Compliance with stress testing in patients discharged from the emergency department following a diagnosis of low-risk chest pain

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ABSTRACT

Objective To determine rates of compliance with outpatient stress testing in patients with a diagnosis of low-risk chest pain, reasons for non-compliance and incidence of adverse cardiac events (ACE).

Methods This was a prospective study of 79 patients who were discharged from the emergency department with low-risk chest pain. Patients were followed-up by phone interview.

Results 36.7% of patients completed EST within 30 days, 2.5% of patients completed their EST within the recommended 72 h. A lack of time was the most common reason for non-compliance and was seen in 32.0% of patients. 20% of ESTs were cancelled by the primary care physician (PCP). 12% of patients were non-compliant, as they believed the pain to be non-cardiac. There were no documented ACEs in the study.

Conclusions Compliance with EST is poor in patients with low-risk chest pain. Non-compliance is related to a number of factors including work commitments, cancellation of studies by the PCP and patients beliefs about the nature of their chest pain.

INTRODUCTION

Chest pain represents one of the most common causes for presentation to the emergency department (ED) in Australia.[1] It is estimated that 25% of patients presenting to an ED with chest pain will be diagnosed with acute coronary syndrome (ACS).[2] ACS accounts for more than 80 000 hospital admissions each year,[1] and incorporates a wide spectrum of disease including ST-segment elevation myocardial infarction (STEMI), non-ST-segment myocardial infarction (NSTEMI) and unstable angina (UA).[3] The 1-year mortality rate for STEMI patients is 9%, 13% for NSTEMI patients and 7% for UA patients,[4] so appropriate triage and risk stratification of patients presenting with chest pain is crucial in order to minimise the rate of missed myocardial infarction (MI) and UA. Two per cent of patients with MI and another 2% of patients with UA will be misdiagnosed and subsequently discharged, with a risk-adjusted mortality ratio of nearly 2 for those who were not hospitalised compared to those who were.[5–7]

After patients who present to ED with chest pain have STEMI and NSTEMI excluded, they are then risk stratified into high, intermediate and low risk, in accordance with the National Heart Foundation of Australia/Cardiac Society of Australia and New Zealand (NHF/CSANZ) guidelines (box 1).[8] Rahman *et al* found that it was safe to discharge patients at low risk for ACS provided they underwent early provocative stress testing.[9] NHF/CSANZ guidelines recommend that this should occur within 72 h of discharge.[8] This recommendation is based on research by Larsson *et al*[10] that demonstrated that there were no significant differences in the rates of severe angina, MI or death when exercise stress testing (EST) were performed at discharge or 1 month later.

While this approach has been shown to be safe in low-risk patients, there is evidence that patient compliance with outpatient EST is poor.[11 12] There does not appear to be an increase in adverse cardiac events (ACE) in the short term for these patients, but patients with significant disease have increased rates of mortality, long term, if they are not followed-up appropriately.[4] Little is known about the reasons for non-compliance in these patients.

The primary objectives of this study are to determine the rates of compliance for outpatient stress testing (at 72 h and 30 days) in patients stratified as being low-risk for ACS as well as reasons for non-compliance. Additionally, we sought to determine the incidence of ACEs in the group studied.

METHODS

This was a prospective study conducted in the ED of Liverpool Hospital, a tertiary care, university affiliated hospital in the southwest of Sydney with an annual ED attendance of 65 000 patients. The study was conducted over a 7-month period from 20 March to 2 November 2012. Ethics approval was granted by the Liverpool Hospital Human Resource Ethics Committee.

Patients were eligible for inclusion if they were over the age of 18 years and deemed to be low risk for ACS according to the NHF/CSANZ guidelines. Patients who were stratified as being intermediate or high risk for ACS were excluded, as were all patients who underwent inpatient stress testing within the Emergency Short Stay Unit (ESSU).

Eligible patients were identified initially by triage nursing staff, and the medical staff assessing the patients, with the investigators responsible for enrolling the patient and obtaining patient consent for the study. If the patient presented after hours, the treating ED doctor obtained consent and relevant contact details, and provided the patient with an information statement. The participation information statement and consent form are provided in online supplementary appendix 1 and 2. A daily review of all patients attending the ED was also conducted using the electronic patient database (FIRSTNET). Eligible patients that had not been

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Box 1 NHF/CSANZ guidelines for risk stratification for acute coronary syndrome (ACS)[20]

High risk

Presentation with clinical features consistent with ACS and any of:

- Repetitive or prolonged (>10 min) ongoing chest pain
- Elevation of at least 1 cardiac biomarker (troponin or CK-MB)
- Persistent or dynamic ST depression, or new T-wave inversion
- Transient ST segment elevation in more than 2 contiguous leads
- Haemodynamic compromise; systolic blood pressure <90 mm Hg, cool peripheries, diaphoresis, Killip Class>1, new onset mitral regurgitation
- Sustained ventricular tachycardia
- Syncope
- LV systolic dysfunction (LVEF <40%)
- Prior PCI within 6 months or prior CABG surgery
- Presence of diabetes with typical symptoms for ACS
- Chronic kidney disease (estimated GFR <60 mL/min) with typical symptoms for ACS

Intermediate risk

Clinical features consistent with ACS and any of:

- Chest pain within past 48 h that occurred at rest, or was repetitive or prolonged (but currently resolved)
- Age >65 years
- Known IHD: prior myocardial infarction (MI) with LVEF >40%, or known coronary lesion >50% stenosed
- No high-risk ECG changes (see above)
- Two or more of: known hypertension, family history, active smoking or hyperlipidaemia
- Presence of diabetes with atypical symptoms for ACS
- Chronic kidney disease—estimated GFR <60 mL/min with atypical symptoms for ACS
- Prior aspirin use

Low risk

Presentation with clinical features consistent with ACS without intermediate or high-risk features

- Onset of anginal symptoms within the last month
- Worsening in severity or frequency of angina
- Lowering in angina threshold

ACS, acute coronary syndrome; CAB, coronary artery bypass grafting; CK-MB, creatine kinase-MB isoenzyme; GFR, glomerular filtration rate; IHD, ischaemic heart disease; LVEF, left ventricular ejection fraction; PCI, primary coronary intervention.

enrolled were contacted by phone, and consent to participate in the study was obtained. All patients who were enrolled were advised of the need to follow-up with their primary care physician (PCP) for an outpatient stress test by the treating doctor, and were given written discharge instructions in addition to a discharge letter for the PCP. They were told to represent to the ED if they experienced further or worsening symptoms. The method of stress testing was predominantly a treadmill exercise stress test using the standard Bruce protocol interpreted by a specialist cardiologist. In patients who were not suitable for a treadmill test due to patient fitness, sestamibi scanning interpreted by a specialist nuclear physician using standard protocols or a stress echocardiogram was performed by a cardiologist.

Table 1 Cardiovascular risk factors of patients

Risk factor	n (%)
Age >65 years	10 (12.7)
Hypertension	21 (26.6)
Diabetes	12 (15.2)
Current smoker	13 (16.5)
Hypercholestrolaemia	22 (27.8)
Family history of IHD	34 (43.0)

IHD; ischaemic heart disease.

One month after discharge, patients were contacted by phone for follow-up. Patients were questioned about any further episodes of chest pain as well as re-presentations to the ED and admissions to hospital for chest pain. Compliance with outpatient stress testing and, if relevant, reasons for non-compliance were also discussed with the patient. The questionnaire used for follow-up has been provided in online supplementary appendix 3. If patients were initially unable to be contacted, phone calls were made weekly for a maximum of 4 weeks, after which the patient was deemed to be lost to follow-up.

The study data was analysed using the SPSS V.20 software package.

RESULTS

A total of 125 patients presented to the ED during the study period who were diagnosed with low-risk chest pain, and referred for outpatient stress tests. Seventy-nine patients were enrolled in the study. Of the 46 patients who were not enrolled, 29 did not consent to enrolment in the study. Ten patients did not speak English and were excluded from the study, and 7 patients were lost to follow-up.

The median age in the group studied was 48 years (range 18–86 years); 45.6% of the patients were male, and the most common cardiac risk factor was a family history of ischaemic heart disease (43.0% of the patient population). The mean number of risk factors was 1.3. Table 1 shows the frequency of cardiovascular risk factors in the study population.

Of the 79 patients enrolled, 29 patients (36.7%) completed their outpatient stress test. Two patients (2.5%) completed their stress test within 72 h of discharge. Of those who underwent outpatient stress testing, 24 (82.8%) performed an EST, 4 (13.8%) performed a stress echocardiogram and one patient (3.4%) underwent a myocardial perfusion scan.

Fifty (63.3%) of the 79 patients were non-compliant with outpatient stress testing with the most commonly cited reason being time constraints due to work (32%). Table 2 shows the various reasons for non-compliance.

Table 2 Reasons for non-compliance with outpatient stress testing at 30 days

Reason	n (%)
Time constraints	16 (32.0)
Decision by PCP or cardiologist	11 (22.0)
Patient forgot	7 (14.0)
No further chest pain, or patient believes pain is non-cardiac	6 (12.0)
Awaiting stress test appointment	10 (20.0)
Total	50

PCP, primary care physician.

ACEs were defined as death, STEMI, NSTEMI, and the need for urgent coronary revascularisation. There were no documented ACEs within 30 days of discharge for the study population. Five (6.3%) of the patients re-presented to the ED. Three patients (3.8%) presented with chest pain, one patient presented with abdominal pain and one patient presented with acute asthma requiring hospital admission. Of the three patients who re-presented with chest pain, one was diagnosed with UA and was considered safe for discharge following a cardiology review, with instructions for urgent follow-up by their regular cardiologist. This patient had completed an EST 4 weeks after initial discharge, and the repeat episode of chest pain occurred 1 week after completion of the EST. While this was not strictly an ACE, it was felt that this represented a significant cardiac event. The second patient presented 1 week after their initial presentation (prior to a booked EST) and was discharged after evaluation with a diagnosis of non-cardiac chest pain. They went on to have a normal EST 3 weeks later. The final patient left the ED against medical advice, as their symptoms had resolved, and did not complete an outpatient EST.

DISCUSSION

The primary benefits of using a risk stratification protocol in the ED are to improve our ability to diagnose cardiac disease in patients presenting with chest pain while allowing for the identification of patients who may be safely discharged from the ED.[11] Implementation of risk stratification guidelines does result in a reduction in the re-presentation rates of patients with chest pain.[13] In our study, 3.8% of patients re-presented with chest pain, which is lower than the rate recorded in prior studies in which up to 17% of patients with negative stress tests re-presented with chest pain.[14]

Patient compliance with outpatient stress testing varies from 42% to 63% when patients are instructed to follow-up with their PCP to organise testing.[11 15–17] The relatively wide range of compliance rates may be partly attributable to the availability of universal health care in some nations and the lack of it in others.[18] In our study, the compliance rate with outpatient stress testing at 30 days was 36.7%, which is comparable to the published literature. The 72 h compliance rate was much less at 2.5%. This is an effect that has been described previously with 72 h compliance rates of 6%.[11]

Compliance rates improve significantly when outpatient stress tests are organised prior to discharge, Meyer demonstrated a 92.2% compliance rate for EST when the procedure was booked prior to discharge, and Richards showed that compliance improved from 56.1% for patients advised to see their PCP to organise the procedure, to 72.5% for patients who had their EST booked prior to discharge.[2 17] The efficacy of this strategy is based on the premise that the fewer steps an individual must take to reach a goal, the more likely they are to complete it. In our study, 32.0% of patients cited time constraints as being the main reason they were unable to complete an EST. Helping patients obtain time off from work, and improving access to transport and childcare services, have also been shown to improve compliance.[19] A direct referral service from the ED for EST while improving the compliance rate would also reduce the number of ESTs cancelled by the PCP. This was a significant proportion (20.0%) of the patients who were non-compliant with outpatient EST. It would also reduce the number of patients who forgot to follow-up with their PCP (14.0% in our study).

In our study, a further 12.0% of patients stated that they did not undergo EST because they did not experience any further chest pain, or they believed that their pain was non-cardiac. This contrasts with available literature where 60% of patients non-compliant with EST believed that they did not have a heart problem or that their pain was non-cardiac.[17] This demonstrates that communication with our patients is vital to convey the reasons why EST is crucial in the work-up of their episode of chest pain.

The availability of outpatient EST facilities was beyond the scope of this study, so it is difficult to comment on the group of patients who were still awaiting EST (20.0%). This could be due to delay in follow-up with their PCP, or it may be due to availability of EST resources.

Our findings indicate that compliance with outpatient EST remains poor. In order to improve this, a number of approaches need to be addressed, including helping patients access time off from work for their procedure, improving compliance by direct referral for EST, and better patient education.

LIMITATIONS

The strengths of this study were that this was a prospective trial with consecutive enrolment of patients with an assessment of compliance and short-term outcomes.

The limitations of this study were that it was a non-randomised observational study. The small sample size limited our ability to assess whether compliance with outpatient stress testing had any effect on patient outcomes in the group studied. Long-term follow-up of patients would have allowed us to determine outcomes of patients particularly in the non-compliant group. A significant number of patients declined to be enrolled in the study that further limited our study size. Follow-up was incomplete in 8.9% of patients, and it is possible that patients who were lost to follow-up or declined to be involved in the study experienced an ACE.

This was also a single-centre study, and the conclusions derived from the study may not be applicable to other patient populations.

CONCLUSION

Patients who are discharged home with a diagnosis of low-risk chest pain are poorly compliant with EST. The 72 h rate is 2.5%, and the 30-day rate is 36.7%. Despite this low compliance rate, there were no documented ACEs highlighting a relatively benign course of events for these patients in the short term. The most commonly cited reasons for non-compliance were lack of time, test cancellation by PCP, and cancellation due to patient beliefs about the chest pain being non-cardiac. Non-compliance with EST could be improved by better patient education and direct referral from the ED for EST.

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Competing interests None.

Ethics approval Liverpool Hospital Human Research Ethics Committee.

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Data sharing statement All the raw data from the study has been made available to the journal, and is free to access for anyone who requires this data.

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