



Computed Tomography Coronary Angiography in Stable Coronary Heart Disease: the UK perspective

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Abbreviations

CACS- Coronary Artery Calcium Score

CHD- Coronary heart disease

CTCA - Computed Tomography

Coronary Angiography

MACE- major adverse cardiac event

PTP- pre-test probability

SIGN- Scottish Intercollegiate

Guidelines

Take Home Messages

- Computed Tomography Coronary Angiography should be the first line investigation in patients with new onset stable chest pain.
- CTCA is an anatomical test which detects the presence of coronary heart disease, with a negative predictive value >99%, i.e. it is excellent as a 'rule out' test.
- The UK does not have the infrastructure or the expertise available to meet the NICE and SIGN guidelines on the investigation of stable chest pain at the moment.
- More work need to be done to formalise training in CTCA for cardiology registrars.

Introduction

One in ten of all chest pain presentations to primary care have been reported to be due to coronary heart disease (CHD)(1,2). In the UK, rapid access chest pain clinics have been proven to be an effective way of identifying patients with angina(3,4). There are a variety of non-invasive tests available for the investigation of patients with stable chest pain including anatomical imaging with CT coronary angiography (CTCA) and functional testing including stress electrocardiography, radionuclide scintigraphy, echocardiography, or magnetic resonance imaging(5–10). Historically, the mainstay non-invasive test has been stress electrocardiography, together with a clinical history and examination(11–13).

What do the guidelines say?

The 2010 National Institute for Health and Care Excellence (NICE) guidelines recommended CTCA for patients with chest pain and low pre-test probability (PTP) of CHD, non-invasive functional imaging tests for patients with intermediate probability of CHD, and suggested proceeding directly to invasive coronary angiography in patients with a high PTP. In 2016, NICE updated these guidelines (14) with a paradigm shift from assessing PTP of CHD influencing the test of choice to offering CTCA as a first-line investigation in patients with new-onset stable chest pain, with functional imaging reserved for patients with inconclusive CTCA or known CHD. This guidance is mirrored by the Scottish Intercollegiate Guidelines Network (SIGN)(15) which suggests CTCA should be considered for the investigation of patients with stable chest pain, while functional testing, including stress electrocardiography, be considered to aid in the risk stratification of patients with known CHD.

This is in stark contrast with the 2013 European Society of Cardiology (ESC) guidelines on the management of stable coronary artery disease (9) where stress testing is first line with CTCA as an alternative modality in patients with low-

intermediate PTP of CHD. The ESC guidelines also allow stress electrocardiography to be used 'if feasible' and if functional imaging testing resources are not available. The American Heart Association (AHA) guidelines, published in 2012 (8), recommend stress testing, including stress electrocardiography in low-intermediate risk patients. CTCA is recommended in patients unable to exercise with intermediate-high PTP of CHD, and in patients with contraindications to stress testing.

Table 1. Summary of Guidelines' Recommendations on the investigation of stable angina.

	NICE guidelines	SIGN guidelines	ESC guidelines	AHA guidelines
CTCA	CTCA to diagnose stable angina if not clear from history alone	CTCA to diagnose stable angina if not clear from history alone	PTP 15-50% and local expertise available	Patients unable to exercise or contra-indications to stress testing
Functional stress testing	Should be considered for risk stratification in patients with known CHD	Should be considered for risk stratification in patients with known CHD	Stress electrocardiography if feasible, stress testing preferred (PTP 15-65%)	For patients with known CHD, and patients with suspected CHD

NICE- National Institute for Health and Care Excellence, SIGN- Scottish Intercollegiate Guidelines Network, ESC- European Society of Cardiology, AHA- American Heart Association, CHD- Coronary Heart Disease, PTP- Pre Test Probability.

Advantages of CTCA

CTCA is an anatomical test which detects the presence of CHD. Sensitivity has been reported as high as 99%(16–18) and specificity of up to 92%(16–18), with a negative predictive value >99%(16–18). A normal CTCA is associated with an annual major adverse cardiac event (MACE) rate of 0.5%, similar to that of a negative radionuclide

scintigraphy scan(19), and broadly similar when compared with an annual MACE rate of <1% for a negative stress-perfusion cardiac MRI scan (20) or a negative stress-echocardiogram (19). A normal stress electrocardiography test may reassure patients and clinicians but does not exclude CHD.

A recent Scottish multicentre study reported that CTCA clarified the diagnosis and altered subsequent investigations and treatments (21). At 5 years, CTCA added to standard care resulted in a lower rate of death from CHD or nonfatal myocardial infarction without a higher rate of invasive coronary angiography or revascularization (22). By comparison, a multicentre study based in the United States and Canada (23), which showed no difference in MACE between anatomical (CTCA) and functional (radionuclide scintigraphy) guided management of patients with stable chest pain. Also, both studies reported that CTCA was associated with less invasive coronary angiography when compared with stress electrocardiography or radionuclide scintigraphy guided care.

Challenges in the UK

Despite the emerging evidence base, the anticipated cost savings and guidelines recommending CTCA as a first line test, one has not observed a surge in CTCA service set-up and delivery in the UK.

In a recent article assessing the preference of UK based cardiologists (24), 162 out of 887 lettered consultants with a representative spread of sub-specialisation expressed a preference (71% of responses) for CTCA as a first line investigation for patients with a low-intermediate probability of CHD, which decreased to 37% with regards to the investigation of patients with an intermediate to high PTP. More importantly, only 26% of the responders stated that their clinical practice reflected NICE guidance, with another 41% following ESC guidance.

In a joint statement by the British Society of Cardiovascular Imaging and the British Society of Cardiovascular CT (25) an estimated 700% increase in cardiac enabled

CT scanners would be required through the UK to provide a service able to cope with universal guideline directed practice. Currently, 68% of the UK centers undertaking CTCA perform <10 scans per week. In Scotland and Wales, there is one centre in each devolved nation performing over 10 scans per week.

A recent paper looking at UK-wide service provision, expertise and projected service delivery (26) reported that 5 out of 70 health regions did not have CTCA capable scanners. For the rest of the UK, there would be a need for investment in more CT scanners, as a recent survey discloses that CT scanners in the UK are some of the most intensely used in Europe (27).

The British Society of Cardiovascular Imaging and the British Society of Cardiovascular CT (25) make a number of recommendations, including (i) that CTCA are performed on cardiac enable CT scanners with reporting facilities, (ii) appropriate training of the projected workforce (radiographers, nurses, radiologists, cardiologists) (iii) appropriate support by the local medical physics departments to ensure that radiation doses are close to the national dose reference level. Besides requiring investment in the infrastructure, there is also a shortage in expertise for this projected service delivery (26), with only 198 accredited practitioners (cardiologists/ radiologists) in a recent paper (26).

Looking to the future

Despite CTCA being included in national cardiology and radiology curricula, routine access to CTCA training is not yet widespread (<50% in most UK deaneries (28)) with an option for post-CCT fellowships being limited to a few individuals. The cardiology curriculum needs to be updated to reflect the change in guidelines and evidence, with a probable downgrading of invasive coronary angiography from Level 3 (i.e. Competent to perform the procedure unsupervised and deal with complications) to a Level 2 (Able to perform the procedure with limited supervision/ assistance). I would be keen to see the guidelines reflected in the curriculum with

DOPS in CTCA being available, and trainees encouraged to be able to report CTCA to a minimum of level 2 (and potentially up to level 3). This, in conjunction with accreditation in CTCA through the European Association of Cardiovascular Imaging or the British Society of Cardiovascular Imaging and organization of regional/ national training days for cardiology/ radiology trainees should build up a momentum to deliver a clinical workforce able to fulfil this unmet need.

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