Editorial

Editorial on 'Estimation of Myocardial Viability in Patients with Ischaemic Mitral Regurgitation' (Morgan *et al.*)

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Ischaemic mitral regurgitation (IMR) is a common finding in the context of coronary artery disease with some studies showing it to be present in 10% of these patients (1,2). It is associated with decreased long-term survival post-MI and post-revascularisation (3). The mainstay of treatment at present consists of myocardial revascularisation. However, the need for concomitant intervention on the mitral valve in those patients with moderate IMR remains an area of much debate in the cardiac surgical community. One of the many factors to consider in this context is the viability of the left ventricular (LV) myocardium and its inherent ability for reverse remodelling. In this study by Morgan *et al.* (4), a direct comparison is made between using LV strain and late gadolinium enhancement (LGE), as markers of the same. They propose that when using cardiac magnetic resonance imaging (cMRI) to assess the myocardium in patients with greater than mild MR, abnormal strain overestimates the number of non-viable LV segments as compared to LGE.

As our readers are aware, IMR occurs following a myocardial infarction (MI) due to decreased LV contraction and displacement of the papillary muscle resulting in tethering of the leaflets. This results in a displacement of the leaflet coaptation point towards the apex and a Carpentier type IIIb defect. Thus, it is not an inherent problem of the valvular apparatus but of the ventricle. Therefore, the primary mechanism of intervention is to aid the reverse remodelling of the LV via coronary revascularisation. But the question remains about whether we should intervene on the mitral valve at the same operation. Three randomised trials have attempted to answer this question (5-7). The two earlier trials (5,6) did show improvement in markers of ventricular reverse remodelling and New York Heart Association (NYHA) class in those patients that underwent CABG with mitral valve repair (MVr) but no difference in survival in the short-term. However, a large multi-centre trial conducted by the Cardiothoracic Surgical Trials Network (7) comparing CABG alone with CABG and MV surgery showed no difference in the survival, LV end-systolic volume index, NYHA class nor incidence of major adverse cardiac and cerebrovascular events. In fact, they showed a greater number of neurological events and supraventricular tachycardias in the group having concomitant MV surgery. As you would expect there was less residual MR post-operatively in those having CABG with MV surgery but even in the CABG alone group 70% had no residual MR. They also demonstrated a significantly higher rate of recurrence of moderate or severe MR in the group undergoing repair as opposed to replacement. Our meta-analysis (8) looked at 11 papers consisting of a total of 1,406 patients with moderate IMR. They found a greater improvement in grade of MR and LV systolic diameter in patients undergoing MVr in addition to CABG as opposed to CABG alone. However, there was no difference in post-operative NYHA class, ejection fraction (EF) or survival. This goes to show that we still need greater clarity on which of our patients will benefit from mitral intervention at the time of CABG.

As is often the case, the answer is 'It depends'. Several factors need to be considered. Patient factors can determine tolerance of a longer operation, such as their age, presence of co-morbidities and LVEF. Another key factor is the likelihood of the ventricle to recover from the ischaemic

insult. If the myocardium is stunned but has the ability to recover on optimising its vascular supply there may be an argument to proceed with CABG alone or perform MV repair rather than MV replacement. However, if there is a large area of myocardial necrosis, difficulty in achieving full revascularisation or there is gross dilatation of the LV then concomitant MV replacement may be considered.

Several imaging modalities have been utilised to assess myocardial viability, including cMRI. Both LV strain (9,10) and LGE measurements (11,12) have been shown to correlate with the degree of viability. The use of viability studies in assessing coronary artery disease patients with LV dysfunction has been studied in recent trials (13,14) and an earlier meta-analysis (15), with mixed results. The meta-analysis of over 3,000 patients by Allman *et al.* (15) showed a strong correlation between identification of viability on non-invasive testing and improved survival following revascularisation. The PARR-2 study (13) looked at the use of positron emission tomography (PET) in guiding the management of patients with severe LV dysfunction and suspected coronary artery disease. It did not show any improvement in clinical outcomes with PET-guided therapy however in nearly a quarter of cases the PET-based advice was not adhered to. Subsequent analysis has shown that in the subset in whom the advice was adhered to, there was an improvement in the clinical outcome. The viability sub-study of the STICH trial (14) found a correlation between myocardial viability and revascularisation which was statistically significant in the univariate analysis but not on multivariable analysis. Therefore, at present the European Society of Cardiology guidelines state that ischaemia and viability testing in patients with coronary disease and heart failure is a Class IIb Level of Evidence B recommendation (16). There are presently no specific guidelines for the use of these studies in the context of IMR.

In the study by Morgan *et al.* (4), analysis was done on cMRI data on 16 patients with greater than mild MR and 7 normal volunteers. They measured longitudinal and circumferential strain, LGE and stress perfusion. They were able to show that in their cohort of patients 7.4% of LV segments had transmural infarcts (TMI), defined as hyperenhancement of >50% of wall thickness, as per LGE. Whereas >14.5% of LV segments were non-viable by strain thresholds (between 1–2.5 standard deviations from normal mean). They found impaired strain in the segments immediately bordering the TMI. These segments though ischaemic may have hibernating myocardium with potential for reverse remodelling and return to normal contractility. Strain was also globally impaired in IMR patients as compared with normal subjects. Therefore, LV strain is likely to over-estimate the number of non-viable segments when compared with LGE in patients with IMR. Though the sample size is small, this study shows the potential importance of using LGE in the assessment of patients with IMR. Uniquely, it also provides a direct comparison between 2 commonly used parameters of viability and would form the foundation of a bigger multi-centre randomised controlled trial.

As cardiac surgeons and cardiologists we will continue to debate the timing and type of surgical intervention indicated in patients with moderate IMR. Viability assessment may play a role in answering this question. This paper has provided some insight into the use of cMRI, and specifically LGE, in determining myocardial viability in this patient cohort. However, larger studies with suitable follow-up and clinical correlation are needed to clarify the role of this assessment modality. This may apply not only to IMR but also to prediction of post-operative contractility after surgery for other pathological entities like degenerative MR and severe aortic stenosis.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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