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Diagnosing coronary artery occlusion in NSTEMI with strain echocardiography

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INTRODUCTION
Non-ST elevation acute coronary syndromes (NSTEMI), as defined by acute cardiac chest pain in the absence of ST elevation, is a common condition with an incidence of 3 per 1000 per year. Patients with ST elevation myocardial infarction (STEMI) should have immediate reperfusion by either mechanical (PCI) or pharmacological (thrombolysis) means, but the role and optimum timing of coronary angiography in NSTEMI (whose incidence is greater than STEMI) remains less well-defined.

Patients with NSTEMI are a heterogeneous group whose presentations are often less clear-cut and in whom comorbidities are more common. Current guidelines suggest urgent angiography is required only in the minority of patients with NSTEMI who have ongoing angina, clinical signs of heart failure, haemodynamic instability or life-threatening arrhythmias. The remaining majority can either undergo angiography within 72–96 h of presentation, or can be managed medically.

STEMI VERSUS NSTEMI
Patients with STEMI usually have an occluded coronary artery. Previously, NSTEMI was thought to result from partial or transient occlusion of a coronary artery. However, Wang et al have shown that among one-quarter of patients with NSTEMI have a coronary artery occlusion, particularly in arteries supplying the inferolateral territories. The same study showed that patients with NSTEMI with an occluded artery have higher levels of markers of myocardial injury and a higher mortality at 6 months than those patients with NSTEMI but without an occluded artery.

There is consensus that patients presenting with STEMI should undergo treatment to ensure rapid reperfusion. In contrast, despite appearing to have an identical angiographic problem, patients with an occluded artery who present with NSTEMI may wait much longer before angiography. Delay before angiography is known to increase mortality in patients with STEMI so it seems plausible that delay might also increase mortality in patients with NSTEMI with an occluded coronary artery. Failure to recognise this significant proportion of patients with NSTEMI with an occluded artery and achieve prompt reperfusion may well increase their risk.

DETECTION OF CORONARY OCCLUSION
But how can coronary occlusion in patients with NSTEMI be detected within a timeframe to allow effective reperfusion in a similar manner to their STEMI counterparts? In their article in this edition of Heart, Grenne et al may provide at least part of the answer (see page 1550). They describe the use of territorial circumferential strain to identify the subset of patients with NSTEMI with a coronary artery occlusion with 90% sensitivity and 88% specificity.

Over 100 patients with acute cardiac pain lasting between 10 min and 3 days and with an indication for coronary angiography under current guidelines underwent echocardiography. In addition to a standard examination, territorial longitudinal and circumferential strain measurements were made in all three coronary artery territories using speckle tracking. Analysis of these images was performed by a blinded observer, and the lowest absolute territorial strain value for each patient was assessed as a marker for identification of a coronary occlusion. Crucially, echocardiography was undertaken at a median of 1 h from presentation, well within a window where effective reperfusion might be possible and beneficial.

Patients subsequently underwent coronary angiography, and the presence or absence of coronary artery occlusion noted. The clinical and echocardiographic parameters of patients with an occluded coronary artery at angiography (which numbered almost a third of the NSTEMI group) were compared with those who did not have an occluded coronary artery.

Neither clinical (including TIMI or GRACE scores) nor ECG features were able to identify the subset of patients with NSTEMI with an occluded coronary artery. CK-MB on admission was significantly higher in patients with an occluded artery. Although a higher peak troponin occurred with coronary artery occlusion, there was no significant difference in the 12 h troponin, precluding its use as a predictor of coronary artery occlusion at an early stage where reperfusion might be attempted. Of the echocardiographic parameters, territorial circumferential and longitudinal strain, territorial circumferential and longitudinal post-systolic shortening and wall motion score index did differentiate those patients with coronary occlusion. However, in a multiple regression model with all of these parameters and left ventricular ejection fraction, only circumferential territorial strain was a significant predictor of coronary occlusion.

Follow-up of the NSTEMI subset of the NSTEMI group showed that those with an occluded coronary artery had a reduced ejection fraction and an increased infarct size, consistent with a previous study.

Patients in the first few hours of an NSTEMI, who often have not yet had biomarkers measured, are typically initially assessed in emergency departments, acute medical units or even under the care of other specialities. Providing access to high-quality routine echocardiography, let alone strain echocardiography, on a 24/7 basis is a challenge, even within cardiology departments. Echocardiography is often provided by on-call cardiology trainees with variable experience in the technique. In this study, both the feasibility (95% of circumferential segments analysed) and reproducibility of strain measurements was very good. However, there is a significant learning curve for performing and analysing strain echocardiography results and establishing such a service for emergency out-of-hours patients, even in cardiology centres, would be a challenge. Outside specialist cardiology centres this is not a realistic proposition. If further studies show that the group of patients defined in the article by Grenne et al and previous work gain prognostic benefit from early intervention,
One solution would involve the consolidation of cardiological expertise into a smaller number of specialist centres providing a round-the-clock service rather than a network of general hospitals feeding patients into specialist centres after risk stratification. In most countries, significant investment has been made to provide a service capable of delivering prompt reperfusion for patients with STEMI. With this in mind, it is more efficient to use established interventional services and invest further to ensure the availability of these new echocardiographic techniques, as well as immediate access to CT coronary angiography and other non-invasive assessments. A prompt decision can then be made on whether to take a patient with NSTEACS to the catheter laboratory to offer urgent intervention.

Whether urgent invasive angiography is of benefit to all patients with NSTEACS is not clear. On one hand, early angiography avoids the risks of antiplatelet and anticoagulant treatment when some patients with NSTEACS (almost a quarter in this study) will eventually be diagnosed with non-coronary chest pain. On the other hand, early angiography exposes patients to procedural risks when they might have been helped with medical management, or an alternative diagnosis may become clear. Is there such a thing as an angiogram that is too early in NSTEACS? The recent NICE guidelines recommend risk stratification for angiography, and early angiography in those with elevated risk. This study appears to have identified such a high-risk group.

This study excludes a number of comorbid conditions often present in the NSTEACS population such as prior myocardial infarction, previous open chest surgery, bundle branch block, severe valvular dysfunction and atrial fibrillation with a rate >100/min. At present, these exclusions reduce the viability of this technique as a ‘screening’ tool for coronary artery occlusion in patients with NSTEACS. An important future challenge is to demonstrate its usefulness in this broader group of patients. Again, the alternative is to consider early angiography in these groups.

In summary, Grenne et al demonstrate findings that if reproduced in further studies with clinical end points may warrant the expansion of echocardiography in the evaluation and risk stratification of acute chest pain. Identifying those patients with NSTEACS with a coronary occlusion and treating early is likely to improve their outcomes. Further studies will be needed to compare the NSTEACS cohort with coronary occlusions, not with other patients with NSTEACS, but with patients with STEMI—is it the angiographic appearance or the ECG which is important? Consideration should be given to an early invasive approach in this subgroup while non-invasive techniques are validated. Even if mortality reduction with early intervention is not confirmed in future trials, earlier risk stratification would lead to earlier discharge, and consequently reduced length of stay.

Is there really any good clinical reason to delay? The promise of better outcomes and shorter lengths of stay with better early triaging of patients with acute coronary syndromes lends further weight to the case for all such patients to be delivered directly to specialist cardiac centres for initial assessment.

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