EM ADVANCES

Emergency department patient compliance with follow-up for outpatient exercise stress testing: a randomized controlled trial

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ABSTRACT

Introduction: Numerous patients are assessed in the emergency department (ED) for chest pain suggestive of acute coronary syndrome (ACS) and subsequently discharged if found to be at low risk. Exercise stress testing is frequently advised as a follow-up investigation for low-risk patients; however, compliance with such recommendations is poorly understood. We sought to determine if compliance with follow-up for exercise stress testing is higher in patients for whom the investigation is ordered at the time of ED discharge, compared with patients who are advised to arrange testing through their family physician (FP).

Methods: Low-risk chest pain patients being discharged from the ED for outpatient exercise stress test and FP follow-up were randomized into 2 groups. ED staff ordered an exercise stress test for the intervention group, and the control group was advised to contact their FP to arrange testing. The primary outcome was completion of an exercise stress test at 30 days, confirmed through both patient contact and stress test results. Patients were unaware that our primary interest was their compliance with the exercise stress testing recommendations.

Results: Two-hundred and thirty-one patients were enrolled and baseline characteristics were similar between the 2 groups. Completion of an exercise stress test at 30 days occurred in 87 out of 120 (72.5%) patients in the intervention group and 60 out of 107 (56.1%) patients in the control group. The difference in compliance rates (16.4%) between the 2 groups was statistically significant ($\chi^2 = 6.69$, $p < 0.001$) with a relative risk of 1.29 (95% confidence interval 1.18–1.40), and the results remained significant after a "worst case" sensitivity analysis involving 4 control group cases lost to follow-up. When subjects were contacted by telephone 30 days after the ED visit, 60% of those who were noncompliant patients felt they did not have a heart problem and that further testing was unnecessary.

Conclusion: When ED staff order an outpatient exercise stress test following investigation for potential ACS, patients are more likely to complete the test if it is booked for them before ED discharge. After discharge, many low-risk chest pain patients feel they are not at risk and do not return to their

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FP for further testing in a timely manner as advised. Changing to a strategy of ED booking of exercise stress testing may help earlier identification of patients with coronary heart disease.

Key words: compliance, adherence, exercise stress test, low-risk chest pain, follow-up

RÉSUMÉ

Introduction : Bon nombre de patients sont examinés dans les salles d'urgence (SU) pour des douleurs thoraciques évoquant un syndrome coronarien aigu (SCA) et reçoivent subséquemment leur congé, s'il est déterminé que le risque est faible. Il est souvent conseillé aux patients à faible risque de subir une épreuve d'effort, dans le cadre d'une investigation de suivi. Pourtant, l'observation de ces recommandations est mal comprise. Nous avons cherché à déterminer si le taux d'observation de la recommandation de subir une épreuve d'effort est plus élevé chez les patients pour lesquels les démarches pour subir l'épreuve sont faites au moment de recevoir leur congé de la SU plutôt que chez les patients à qui l'on conseille de prendre les dispositions pour subir cette épreuve par l'intermédiaire de leur médecin de famille (MF).

Méthodes : Nous avons randomisé les patients présentant des douleurs thoraciques à faible risque en deux groupes : le premier formé des patients ayant reçu leur congé et devant subir une épreuve d'effort en consultation externe; le deuxième formé des patients devant prendre les dispositions pour subir cette épreuve par l'intermédiaire de leur MF. Le personnel de la SU a pris les dispositions relatives à l'épreuve d'effort pour les patients du groupe d'intervention, et les patients du groupe témoin ont été avisés de communiquer avec leur MF pour subir ce test. La réalisation de l'épreuve dans les 30 jours, confirmée par le contact avec le patient et les résultats du test, constitue la principale mesure de résultats. Les patients ne savaient pas que notre intérêt premier était de déterminer s'ils avaient observé la recommandation de subir une épreuve d'effort.

Résultats : L'étude comptait 231 patients, et les caractéristiques de base étaient semblables pour les deux groupes. La réalisation de l'épreuve d'effort dans les 30 jours a eu lieu chez 87 des 120 patients (72,5 %) du groupe d'intervention et chez 60 des 107 patients (56,1 %) du groupe témoin. La différence des taux d'observation (16,4 %) entre les deux groupes était statistiquement significative (χ^2 = 6,69; p < 0,001) avec un risque relatif de 1,29 (intervalle de confiance à 95 %, 1,18 à 1,40), et les résultats sont demeurés significatifs après la réalisation d'une analyse de sensibilité (scénario du pire cas) mettant à contribution quatre patients du groupe témoin perdus de vue. Lorsqu'on a téléphoné aux sujets 30 jours après leur visite à la SU, 60 % des patients qui n'avaient pas suivi la recommandation estimaient qu'ils n'avaient pas de problème cardiaque et qu'aucune épreuve additionnelle n'était nécessaire.

Conclusion : Lorsque le personnel de la SU recommande la réalisation d'une épreuve d'effort en consultation externe à la suite d'un examen médical pour suspicion d'un SCA, les patients sont plus susceptibles de se présenter à l'épreuve si les dispositions sont prises par le personnel avant qu'ils reçoivent leur congé. Autrement, après leur congé de la SU, bon nombre de patients présentant des douleurs thoraciques à faible risque estiment qu'ils ne sont pas à risque et ne consultent pas leur MF pour subir des tests additionnels en temps utile, tel qu'il leur est recommandé. L'adoption d'une stratégie concernant la prise d'un rendez-vous en SU pour une épreuve d'effort pourrait aider à reconnaître plus tôt les patients ayant une insuffisance coronarienne.

Introduction

Patients who present to emergency departments (EDs) with possible acute coronary syndrome (ACS) represent a significant proportion of the ED population and pose diagnostic and disposition challenges.[1] A US study suggests that approximately 2.1% of such patients are discharged from the ED with a missed diagnosis of acute myocardial infarction and an additional 2.3% with unstable angina are also missed.[2] The risk-adjusted mortality for these patients has been reported to be 1.9 times higher than for those who are hospitalized.[2] A recent Canadian study found 5.3% of ED patients with ACS are missed and discharged from the ED.[3] Despite the significant risks associated with inappropriate ED discharge, system constraints and cost preclude admitting all patients who present to the ED with the potential for ACS. Clinicians must therefore decide which chest pain patients are at low risk for having ACS. In centres where chest pain units exist, definitive tests to investigate ACS can be done rapidly in low-risk patients. However, most hospitals do not have such facilities and investigations are performed on an outpatient basis. In Canada, this typically consists of an exercise stress test to determine the need for treatment or further (typically

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angiographic) investigation. According to the American College of Cardiology and the American Heart Association Task Force (ACC/AHA), exercise stress testing is a class I recommendation for patients with possible coronary artery disease (CAD) based on age, sex and symptoms.[4] One study indicated that up to 10% of people who are stratified as having low-risk chest pain have CAD. This underscores the importance that this population be investigated promptly with an exercise stress test or other modalities.[5]

In Canada, the approach to arranging an exercise stress test is location dependent and is typically arranged by the family physician (FP) following discharge from the ED, but can also be arranged by ED staff at the time of discharge. It is not known which route offers the highest compliance rate, nor are the reasons known for noncompliance in this population. The objective of our study was to determine if compliance with follow-up for exercise stress testing is higher in patients for whom the investigation is ordered at the time of ED discharge, compared with patients who are advised to arrange testing through their FP.

Methods

Ethics

This study was formally reviewed and approved by our institution's Research Ethics Board.

Study design

This was a randomized controlled trial in which patients were allocated to 1 of 2 groups using a series of shuffled, then numbered opaque envelopes.

Setting

Three urban, academic EDs in Hamilton, Ontario.

Selection of participants

Patients presenting to one of the study EDs with chest pain of possible cardiac ischemic origin between November 2002 and September 2003 were eligible if they did not have a specialty consultation and if they were being discharged home to be managed by their FP. Additional inclusion criteria were that patients had to:

1. be aged 18 years or older;
2. have a telephone number for follow-up contact;
3. have an FP;
4. have normal cardiac markers (creatinine kinase or troponin T);
5. be 6 to 8 hours from the onset of symptoms;
6. have a normal electrocardiogram;
7. have no history of ischemic heart disease; and
8. have the ability to perform an exercise stress test.

Patients meeting all of the eligibility criteria were invited to participate and consent was obtained from those in agreement. Patients were blinded to the compliance objective of the study. Patients were simply told that "the study was looking at what happened to patients after going home with chest pain."

ED staff responsible for recruitment and consent procedures were trained on an ongoing, one-to-one basis by the investigators and were provided with monthly feedback on their performance.

Interventions

In the intervention group, ED staff faxed a requisition to the exercise stress test lab. Patients in this group were then instructed to return for an exercise stress test when notified by the exercise stress test lab. The staff at the exercise stress test lab were not aware of the study, and standard lab requisitions were used. Patients in the control group were advised to contact their FP for an exercise stress test, and a copy of their chart was mailed to their FP with a note recommending an exercise stress test.

Methods and measurements

Demographic and baseline characteristic data were collected for each patient at the time of enrollment.

The primary outcome (performance of exercise stress test) was confirmed in 2 ways. For those in the intervention group, performance of the exercise stress test was established by the receipt of the test result from the exercise stress test lab and contact with the patient by phone. In the control group, performance of the exercise stress test was established by the receipt of the test result from the FP and contact with the patient by phone. For patients in either group who did not comply with the request to follow-up for an exercise stress test, the reason for noncompliance was sought and documented during the phone contact.

Data collection and processing

Data collection and entry was conducted by a single member of the investigative team who was blind to group allocation. Data were entered into a Microsoft Excel database (Microsoft Corp, Redmond, Wash.).

Outcome measures

The primary outcome was the completion of the exercise stress test within 30 days of discharge from the ED.

Primary data analysis

Based on data from a pilot study, we anticipated a 70%

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compliance rate for the intervention group and a 50% compliance rate for the control group. Using an α value of 0.05 and a β value of 0.1 (i.e., power of 90%), we calculated a required sample size of approximately 100 subjects per group to detect an absolute improvement of 20% or more from a baseline rate of 50%.

The difference in compliance rate was assessed using chi-squared analyses. In addition, a worst-case sensitivity analysis was incorporated so that all patients who were appropriately enrolled were included in the analysis. For this sensitivity analysis, those lost to follow-up in the intervention group were assumed to have been noncompliant and those lost to follow-up in the control group were assumed to have been compliant. Data analysis was conducted on coded data with the analyst blind to group allocation. Summary measures are presented as proportions, relative risk with 95% confidence intervals (CIs) and the number needed to treat to achieve the additional compliance of 1 patient. All data analyses were performed using SPSS version 11 (SPSS, Chicago, Ill.).

Results

Of the 238 patients randomized in this study, 231 (97.1%) were included in the final analyses. Four patients were incorrectly enrolled and were therefore excluded because they did not meet inclusion criteria, and 3 patients withdrew consent prior to the intervention and so were excluded (Fig. 1). Baseline characteristics were similar between the 2 groups (Table 1). An exercise stress test within 30 days of randomization was completed in 87 of 120 (72.5%) patients in the intervention (ED-ordered exercise stress test) group and 60 of the 107 (56.1%) patients in the control (FP-ordered exercise stress test) group (Table 2). Four control group patients and no intervention group patients were lost to follow-up. The 16.4% difference in compliance rates between the 2 groups was statistically significant ($\chi^2 = 6.69$, $p < 0.001$) with a relative risk of 1.29 (95% CI 1.18–1.40). The number of exercise stress tests that would need to be ordered in the ED rather than arranged by FPs to achieve the additional compliance of 1 patient (number needed to treat) was 6.

Because 4 patients were lost to follow-up, a "worst case scenario" sensitivity analysis was completed assuming that all 4 control patients had been compliant. This resulted in a 57.7% compliance rate (64/111). The resulting revised absolute compliance rate increase of 14.8% remained statistically significant ($\chi^2 = 5.6$, $p < 0.001$) with a relative risk of 1.26 (95% CI 1.15–1.37). Under the assumptions of this sensitivity analysis, the adjusted number of stress tests that would need to be ordered in the ED rather than arranged

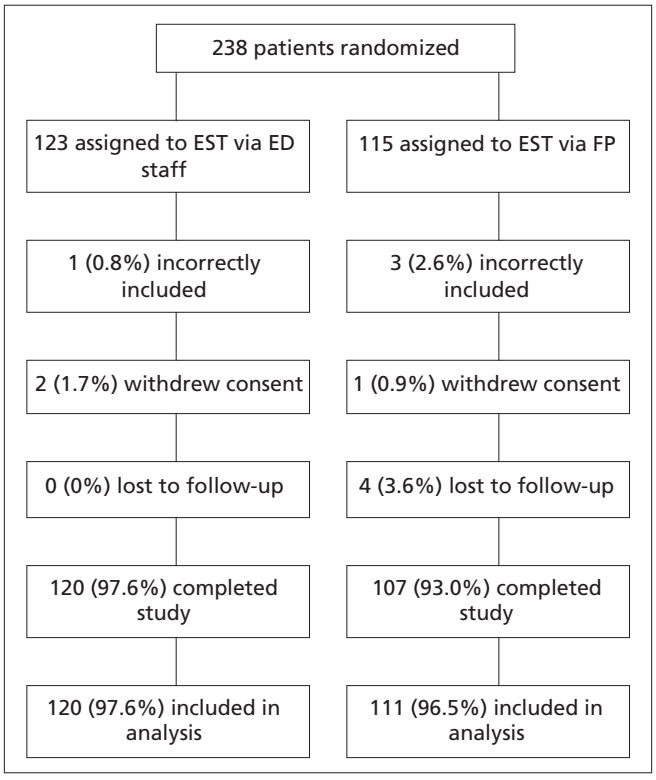

Fig. 1. Flow of patient participation. EST = exercise stress test; ED = emergency department; FP = family physician.

Table 1. Baseline characteristics of study patients

	Group, %*	
Variable	EST via ED	EST via FP
Mean age, yr	53.5	51.8
Male sex	64.0	58.0
Employed	63.0	61.1
Married	75.7	79.6
Diabetes	11.6	6.7
Hypertension	33.9	43.7
Current smoker	28.6	21.4
Family history of CAD	32.1	33.3

EST = exercise stress test; ED = emergency department; FP = family physician; CAD = coronary artery disease.
*Unless otherwise indicated.

Table 2. Outcome rates per group

Outcome	No. (and %) EST via ED; (n = 120)	No. (and %) EST via FP; (n = 107*)
EST in 30 days	87 (72.5)	60 (56.1)
No EST in 30 days	33 (27.5)	47 (43.9)
Lost to follow-up	0 (0.0)	4 (3.7)

EST = exercise stress test; ED = emergency department; FP = family physician.
*4 of the 111 patients in this group were lost to follow-up and are included in an additional worst case" sensitivity analysis.

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by FPs to achieve the additional compliance of 1 patient (number needed to treat) was 6.8.

During telephone contact, the responses to a question about the reason for noncompliance were varied. Twenty (60.6%) patients in the intervention group and 28 (65.1%) in the control group said that they did not feel they had a heart problem and that the exercise stress test was unnecessary. Other responses included difficulty taking time from work, family or other time barriers, transportation difficulties getting to the exercise stress test lab or FP office, and forgetfulness.

Discussion

Our study shows that only 56.1% of patients discharged from the ED after investigation for ACS are compliant with exercise stress tests at 30 days when patients are required to make arrangements for exercise stress test via their FPs. This low rate of compliance is of concern given the mortality and morbidity associated with untreated CAD. In contrast, when the exercise stress test arrangements are made by ED staff, patients are more likely to undergo exercise stress tests. Approximately 6–7 exercise stress tests would need to be booked through the ED for each additional compliant patient beyond an FP-arranged booking approach.

Patient compliance with outpatient clinic follow-up from Canadian EDs has been documented to be as high as 86% for orthopedic clinics and 60% for gynecology clinics.[6] In the United States, compliance rates are usually less than 50%, perhaps because of the lack of universal medical care.[7]

There are a number of possible explanations for the differences we found in exercise stress test compliance between the approaches we studied. As early as 1952, investigators recognized that much of human behaviour is influenced by situational circumstances known as "channel factors."[8] This moniker was developed to indicate that often seemingly minor barriers can impede a desired behaviour and that removing these barriers can facilitate the behaviour. For example, the fewer steps that an individual must take to reach a goal, in this case exercise stress test, the more likely he or she is to follow through. A study of follow-up of patients with childhood asthma after an ED visit found that when parents were given help to overcome simple barriers (e.g., time off work, parking and transportation) compliance improved.[9,10] When designing our study, we hypothesized that the possible additional requirement of a return visit to the FP to arrange an exercise stress test would reduce patient compliance, and our results support this hypothesis.

The patients in our control group, who received the usual care in our institution of FP follow-up for an exercise stress test, faced more potential barriers or decision points. Specifically, the patient had to arrange and attend a visit with the FP to discuss the exercise stress test, the FP's office had to arrange the test, the exercise stress test lab had to provide the patient or the FP with the booking and then the patient had to attend the test appointment. That said, it was striking that none of the noncompliant patients in the control group of our study had even arranged a follow-up appointment with an FP at 30 days, so it was at this point that a barrier or decision point seems to have occurred. When the exercise stress test booking was made by the ED, the main decision for the patient was simply determining whether or not to attend the appointment.

Interestingly, as an explanation for their noncompliance, more than 60% of the noncompliant patients stated that they felt they did not have a heart problem and that further testing was unnecessary. This suggests that it may be important for emergency physicians to emphasize the importance of further investigation for patients with low-risk chest pain in the ED if they are being discharged back to the care of the FP.

Our findings clearly indicate the benefits of exercise stress test booking for patients at the time of ED discharge. This change in procedure is fairly simple and is associated with lower health care system costs, compared with referral back to the FP for exercise stress test. However, it does necessitate added work for the ED staff and if the patient has no FP, which is increasingly the case, it may require greater responsibility for the emergency physician to follow up on the test results if an alternative arrangement is not available. These factors could impede the implementation of an ED-booked exercise stress test approach. Future studies should examine whether this simple change in procedure results in earlier or increased identification of CAD in low-risk chest pain patients presenting to the ED, thereby reducing CAD-related morbidity and mortality.

Limitations

Our study employed a convenience sampling method because limited resources precluded enrollment of all eligible patients presenting to the EDs during the study period. If compliance characteristics vary across different times and days of ED presentation, it is possible that selection bias and erroneous estimates could result from this approach. Our randomization method used sealed opaque envelopes that concealed the allocation sequence. Although there was no indication of interference with the envelopes, this method is still vulnerable to tampering when unsupervised.

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Finally, the reported reasons for noncompliance were not assessed using a standardized questionnaire and were recorded by a single team member and thus should be interpreted with caution.

Conclusion

When ED staff order an outpatient exercise stress test following investigation for potential ACS, patients are more likely to complete the test if it is booked for them before ED discharge. After discharge, many low-risk chest pain patients feel they are not at risk and do not return to their FP for further testing in a timely manner as advised. Changing to a strategy of ED booking of exercise stress testing may help earlier identification of patients with coronary heart disease.

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Competing interests: None declared.

References

1. Hill S, Devereaux PJ, Griffith L, et al. Can troponin I measurement predict short-term serious cardiac outcomes in patients presenting to the emergency department with possible acute coronary syndrome? CJEM 2004;6:22-30.

2. Pope JH, Aufderheide TP, Ruthazer R, et al. Missed diagnoses of acute cardiac ischemia in the emergency department. N Engl J Med 2000;342:1163-70.

3. Christenson J, Innes G, McKnight D, et al. Safety and efficiency of emergency department assessment of chest discomfort. CMAJ 2004;170:1803-7.

4. Gibbons RJ, Balady GJ, Bricker JT, et al; American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Committee to Update the 1997 Exercise Testing Guidelines. ACC/AHA 2002 guideline update for exercise testing: summary article. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1997 Exercise Testing Guidelines). J Am Coll Cardiol 2002;40:1531-40.

5. Meyer M, Mooney R, Sekera A. A critical pathway for patients with acute chest pain and low risk for short-term adverse cardiac events: role of outpatient stress testing. Ann Emerg Med 2006;47:435.e1-3.

6. Murray MJ, LeBlanc CH. Clinic follow-up from the emergency department: Do patients show up? Ann Emerg Med 1996;27:56-8.

7. Thomas EJ, Burstin HR, O'Neil AC, et al. Patient noncompliance with medical advice after the emergency department visit. Ann Emerg Med 1996;27:49-55.

8. Lewin K. Group decision and social change. In: Swanson GE, Newcombe TM, and Hartley EL, editors. Readings in social psychology. New York (NY): Henry Holt; 1952.

9. Baren JM, Shofer FS, Ivey B, et al. A randomized, controlled trial of simple emergency department intervention to improve the rate of primary care follow-up for patients with acute asthma exacerbations. Ann Emerg Med 2001;38:115-22.

10. Zorc JJ, Scarfone RJ, Li Y, et al. Scheduled follow-up after a pediatric emergency department visit for asthma: a randomized trial. Pediatrics 2003;111:495-502.

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