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Case report

Severe mitral regurgitation in a young patient - how would you treat?

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Abstract We present a case of 55-years old man with severe mitral regurgitation with significantly reduced ejection fraction, paroxysmal atrial fibrillation and hypertension, who underwent surgical procedure of the replacement of the mitral valve.

Key words mitral regurgitation, low ejection fraction, surgical valve replacement

Introduction

Mitral regurgitation (MR) represents the second most frequent indication for valve surgery[1]. However, in order to select appropriate treatment, one needs to differentiate between primary (organic) MR which is in vast majority degenerative (other causes include coronary artery disease, infective endocarditis or connective tissue disease) and secondary (functional) MR which is consequence of mitral annular dilatation in dilated or ischaemic cardiomyopathy. In contrast to degenerative i.e. primary MR, where surgical correction of leaflet pathology lead to excellent long-term outcomes, the management of secondary MR was less beneficial[2]. Despite surgical management of severe secondary MR may provide freedom from symptoms immediate after operation, no study has demonstrated a mortality benefit when compared with patients treated with medical management[3].

The most common indication[2] for mitral valve surgery is symptomatic chronic severe primary MR with a left ventricular ejection fraction (LVEF) of >30% (Class I). Furthermore, mitral valve surgery is indicated in symptomatic patients with severe systolic dysfunction (LVEF <30%, and/or left ventricular end-systolic diameter [LVESD] >55 mm) refractory to medical therapy (Class IIa). Surgery is also indicated in asymptomatic patients with LVESD ≥45 mm and/or LVEF ≤60%, Class I) and in those with LVESD >45 mm and LVEF >60%) and atrial fibrillation secondary to mitral regurgitation, or pulmonary hypertension (systolic pulmonary pressure at rest >50 mmHg, Class IIa).

Indications for surgery for severe secondary MR are more limited[2]. Surgery is indicated in patients with severe secondary MR undergoing coronary artery bypass surgery with an LVEF >30% (Class I). Surgery should be considered in symptomatic severe secondary mitral regurgitation with an LVEF <30% provided there is an option for revascularisation and recruitable viable myocardium (Class IIa). Finally, surgery may be considered for symptomatic severe secondary MR and an LVEF >30% despite optimal therapy and low surgical risk (Class IIb). The role of concomitant mitral valve surgery for moderate ischaemic MR in patients undergoing coronary artery bypass grafting remains controversial with a recent study finding no evidence of benefit for concomitant valve surgery[4].

However, in everyday routine, when patients are presented with long-lasting MR, one may find it difficult to differentiate between primary and secondary MR.

Case presentation

A 55-year-old man presented to our institution complaining of recurrent dyspnea, palpitation as well as abdominal pain. He has a past history for paroxysmal atrial fibrillation, hypertension and dyslipidemia. Considering other risk factors, he is smoker for past 30 years and had a history of "heavy" drinking. At admission, transthoracic echocardiogram revealed significant left atrial (85 mL) and ventricular (volume 198mL, LVESD=44mm) enlargement with no wall motion abnormalities (LVEF of 29%), severe mitral regurgitation due to incomplete coaptation of the degenerative mitral valve leaflets, mild right ventricular enlargement, systolic dysfunction (TAPSE 16mm), severe tricuspid regurgitation, systolic pulmonary pressure at rest of 46 mmHg, and no pericardial effusion.

A transesophageal echocardiogram confirmed severe left atrial enlargement (64x56mm), restricted mitral valve leaflets resulting in incomplete coaptation and severe mitral regurgitation in an excentric lateral flow (Figure 2). No vegetations were seen. Following measurements were taken: effective regurgitant orifice (ERO) 50 mm^2, regurgitation volume 76 mL, MR maximum velocity 5.56 m/s, MR velocity time integral 146 cm.

One may argue if it is long-lasting primary MR with left ventricular dysfunction or secondary MR due to idiopathic dilatation of the left ventricle. How would you treat this patient?

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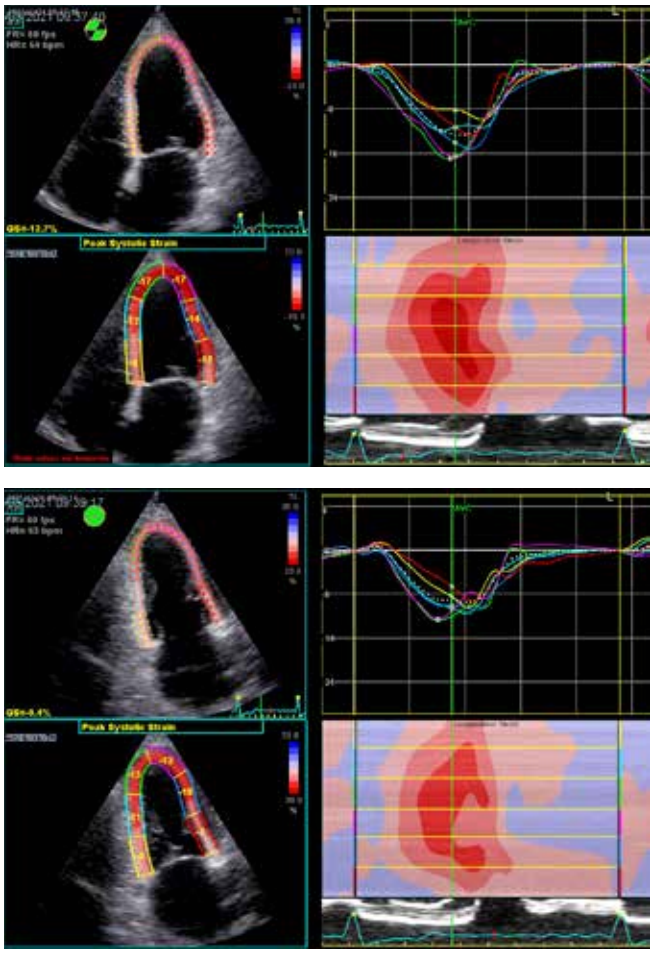

Figure 1. Reduced global longitudinal strain of the left ventricle = -14.3%

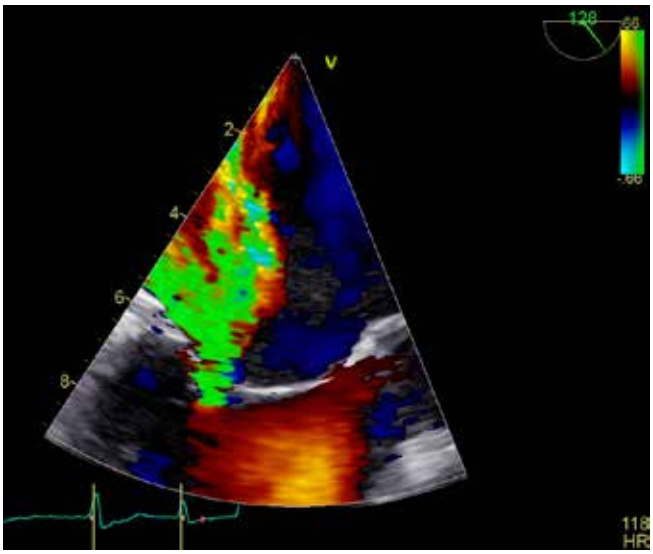

Figure 2. A transesophageal echocardiogram confirmed restricted mitral valve leaflets resulting in incomplete coaptation and severe mitral regurgitation in an excentric lateral flow

Discussion

Non-beneficial results of surgical therapy have triggered transcatheter options for the management of secondary MR. Recently, two randomized trials were performed. The COAPT trial (Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients With Functional Mitral Regurgitation) was the first study to show a benefit in mortality with percutaneous intervention in the management of secondary MR[5]. In contrary, the MITRA-FR trial (Percutaneous Repair With the MitraClip Device for Severe Functional/Secondary Mitral Regurgitation) failed to detect any difference in mortality with treatment[6]. The divergence between the COAPT and MITRA-FR studies may be opportunity to improve our understanding of which patients may benefit from correcting secondary MR[7]. LVEF did not differ between trials (31% in COAPT; 33% in MITRA-FR), but COAPT included patients with LVEF ≥20%, and MITRA-FR included patients with LVEF ≥15-40%. Those in the MITRA-FR trial had larger volumes (left ventricular end-diastolic volume 252 mL vs. 192 mL) and less MR (ERO 31 mm^2 vs. 41 mm^2) than patients in COAPT, which excluded patients with left ventricular end-systolic diameter ≤70mm).

It would be expected that mitral regurgitation increases with enlargement of left ventricle as a result of leaflet tethering and annular dilatation. Indeed, the ERO is dependent on the size of left ventricle and function for any given regurgitant fraction and thus, one needs to be cautious when interpreting ERO in isolation without the other variables (8). The ERO threshold required to achieve a regurgitant fraction of >50% increases with increasing left ventricle size or decreasing function. In "proportionate" MR, the estimated degree of MR is proportionate to the size of the left ventricle. In "disproportionate" MR, the degree of MR is unexpectedly large compared with the left ventricle size. Bartko et al. noted that survival was worst in those with "disproportionate" MR compared with proportionate (i.e., relatively non-severe) MR[9]. The MITRA-FR study enrolled patients with relatively large left ventricle with moderate MR. Those in COAPT had a greater degree of MR compared with the left ventricle size (patients in COAPT trial who did not benefit had relatively modest MR (<30 mm^2) with larger left ventricle (>96 mL/m^2). Based on these results, it appears that patients who may benefit from intervention are those with the greatest amount of MR with respect to left ventricle size and function. These patients will have left ventricle with severe MR.

The very complex and dynamic aspects of MR represent an interplay between the mitral apparatus and the left ventricle. The strategy to improve left ventricle function is fundamental for prognosis. Therefore, an approach based on left ventricle is highlighted in another trial of surgical treatment of moderate secondary MR, where 67.7% of patients randomized to coronary artery bypass grafting alone (compared with coronary artery bypass grafting plus MR repair) had improvement in MR at 2 years[2]. The COAPT and MITRA-FR trials have shown us the importance of preoperative medical therapy directed by a heart failure specialist and other strategies to improve left ventricle systolic function, including cardiac resynchronization therapy or revascularization. A team approach with aim to maximize medical therapy and assess best possible image analysis, will help in selecting from the variety of treatment options available. For example, recent studies suggest that left ventricular glo-

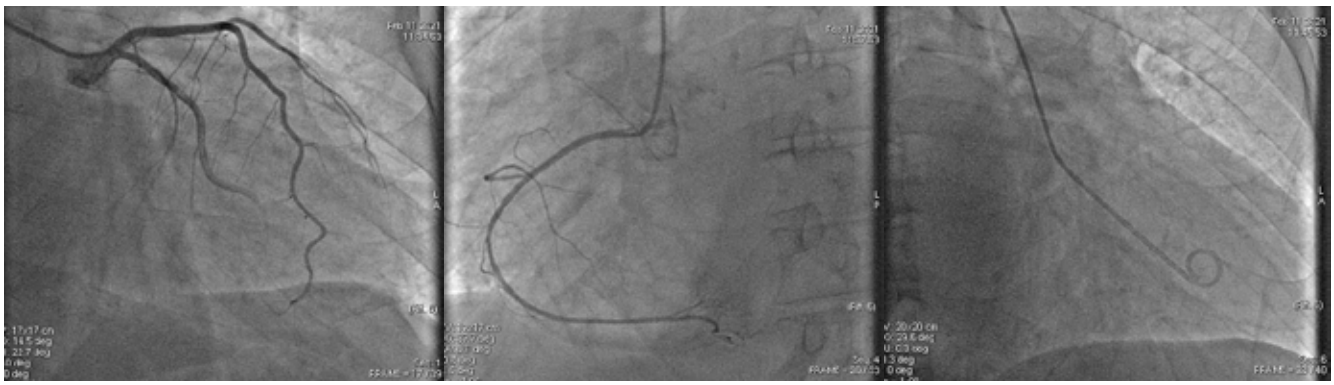

Figure 3. Coronary angiography revealed no obstructive coronary artery disease. Left ventricular end-diastolic pressure = 29-33 mmHg

bal longitudinal strain is a predictor of left ventricular dysfunction after surgery in asymptomatic patients with chronic MR[10]. Hence, it may be helpful tool for clinical decision-making in these patients. Only patients with MR out of proportion to that expected of the left ventricle dysfunction should be considered for surgery.
Our patient underwent surgical mitral valve replacement 1 month ago.

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Sažetak

Teška mitralna regurgitacija kod mladog pacijenta – kako lečiti?

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Predstavljamo 55-godišnjeg pacijenta sa teškom mitralnom regurgitacijom i značajno smanjenom ejekcionom frakcijom, paroksizmalnom atrijalnom fibrilacijom i hipertenzijom, koji je upućen na hiruršku zamenu mitralne valvule.

Ključne reči: mitralna regurgitacija, samnjena ejekciona frakcija, hirurška zamena mitralne valvule