Mitral valve repair for severe mitral regurgitation: the way forward?

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Severe primary mitral regurgitation (MR) has a poor outcome if left uncorrected. Successful mitral valve repair has the unique potential to restore normal life expectancy and is superior to valve replacement. Despite this, mitral repair is performed relatively infrequently and many patients with potentially reparable valves have a replacement instead, subjecting them to unnecessary risk. Surgery in asymptomatic patients is a particularly difficult issue with some units advocating surgery irrespective of symptoms, based purely on the severity of regurgitation. This strategy cannot be widely adopted with the current patchy provision of high-quality valve repair surgery. Misplaced enthusiasm for early operation runs the risk of a failed repair and the hazards of a mechanical prosthesis. To ensure optimal treatment for patients with MR, cardiologists must be aware of the indications for valve repair and ensure that patients with potentially reparable valves are referred to surgeons with proven expertise, even if this means a shift from established practice. Surgical units need to promote subspecialization and rigorously audit their outcomes. There are currently no agreed standards for best practice in mitral valve repair and this is an area where professional societies may wish to take a role.

Introduction

Degenerative valve disease is the commonest cause of symptomatic mitral regurgitation (MR) in the western world.1 It is a progressive condition and, if left untreated, severe regurgitation may lead to worsening heart failure and death.2,3 No medical treatment has been shown to improve survival, but on the basis of non-randomized studies mitral valve repair appears to have the unique potential to restore normal life expectancy.4,5 For valve repair to achieve an improvement in prognosis, it must effectively eliminate regurgitation and must be performed before the onset of limiting symptoms or the development of left ventricular dysfunction.6–7 Mitral valve replacement is not equivalent, as in common with all other operations involving prosthetic valves, it exposes the patient to the continuous risks of prosthetic failure and thromboembolism.8–10

Underperformance

Mitrval valve repair is an effective treatment, but there is abundant evidence that it is underused. The EuroHeart survey found that around 50% of patients with MR receive a valve replacement rather than a repair and about one-third of these replacements are performed because of a lack of local expertise in repair surgery.11 The situation is little different in the USA where, according to the largest database, just over a third of operations for MR in 2000 were repairs.12 Moreover, the majority of these repairs were by simple annuloplasty suggesting that valves amenable to more complex repair were instead being replaced. There is also a problem with relatively high percentages of patients being operated on either as emergencies or too late in the course of the disease. A total of 48% of patients in the EuroHeart survey were in NYHA Class III or IV at the time of surgery.11 Unpublished data from the Northwest of the UK show a similar picture with almost half of patients undergoing mitral valve repair in one high-volume centre being in NYHA Class III or IV or having echocardiographic evidence of significant preoperative LV impairment.

Appropriate referral

So, what can be done in practice to increase rates of valve repair? The first step, and possibly the most important, is to increase awareness among cardiologists. Northrup13 found highly variable rates of referral for valve repair from cardiologists, even when they practiced in the same locality or within the same group. This may in part reflect...
variable understanding of the benefits and scope of valve repair or possibly lack of confidence in local surgical expertise. Cardiologists lacking a clear understanding of the reparability of a mitral valve are more likely to accept their patient receiving a valve replacement. It should no longer be acceptable for a cardiologist to refer a patient for 'valve surgery' without an informed consideration of the best operation for that individual. Cardiologists who are themselves uncertain of the suitability of a valve for repair need to be able to refer to a colleague with a specialist interest.

So, who should be referred? It is generally accepted that patients with limiting symptoms or a reduced ejection fraction should be referred for surgery, ideally valve repair, without delay unless there are compelling reasons not to operate. More difficult are the asymptomatic patients with severe MR. Since it is arguable that the vast majority of patients with severe MR eventually need surgery, one approach to simplify decision-making and increase referral rates would be to refer all patients to surgery shortly after diagnosis. This concept has received some support from a recent paper from the Mayo Clinic. A total of 456 patients with isolated organic MR were recruited and regurgitation quantified to calculate regurgitant volume per beat and effective regurgitant orifice area (EROA). Overall, survival at 5 years was lower than expected in those patients with moderate or severe regurgitation at diagnosis. Among patients who did not have valve surgery, EROA was a strong independent predictor both of survival and of the occurrence of cardiac events. The medical treatment received by this group is unknown. Half the patients underwent mitral valve surgery at a mean of around 15 months after assessment, with a 30 day mortality of 1%. In the great majority (91%), a valve repair was performed and in those subjects with severe regurgitation surgery restored survival to normal. There are obvious caveats to this approach. Most echo laboratories do not routinely measure EROA and, although it is clearly an important prognostic indicator, decisions about surgery cannot be made on the basis of EROA alone. It is the reliable identification of patients with severe MR, rather than the specific method used that is important, and different centres will have different levels of experience with particular techniques. Moreover, the excellent surgical outcomes achieved by some centres need to be put into perspective with results from a wide range of institutions and in relation to patient characteristics.

An alternative approach, and one that is more widely followed, is to monitor patients on a regular basis to ensure that they remain asymptomatic and that left ventricular function remains normal. This is not necessarily an easy task as the onset of symptoms may be insidious and go unnoticed, especially in more sedentary patients. Furthermore, a normal EF can mask significant left ventricular contractile dysfunction and provide false reassurance. Nonetheless, Rosenhek et al. have convincingly demonstrated that regular and systematic review in expert hands does provide good outcomes. They used a methodical, integrated approach to the semi-quantitative assessment of MR in line with the recommendations of the American Society for Echocardiography. It must be emphasized, however, that insufficiently rigorous follow-up risks missing the first signs of incipient decompensation and hence the optimal time for valve repair. Casual outpatient review is not adequate. On the other hand, misplaced enthusiasm for early operation runs the risk of condemning a previously asymptomatic patient to the inconvenience and hazards of surgery and the possibility of a failed repair and a mechanical prosthesis. In this respect, the aetiology of the regurgitation is of critical importance as valves with anterior or bileaflet abnormalities are substantially more difficult to repair than those with isolated posterior leaflet prolapse. Failed repair requiring a prosthetic valve is a far from trivial event. Even modern mechanical prostheses in the mitral position carry a 10 year cumulative risk of embolic stroke of around 13%. In practice, a holistic approach is required, integrating all clinical and echocardiographic assessments and including in doubtful cases measures of functional capacity and the response of MR and pulmonary pressures to exercise. This is best provided by experienced cardiologists working as part of a team with a specialist interest in dealing with valve problems.

A randomized trial of the timing of mitral valve repair?

No matter how well conducted, the results of non-randomized studies always carry the inherent risk of selection bias and trials primarily aimed at assessing the effects of surgery may not guarantee optimal management in the more conservative arm. The good long-term results of valve repair in asymptomatic patients with severe mitral insufficiency may in part be due to the selection of low-risk patients, whereas patients who are not offered surgery may be at higher operative risk. In most studies, it is not clear why patients were not operated on early. Past experience shows that reliable results for comparisons of alternative treatment strategies can be obtained only by randomized studies. Randomized trials of valve surgery are relatively scarce but have had major impacts on practice.

Consequently, there is a case for a randomized trial comparing the two approaches of early surgery and watchful waiting in asymptomatic patients with severe primary mitral insufficiency to determine if there is a definite benefit from early operation. The precise design of such a trial is complicated by the sparse data available on the longer-term results of mitral valve repair outside of highly specialized centres and is beyond the scope of this article. However, if it were to happen then it would certainly need to be large, have prolonged follow-up, and should involve units or networks that can already demonstrate good surgical outcomes. The main outcome measures should include death, non-fatal cardiovascular events, and left ventricular function.

Changing referral patterns

The next key step to increase mitral repair rates is to ensure referral to a surgical team with the skills to repair the valve. Here again the onus is on the cardiologist as the EuroHeart experience suggests that this team will not always be in the locality. There are inevitable barriers to referring beyond established patterns, particularly in an era of declining cardiac surgical volumes and the perceived pressure for all centres to provide a comprehensive service.
Cardiologists acting in the best interests of their patients need to be prepared to break from traditional referral patterns and send their patients to surgeons with recognized expertise in valve repair. Such surgeons appear to be in short supply. The generally low volumes of mitral operations make it hard for surgical trainees to acquire experience. Once in independent practice, and with early morbidity and mortality subject to close scrutiny, there are few incentives for interested surgeons to develop skills in a longer and more complex operation where the benefits are largely long term. Routine cross referral of repairable valves from non-repair surgeons to repair surgeons may also be less likely to occur as overall surgical activity declines.

Surgical responsibilities

The onus on surgeons is to reorganize practice to accommodate these changing referral patterns. Surgical services should agree which of their number are going to develop and maintain subspecialist experience in valve repair and redistribute referrals appropriately. Not all valves are equally repairable and transparent audit of results is essential to develop and maintain confidence in the quality of a valve repair service. Systematic follow-up data is vital as durability of repair is an essential measure of success, particularly in minimal or asymptomatic patients. This must go further than crude mortality or reoperation figures. Quality is key and simply doing more valve repair operations without assessing outcomes is pointless. A valve repair in an asymptomatic patient that leaves moderate MR a year later will not cause that patient to feature in early mortality or reoperation statistics, but is hardly a successful result.

Standards for repair centres?

The recent publication of the updated AHA/ACC guidelines on management of valve disease should provide an impetus to the development of mitral valve repair. They differ in several key respects from the previous version published in 1998. For MR, two statements are particularly important. Firstly, cardiologists are strongly encouraged to send potential candidates for valve repair to centres experienced in the operation and secondly in asymptomatic patients should only be considered when the likelihood of successful valve repair is greater than 90% in an experienced centre. It is clear that the drive to earlier operation in some centres is in contrast to the inadequate provision of valve repair in the wider community. Patchy provision is inequitable and clinically indefensible. The excellent results from high-volume repair centres cannot be extrapolated to all surgical units and, in the absence of a randomized trial, prophylactic valve repair certainly cannot be generally recommended. There is as yet no accepted definition of exactly what constitutes best practice in mitral valve repair or what constitutes an expert centre. In an attempt to redress this, a group from the UK, some of whom are authors of this paper, has recently published a set of proposed standards that seek to define best practice in mitral valve repair and hence criteria for an expert centre.

There are a number of models whereby such standards could be adopted more widely through local, regional, or national networks. One potential strategy would be to limit valve repair to a relatively small number of designated units such as the case for other relatively low-volume specialist procedures such as surgery for complex congenital heart disease or transplantation. No one solution will suit all communities but in our view, the setting of standards against which units can measure their systems and performance will promote a culture of quality improvement. It is possible that, in future, professional societies might wish to define criteria for valve repair centres.

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References

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MRI findings of small isolated congenital left ventricular diverticulum

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A 37-year-old man was studied for chest pain. No abnormal findings were noted in clinical examination and chest X-rays. The electrocardiogram showed sinus rhythm of 64 bpm and ST-abnormalities (ST-T elevation) in the inferior and precordial leads. Coronary angiography was normal and left ventricular angiography revealed normal ejection fraction and a small finger-like shaped image at the inferior wall. There was not a good echocardiographic acoustic window. The patient was submitted to MRI exam in order to better define the unusual aspect. The study clearly defined a small isolated diverticulum located at mid-inferior segment of left ventricular wall [short (Panel A) and long-axis (Panel B) spin-echo image]. On dynamic images, it appeared as muscular type because of changing during cardiac contraction, with maximum diameter in diastolic phase and complete emptying during systole (Panels C-E; movies 1-3). No abnormality was noted both in perfusion phase post-gadolinium and in delayed images at 5-10-15-20 min. Medical therapy including cardioaspirin and beta-blocker was given and a close follow-up (3-6 months) with MRI was planned.

In conclusion, MRI allows a complete assessment of congenital left ventricular diverticulum (LVD) identifying fibrous or muscular type and relationship with other cardiac structures. Because of its non-invasive nature and parameter reproducibility, MRI alone can provide excellent monitoring of LVD follow-up in patient treated with conservative approach.

Panel A. Short-axis spin-echo image.
Panel B. Long-axis spin-echo image.
Panels C-E. Dynamic cardiac images in diastole.
Panels C-E. Dynamic cardiac images in systole.
Supplementary movie is available at European Heart Journal online.