

RESEARCH

Clinician referrals for stress echocardiography: are we compliant with the NICE guidelines?

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Abstract

Accurate diagnosis of stable angina is of paramount importance, and where possible, this should be based on clinical history. In cases of uncertainty, the National Institute for Health and Care Excellence (NICE) provides a framework for assisting diagnosis based on pre-test likelihood (PTL) of coronary artery disease. Functional testing such as stress echocardiography (SE) is recommended as a first-line investigation in patients with PTL of 30–60%. This study evaluated hospital clinicians' adherence to this recommendation. A prospective analysis of patients referred for SE at a district general hospital between March and May 2013 was performed. Data were extracted from an electronic database of SE reports and medical notes. A total of 193 patients were assessed. The most common PTL was 61–90%, accounting for 40% of the cohort. Of them, 14% had a PTL of 30–60%. Of these, 15% had positive SE; 57% described non-anginal pain, as defined by NICE, of whom only nine cases had SE positivity. None of these patients required revascularisation. Findings suggest that SE is being used in a much broader selection group than advocated by NICE. This may often be for its exclusion value rather than to stratify risk. Although utility may be justified in high-risk patients to avoid proceeding directly to invasive angiography, SE appears to add little in those with non-anginal pain and with low PTL. Greater focus should be directed towards characterisation of symptoms, which may negate the need for subsequent investigation.

Key Words

- ▶ stress echocardiography
- ▶ stable angina
- ▶ chest pain
- ▶ NICE

Introduction

Chest pain is a diagnostic challenge and accounts for ~1.5% of presentations in the primary care setting (1). A significant proportion of these have a suspected diagnosis of angina (2). General practitioners are encouraged to refer patients with new or recent-onset chest pain to specialist clinics to inform diagnosis, risk stratify and determine the need for revascularisation. Rapid access chest pain clinics were rendered the national standard of care following their inclusion in the National Service Framework (3). Patients are reviewed within 2 weeks of initial referral.

Once referred, the hospital clinician is required to identify those presenting with symptoms suggestive of stable angina. The National Institute for Health and Care

Excellence (NICE) offers guidance to assist in assessment and diagnosis (Clinical Guideline 95) (4). Clinicians are first encouraged to characterise the presentation of chest discomfort as 'typical angina', 'atypical angina' or 'non-anginal'. 'Typical' anginal pain is described as i) constricting discomfort in the front of the chest, or in the neck, shoulders, jaw or arms, ii) precipitated by exertion and iii) relieved by rest or GTN within 5 min. Presence of two of these three characteristics is defined as 'atypical' and one or none as 'non-anginal.'

In those instances where angina cannot be diagnosed or excluded on clinical grounds, a framework is provided to estimate the likelihood of underlying significant

coronary artery disease (CAD). This is based on the characteristics of symptoms, age, sex, ECG changes and the risk factors of diabetes, smoking and hyperlipidaemia. Consequently, a pre-test likelihood (PTL) of CAD can be obtained. It is suggested that for patients with a PTL of >90% and a typical history, further testing is not necessary and they should be managed as angina. In those with diagnostic uncertainty and a PTL of 61–90%, invasive coronary angiography should be offered as first line if appropriate. Non-invasive functional testing such as stress echocardiography (SE), myocardial perfusion scintigraphy or stress cardiovascular magnetic resonance imaging is recommended in those patients with a PTL of 30–60%. For those with a PTL of 10–29%, CT calcium scoring should be performed in the first instance. In those with a PTL of <10%, alternative diagnoses should be sought.

The primary objective of this study was to evaluate the adherence of clinicians with the NICE guidance in their referrals for SE. Secondary areas of interest included demographic profile, prescription of anti-anginals and correlations among typicality of symptoms, PTL, SE positivity and angiographic lesions.

Methods

All patients referred for SE for the assessment of chest pain of recent onset at Pinderfields General Hospital in Wakefield were prospectively included in this observational audit. Both exercise and dobutamine SE were included. Exclusion criteria included patients referred for indications other than diagnosis of stable angina (such as identification of revascularisation targets and severity assessment of valvular disease), and those with an established history of CAD such as prior percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG).

The attending imaging cardiologist performed a chest pain history, and categorised the pain as typical angina, atypical angina or non-anginal chest pain as defined by current national and international standards (4, 5). Risk stratification for underlying CAD was performed through calculations of PTL according to the NICE guidelines (CG95) (4). Medical case notes and electronic records were reviewed to establish findings on angiography if performed. Data were gathered in an electronic database.

Statistical analyses were performed using Minitab 16. Dichotomous variables were tested using Fisher's exact test. A one-sample *t*-test was performed to assess mean values. Two-tailed testing with a probability value of ≤ 0.05 was considered statistically significant.

Table 1 Demographic profile of study group ($n=193$).

	Value	95% CI
Age in years (mean)	59.1	57.4–60.8
Age distribution		
20–40 (%)	5.7	3–11
41–60 (%)	47.7	41–55
61–80 (%)	42.0	35–49
> 80 (%)	4.7	2–8
Sex		
Male (%)	54	48–61
Female (%)	46	38–52
Smoker (%)	28	22–35
Type 2 diabetes (%)	18	13–24
Raised cholesterol (%)	31	25–38
Resting ECG changes (%)	8	5–13

Results

Demographics

Totally, 193 consecutive patients referred for SE between March and May 2013 were included (54% male; mean age 59.1 ± 12.3 years). The demographic profile of the study population is summarised in Table 1.

Anti-anginal therapy

At the time of referral, 90 patients (47%) were on no anti-anginals. Of those who were on anti-anginal therapy, 68% (70/103) were on β -blocker, 50% (52/103) on calcium channel antagonist and 22% (23/103) on vasodilator(s).

Typicality of symptoms

Distribution of referrals by typicality of symptoms is summarised below (Fig. 1). Only 22% (42/193) were deemed to have typical anginal symptoms, 43% (18/42) of whom subsequently had positive SE, 21% (41/193) described atypical pain and 57% (110/193) reported non-anginal pain. Of the 110 patients with non-anginal pain, nine had positive SE and none required revascularisation on angiography.

Correlations of PTL with symptoms and SE result

Correlation of PTL with typicality of symptoms (Fig. 2) and SE positivity (Fig. 3) is outlined. Data are also summarised in Table 2. Of these referrals, 18% (35/193) had a PTL of <10%, of whom 91% (32/35) had non-anginal pain. In this PTL subgroup, one patient had positive SE and the subsequent angiography demonstrated minimal atheroma only. 20% of referrals (39/193) had a

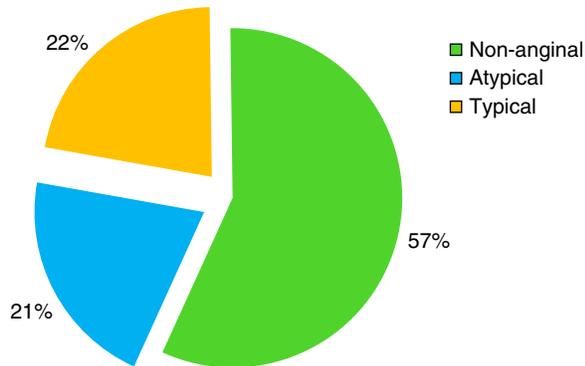


Figure 1
Distribution of referrals for stress echocardiography by typicality of symptoms.

PTL of 10–29%. Within this group, 59% (23/39) had non-anginal pain and 38% (15/39) had atypical pain. Overall, 90% (35/39) of those with PTL of 10–29% had negative SE and 14% (27/193) had a PTL of 30–60%, the cohort in which NICE recommends functional testing such as SE. Of these, 15% (4/27) had positive SE. In this subgroup, 55% (15/27) had non-anginal pain, 15% (4/27) had atypical pain and 30% (8/27) had typical pain at assessment. The most common PTL was 61–90% (78/193=40%). Of these patients, 49% (38/78) had non-anginal pain, 24% (19/78) had atypical pain and 27% (21/78) had typical anginal pain. In this PTL group, 22% (17/78) had positive SE. Of the referrals, 7% (14/193) had a PTL of >90%, of whom 86% (12/14) had typical angina on clinical assessment. In this PTL subgroup, 71% (10/14) had positive SE and, of these, 29% (4/14) required revascularisation.

Correlations of SE with angiography

From all 193 SE performed, 36 cases were positive (19% of cohort). Of these, 18 were referred for invasive angiography. The remainder were deemed unsuitable for further investigations by the individual clinician because of patient preference or existence of co-morbidities. Of the 18 who underwent angiography, ten had significant lesions that required intervention (PCI or CABG).

Discussion

The NICE guidelines for the assessment and diagnosis of recent-onset chest pain (Clinical Guideline 95) provide a structured framework to facilitate accurate diagnosis and guide management strategy. Stable angina may be diagnosed by clinical assessment alone based on typicality

of symptoms, in which case no further investigations are necessary. In those patients for whom stable angina cannot be confirmed or excluded based on assessment alone, recommendations are made to estimate likelihood of significant CAD based on PTL. Significant CAD is defined as $\geq 70\%$ diameter stenosis of at least one major epicardial artery or $\geq 50\%$ diameter stenosis in the left main stem (4).

NICE advocates the use of functional testing such as SE in those patients with a PTL calculated between 30 and 60%. Results from this audit suggest poor compliance. Only a small proportion of referrals, 14%, adhered to this recommendation. Indeed, results suggest that a group of patients of both low and high risk, selected in a far broader way, are currently being referred for SE in this single centre study. For instance, the PTL of highest frequency was 61–90%. NICE recommends angiography as a first-line investigation for these patients, though the results of this study strongly imply that SE is being undertaken first. This may reflect the perception among clinicians that a non-invasive, cost-effective investigation is preferable in the first instance, so that only patients with a greater degree of risk from CAD, as evidenced by SE results, are exposed to the risks of invasive angiography. Indeed, of the 78 patients within this category, only 17 had positive SE. The use of non-invasive imaging (including SE) as a gatekeeper to invasive X-ray angiography (XRA) has been demonstrated to be cost effective and helps prevent invasive procedures in 20–25% of patients (6). Further research is required for the use of non-invasive imaging in those with a high PTL of underlying CAD and to assess long-term outcomes.

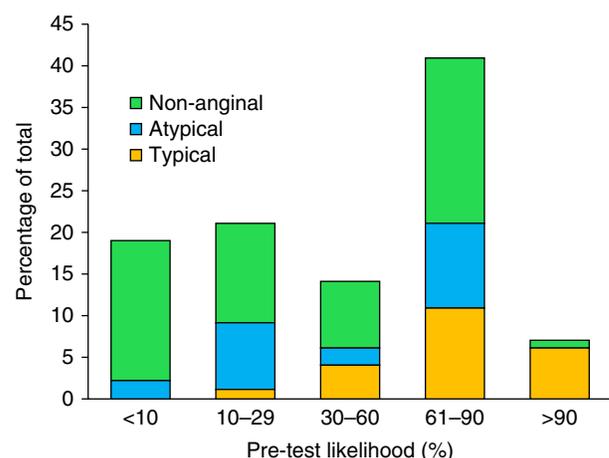


Figure 2
Correlation of pre-test likelihood (PTL) with typicality of symptoms.

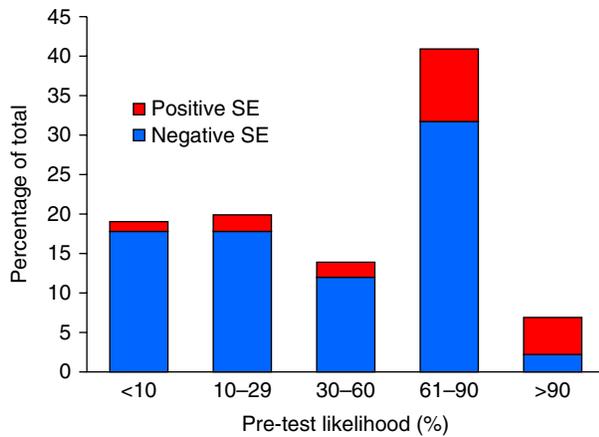


Figure 3 Correlation of pre-test likelihood (PTL) with stress echo positivity.

The majority of patients in the 61–90% category had pain that was either atypical (24%) or non-anginal (49%). It may be that SE is being used in these patients to exclude reversible ischaemia in view of their high-risk status on the basis of co-morbidities and demographic profile in cases where clinical evaluation suggests that angina is unlikely. Conversely, of the subgroup of patients with typical angina (22%), only 43% had positive SE. If functional imaging had not been performed, these negative cases may potentially have been exposed to invasive testing on prognostic grounds, as well as delaying diagnosis and treatment for the genuine cause of symptoms. Although it is difficult to ascertain as to whether the clinician has confidently diagnosed angina in these cases, these results in conjunction may reflect the concern that positive diagnosis of angina is not always obtained on clinical assessment alone and that a non-invasive investigation is being utilised as a means to prevent over-diagnosis.

Further evidence from this analysis corroborates the suggestion that SE is being used as a modality to confidently exclude angina, which is a clinical diagnosis, rather than a means of risk stratification for underlying CAD in those with diagnostic uncertainty. Of the referrals, 110 patients (57%) had non-anginal pain, as characterised by NICE. Of them, positive SE was found only in nine cases and none required angiographic revascularisation. It is clear from this that if patients do not have a typical history of angina, it may be appropriate to refrain from further testing. However, despite clinical judgement suggesting a non-ischaemic aetiology for chest pain, further evaluation is still being sought to confirm or refute conclusions. An

inference from this may be that accurate characterisation of the history of chest pain is lacking. This is accentuated by the finding that 18% of patients had a PTL of <10%, and of these, the vast majority (91%) had a history suggestive of non-anginal chest pain. One may speculate that incorrect characterisation of chest pain before referral for SE is a consequence of time restraints and unremitting pressures for patient turnover in the outpatient setting. Additionally, these findings may reflect the perceived pressure clinicians find themselves under to offer functional assessment to reassure patients that their symptoms do not engender significant risk. Although NICE provides guidance on diagnosis and risk stratification, this does not take into account the value of extra reassurance that objective testing can give to patients.

A secondary outcome of interest was prescription of anti-anginals at the time of referral for SE. Of these patients, 47% had not been commenced on any appropriate therapy. This inconsistency supports the notion that functional imaging is being perceived incorrectly as a modality to confidently exclude angina, as anti-anginal therapy with aspirin, statin, β -blocker and GTN spray is likely to have been instituted if the referring clinician had a strong clinical suspicion. A larger number of patients had been commenced on β -blocker therapy compared with calcium channel antagonist (68 vs 50%), though both were used more than vasodilators (23%). Current guidance recommends either a β -blocker or a calcium channel antagonist as first-line treatment of stable angina (7), and this is reflected in our study findings. The marginal preference for β -blockers may simply reflect the individual clinician practice or the presence of contra-indications, which may have influenced decision making.

Overall, it appears that the PTL calculated by NICE significantly over-estimates actual prevalence of flow-limiting CAD in patients presenting with chest pain. Only ten patients from those referred had significant lesions demonstrable on angiography. Even in those with

Table 2 Relationship between pre-test likelihood (PTL), typicality of symptoms and SE positivity.

Pre-test likelihood (%)	Typicality of symptoms (% of total)			Stress echo positivity (% of total)
	Non-anginal	Atypical	Typical	
<10	17	2	0	1
10-29	12	8	1	2
30-60	8	2	4	2
61-90	20	10	11	9
>90	1	0	6	5

a PTL of >90%, 71% did not require revascularisation. The tool to calculate PTL is derived from the use of data from a single prospective validation study (8). This was performed in 1993 and incorporated a cohort of 1030 consecutive patients referred for non-invasive testing for CAD in the outpatient setting. Notably, however, only a small percentage of this cohort (16%) subsequently underwent angiography. Additionally, the tool incorporates non-modifiable risk factors (age and sex) and modifiable risk factors (smoking, diabetes and hyperlipidaemia). However, other established risk factors for CAD such as hypertension and family history are not included. One may therefore argue that this tool itself has intrinsic limitations, and this has repercussions on validity of use to accurately assess risk.

Limitations

This is a single centre study with a limited sample size referred for SE within a 3 month window. This study only assesses referral indications and results in one of the imaging modalities and PTL categories recommended by the NICE guidelines (CG95). Nevertheless, the results represent the current practice in a large NHS trust, and one which has access to all alternative imaging modalities recommended in the NICE guidance. Therefore, it is improbable that local resource availability would have influenced results. Furthermore, referrals were accrued from a large consultant body of over 15 individuals (from the specialties of cardiology and acute medicine), and trends are therefore unlikely to be skewed by the influence of individual clinicians.

Conclusion

Our findings demonstrate that clinicians' use of SE diverges from the NICE recommendations. In particular, it is currently being utilised as a primary investigation of choice for a much wider selection of patients. A large proportion of referrals appear to have a history that is non-suggestive of angina, the vast majority of which result in subsequent negative functional imaging. Accurate characterisation of the history at presentation and risk stratification by calculating PTL is essential and may avoid

further testing which is unnecessary and unlikely to return a positive result.

Declaration of interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

Funding

This research did not receive any specific grant from any funding agency in the public, commercial or not-for-profit sector.

Author contribution statement

N Artis was involved in initial design, supervision and reporting of studies. E Wass, D Wilson, A Carr, N Watchorn, R K Hobman, and D Gill generated the database of images. P A Patel, K A Ravi and J Kane contributed to data collection. P A Patel and K A Ravi wrote the manuscript with equal responsibilities as primary authors. D P Ripley, W P Brooksby, N Kilcullen and N Artis provided additional reviews.

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Received in final form 14 May 2014

Accepted 9 July 2014