

## Original Article

# A clinical practice audit of management and outcomes of patients presenting with chest pain to the Medical Admissions Unit

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## Abstract

Acute central chest pain accounts for a significant proportion of emergency medical admissions. If chest pain evaluation is systematic & risk-based, it may prevent unnecessary admissions. This audit aims to observe various aspects of management of patients admitted with chest pain; areas needing review are identified and improvements on current practice are considered.

The study observed the current practices in 292 admissions for chest pain to the Medical Admissions Unit over a 3 month period. The relative frequency of risk factors and utilisation of resources were observed. Ninety-one patients (31.2%) that were admitted with chest pain had a diagnostic ECG or raised cardiac enzymes. Twenty-one patients (7.2%) had an urgent exercise stress test (EST) whilst 27 patients (9.2%) had an urgent coronary angiogram. In all, 16 patients (5.5%) were re-admitted with a cardiac event and 8 patients (2.7%) died within 3 months. The presence of age >65, diabetes or hypertension were associated with a high rate of adverse events (13.9%, 16.4%, and 11.6% respectively).

## Keywords

Chest pain, cardiac enzymes, EST, coronary angiogram, Medical Admissions Unit

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## Introduction

Management of patients presenting with chest pain is a difficult process. Whereas diagnostic electrocardiogram (ECG) changes including ST changes and significant arrhythmias and elevated cardiac enzymes identify those with acute cardiac pathology, a considerable majority of patients have an indeterminate ECG and normal cardiac enzymes. An audit of the current practice was carried out.

The objective of the initiative was to observe various aspects of management of patients admitted with chest pain to the Medical Admissions Unit (MAU). Areas needing review were identified and improvements on current practice were considered.

## Method

Two hundred and ninety-two patients that were admitted with chest pain in the MAU between April and June 2007 were studied, using data from the MAU database, PAS and designated data sheets.

## Analysis

Demographic features of the population group were gathered. Risk stratification was carried out for each patient based on age, symptoms, known risk factors, ECG findings and cardiac enzymes. Length of stay and utilisation of resources were observed. Adverse outcomes were recorded in terms of readmissions with cardiac events and mortality within 3 months.

Conclusions derived from the data were used to appraise current practice and discuss the feasibility of implementing appropriate changes.

## Results

The results of the study are presented as follows:

- Risk Factors
- ECG and Cardiac Enzymes
- Resources and Special Investigations
- Outcomes

## Risk factors

The commonest risk factors were hypertension, history of ischaemic heart disease (IHD) and smoking (Figure 1).

**ECG and cardiac enzymes**

One hundred and eighty-six patients (63.7%) had a normal ECG. 70 patients (23.9%) had a diagnostic ECG (defined as ST elevation/depression or arrhythmia). The rest had non-diagnostic ECG changes (Q waves, T wave changes, LVH) (Figure 2).

Thirty-six patients (12.3%) were found to have elevated cardiac enzymes (creatine phosphokinase: CPK).

Ninety-one patients (31.2%) had diagnostic ECG changes (ST changes, or arrhythmia) and/or elevated cardiac enzymes. Of the patients with diagnostic ECG/enzymes, 15 (16.5%) patients had both diagnostic ECG and elevated enzymes, 55 (60.4%) patients had diagnostic ECG only and 21 (23.1%) had elevated cardiac enzymes only.

Therefore 1/3 of patients had a clear diagnosis of a cardiac event (acute coronary syndrome or a significant cardiac arrhythmia) whilst 2/3 of patients could not be diagnosed on the basis of ECG or cardiac enzymes (Figure 3).

**Resources and special investigations**

Figure 4 shows the distribution of the number of patients that were monitored or had a special investigation during their stay in the MAU. The relatively low use of echocardiography, ventilation perfusion (V/Q) scan and CT thorax was noted.

**ECG monitoring**

Fifty-six patients (19.2%) were put on continuous ECG monitoring, of which 6/56 (10.7%) were found to have an arrhythmia. Conversely 4/5 of patients admitted with chest pain were not monitored.

**Exercise stress ECG**

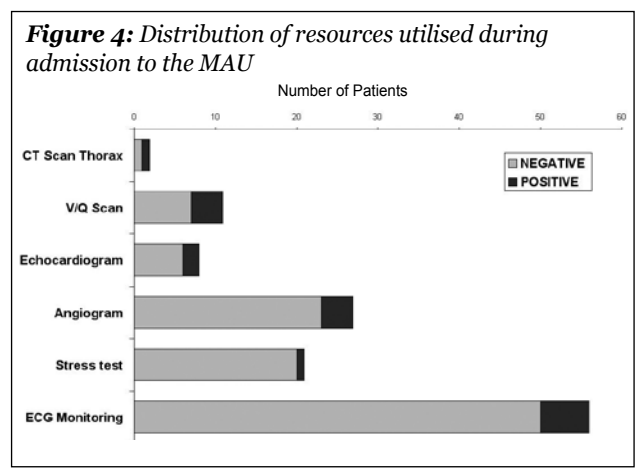
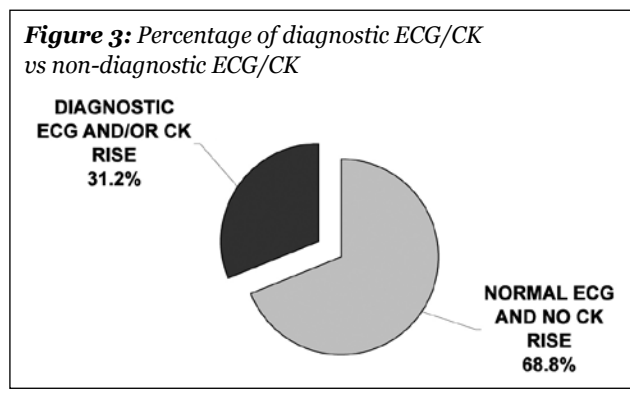
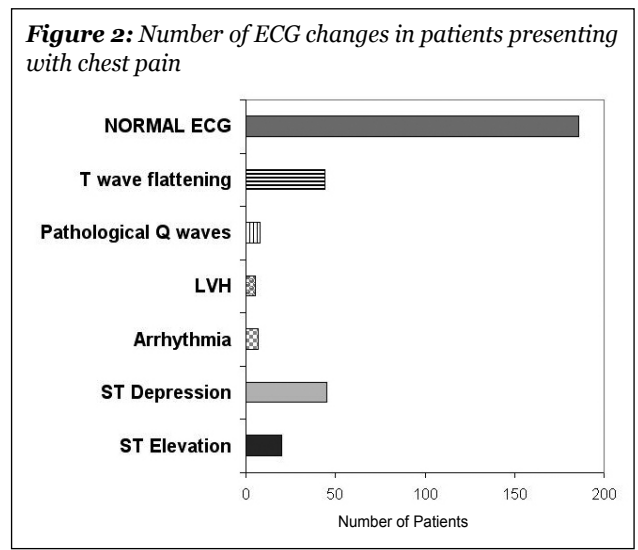
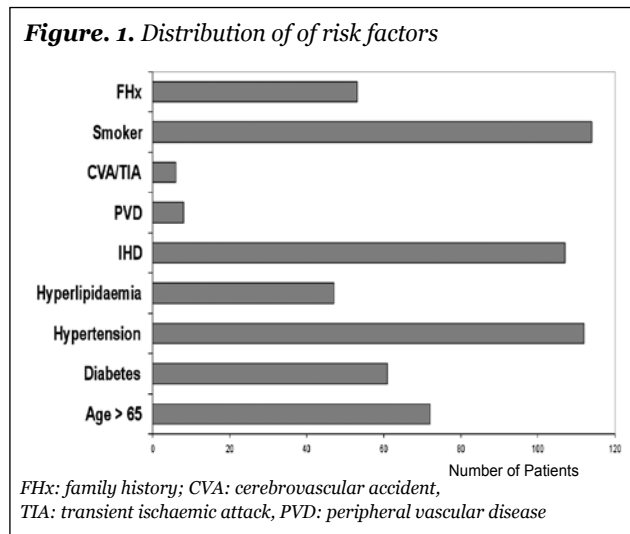
Only 21 patients (7.2%) had an EST, during admission, most of which (20/21, 95.2%) were negative. This essential screening tool was underutilised. Although many patients would have had an EST booked on discharge, elective EST did not facilitate a safe discharge in patients at risk who had negative ECG and enzymes.

**Coronary angiography**

A significant number of patients (n=27, 9.2%) had an angiogram performed in the first 72 hours, of which a significant proportion (23/27, 85.2%) were negative.

**CT scan thorax**

Only 2 patients (0.7%) had a CT Thorax, of which one was positive.



*Pulmonary ventilation perfusion scan*

11 patients (3.8%) had a V/Q scan, of which 4/11 (36.4 %) were positive. Thus although few V/Q scans were done for patients presenting with chest pain, more than 1/3 were positive.

*Echocardiography*

8 patients (2.7%) had an echocardiogram, one fourth of which (2/8, 25%) were abnormal.

*EST vs. angiography*

More angiograms (27) were carried out during admission than ESTs (21) (Figure 5).

**Outcomes**

**Rate of admission vs. discharge**

One hundred and twenty-nine patients (44.2%) were discharged from MAU. More than half of the patients (n=159, 54.4%) were admitted to medical wards for further evaluation. A small percentage (n=4, 1.4%) was transferred to the Coronary Care Unit (CCU).

*Distribution of length of stay*

Most patients spent 1 or 2 days in MAU. Roughly, half the patients staying 1 or 2 days were either discharged or transferred to the wards (Figure 6). A smaller number stayed 3 days or more and most of these patients were transferred to the wards.

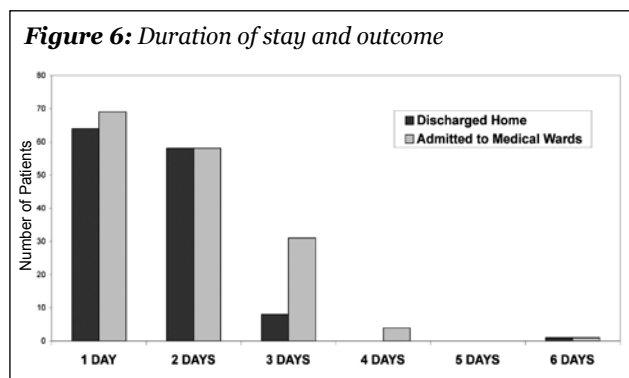
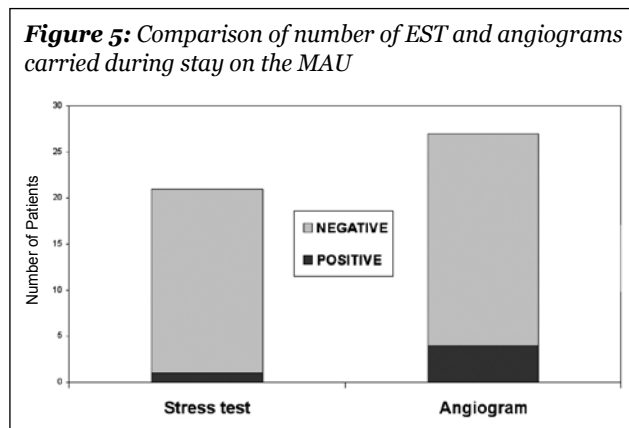


Figure 7 compares the number of patients who were not diagnosed by ECG/CPK with the number of those who underwent an in-patient EST. An urgent EST could potentially have helped in the former group.

*Adverse events (re-admission with cardiac event or mortality) at 3 months*

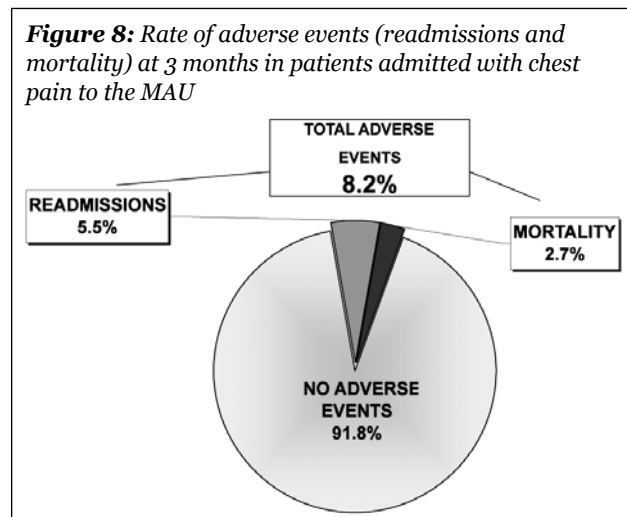
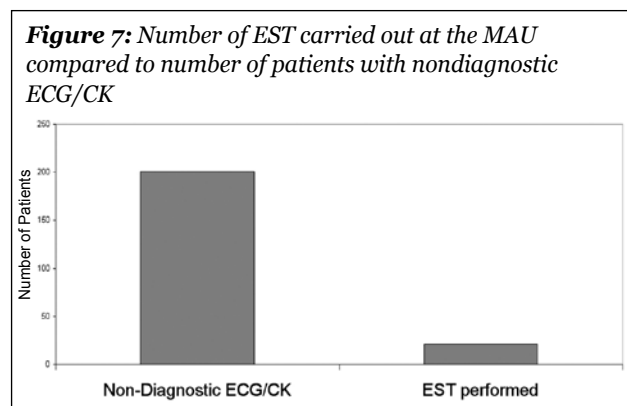
Sixteen patients (5.5%) were re-admitted with a cardiac event and 8 patients (2.7%) died within 3 months, giving a total adverse event rate at 3 months of 8.2% (n=24) (Figure 8).

In 3 months, 4.7% (6/129) of patients that were discharged home from the MAU had an adverse event in 3 months whilst 11.0% (18/163) of patients that were transferred to the wards for further evaluation suffered an adverse event.

Figure 9 shows the contribution of risk factors to the likelihood of re-admission. The biggest single risk factor giving the highest rate of adverse events at 3 months was diabetes (10/61, 16.4%).

**Discussion**

This study was aimed at reviewing the current practice with regards to the local management of chest pain in the (MAU). Standardisation of clinical management is best achieved in a single dedicated unit that is run by medical and nursing staff that is well accustomed to the management of these symptoms.<sup>1</sup>



## Summary of results

### Risk factors

- The commonest risk factors were Hypertension, history of IHD and smoking.

### ECG and cardiac enzymes

- The commonest ECG abnormalities were ST Depressions (n=45, 15.4%) and T wave flattening/inversions (n=44, 15.1%).
- 70 patients (23.9%) had a diagnostic ECG (ST changes or arrhythmia)
- 36 patients (12.3%) were found to have elevated cardiac enzymes (CPK).
- 15 (16.5%) patients had both diagnostic ECG and elevated enzymes,
- 55 (60.4%) patients had diagnostic ECG only and
- 21 (23.1%) had elevated enzymes only.
- 1/3 of patients (n=91, 31.2%) had a clear diagnosis of acute coronary syndrome or a significant cardiac arrhythmia based on ECG/cardiac enzymes.

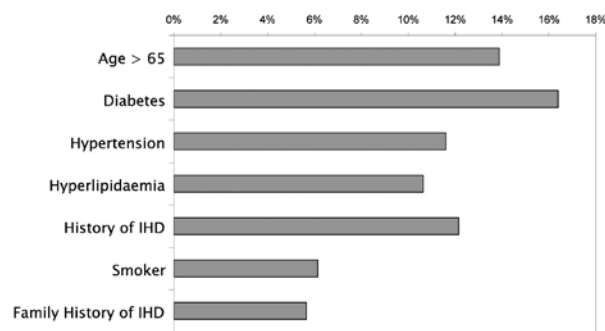
### Resources and special investigations

- 1 in 5 had continuous ECG monitoring (n=56, 19.2%), of which 1/10<sup>th</sup> had a documented arrhythmia (6/56, 10.7%).
- 21 patients (7.2%) had an urgent EST, most of which (20/21, 95.2%) were negative.
- 27 patients (9.2%) had an angiogram performed during admission i.e. in the first 72 hours, most of which (23/27, 85.2%) were negative.
- 11 patients (3.8%) had a V/Q scan, of which, more than one third were positive (4/11, 36.4 %).
- 8 patients (2.7%) had an echocardiogram, 3/4 of which were negative (6/8, 75%).
- Urgent angiography (within 72 hours) was more utilised than urgent EST.

### Outcomes and adverse events

- More than half of the patients were transferred to medical wards for further evaluation.
- 247 patients (84.5%) spent 1 or 2 days in the MAU.
- 16 patients (5.5%) were re-admitted with a cardiac event and 8 patients (2.7%) died within 3 months, giving a total adverse event rate at 3 months of 8.2% (n=24).
- Adverse events in 3 months occurred in 4.7% (6/129) of patients that were discharged home from the MAU and in 11.0% (18/163) of patients that were transferred to wards for further investigation.
- The single risk factor giving the highest rate of adverse events at 3 months was diabetes (10/61, 16.4%).

**Figure 9:** Rate of adverse events (readmissions and mortality) at 3 months in the presence of a cardiovascular risk factor



Standardised care that combines efficiency and safety requires the implementation of guidelines that are used internationally. Such guidelines exist and have been validated in clinical trials.<sup>2-5</sup> However, the implementation of these guidelines needs to be tested locally, mainly to assess feasibility.

This study observes various facets of managing patients with chest pain, which can be analysed individually. The distribution of risk factors (Figure 1), shows hypertension, history of IHD and smoking as the commonest risk factors. It is pertinent to note that a significant proportion of patients with chest pain had a history of IHD. This means that the population of patients admitted with chest pain is a biased sample of the general population. They are at risk of cardiac events irrespective of the ECG or cardiac enzymes on presentation. This group of patients is a special group, because investigations are not targeted towards diagnosis (they have already been diagnosed with IHD), but rather represent a group of patients that require adjustments in their medical treatment or a decision to intervene (PCI or CABG).

ECG changes were common and found in 36.3% (n=106) of patients admitted with chest pain (Figure 2). However only circa one fourth (n=70, 23.9%) had a diagnostic ECG (ST elevation/depression or arrhythmia) and 12.3% (n=36) had elevated cardiac enzymes.

Thus, serious cardiac pathology could be diagnosed in only 31.2% (n=91) on the basis of ECG and cardiac enzymes (Figure 3). CPK was the cardiac enzyme used. This leaves approximately 2/3 of patients without a clear diagnosis based on ECG and cardiac enzymes. These patients would benefit from an algorithm for safe discharge.

This study observed the use of resources (Figure 4) whilst the patients were in the MAU, namely cardiac monitoring, EST and the use of special imaging techniques (angiogram, V/Q scan, echocardiography or CT Thorax).

Continuous cardiac ECG monitoring was carried out in 1/5 of patients and of these, a significant arrhythmia was detected in 10.7% (6/56). In other words, 1 in 5 patients were monitored, of which 1 in 10 had an arrhythmia. Ideally, all patients with

chest pain should be monitored. Clearly, logistics will not allow this and prioritisation will always be required, though more monitoring services would improve the standard of care. Despite the logistic limitations, the pick up rate of arrhythmias (6/56, 10.7%) was significant indicating that the choice of patients that were monitored was appropriate.

The number of ESTs carried out before discharge was extremely low. Only 7.2% ( $n=21$ ) had an EST before discharge, of which 95.2% (20/21) were negative. This is the most evident observation especially when comparing with the rate of coronary angiography. More urgent angiograms, (85.2% of which were normal) than urgent EST were performed ( $n=27$ , 9.2% vs.  $n=21$ , 7.2%, respectively). Exercise ECG testing increases the diagnostic value of the chest pain algorithm protocol when combined with serial enzymes and resting ECG.<sup>6</sup>

Three special imaging studies (CT Thorax, V/Q scan and echocardiogram) are useful in identifying alternative causes for chest pain. CT Thorax was rarely used. Significantly, of the 3.8% ( $n=11$ ) that had a V/Q scan, 36.4% (4/11) were positive. The low utilisation of V/Q scanning combined with the very high yield suggests an efficient use of this resource, though the safety of this possible underutilisation needs further evaluation. Only 2.7% ( $n=8$ ) had an echocardiogram. Echocardiography is a noninvasive investigation that can be useful in evaluating chest pain. It can exclude pericardial effusions, detect global contractility dysfunctions indicating a possible myocarditis or regional abnormalities indicating ischaemia. The current 'rule out MI' approach to the management of chest pain tends to minimise the importance of other causes of chest pain.

Figure 7 compares the number of patients with non-diagnostic ECG/cardiac enzymes with the number of urgent EST. This is the group where an urgent EST prior to discharge would have helped identify the medium and high risk patients that need admission and further work up, from the low risk patients that can be evaluated on an outpatient basis.

This study observed the safety of the current discharge practices. This was measured in numbers of adverse events i.e. re-admission with cardiac events or mortality within 3 months of admission to MAU. Overall 8.2% ( $n=24$ ) had an adverse event within 3 months (Figure 8). Most likely this represents a group of patients with significant morbidity prior to admission.

Although decisions to admit patients for further evaluation to medical wards identified a high risk group of patients (11% adverse event rate) those that were discharged nevertheless suffered a significant 4.7% adverse event rate. An urgent EST may have identified high risk patients within this group.

Logistic constraints would necessitate prioritisation for urgent EST, based on cardiac risk factors. The study (Figure 9) clearly shows the impact of the various cardiac risk factors on the rate of adverse events at 3 months. As would be expected, age >65y (13.9%), diabetes (16.4%) and hypertension (11.6%) were the most predictive of adverse events.

## Conclusions

This study looked closely at the current practice with regard to the management of patients presenting with chest pain in the MAU. ECG and cardiac enzymes can diagnose 1/3 of patients, leaving 2/3 of patients that are being managed in a variable way. More than half are admitted for longer stays in hospital. Despite this, there is a significant rate of adverse events within 3 months. More continuous ECG monitoring facilities are required.

Urgent EST is underutilised whereas urgent angiography is over utilised. Urgent targeted bedside echocardiography provides key information and should be more widely available. The pick up rate for V/Q scan is high but utilisation is low. Although efficient, the safety of this practice needs to be studied further.

Overall, patients are spending an average of 2 days in MAU. The implementation of a clinical algorithm that includes a lower threshold for in-patient EST may reduce this stay safely to 1 day or less for low to medium risk patients and may reduce requests for urgent angiography.

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