 (26.6)	111 (28.8)	147 (25.2)	
Nonspecific ST-segment changes	309 (31.9)	126 (32.6)	183 (31.3)	
Abnormal not diagnostic	232 (23.9)	93 (24.1)	139 (23.8)	
Ischemia known to be old	101 (10.4)	35 (9.1)	66 (11.3)	
Ischemia not known to be old	70 (7.2)	21 (5.4)	49 (8.4)	

ECG = electrocardiogram; SD = standard deviation.
*Unless otherwise indicated.

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physicians, less frequently opted for coronary angiography. As neither study collected data on patient preference, the degree to which this may have influenced results is uncertain.

Another study on ED patients reported findings consistent with our observations. Kaul and colleagues[7] collected data on 54 134 ED patients in Alberta. These investigators identified ED patients admitted for AMI, unstable angina, stable angina and chest pain by merging data from 2 large databases in Alberta — the Ambulatory Care Classification System database and a hospital discharge database.[5] They observed that women with each diagnosis were less likely than men to undergo revascularization within 1 year. In addition, these management differences were not associated with sex differences in mortality at 1 year, suggesting that the lower rates of investigation and intervention in women did not result in worse outcomes.

Other studies that explore sex differences in clinical presentation in patients with ACS may put our observations in perspective. In their systematic review of studies comparing symptoms of ACS in men and women, Patel and coauthors[14] found that women with ACS more frequently experienced back, jaw and neck pain, nausea and/or vomiting, dyspnea, palpitations and dizziness, whereas men more frequently presented with chest pain and diaphoresis. Similarly, Milner and colleagues[15] in their study of 2073 patients admitted to hospital for AMI found that women were less likely than men to have a chief complaint of chest pain associated with

Table 3. Characteristics of chest pain history and physical examination for 970 emergency department patients with chest pain, by sex

Characteristic	No. (%) of patients*		*p* value
	Female sex, *n* = 386	Male sex, *n* = 584	
Mean (SD) duration of chest pain, h	6.4 (2.8)	5.9 (3.0)	0.048
Pain present on ED arrival	244 (63.4)	370 (63.4)	0.97
Pain resolved before evaluation	203 (53.3)	335 (58.0)	0.15
Pain worse with exertion	99 (25.7)	188 (32.3)	0.07
Pain similar to previously diagnosed ischemia	69 (17.9)	151 (26.0)	0.001
Location of pain on chest†			
Centre	252 (65.5)	328 (56.3)	0.004
Left anterior	116 (30.1)	226 (38.8)	0.006
Left lateral	24 (6.2)	43 (7.4)	0.49
Right anterior	23 (6.0)	26 (4.5)	0.29
Right lateral	6 (1.6)	8 (1.4)	0.81
Pain description†			
Pressure/squeezing	202 (52.6)	278 (47.9)	0.15
Heavy	77 (20.1)	101 (17.4)	0.30
Sharp	70 (18.2)	120 (20.7)	0.35
Indigestion/burning quality	31 (8.1)	71 (12.2)	0.04
Radiation†			
Right arm/shoulder	16 (4.2)	19 (3.3)	0.48
Left arm/shoulder	124 (32.1)	157 (27.0)	0.09
Both arms/shoulders	30 (5.2)	26 (6.7)	0.31
Neck/jaw	72 (18.9)	74 (12.7)	0.01
Back	68 (17.6)	58 (10.0)	< 0.001
Associated symptoms†			
Nausea or vomiting	108 (28.1)	107 (18.4)	< 0.001
Shortness of breath	156 (40.5)	217 (37.3)	0.31
Diaphoresis	64 (16.6)	148 (25.4)	0.001
Chest wall tenderness (reproducing presenting symptom)	64 (16.9)	59 (10.3)	0.003
Pain typical for acute coronary syndrome	143 (37.1)	266 (45.7)	0.008
Pretest probability < 10%	328 (85.0)	446 (76.4)	0.001

ED = emergency department; SD = standard deviation.
*Unless otherwise indicated.
†Some patients reported pain in more than 1 location, used more than 1 descriptor for the pain, reported radiation of the pain to more than 1 location and reported 1 or more associated symptoms.

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their AMI. As most patients present to the ED with a primary symptom or complaint *before* diagnosis, much of ED-based research is based on chief complaints. In our study and another recent ED-based study[3] patients with a primary complaint of chest pain were enrolled. If women with ACS are less likely to present with chest pain, it would therefore not be unexpected to observe a lower rate of ACS in our cohort. In this context, our study is consistent with other literature that suggests women with ACS present differently than men.[16,17] However, among those who present with chest pain, women may have a lower rate of ACS.

One may question whether our observations were potentially influenced by workup or verification bias (e.g., women who underwent less intensive investigation before ED presentation were considered to have a lower pretest probability for ACS by emergency physicians, underwent less intensive investigation and were therefore less frequently diagnosed with ACS). Although we considered this possibility, this explanation does not appear to be consistent with our observations. In our cohort ECGs were obtained in 100% of patients and cardiac troponin T levels in 99%. This suggests that the workup for AMI was not biased between sexes. In addition, similar proportions of men and women were referred for cardiac stress testing, and stress tests were less frequently positive for ischemia in women. Of those who were referred for angiography, there was a similar rate of significant coronary artery disease between sexes, and we observed no significant sex differences in revascularization among those diagnosed with significant coronary disease. These observations suggest that differences in the probability of ACS are a more likely explanation for management differences than bias.

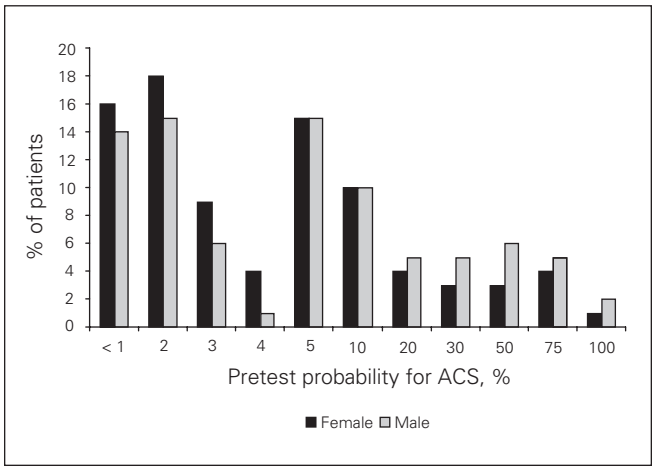

Fig. 2. Physicians' assessment of pretest probability for acute coronary syndrome (ACS), by sex.

Limitations

Our study had several limitations. We only included patients who presented with chest pain. Patients at risk for ACS who presented with non–chest pain syndromes such as shortness of breath, nausea, back pain, palpitations or generalized fatigue were not included. This limits the generalizability of these findings to those patients who present to the ED with a presenting symptom of chest pain. The patient sample was recruited from a single Canadian ED and findings may vary in

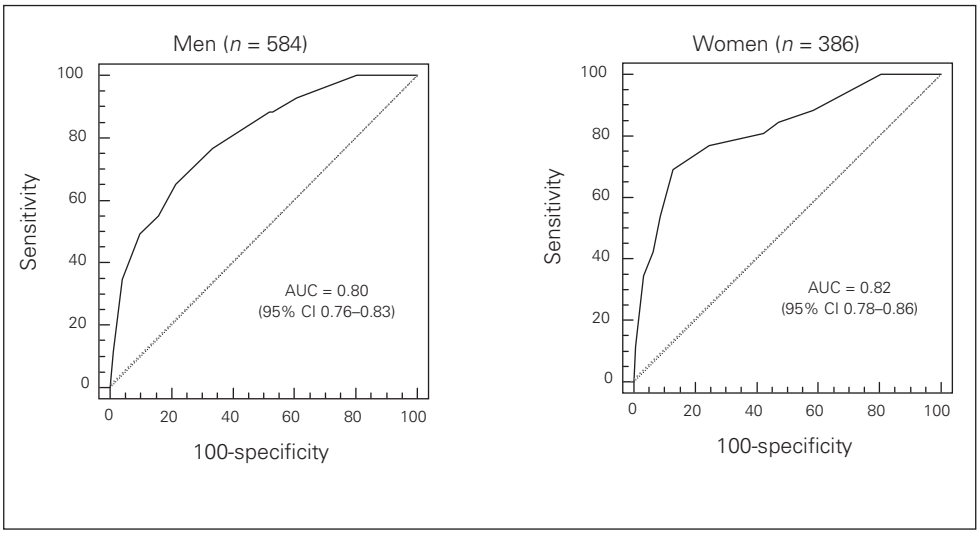

Fig. 3. Diagnostic accuracy of clinicians' pretest probability assessment for acute coronary syndrome by sex ($p = 0.73$ for difference). AUC = area under the receiver operating characteristic curve; CI = confidence interval.

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Table 4. Management and outcomes for 970 emergency department patients with chest pain, by sex

Management and outcome	No. (%) of patients: Female sex, *n* = 386	Male sex, *n* = 584	*p* value
Investigations			
Cardiac stress testing	113 (29.3)	187 (32.1)	0.36
Positive for cardiac ischemia	17 (4.4)	46 (7.9)	0.03
Positivity of tests performed	17 (15.0)	46 (24.6)	0.05
Coronary angiography	36 (9.3)	110 (18.9)	< 0.001
Significant coronary disease*	29 (7.5)	90 (15.4)	< 0.001
Positivity of tests performed	29 (80.6)	90 (81.8)	0.87
Cardiovascular outcomes			
Acute myocardial infarction	18 (4.7)	49 (8.4)	0.03
Revascularization†	21 (5.4)	70 (12.0)	< 0.001
Significant coronary disease*	21 (72.4)	70 (77.8)	0.55
Referred for coronary angiography	21 (58.3)	70 (63.6)	0.57
Death from cardiac or unknown cause	0 (0.0)	2 (0.34)	0.52

*We defined significant coronary artery disease as ≥ 70% stenosis in any of the major epicardial coronary arteries.
†Pericutaneous coronary intervention or coronary bypass grafting.

Table 5. Adjusted multiple logistic regression models predicting the odds of angiography in 970 patients with chest pain*

Variable	Odds ratio	95% CI
Female sex	0.63	0.37–1.10
Age, yr	0.97	0.95–0.99
TIMI risk score	1.70	1.24–2.32
Elevated cardiac troponin	4.21	2.33–7.61
New ischemia on ECG	1.20	0.56–2.54
Total number of cardiac risk factors	1.04	0.43–2.52
Typical pain	2.53	1.40–4.59
Pretest probability for acute coronary syndrome	1.24	1.11–1.38

CI = confidence interval; ECG = electrocardiogram; TIMI = thrombolysis in myocardial infarction.
*Hosmer–Lemeshow *p* value = 0.23.

other regions or countries with different ethnic and socio-cultural characteristics.

Only 72% of eligible patients were enrolled. This is likely because physicians less reliably completed data collection forms at night when the ED was particularly busy. We collected demographic and cardiovascular history characteristics for all eligible patients who were missed and included, and observed no appreciable differences between groups. This decreases the risk of selection bias in our cohort.

CONCLUSION

Compared with men, women presenting to the ED with chest pain less frequently had typical features of chest pain, were more frequently classified as having a low pretest probability for ACS, had a lower rate of stress tests positive for ischemia and had a lower rate of AMI. These data suggest that sex differences in management were likely appropriate for the probability of disease. Future studies evaluating sex differences in patients with possible ACS should explore the impact of patient preference on investigation and intervention.

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Correspondence to: Dr. Erik Hess, Department of Emergency Medicine, Division of Emergency Medicine Research, Mayo Clinic College of Medicine, 200 First St. SW, Rochester MN 55905; hess.erik@mayo.edu

The Penelope Gray-Allan Memorial *CJEM* Writing Award: call for papers

The Canadian Association of Emergency Physicians and the editorial board of *CJEM* are pleased to announce a call for papers for the first annual award in honour of *CJEM*'s late managing editor, Penelope Gray-Allan. The writing award is open to any FRCPC or CFPC emergency medicine resident in Canada.

The prize will be awarded for a Humour and Humanity article submitted to *CJEM* by a resident. The paper should be no more than 1000 words. All of the submissions will be judged by either the *CJEM* Senior Editorial Board, or a committee established by the Senior Editorial Board.

The winning paper will be published in the CAEP Annual Conference edition of *CJEM*. The author of the winning paper will receive airfare to the CAEP conference, conference admission and 3 nights of hotel accommodations.

The author of the winning paper will receive a plaque acknowledging him/her as the recipient of the annual Penelope Gray-Allan Memorial *CJEM* Writing Award at the awards ceremony of the CAEP Annual Conference. The first award will be presented at CAEP2011.

Papers may be submitted at http://mc.manuscriptcentral.com:80/cjem. Submissions are due by Jan. 1, 2011. Please address any questions to cjem@rogers.com.

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ORDERS AND INTERVENTIONS

ADDRESSOGRAPH

COMPLETE OR REVIEW ALLERGY STATUS PRIOR TO WRITING ORDERS

Early Goal Directed Therapy for the Treatment of Sepsis

(items with check boxes must be selected to be ordered)

Time Processed
RN/LPN Initials
Comments

Date: _____ Time: _____

A. Sepsis Pathway Weight: _____

☐ Normal saline IV bolus 20 to 30 mL/kg _____L (maximum 2 L) over 30 minutes.

Emergency physician to reassess immediately following IV bolus. Time: _____H

B. Early Goal Directed Therapy (EGDT) Protocol

Activate EGDT protocol if severe sepsis presented as one of the following:

☐ systolic BP less than 90 mmHg after IV bolus of normal saline 20 to 30 mL/kg.

☐ systolic BP greater than 90 mmHg and serum lactate greater than 4 mmol/L.

C. EGDT Protocol Phase I (GOAL: Implement orders within 1 hour of patient arrival)

Activated at: _____H Time Completed: _____H

Intubation and ventilation if overt respiratory distress
NPO
Monitor (BP, HR, RR, O_2 Sat, Foley catheter to urometer)
Maintain patient at 45 degrees/semi-recumbent
Supplemental 0_2 to maintain saturation greater than 92%
Serum lactate Q3H
500 mL NS bolus Q15MIN to titrate HR less than 100 BPM, MAP greater than 65 mmHg and urine output greater than 0.5 mL/kg/H

Prescriber's Signature	Printed Name	College ID

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Early Goal Directed Therapy for the Treatment of Sepsis

(items with check boxes must be selected to be ordered)

Date: _____ Time: _____

Time Processed RN/LPN Initials Comments

Antibiotic Medications (GOAL: administer within 1 hour of activation) Time initiated: _____H
All antibiotic orders valid for 24 hours only.

Sepsis unknown source

☐ piperacillin-tazobactam 3.375 g IV Q6H
** **OR** **
☐ ciprofloxacin 400 mg IV Q12H ** **AND** ** clindamycin 900 mg IV Q8H

If suspect MRSA, **ADD**
☐ vancomycin (20 mg/kg) _____mg IV load, then (15 mg/kg) _____mg IV Q12H

Pneumonia suspected

☐ moxifloxacin 400 mg IV Q24H
** **OR** **
☐ ceftriAXONE 2 g IV Q24H ** **AND** ** azithroMYCIN 500 mg IV Q24H

Skin and soft tissue suspected

☐ ceFAZolin 2 g IV Q8H
** **OR** **
If penicillin allergic
☐ clindamycin 900 mg IV Q8H
** **OR** **
If suspect MRSA
☐ vancomycin (20 mg/kg) _____mg IV load, then (15 mg/kg) _____mg IV Q12H

GI suspected

☐ piperacillin-tazobactam 3.375 g IV Q6H
** **OR** **
☐ ciprofloxacin 400 mg IV Q12H ** **AND** ** metronidazole 500 mg IV Q8H (No substitution)

Urosepsis suspected

☐ ceftriAXONE 2g IV Q24H
** **OR** **
☐ gentamicin (1.5 mg/kg) _____mg IV Q8H

If risk factor for Enterococcus present (indwelling Foley catheter, recent hospitalization, recent instrumentation, anatomical tract abnormality), **ADD**
☐ ampicillin 1 g IV Q6H
** **OR** **
☐ vancomycin (20 mg/kg) _____mg IV load, then (15 mg/kg) _____mg IV Q12H

CNS suspected

☐ ceftriAXONE 2 g IV Q12H ** **AND** ** vancomycin (20 mg/kg) _____mg IV load, then (15 mg/kg) _____mg IV Q12H

If risk factors for Listeria present (pregnant, age greater than 50, immunocompromised, DM, end stage renal disease), **ADD**
☐ ampicillin 2 g IV Q4H

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_____ _____ _____
Prescriber's Signature Printed Name College ID

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Early Goal Directed Therapy for the Treatment of Sepsis

(items with check boxes must be selected to be ordered)

Date: _____ Time: _____

Time Processed RN/LPN Initials Comments

SEVERE SEPTIC SHOCK (unresponsive to aggressive fluid therapy AND requiring vasopressors,

ADD Time initiated: _____ H

☐ imipenem 500 mg IV Q6H
**** AND ****
vancomycin (20 mg/kg) _____mg IV load, then (15 mg/kg) _____mg IV Q12H
**** OR ****

If penicillin allergic
☐ ciprofloxacin* 400 mg IV Q12H
**** AND ****
metronidazole 500 mg IV Q8H (No substitution)
**** AND ****
vancomycin (20 mg/kg) _____mg IV load, then (15 mg/kg) ____ mg IV Q12H

*If suspect ciprofloxacin-resistant Gram negative organism. Risk factors include:

- VGH admission or ED visit less than or equal to 4 weeks
- positive urine culture less than or equal to one year
- antibiotic use less than or equal to 3 months

☐ REPLACE ciprofloxacin with amikacin (7.5 mg/kg) _____mg IV Q8H

Note: The above antibiotic regimens may need to be adjusted for patients with renal impairment

Consult ICU Time consulted: _____H Time arrived: _____H

Determine who early goal directed therapy physician will be:
☐ Emergency Physician
☐ Intensivist

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_____ _____ _____
Prescriber's Signature Printed Name College ID

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ORDERS AND INTERVENTIONS

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COMPLETE OR REVIEW ALLERGY STATUS PRIOR TO WRITING ORDERS

Early Goal Directed Therapy for the Treatment of Sepsis

(items with check boxes must be selected to be ordered) **(Page 4 of 4)**

Date: _____ Time: _____

Time Processed
RN/LPN Initials
Comments

D. EGDT Protocol Phase II (GOAL: Implement orders within 4 hours of activation)

Placement of Central Venous Catheter Time: _____H Site: _____ (SC or IJ)

Placement of Arterial catheter Time: _____H

Measure central venous pressure (CVP):

GOAL: CVP 8 to 12 mmHg (12 to 15 mmHg if ventilated) Time attained: _____H

(i) If CVP less than 8 mmHg (or 12 mmHg if ventilated) give NS 500 mL IV Q15 MIN, repeat until CVP 8 to 12 mmHg (or 12 to 15 mmHg if ventilated) then continue at 150 mL/H.

(ii) Once CVP greater than 8 mmHg (or 12 mmHg if ventilated) measure mean arterial pressure (MAP)

If CVP greater than 8 mmHg (or 12 mmHg if ventilated) and MAP less than 65 mmHg initiate vasopressors

GOAL: MAP greater than 65 mmHg (or SBP greater than 90 mmHg)

Time attained: _____H

☐ NORepinephrine 2 to 20 mcg/MIN (first line therapy in sepsis)

If CVP greater than 8 mmHg and MAP greater than 65 mmHg **then** measure Central Venous O_2 Saturation ($ScvO_2$) Q30 MIN:

GOAL: $ScvO_2$ greater than 70% Time attained: _____H

☐ If $ScvO_2$ less than 70% and Hg less than or equal to 100 g/L
- (i) Transfuse 2 units pRBC (complete Blood Transfusion Service – Transfusion Medicine Group & Screen, Red Cells and Platelets order # 618)
- (ii) Post transfusion Hg and repeat until Hg greater than 100 g/L

☐ If $ScvO_2$ less than 70% and Hg greater than 100 g/L
- (i) Start DOBUTamine 2.5 mcg/kg/MIN IV
- (ii) Titrate 2.5 mcg/kg/MIN Q30 MIN to target $ScvO_2$ greater than or equal to 70% (maximum dose: 20 mcg/kg/MIN)

Intubation and ventilation to decrease respiratory muscle O_2 consumption if:

☐ above values unobtainable
☐ worsening hypoxemia

Consider steroid if septic shock refractory to fluids and vasopressors

☐ hydrocortisone 100 mg IV Q8H

_____ _____ _____

Prescriber's Signature Printed Name College ID

EGDT Rev. Dec-08

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