A Rapid Diagnostic and Treatment Center for Patients With Chest Pain in the Emergency Department

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Study objective: To evaluate a comprehensive diagnostic 9-hour evaluation (Heart ER Program) for patients with possible acute ischemic coronary syndromes.

Design: Retrospective review of consecutive patients.

Setting: Urban tertiary care emergency department.

Participants: A total of 1,010 patients with symptoms suggestive of acute ischemic coronary syndrome was enrolled in the Heart ER Program over the first 32 months of operation. Patients with history of coronary artery disease, hemodynamic instability, acute ST-segment elevation or depression of more than 1 mm, or a clinical syndrome consistent with unstable angina were directly admitted to the hospital.

Intervention: Patients underwent serial testing for creatine kinase (CK-MB) on presentation to the Heart ER and 3, 6, and 9 hours later with continuous 12-lead ECGs/serial ST-segment trend monitoring for 9 hours. Two-dimensional echocardiography and graded exercise testing were performed in the ED after the 9-hour evaluation period.

Results: Of 1,010 patients, 829 (82.1%) were released home from the ED; 153 (15.1%) required admission for further cardiac evaluation. Fifty-two of 153 (33.9%) admitted patients were found to have a cardiac cause for their symptoms; 43 had acute ischemic coronary syndromes (12, acute myocardial infarction; 31, angina or unstable angina).

Conclusion: The Heart ER program provides an effective method for evaluating low- to moderate-risk patients with possible acute ischemic coronary syndrome in the ED setting.

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INTRODUCTION

The evaluation of patients presenting to the emergency department with chest pain is challenging for the clinician. Little objective evidence is available to differentiate patients presenting with coronary artery disease from those who have other causes of chest pain. The clinician must rely on the patient's description of chest discomfort; the presence or absence of symptoms such as nausea, vomiting, or diaphoresis; and the presence of risk factors for coronary artery disease to determine the likelihood of a particular patient having an acute ischemic coronary syndrome.

Definitive laboratory data are difficult to obtain. The 12-lead (ECG) is diagnostic in only 50% of patients presenting to the ED with acute myocardial infarction (AMI).[1-4] A single determination of a serum marker for myocardial injury such as the isoenzyme CK-MB, obtained on presentation to the ED, has a sensitivity of 35% for detecting AMI because of the kinetics of creatine kinase release.[5-7]

Reliance on clinical findings and conventional diagnostic testing to make hospitalization and treatment decisions has resulted in several undesirable outcomes. Approximately 2% to 5% of patients presenting to the ED with chest discomfort and AMI are inadvertently released home.[8-11] These patients may experience untoward events as the result of such a decision, including death due to arrhythmia or pump failure. Twenty percent of the malpractice dollars awarded from the practice of emergency medicine in the United States are associated with the treatment of myocardial ischemia and AMI.[12] Physicians respond to these circumstances by following a liberal admission policy for patients with chest pain.

Patients are frequently admitted to CCUs or telemetry units with chest discomfort due to noncardiac causes. This policy results in the allocation of costly resources for monitoring of many patients with ambiguous presentations resulting from benign disorders. Costs for the admission and inpatient evaluation of patients with chest pain are substantial, with estimates ranging from $5 to $10 billion each year.[13,14] Because only 30% to 40% of such patients are ultimately determined to have acute ischemic coronary syndromes, $3 to $6 billion are currently allocated to hospitalize patients with noncardiac chest pain.

To establish the feasibility of rapidly evaluating patients who have chest pain and a low to intermediate probability of cardiac etiology in a noncoronary care unit setting, we developed the Heart ER program.[15] Any patient with transient chest discomfort clinically consistent with acute myocardial ischemia or AMI, and an initially nondiagnostic 12-lead ECG, is evaluated over a 9-hour period in the ED.

MATERIALS AND METHODS

The Heart ER program was established on October 17, 1991, at the University of Cincinnati Center for Emergency Care. This report relied on data generated through June 1, 1994. The protocol-driven care rendered to patients admitted to the Heart ER has been considered standard of care at our institution since origination. Publication of data from the Heart ER program has been approved by the Institutional Review Board of the University of Cincinnati.

Patients of either sex, older than 25 years, who present to the ED with nontraumatic chest discomfort are candidates for the Heart ER protocol. Patients with a clinical presentation consistent with acute myocardial ischemia or AMI, and an initial 12-lead ECG nondiagnostic of ischemia or AMI, are eligible. Clinical presentation suggesting acute ischemic coronary syndrome, including history of chest discomfort and risk factors for coronary artery disease, is of critical importance in the identification of patients for the Heart ER protocol. The initial ECG is considered diagnostic of AMI or myocardial ischemia when ST-segment elevation or depression is greater than 1 mm or 0.1 mV in two electrically contiguous leads. Patients younger than 25 years who admit to recent cocaine or other sympathomimetic amine drug use are also candidates for this protocol.

Patients with hypotension, defined as systolic blood pressure less than 90 mm Hg, are excluded. A history of coronary artery disease or a clinical syndrome of persistent or frequently recurring chest pain consistent with unstable angina also serves to exclude a patient from evaluation in the Heart ER.

Patients enrolled in this protocol are evaluated with the use of a standard single-lead arrhythmia monitor (Datascope, Inc) and administered 2 L of oxygen per minute by nasal cannula. A saline solution–filled intravenous catheter is placed, and the patient is given two 325-mg aspirin tablets orally. Sublingual nitroglycerin is administered if clinically indicated. The patient is repeatedly evaluated by an emergency physician while in the Heart ER over a 9-hour period. The development of hemodynamic instability, significant arrhythmia, or frequently recurring chest pain consistent with myocardial ischemia results in the patient's admission to the CCU or a telemetry unit directly from the Heart ER.

The patient is subjected to serial CK-MB determinations—on presentation to the ED and 3, 6, and 9 hours after ED presentation—using the ICON-QSR monoclonal antibody method (Hybritech, Inc) and the Stratus CK-MB fluorometric enzyme immunoassay (Baxter Stratus, Inc). Serum CK-MB levels greater than 7 ng/mL (ICON-QSR) or 6 ng/ml (Stratus), with a relative index greater than 5% (CK-MB/total CK), are considered positive for myocardial injury. Patients with elevated CK-MB levels are admitted to the coronary care unit for further evaluation and management.

Once identified for possible admission to the Heart ER, the patient undergoes a chest radiograph for evaluation of noncardiac chest discomfort. If a cardiac cause of the chest pain is still suspected after chest radiograph, the patient is fitted with an ELI-100 12-lead continuous ST-segment monitor (Mortara Instrument, Inc) for continuous ST-segment evaluation over a 9-hour period. This computerized device acquires a serial 12-lead ECG automatically every 20 seconds while the patient is in the Heart ER program.

An alarm is set on the ELI-100 ST-segment monitor for ST-segment elevation or depression of 0.1 mV (1 mm) in two electrically contiguous leads or ST-segment elevation or depression of 0.2 mV (2 mm) in a single lead. The initial ECG tracing establishes baseline levels for ST-segments of all 12 leads. Subsequent ECGs obtained every 20 seconds are then automatically compared with the baseline pattern. If ST-segment changes occur that exceed the alarm criteria, we obtain three additional ECGs over the next 60 seconds to establish the validity of the ST-segment elevation or depression. If the preset criteria for ST-segment elevation or depression are confirmed after four sequential ECGs, an alarm tone sounds and a 12-lead ECG is printed for physician review. The baseline is now established at this new level for ST-segments, and ECG monitoring continues.

Physician interpretation of actual 12-lead ECGs over the 9-hour period ensures detection of R-wave amplitude changes or subtle changes in T waves not detected on the basis of ST-segment alterations. The computer also provides ST-segment trends to the clinician. Printing of the individual 12-lead ECG responsible for triggering an alarm allows physician interpretation of alarm states to ensure that indicated ST-segment deviations are not artifactual. Prolonged patient movement may result in baseline changes that are interpreted by the device as significant ST-segment abnormalities.

After the 9-hour evaluation, if a patient has no evidence of ST-segment instability indicating evolving AMI or myocardial ischemia at rest and no serum CK-MB increase indicating myocardial necrosis, the patient is evaluated by a cardiologist who records history and performs a physical examination. The patient then undergoes two-dimensional echocardiography at rest while in the ED (Hewlett-Packard Company, Inc, McMinnville, Oregon). Patients with evidence of segmental wall motion abnormalities, significant valvular abnormalities, large pericardial effusions, or global myocardial dysfunction on rest echocardiography are admitted for further diagnostic testing and treatment.

In our protocol, echocardiography is performed by the cardiologist after a 9-hour evaluation period in the Heart ER program immediately before graded exercise testing. If performed in the ED before serial CK-MB and serial ECG evaluation, echocardiography indicating acute myocardial ischemia or AMI would obviate further diagnostic testing in the ED. The patient is then admitted for usual inhospital serial CK-MB level determinations and serial ECGs.

Patients in the Heart ER program without echocardiographic evidence of cardiac disease subsequently undergo graded exercise testing (Quinton Instrument Company) according to a maximal Bruce protocol. If the graded exercise test is positive—indicated by horizontal or downsloping ST-segment depression of 1 mm or greater than normal baseline ECG, accompanied by chest discomfort—the patient is admitted to the hospital for further evaluation. Patients in whom ST-segment elevation develops during the examination are considered to have had positive tests. If the graded exercise test is negative for exercise-induced myocardial ischemia, the patient is released from the ED with instructions for follow-up in the chest pain clinic or to see their referring physician as an outpatient within 24 to 48 hours. In some patients, an abnormal baseline ECG precludes a definitive stress test in the absence of a combined nuclear scan. Such patients are released from the ED if their treadmill test reveals reasonable exercise capacity for age and conditioning, no significant arrhythmias, and no worrisome ECG changes. These patients undergo follow-up in cardiology clinic with plans for definitive treadmill thallium testing within 10 days. If such patients have worrisome but nondiagnostic treadmill test results, they are admitted for additional inpatient evaluation.

Standard descriptive statistics were used to evaluate the four diagnostic methods used in the Heart ER Program: serial serum CK-MB determinations, serial 12-lead ECGs, two-dimensional echocardiography, and graded exercise

testing. Patients were routinely followed in the University chest pain clinic on release from the ED. Follow-up data obtained on Heart ER patients included cardiac complications, noncardiac complications, and further diagnostic evaluation. Mortality data for patients were obtained 1 month after enrollment in the Heart ER. Thirty-day mortality was obtained because 1) significant cardiac dysfunction related to the initial ED visit should be evident by this time, 2) follow-up information about actual cause of chest pain could be obtained, and 3) most large trials evaluating the use of thrombolytic therapy in patients with AMI have used a 30-day interval as a significant milestone for complications and death. If a patient evaluated in the Heart ER could not be contacted by telephone or letter, data from the City of Cincinnati and the Hamilton County Bureau of Vital Statistics were used.

RESULTS

One thousand ten patients were enrolled in the Heart ER Program after presenting to the ED with chest discomfort. These patients ranged in age from 19 to 89 years. Four hundred ninety-eight women and 512 men were evaluated. Average age for the entire population was 45.0 years, with an average age of 47.2 years for women, and 42.8 years for men (Table 1). The ethnic makeup of the patient population evaluated in the Heart ER program because of chest pain reflects the entire population presenting to our ED with all complaints (African-American, 59.7%; Caucasian, 38.7%; Asian, 0.6%; other, 1.0%).

One hundred fifty-three of 1,010 patients (15.1%) evaluated through this protocol were subsequently admitted to hospital. Fifty-two of 153 admitted patients (34.0%) had cardiac diagnoses confirmed during hospitalization. Eight hundred twenty-nine of the 1,010 patients (82.1%) evaluated in the Heart ER were released home from the ED. Twenty-eight patients (2.8%) were released from the ED against medical advice before completion of the Heart ER protocol (Table 2).

Of 1,010 patients enrolled in the Heart ER, 29 had positive serial CK-MB assay results in the ED. Of the 12 patients determined during hospitalization to have AMI, all had positive CK-MB assay results in the ED (sensitivity, 100%). Seventeen patients without AMI were found to have positive CK-MB assay results during the Heart ER protocol (specificity, 98.3% [981 of 998]). Eight had relative indexes (CK-MB/total CK) of less than 5% and were released home from the ED. Of nine patients without AMI admitted to hospital with a positive Heart ER CK-MB series, two had used cocaine, three were found to have ischemic heart disease, and four were discharged with noncardiac causes of chest pain (Table 3).

Eleven of 52 patients with cardiac disease had evidence of ischemia or evolving AMI on serial 12-lead ECG/ST-segment trend monitoring (sensitivity, 21.2%). Six patients (specificity, 99.4% [952 of 958]) had serial 12-lead ECG/ST-segment trend monitoring consistent with myocardial ischemia or evolving AMI in the ED; however, hospitalization revealed noncardiac causes of chest discomfort (Table 3).

Of 1,010 patients evaluated in the Heart ER protocol, 901 underwent two-dimensional echocardiography while in the ED. Of the 153 patients admitted from the

Table 1.
Age and gender distribution of 1,010 patients enrolled in the Heart ER Program from October 17, 1991, through June 1, 1994.

Age (yr)	Female	Male	Total
19-29	28	58	86
30-39	118	181	299
40-49	152	146	298
50-59	115	57	172
60-69	61	50	111
70-79	21	17	38
80-89	3	3	6
Total	**498**	**512**	**1010**
Average age (yr)	47.2	42.8	45.0

Table 2.
Outcome data for 1,010 patients evaluated in the Heart ER Program.

Outcome	No. of Patients
Released home from ED	829
Released AMA from ED	28
Admitted to hospital for further evaluation	153
Cardiac disease	52/153 (34.0%)
Ischemic cardiac diagnoses	
AMI	12
PTCA	7
CABG	1
Angina/unstable angina	31
PTCA	5
Nonischemic cardiac diagnoses	
Dilated cardiomyopathy	2
Hypertrophic cardiomyopathy	2
Congestive heart failure	3
Mitral valve prolapse	1
Pericardial effusion	1

AMA, against medical advice; *AMI*, acute myocardial infarction; *PTCA*, percutaneous transluminal coronary angioplasty; *CABG*, coronary artery bypass grafting.

Heart ER, 52 had cardiac disease, confirmed by standard in-hospital evaluation. Nineteen of the 52 patients underwent two-dimensional echocardiograms while in the ED. Nine patients (sensitivity, 47.4% [9 of 19]) were found to have abnormal two-dimensional echocardiograms with segmental wall motion abnormality or global dysfunction, whereas an additional nine patients had false-positive echocardiographic studies (specificity, 99.0%; negative predictive value, 99.0%) (Table 3).

Of the 1,010 patients evaluated in the Heart ER program, 791 underwent graded exercise tests. Two hundred nineteen patients were not studied in the ED because of hospital admission for possible acute ischemic coronary syndrome, making exercise testing potentially unsafe (42.5% [93 of 219]); or because of underlying physical constraints such as morbid obesity, severe arthritis, or underlying pulmonary disease that made exercise impossible (48.4% [106 of 219]). Twenty of 219 patients (9.1%) were released from the ED against medical advice before undergoing graded exercise testing.

Seven hundred eighty-two patients had negative or nondiagnostic graded exercise tests. Of the 52 patients with cardiac disease identified when hospitalized from the Heart ER program, only 14 underwent testing in the ED. Of these 14 patients, only 4 had positive graded exercise tests (sensitivity, 28.6%). Five patients had false-positive tests performed resulting in hospital admission (specificity, 99.4% [772 of 777]). Only 10 of the 791 patients undergoing exercise testing had falsely negative treadmill test results (negative predictive value, 98.7% [772 of 782]) (Table 3).

One hundred thirteen patients (11.2%) evaluated in the Heart ER had chest pain and admitted to recent cocaine use. Ten of these individuals were admitted because of ischemia detected by serial 12-lead ECG/ST-segment trend monitoring (4), ongoing chest pain suggestive of unstable angina (3), elevated CK-MB levels (2), or acute stroke (1). One patient was found to have dilated cardiomyopathy during inpatient evaluation; no patient developed AMI.

One-month mortality information was obtained on patients enrolled in the Heart ER program. These data were obtained through follow-up at the University of Cincinnati chest pain clinic, other University Hospital clinics, private physicians, telephone or letter contact, and the City of Cincinnati/Hamilton County death records. One patient released home after a negative Heart ER evaluation was admitted to the hospital 3 days later with AMI. Five patients died within 1 month of enrollment in the Heart ER. One patient was admitted from the Heart ER directly to the CCU for unstable angina and died later that evening of AMI. One patient was admitted to another hospital 1 week after Heart ER evaluation for liver failure with encephalopathy and died shortly thereafter. One patient who had a negative evaluation in the Heart ER program died 3 weeks later, in another city, of unknown cause; no autopsy report was obtained. A fourth patient committed suicide 3 weeks after evaluation. Finally, the fifth patient died 3 weeks after Heart ER evaluation, in hospital, of respiratory failure resulting from chronic obstructive pulmonary disease.

DISCUSSION

The correct diagnosis and triage of patients presenting to the ED with chest pain is important to the emergency physician. To avoid release home of a patient with AMI, most emergency physicians attempt to admit all patients in whom the possibility of acute coronary ischemia exists. Therefore many patients with noncardiac chest pain are admitted to hospitals each year.[16-18] These patients occupy expensive intensive care beds, substantially increasing the financial cost for the diagnosis and treatment of myocardial ischemia and AMI.

Despite vigorous efforts to identify patients with ischemic myocardial disease, nationally 2% to 5% of patients presenting to the ED with AMI and chest pain are inadvertently released home.[8-11] Consequently, 20% of the dollars lost in malpractice litigation for emergency physicians are related to the emergency diagnosis and treatment of AMI.[12] Improved strategies for the diagnosis of AMI and myocardial ischemia in patients presenting to the ED with chest pain and initially nondiagnostic

Table 3.
Descriptive statistical analysis of the four diagnostic tests performed during the Heart ER evaluation.

Test	n	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
Serial CK-MB assay	1,010	100 (12/12)	98.3 (981/998)	41.4 (12/29)	100 (981/981)
Serial ECG/ST-segment monitoring	1,010	21.2 (11/52)	99.4 (952/958)	64.7 (11/17)	95.9 (952/993)
Echocardiography	901	47.4 (9/19)	99.0 (873/882)	50.0 (9/18)	99.0 (873/883)
Graded exercise testing	791	28.6 (4/14)	99.4 (772/777)	44.4 (4/9)	98.7 (772/782)

ECGs could accelerate the release of patients with benign causes of chest pain, improve identification of patients who are candidates for coronary therapy, and reduce cost.

The Heart ER protocol was introduced at the University of Cincinnati Center for Emergency Care to systematically evaluate patients with low to moderate risk of a coronary cause of their symptoms. The program was also designed as a cost-effective alternative to the typical 2- to 3-day inhospital evaluation to rule out AMI.[19,20] This protocol provides a consistent approach for each patient that includes testing for AMI with serial serum CK-MB assays; observing for rest ischemia using serial ECGs with ST-segment trend monitoring; screening for severe ischemia, current or prior infarction evidenced by regional wall motion abnormalities using two-dimensional echocardiography; and treadmill testing for exercise-induced myocardial ischemia.

The Heart ER program has proved effective in detecting AMI and myocardial ischemia in the low- to moderate-risk patient with chest pain presenting to the Center for Emergency Care. Previous studies have demonstrated that the diagnosis of AMI can be effectively established through immunochemical detection of CK-MB within 5 or 6 hours after symptom onset, with a sensitivity approaching 100%.[21-23] These findings were confirmed with high-voltage electrophoresis techniques for CK-MB isoforms.[24] Serial sampling for CK-MB in the ED over a period of 9 hours effectively identifies the patient with myocardial necrosis.[23] Serial 12-lead ECGs provide virtually continuous information about ST-segments. Serial 12-lead ECGs/ST-segment trend monitoring has provided sensitive detection of reperfusion in patients receiving thrombolytic therapy after presenting to the ED with AMI and ST-segment elevation.[25-31] Such serial ECG and ST-segment surveillance provides the clinician with detailed information about the resting patient's cardiac electrical activity while in the Heart ER.[32] Because patients with silent myocardial ischemia have morbidity and mortality similar to that in individuals with painful ischemia,[33] continuous serial 12-lead ECGs/ST-segment trend monitoring provides constant cardiac electrical data for asymptomatic and symptomatic patients.

If serial CK-MB determination and serial ECG/ST-segment trend monitoring demonstrate no evidence of rest ischemia or AMI over a 9-hour period, a two-dimensional rest echocardiogram is performed. Previous studies have suggested that the echocardiogram is a sensitive method for detecting AMI and myocardial ischemia in the initial evaluation of chest pain.[34-36] Sensitivity in detecting acute myocardial ischemia and AMI approached 90% in patients without previous AMI with two-dimensional echocardiography. In addition to detecting segmental wall motion abnormality as an indicator of severe acute ischemia, AMI, or possible prior infarction, the echocardiogram detects pericardial effusions, significant valvular dysfunction, hypertrophic cardiomyopathy, and dilated cardiomyopathy. Two-dimensional echocardiography was performed before exercise on a treadmill.

After echocardiography, the patient underwent a graded exercise test consisting of a maximal Bruce protocol. Several studies have shown evidence of the safety of exercise testing in low-risk patients presenting to the ED with chest pain.[37,38] Exercise testing has been found to be a powerful tool for prognosis in the ambulatory patient.[39] In the Heart ER program, the successful completion of graded exercise testing without chest pain, ST-segment depression, or significant arrhythmia resulted in the patient being released from the ED.

Through this diagnostic sequence, 153 of 1,010 patients were admitted to the hospital during their Heart ER evaluation. Eventually, 43 patients were discharged from hospital with ischemic cardiac diagnoses: 12 with AMI and 31 with angina/unstable angina. Nine patients were found to have nonischemic cardiac disease such as dilated and hypertrophic cardiomyopathy. Many of the remaining 90 patients discharged from hospital with noncardiac diagnoses were initially admitted because they could not run on a treadmill or because they had nondiagnostic or equivocal graded exercise tests. The limitation of treadmill testing with an abnormal baseline ECG would be mitigated by the addition of dobutamine echocardiography to the Heart ER protocol; this might further reduce unnecessary admissions.[40]

Thirty-day mortality data indicate that low- to moderate-risk patients can be safely released from the ED after evaluation according to the Heart ER protocol. Some patients released from the Heart ER Program, as it is currently structured, may require further diagnostic testing as outpatients. Two patients released from the ED after Heart ER evaluation were scheduled for outpatient dipyridamole thallium testing (DPT) because of inconclusive graded exercise testing. One patient failed to appear for the DPT test; recurrent chest pain developed, and she underwent percutaneous transluminal coronary angioplasty 1 month later. The second individual also failed to submit to DPT testing for which he had been scheduled as an outpatient; an AMI developed 1 month later in hospital, and the patient died 6 months later. A benign but nondiagnostic treadmill test correctly identified patients from the Heart ER who could be safely released from the ED, with subse-

quent definitive stress thallium testing to be performed within 10 days. Failure to appear for definitive stress thallium testing did leave some patients at risk, as these two cases illustrate. In the near future, definitive stress testing for patients who are unable to exercise or who have abnormal baseline ECGs will be available in the Heart ER program with the addition of dobutamine echocardiography.

A negative evaluation in the Heart ER program does not completely rule out the possibility of coronary artery disease. One individual who had a negative evaluation, including treadmill testing, presented to our ED 3 days later with AMI. Essential to the comprehensive evaluation of the Heart ER protocol is rapid follow-up by the patient's physician or by an urgent chest pain clinic.

The evaluation of patients with low to moderate risk of myocardial ischemia and AMI was the stimulus for the development of the Heart ER program. The inclusion of extremely low risk patients in the Heart ER program, who before the institution of this protocol were released home from the ED, could improve the safety profile for the program. In addition, the placement of these patients in the Heart ER program could actually be more expensive than the conventional admission of patients with low to moderate risk directly to the CCU or a monitored bed (step down unit), creating an additional group of patients who receive care that is more expensive than the usual ED evaluation and release.

This concept is not supported by the hospital discharge data obtained from patients admitted directly to the CCU while the Heart ER program has been operational. Noncardiac discharge diagnoses were decreased by 14% from the CCU/step down service over a 3-month period 1 year after the Heart ER program was initiated, compared with the 3-month period before program initiation. An increase in the acuity of patients admitted to the CCU would be expected if low- to moderate-risk patients previously evaluated in this setting were released from the ED. For example, only 10 of 113 patients presenting with chest pain after cocaine use required hospital admission. One hundred three patients were evaluated completely in the Heart ER. Before the development of this protocol, standard practice was to admit patients with cocaine-induced chest pain consistent with myocardial ischemia.

In addition, CCU/step down cardiac admissions have not increased during the 2 years this program has been in effect. Before development of the Heart ER program, CCU/step down unit cardiac admissions had risen at an annual rate of 15% per year for each of the 3 years before the initiation of the Heart ER program. This stabilization provides additional critical care bed space for higher acuity patients.

Even though all patients released from the ED after Heart ER evaluation were scheduled to be seen the next day for 12-lead ECG and serum CK-MB level determination, only 25% of patients returned. Although no patients with AMI or unstable angina were identified in this group, this statistic does not represent the entire population released after the protocol. This observation leads us to conclude that routine 1-day follow-up cannot be depended on as part of the Heart ER program.

CONCLUSION

The Heart ER has proved to be an effective and safe method for evaluating low- to moderate-risk patients with chest pain in the ED. Such a systematic approach in a difficult-to-assess patient population appears to provide a consistent evaluation. Further work is required to evaluate the cost-effectiveness of this approach compared with standard inhospital evaluation.

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