Novel treatment (new drug/intervention; established drug/procedure in new situation)

Application of a novel percutaneous transluminal mitral commissurotomy technique in deformed mitral valve

Tony Thomas, Rajiv Ananthakrishna, Nagamani Alur Chikkabasavaiah, Ramesh Basavappa

Department of Cardiology, Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bangalore, Karnataka, India

Correspondence to Rajiv Ananthakrishna, rajiva.ms@gmail.com

Summary

A 40-year-old woman, known to suffer from rheumatic heart disease, presented with New York Heart Association class III breathlessness of 6 months duration. Transthoracic echocardiogram revealed severe mitral stenosis with deformed double orifice-like mitral valve and severe interatrial septal bulge. Considering the unfavourable anatomy, a high-risk percutaneous transluminal mitral commissurotomy (PTMC) was planned. Initial septal puncture resulted in pericardial effusion with tamponade, which was effectively managed by pericardiocentesis. After haemodynamic stabilisation and a fresh septal puncture, repeated efforts were made to negotiate the balloon across the deformed valve using the conventional Inoue technique. As the attempts were unsuccessful, the authors planned for over-the-wire (OTW) technique, with which the procedure was accomplished successfully. A technically challenging case of PTMC in the presence of adverse factors is presented herein. OTW technique is a useful alternative in the presence of deformed mitral valve.

BACKGROUND

Rheumatic heart disease (RHD) continues to be a major cause of concern in developing countries. Percutaneous transluminal mitral commissurotomy (PTMC) was a major breakthrough in the management of patients with mitral stenosis (MS). It avoided or delayed the need for mitral valve replacement. A severely deformed mitral valve apparatus has been considered a contraindication for PTMC because of the technical difficulties in crossing the valve with conventional technique and risk of complications. With modification of the existing method to a novel over-the-wire (OTW) technique, the procedure can be effectively done in such difficult circumstances. The details are discussed in this case report.

CASE PRESENTATION

A 40-year-old woman, a known case of RHD, presented with New York Heart Association (NYHA) class III breathlessness of 6 months duration. There was no history of chest pain on exertion, palpitation, syncope or swelling of lower limbs. On examination, her pulse rate was 110/min with irregular rhythm and blood pressure was 100/70 mm Hg. Cardiovascular examination revealed a long mid-diastolic murmur at the apex with a loud pulmonary component of second heart sound. ECG confirmed the clinical suspicion of atrial fibrillation.

Transthoracic echocardiogram (TTE) showed severe MS with a mitral valve orifice area of 0.9 cm² and a valve gradient of 33/24 mm Hg. Mitral valve morphology was severely deformed with a double orifice-like picture (figure 1). Left atrium (LA) was dilated with severe interatrial septal bulge (figure 2). In addition, there was severe submitral fusion. The Wilkin's score was 11 (leaflet mobility 3, valvular thickening 3, subvalvular thickening 4 and calcification 1). There was grade I mitral regurgitation and no obvious LA clot. Pulmonary artery systolic pressure was

60 mm Hg. Transesophageal echocardiography excluded LA thrombus. Treatment options: PTMC versus mitral valve replacement were discussed with the patient and family members. The patient opted for PTMC.

TREATMENT

The patient was taken up for PTMC with the anticipation and preparedness to manage the probable complications of cardiac tamponade and severe mitral regurgitation. The septal puncture was done using the Brockenbrough needle inserted through the Mullins sheath, in 90° lateral view. It was effortful in view of the distorted anatomy, secondary to giant LA. After introduction of coiled 0.025-inch guidewire into LA, septal dilatation was performed. Following septal dilatation, the patient developed hypotension and TTE showed large pericardial effusion with tamponade. Urgent pericardiocentesis was done via lateral approach and frank blood was aspirated (figure 3). A pigtail catheter was placed inside the pericardial cavity and continuous aspiration was done with autotransfusion. Septal dilator was placed across the interatrial septum. After 15 min of aspiration, the pericardial collection resolved. The haemodynamic status of the patient stabilised. Subsequently, the septal dilator was removed from the LA and it was confirmed by TTE that there was no reaccumulation of fluid in the pericardial cavity.

A fresh septal puncture was attempted after visualising the appropriate site in multiple angiographic views, and the 0.025-inch coiled guidewire was inserted into the LA. The puncture site was dilated using the dilator, advanced over the guidewire. Subsequently, 26 mm Accura balloon was moved into the LA over the guidewire. The guidewire was removed and attempts were made to navigate the balloon across the mitral valve into the left ventricle (LV) using the J-stylet. Despite repeated attempts, we were unrewarded in advancing the balloon across the mitral valve,

Figure 1 Pre-PTMC apical four chamber view with colour Doppler showing two forward jets across the mitral valve.

Figure 2 Pre-PTMC apical four chamber view showing the dilated left atrium with severe bulge of the interatrial septum towards right atrium.

Figure 3 Fluoroscopy showing the coiled wire in the left atrium after septal puncture and pigtail catheter in the pericardial cavity via lateral approach for pericardiocentesis.

owing to the distorted anatomy and double orifice configuration of the mitral valve. Therefore, it was planned to attempt OTW technique. The stylet was removed and the guidewire was reinserted via the central lumen of the balloon catheter. The wire was negotiated across the mitral valve into the LV and the balloon was advanced over the wire. Subsequently, the procedure was completed with three inflations (figure 4) using 22, 22.5 and 23 cc volume till a satisfactory result was obtained. The patient did not develop any worsening of the mild mitral regurgitation which was present before the procedure.

OUTCOME AND FOLLOW-UP

Post PTMC TTE showed a mitral valve orifice area of 1.7 cm² and a mitral valve gradient of 13/6 mm Hg (figure 5). Further in-hospital course was uneventful. The patient is in NYHA class I at 6 months follow-up.

DISCUSSION

RHD continues to be a major cause of concern in developing countries. PTMC is an important therapeutic option for patients with rheumatic MS. Since its first description in 1984,¹ PTMC has emerged as the treatment of choice in suitably selected patients.^{2–3} The expanding balloon splits fused commissures in the same manner as a surgical

commissurotomy.^{4–5} Patients with symptoms of at least moderate MS should be selected for PTMC based on mitral valve morphology. Asymptomatic patients should be considered for PTMC when they develop pulmonary hypertension or new-onset atrial fibrillation.⁵ Although the procedure can be performed safely with thrombus localised to the LA appendage,⁶ thrombus within the body of LA is a contraindication to this procedure. Moderate or severe ($\geq 2+$ on a scale of 0–4, determined angiographically) mitral regurgitation is another important contraindication for PTMC. The ideal patient has pliable, non-calcified mitral leaflets with mild subvalvular disease.⁷ Valve deformity increases substantially with age. Older patients who present with MS often have valves poorly suited for PTMC. Many find the echocardiographic scoring system of Wilkins *et al*⁸ useful in assessing patients for PTMC. Higher scores indicate more severe anatomic disease and a lower likelihood of a successful procedure. Another scoring system has been put forward by Lung *et al*.⁹

The main risk during trans-septal catheterisation is inadvertent puncture of adjacent structures (the aortic root, coronary sinus or posterior free wall of the right atrium) rather than the fossa ovalis leading to haemopericardium. The risk is higher in the presence of severe interatrial septal bulge, as the conventional landmarks do not hold well. Presence of significant septal bulge is one of the known predisposing

Figure 4 Fluoroscopy showing the balloon being navigated across the mitral valve and inflated using the OTW technique.

factors for the ‘stitch effect’. Viewing the probable puncture site in more than one angiographic plane enables correct puncture. Our patient also had severe septal bulge and we had to encounter cardiac tamponade.

Haemopericardium related to trans-septal catheterisation, atrial puncture or, rarely, left ventricular apical perforation by the balloon or wires varies in incidence from 0.5% to 10%.^{9 10} Prompt recognition and management, as in our case, is the key if this complication develops. If pericardial effusion occurs, prompt pericardiocentesis is mandatory. When stitch effect is suspected, the septal dilator should be kept across the interatrial septum as this acts to plug the rent and prevents bleeding into the pericardium. Most often, the effusion settles without further intervention. Surgical repair is warranted if the above strategy fails to control the effusion.¹¹

The second obstacle we had to encounter was the arduous task of negotiating the balloon across the deformed double orifice mitral valve using the conventional Inoue technique. Hence, we resorted to OTW technique. Here, the same coiled 0.025-inch guidewire, as used in the conventional technique, is steered across the mitral orifice into the LV and then the balloon is guided across the wire

into the LV. There are reports of OTW technique from our own institute and other centres as well.^{6 12 13} In cases with critical MS and when there is abnormal bulge of the interatrial septum, the usual direct method of crossing the mitral valve may not be successful. In such cases, alternative OTW techniques to cross the mitral valve have been advocated. This technique involves direct positioning of a pigtail Inoue wire into the LV through the Mullin sheath, followed by introduction of a balloon catheter over the wire. The other indication for OTW technique is presence of left atrial thrombus (type Ia, Ib and IIa).⁶ There are no major complications attributable to this technique.^{6 12} In the present report, OTW technique was applied in view of the highly deformed double orifice mitral valve rather than the septal bulge. To the best of our knowledge, OTW technique in the presence of severely deformed mitral valve has not been previously described. Before weighing the option of mitral valve replacement, it may be worthwhile to consider this technique in difficult situations, like the one described above. If successful, it will have a significant impact on patient management, potentially delaying or avoiding a more morbid surgical intervention.

Figure 5 Post-PTMC parasternal short axis view showing mitral orifice area of 1.7 cm² with a well-split medial commissure.

Learning points

- ▶ Gross interatrial septal bulge and deformed mitral valve apparatus are major challenges to interventional cardiologist during PTMC.
- ▶ PTMC performed by OTW technique can be successfully employed in severely deformed double orifice-like mitral valve.
- ▶ Pericardial tamponade should be anticipated and managed appropriately during PTMC, especially in cases of distorted interatrial septal anatomy.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. **Inoue K**, Owaki T, Nakamura T, *et al.* Clinical application of transvenous mitral commissurotomy by a new balloon catheter. *J Thorac Cardiovasc Surg* 1984;**87**:394–402.
2. **Carroll JD**, Feldman T. Percutaneous mitral balloon valvotomy and the new demographics of mitral stenosis. *JAMA* 1993;**270**:1731–6.
3. **Lock JE**, Khalilullah M, Shrivastava S, *et al.* Percutaneous catheter commissurotomy in rheumatic mitral stenosis. *N Engl J Med* 1985;**313**:1515–18.
4. **Inoue K**, Feldman T. Percutaneous transvenous mitral commissurotomy using the Inoue balloon catheter. *Cathet Cardiovasc Diagn* 1993;**28**:119–25.
5. **Bonow RO**, Carabello BA, Chatterjee K, *et al.* 2008 Focused update incorporated into the ACC/AHA 2006 guidelines for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 1998 Guidelines for the Management of Patients With Valvular Heart Disease): endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *Circulation* 2008;**118**:e523–661.
6. **Manjunath CN**, Srinivasa KH, Ravindranath KS, *et al.* Balloon mitral valvotomy in patients with mitral stenosis and left atrial thrombus. *Catheter Cardiovasc Interv* 2009;**74**:653–61.
7. **Fatkin D**, Roy P, Morgan JJ, *et al.* Percutaneous balloon mitral valvotomy with the Inoue single-balloon catheter: commissural morphology as a determinant of outcome. *J Am Coll Cardiol* 1993;**21**:390–7.
8. **Wilkins GT**, Weyman AE, Abascal VM, *et al.* Percutaneous balloon dilatation of the mitral valve: an analysis of echocardiographic variables related to outcome and the mechanism of dilatation. *Br Heart J* 1988;**60**:299–308.
9. **lung B**, Cormier B, Ducimetière P, *et al.* Immediate results of percutaneous mitral commissurotomy. A predictive model on a series of 1514 patients. *Circulation* 1996;**94**:2124–30.
10. Complications and mortality of percutaneous balloon mitral commissurotomy. A report from the National Heart, Lung, and Blood Institute Balloon Valvuloplasty Registry. *Circulation* 1992;**85**:2014–24.
11. **Panneerselvam A**, Bhat P, MohanRao P, *et al.* Gelatin sponge mimicking left atrial clot in rheumatic mitral stenosis. *J Cardiol Cases* 2011;**3**:e43–5.
12. **Manjunath CN**, Srinivasa KH, Patil CB, *et al.* Balloon mitral valvuloplasty: our experience with a modified technique of crossing the mitral valve in difficult cases. *Cathet Cardiovasc Diagn* 1998;**44**:23–6.
13. **Thirumalai P**, Prabhakar D, Anandan M, *et al.* Percutaneous transluminal mitral commissurotomy—experience with inoue balloon and over the wire technique. *J Assoc Physicians India* 2002;**50**:796–9.

This pdf has been created automatically from the final edited text and images.

Copyright 2011 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Please cite this article as follows (you will need to access the article online to obtain the date of publication).

Thomas T, Ananthakrishna R, Chikkabasavaiah NA, Basavappa R. Application of a novel percutaneous transluminal mitral commissurotomy technique in deformed mitral valve. *BMJ Case Reports* 2011;10.1136/bcr.04.2011.4116, date of publication

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow