The consequences of applying NICE chest pain guidelines to an acute medical population: a role for cardiac computed tomography

C. PATTERSON1, L. BRYAN1, E. NICOL2, M. DUNCAN3, D. BELL4 and S. PADLEY1

From the 1 Chelsea and Westminster Hospital, 2 Royal Berkshire Hospital, 3 University College London Hospital, 4 Imperial College London, UK

Address correspondence to C. Patterson, Department of Medicine and Therapeutics, Chelsea and Westminster Hospital, 369 Fulham Road, London SW10 9NH, UK. email: cmpatterson@doctors.net.uk

Received 15 June 2010 and in revised form 26 July 2010

Summary

Background: Cardiac computed tomography (CCT) is a well-validated investigation for the non-invasive assessment of coronary artery disease (CAD). The National Institute for Clinical Excellence (NICE) have recently released guidelines incorporating CCT into the diagnostic algorithm for chest pain of recent onset.

Aim: To assess the frequency of eligibility for CCT in medical admissions with suspected cardiac chest pain using criteria defined by NICE.

Design: A retrospective, observational study, set in a teaching hospital acute medical unit.

Methods: A total of 198 consecutive patients admitted over a 4-month period with suspected cardiac chest pain (57% male; mean age 63.5 years) were assessed for eligibility for CCT based on NICE guideline criteria.

Results: Of the 198 patients admitted, 65 (33%) patients were excluded by a raised troponin I or ischaemic ECG changes; 100 (51%) patients were excluded by pain categorized as non-anginal and 171 (86%) patients were excluded by a modified Diamond Forrester score outside the range 10–29%. Applying NICE criteria to this population ultimately resulted in 2 (1%) patients recommended for CCT, 12 (6%) for functional cardiac testing and 17 (9%) for invasive angiography.

Conclusions: Applying current NICE guidelines for chest pain of recent onset to medical admissions results in a lesser uptake of CCT than functional testing and invasive angiography. If the NICE guidelines are revised to include patients with an intermediate pre-test probability of CAD, CCT may have a greater role.

Introduction

Symptoms of coronary artery disease (CAD) affect up to two million individuals in the UK and result in around 150 000 hospital admissions per annum.1 The most common symptom attributable to CAD is chest pain; however, angina is not the only cause of chest pain and the diagnosis or exclusion of CAD is a recognized challenge. The National Institute for Clinical Excellence (NICE) have published guidelines that aim to provide an evidence-based, cost-effective, diagnostic approach to patients with ‘chest pain of recent onset’. This guideline is subdivided into acute and stable chest pain algorithms. Patients with acute chest pain in whom acute coronary syndrome is excluded but myocardial ischaemia is still suspected should be investigated as stable chest pain. Cardiac computed tomography (CCT) has been incorporated into the stable chest pain algorithm. CCT in this context comprises coronary

© The Author 2010. Published by Oxford University Press on behalf of the Association of Physicians. All rights reserved. For Permissions, please email: journals.permissions@oxfordjournals.org
calcium scoring ± progression to CT coronary angiography.

NICE advocate risk stratification of patients with suspected stable CAD using modified Diamond Forrester (DF) criteria, which assign patients within age and sex categories to higher or lower risk according to whether they have any of diabetes, hyperlipidaemia or a history of smoking. Patients with a history of non-anginal chest pain are not recommended for further cardiac investigation. Those with a history of atypical or typical cardiac chest pain and a risk score between 10% and 90% should be investigated further. CCT is recommended for those with a risk score of 10–29%, functional cardiac testing for those with a risk score of 30–60% and invasive coronary angiography for those with a risk score of 61–90%. Above 90%, it is recommended that patients are treated for angina without further diagnostic testing.

CCT is a non-invasive investigation which has the capability to detect early atherosclerotic change in the form of coronary calcium, and to demonstrate coronary luminal narrowing suggestive of obstructive coronary artery disease. The established strength of the technique lies in its high negative predictive value. It has been extensively validated against radionuclide perfusion scanning and invasive angiography. Randomized controlled trials have demonstrated the utility of CCT in clinical decision-making in emergency departments in the USA. In patients with low-intermediate risk of CAD, negative CCT has been reported to facilitate discharge without major adverse cardiac events for up to 5 years. CCT has been reported to reduce diagnostic time, cost and requirement for repeat evaluation for recurrent chest pain, and has been shown to be more cost-effective than exercise testing and stress echocardiography in the triage of emergency department patients with acute chest pain.

There is little published data regarding the use of CCT in the UK hospital setting where chest pain patients are often managed in acute medical units. Referrals to acute medical units originate from both general practitioners and emergency departments. This retrospective observational study was designed to assess the frequency of CCT use in patients admitted to an acute medical unit with suspected cardiac chest pain, using the criteria for CCT defined by NICE.

**Methods**

All patients admitted to the Acute Medical Unit at Chelsea and Westminster Hospital with suspected cardiac chest pain in the 4 months between November 2009 and March 2010 were identified from ward records and their notes reviewed. Chest pain was categorized as non-anginal, atypical or typical for angina based on a score out of three for pain retrosternal in location, exacerbated by exercise and relieved by rest/nitroglycerine. Clinical risk scoring was undertaken according to the NICE-modified DF criteria. Patients were deemed eligible for CCT if they had typical or atypical anginal chest pain and a modified DF score in the range 10–29%. Patients were deemed ineligible for CCT if they had a positive troponin I, ischaemic ECG changes (ST-T change/Q waves), known coronary artery disease with previous coronary intervention (percutaneous coronary intervention/coronary artery bypass grafting), dysrhythmia with heart rate >70 b.p.m., allergy or previous intolerance of iodinated contrast, renal dysfunction (creatinine ≥150 µmol/l) or pregnancy.

**Results**

Tables 1 and 2 demonstrate the multiple, often concurrent, reasons why individual patients were excluded from CCT. Of the 198 patients assessed, 42 (21%) patients were excluded for two or more reasons. Overall, of the 198 patients, 2 (1%) patients admitted would have been eligible for CCT (Figure 1); 12 (6%) patients would have been recommended for functional cardiac testing and 17 (9%) patients for invasive angiography on the basis of risk scoring, the nature of pain described (Table 1) and an absence of features of acute coronary syndrome. If the criteria for CCT had been broadened to include all patients with a risk score of 10–60%, 14 (7%) of 198 patients admitted would have been eligible for the investigation.

**Discussion**

Since Diamond and Forrester outlined their risk stratification tool in 1979, the use of pre-test probability scoring to determine risk of coronary artery disease and to guide investigation has become commonplace. NICE guidelines currently recommend CCT only for those patients with a modified DF score in the range 10–29%. These narrow parameters would have excluded more than 85% of patients admitted with suspected cardiac chest pain. Although there is evidence to support the broadening of CCT inclusion criteria to include patients at intermediate risk of coronary artery disease,
intervention due to the lesser positive than negative predictive value of CCT and the difficulties of image attenuation with extensive coronary calcification and in situ stents. While there is increasing evidence that CCT may be used to detect in-stent re-stenosis,\(^{18}\) in this study, a history of coronary intervention excluded 22% of the population from CCT.

Nevertheless, over half of patients admitted to the acute medical unit in this study had chest pain categorized as non-anginal. The high percentage of patients with non-anginal symptoms despite clinically suspected myocardial ischaemia justifies application of the ‘stable’ chest pain algorithm to what is essentially an ‘acute’ medical population and reflects the diverse referral sources via which these patients are admitted to hospital (general practitioners and the emergency department). According to NICE, patients with non-anginal pain should be excluded from further cardiac investigation. At present, exercise ECG is widely used in this group for diagnosis and prognostication of potential obstructive coronary artery disease. NICE does not advocate exercise ECG testing in the stable chest pain algorithm. There is concern in the medical literature that the ‘chest pain of recent onset’ guideline focuses on anatomical diagnosis at the expense of functional assessment and risks being ignored by UK cardiology.\(^ {19}\) If these concerns are widespread, CCT uptake may be even lower than eligibility alone would indicate.

The results of this study suggest that while CCT will only be applicable for around 1% of patients admitted with chest pain, six times more will require functional cardiac testing and around eight times more will require invasive angiography. CT is universally available in NHS hospitals that admit acute medical patients and, with appropriate software and training, a CCT service can be established to provide rapid diagnostic assessment of patients with suspected CAD. By comparison, functional and invasive cardiac testing are of limited availability. Increasing the number of patients requiring these services is likely to result in delays to diagnosis and increased duration of hospital admission with resultant cost implications. It is apparent that investment may be better justified in functional and invasive cardiac testing than in the development of CCT services for acute medical admissions, to meet current NICE criteria.

**Conclusions**

CCT is an extensively validated investigation for the assessment of suspected coronary artery disease.
Recently issued NICE guidelines recommend CCT in a limited patient group. Applying NICE criteria to patients admitted to an acute medical unit with suspected cardiac chest pain results in a negligible number of patients being recommended for CCT relative to functional and invasive cardiac testing services. While the results were obtained retrospectively and are therefore susceptible to interpretation bias, they do not support large-scale investment in CCT services within the acute medical unit setting to meet the current NICE guidelines. Such investment may be appropriate if NICE broaden the criteria for CCT eligibility to include patients with an intermediate pre-test probability of coronary artery disease. NICE have highlighted the need for further prospective evaluation into the diagnostic utility and cost effectiveness of CCT before the guidelines are amended.

**Funding**

This work was supported by the Defence Postgraduate Medical Deanery (to C.P., E.N.) and by the Chelsea and Westminster Health Charity (to C.P.).

**Conflict of interest:** None declared.

**References**


