ESC European Society of Cardiology

European Heart Journal - Case Reports (2022) **6**, 1–5
https://doi.org/10.1093/ehjcr/ytac374

CASE REPORT
Other

Re-intervention percutaneous balloon mitral valvuloplasty in a patient with left atrial appendage thrombus: a case report

Rujuta Parikh†, Gaurav Singh†, Ashish Mishra†, and Kamal Sharma *†

Department of Cardiology, U. N. Mehta Institute of Cardiology and Research Centre (UNMICRC), Civil Hospital Campus, Asarwa, Ahmedabad 380016, Gujarat, India

Received 2 November 2021; first decision 21 December 2021; accepted 13 September 2022; online publish-ahead-of-print 16 September 2022

Background Percutaneous balloon mitral valvuloplasty (PBMV) using an Accura balloon is an effective method for management of rheumatic mitral stenosis.

Case summary Herein, we present a case of a 43-year-old female, who had undergone a previous PBMV, who presented with very severe mitral re-stenosis with Type Ia left atrial (LA) clot, in atrial fibrillation and New York Heart Association functional Class III. We used the modified septal puncture and over-the-wire technique, avoiding inadvertent manipulation of the LA clot for PBMV. The mitral valve was successfully dilated from 0.9 to 1.5 cm^2, and the patient had an uneventful post-procedure recovery.

Discussion The presence of LA clot and mitral re-stenosis in a previously intervened valve are considered unfavourable characteristics for a PBMV procedure, and patients are usually advised surgical intervention. These patients are also high-risk candidates for surgery due to late presentation with advanced disease and poor functional capacity. Our patient underwent successful re-intervention with PBMV despite having suboptimal characteristics.

Keywords Balloon angioplasty • Case report • Left atrial thrombus • Mitral valve disease percutaneous intervention

ESC Curriculum 4.4 Mitral stenosis • 5.3 Atrial fibrillation • 2.2 Echocardiography

Learning points

- Rheumatic mitral stenosis is a pathology very much rampant in developing countries. Poor socio-economic conditions and limited health care accessibility often brings patients in late stages of the disease with significant morbidity.
- In patients with low-to-intermediate echo score, repeat percutaneous balloon mitral valvuloplasty (PBMV) should be the procedure of choice despite challenges such as re-stenosis and LA thrombus.
- Modified septal puncture technique and over-the-wire technique can be used for PBMV to avoid entry into LA appendage or manipulation above the fossa ovalis.

Introduction

The technique of percutaneous balloon mitral valvuloplasty (PBMV) introduced by Kanji Inoue in 1982 revolutionized the management of symptomatic mitral stenosis (MS). The 2021 European Society of Cardiology guidelines consider old age, previous history of commisurotomy, New York Heart Association (NYHA) Class IV symptoms, permanent atrial fibrillation (AF), severe pulmonary arterial hypertension (PAH), Wilkin's score >8, severe tricuspid regurgitation (TR), and presence of left atrial (LA) thrombus as unfavourable characteristics for PBMV.[1] However, in resource limited countries with high prevalence of rheumatic heart disease, patients often present with debilitating symptoms in later stages of the disease and are often poor candidates for surgery. Here, we report a case of 43-year-old female who underwent successful re-intervention with PBMV for mitral re-stenosis with AF with LA thrombus Type Ia.

* Corresponding author. Tel: +91 9426020154, Fax: +079 22682092, Email: kamalsharma1975@gmail.com
† All authors are equally contributed to the case report.
Handling Editor: Sameh Shaheen
Peer-reviewers: Luis Antonio Moreno-Ruiz and Livia Gheorge
Compliance Editor: Reshma Amin
Supplementary Material Editor: Fabienne Vervaat

Timeline

2015	Patient first presented with progressive New York Heart Association (NYHA) Class III dyspnoea over a period of 4 years. She was diagnosed as having rheumatic affection of mitral valve and severe mitral stenosis in atrial fibrillation (AF). She was stabilized medically with rate control, diuretics and underwent a balloon mitral valvotomy.
2015–20	Patient was irregular in follow-up, being in NYHA Class I. She was advised Benzathine Penicillin prophylaxis, oral anticoagulation and rate control medications for AF.
Day 1	Presentation to the emergency for dyspnoea and palpitations Class III. Clinical examination, baseline investigations and a diagnosis of mitral re-stenosis with AF with LAA clot in a case of rheumatic heart disease with previous percutaneous balloon mitral valvuloplasty (PBMV) is established.
Day 3	After initial medical stabilization, patient taken for re-intervention PBMV
Day 5	After observation for 48 h and having an uneventful post-procedure recovery, patient was discharged.

Case

A 43-year-old female, presented with symptoms of dyspnoea and palpitations NYHA Class III for the last 2 months. Her past history was notable for having undergone PBMV 6 years ago following which she had remained in functional Class I for 5 years. She started having progressive worsening of dyspnoea which had progressed to NYHA Class III now for the last 2 months. She was in AF, with controlled ventricular rate of 72 b.p.m. and resting room air saturations of 90%. On auscultation, she had a loud S1. A mid diastolic murmur with opening snap could be appreciated at the apex. Bilateral lower zone fine crepitations were present on examining the lungs. Her chest X-ray was suggestive of pulmonary congestion (see Supplementary material online, *Figure S1*). Her transthoracic echocardiography revealed rheumatic affection of mitral valve with mitral valve area (MVA) of 0.9 cm^2 (*Figure 1A*), mean gradient of 13 mmHg (*Figure 1B*), moderate TR, moderate PAH with Wilkins score of 8/16 [mobility: 2, thickness: 2, calcification: 3, subvalvular pathology: 1, Appendix]. Trans-esophageal echocardiogram (TEE) was done which showed Manjunath Type Ia LA clot (*Figure 2*). She was on oral anticoagulation, Nicoumalone 2 mg daily, with prothrombin time-international normalized ratio in therapeutic range with time in therapeutic range of 70%. She was on metoprolol extended release 50 mg once a day. She was stabilized first with intravenous furosemide, digoxin, and initial bi-level positive airway pressure support for 3 h. She was switched to intravenous heparin infusion. Routine investigations ruled out anaemia, thyroid disorder, or sepsis that might have aggravated her underlying heart disease. After explaining risks of thromboembolism and open mitral commisurotomy/mitral valve replacement (MVR) as alternative, in view of symptomatic very severe MS, she was taken for PBMV.

Femoral artery access was obtained with 5F sheath. A pigtail catheter was introduced and baseline left ventricular end-diastolic pressure of 6 mmHg was noted. Trans-mitral end-diastolic gradient was noted to be 15 mmHg. The pigtail was then positioned in aortic root in non-coronary cusp. A 0.032″ wire was introduced into the Innominate vein. Mullins sheath was tracked over the 0.032″ wire (see Supplementary material online, *Figure S2*). Brockenbrough needle was introduced and together with Mullins sheath, was descended into the right atrium with clockwise rotation from 12 to 5 o'clock position (see Supplementary material online, *Figure S3*). The interatrial septum was punctured at fossa ovalis after confirming the position in antero-posterior and lateral views (see Supplementary material online, *Figure S4*). The transseptal puncture technique used in this patient was unique in being more superior and lateral than the conventional technique to avoid inadvertent entry or manipulation of LA appendage during PBMV. The main axis of LA appendage is anteriorly oriented, hence a puncture at the supero-anterior quadrant of the fossa ovalis facilitates to keep the guidewire away from the LA appendage so as to prevent embolization of LA clot. Also, the coiled guide wire was introduced directly into the LV away from the appendage. Septal dilatation was done and 24 mm Accura balloon introduced over the wire. Accura balloon unlike Inoue balloon has single balloon and is easy to use. The balloon was inflated across the mitral valve (see Supplementary material online, *Figure S5*) and the mean gradient fell to 4 mmHg. Post-procedure MVA was found to be 1.5 cm^2 (*Figure 3A*) with mean mitral valve gradient of 5 mmHg (*Figure 3B*), and the patient had an uneventful post-procedure recovery.

Due to a hugely dilated LA, a supero-anterior puncture (see Supplementary material online, *Figure S6*) was done to allow a more vertical LV entry over the wire and this facilitated avoiding the LA appendage. Thus when compared with low inter atrial puncture as described by Manjunath, we differ in following:

(1) Puncture technique.
(2) Over-the-wire entry.
(3) Re-intervention in mitral re-stenosis.

Such a technique would be feasible in LA clot Types Ia, Ib, and IIa. As the coiled guide wire is introduced at the fossa ovalis, it is directed vertically down towards the LV. It thus helps to avoid manipulation of structures superior to the plane of fossa ovalis, leaving thrombi of Types Ia, Ib, and IIa if any, untouched. Possible complications in this technique includes formation of atrio-aortic fistula, entanglement of coiled wire into mitral apparatus, clot embolization, and formation of interatrial septal haematoma.

On follow-up visit to the out-patient department, patient was better, in NYHA functional Class II. She had an MVA of 1.5 cm^2 and a mean gradient of 6 mmHg. She was continued on oral anticoagulation, metoprolol, digoxin, and diuretics.

Discussion

Rheumatic MS is associated with LA thrombus in 3–13% patients in sinus rhythm[2] and 33% in patients with AF.[3] The risk factors for LA thrombus formation in MS include AF, previous embolic episodes, age >40 years, LA dimension >45 mm, LA appendage emptying velocity <20 cm/s, infero-superior LA dimension >69 mm, mean mitral gradient >18 mmHg and spontaneous echo contrast Grade >3 on TEE.[4,5] The LA thrombus is classified based on location and mobility as follows (see Supplementary material online, *Figure S7*):

Type Ia: LA clot confined to appendage.
Type Ib: LA appendage clot protruding into cavity.
Type IIa: LA roof clot limited to a plane above fossa ovalis.
Type IIb: LA roof clot extending below the plane of fossa ovalis.
Type III: layered clot over the interatrial septum.
Type IV: mobile clot which is attached to LA free wall, roof or IAS.
Type V: ball valve thrombus.

Manjunath *et al.*[4] performed PBMV in 108 patients with severe MS and LA clot Types Ia, Ib, or IIa. All patients in the study group underwent PBMV by modified over-the-wire technique. They found a significant improvement in MVA, mean mitral valve gradient, pulmonary artery systolic pressures and mean LA pressures without any increase in

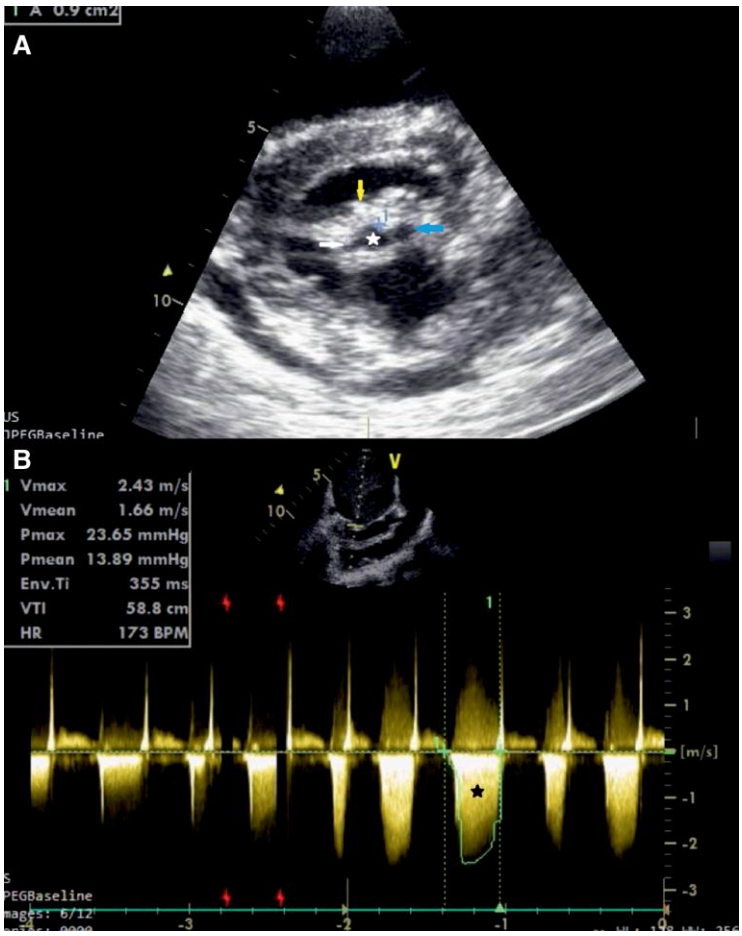

Figure 1 The morphologic and haemodynamic characteristics of the patient on presentation. (*A*) Pre-balloon mitral valvuloplasty thickened anterior and posterior mitral valve leaflets with fish mouth opening and mitral valve area of 0.9 cm^2. (*B*) Pre-balloon mitral valvuloplasty mean mitral valve gradient of 13.8 mmHg.

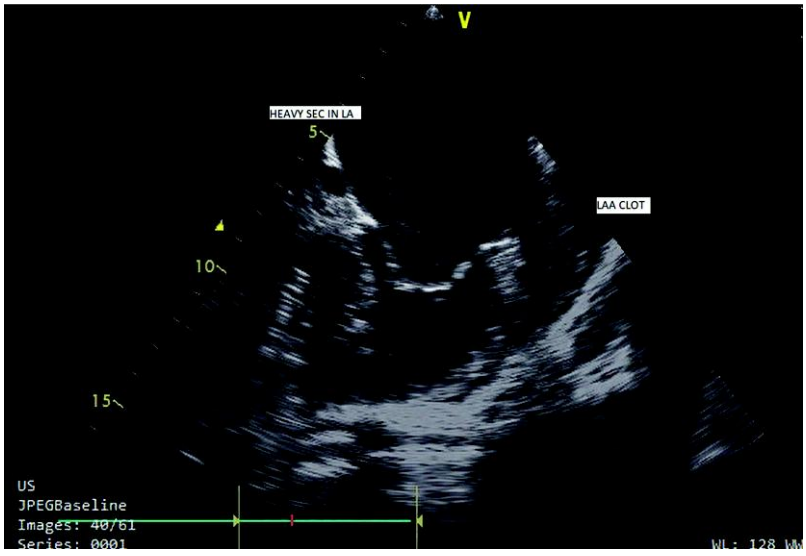

Figure 2 Trans-esophageal echocardiogram showing spontaneous echo contrast in left atrial and LAA clot Type IA.

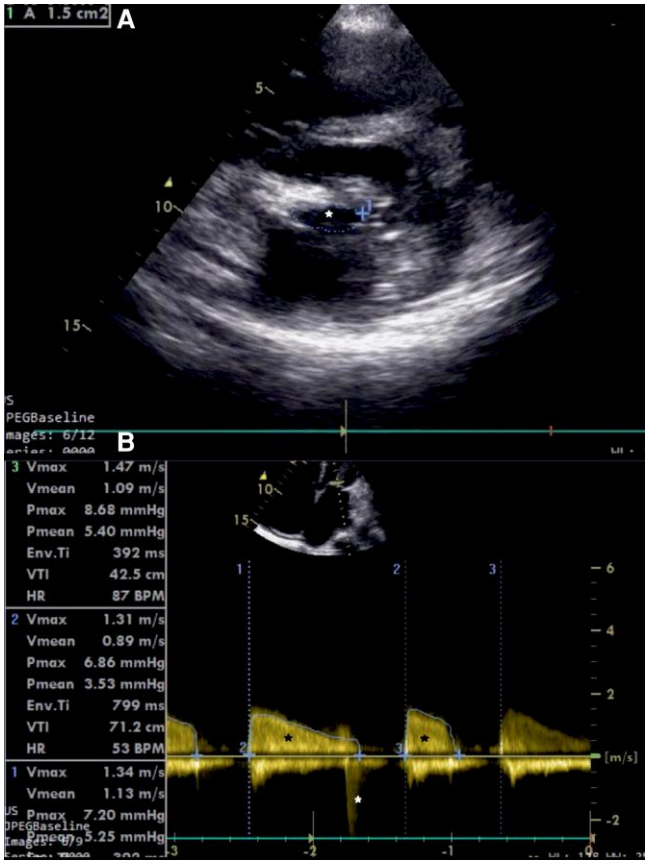

Figure 3 The morphologic and haemodynamic characteristics of the patient after performing percutaneous balloon mitral valvuloplasty is depicted. (*A*) Post-balloon mitral valvuloplasty mitral valve area of 1.5 cm^2. (*B*) Post-balloon mitral valvuloplasty mean mitral valve gradient of 5.2 mmHg averaged over three heart cycles in atrial fibrillation with controlled ventricular rate.

thromboembolic episodes when compared with the control group of severe MS without LA thrombus.

Shaw *et al.*[6] reported successful PBMV in 21 patients with clot localized entirely to LA appendage. Six patients with LA appendage clot protruding out of the appendage were anticoagulated for another 1 month. On repeat echocardiographic examination, three of them demonstrated partial resolution with clot being confined to LA appendage only, who underwent successful PBMV.

Mitral re-stenosis after previous PBMV occurs at the rate of 7–21%. The incidence increases after 5 years of follow-up.[7] Wilkins score >8, Post PBMV MVA <1.8 cm^2, pre-existing AF, higher age and NYHA functional Class III or IV have been identified as risk factors for development of re-stenosis.[8] The dominant pathophysiology of mitral valve re-stenosis includes thickening of leaflets due to fibrosis, calcifications, fusion of commissures and shortening of chordae tendineae resulting in narrow orifice.

Sharma *et al.*[9] studied 70 patients with a history of prior intervention, either surgical or percutaneous, in a prospective, open-label, randomized study. Forty-four patients had undergone a prior PBMV and 26 patients had undergone a prior surgical commissurotomy. All of them underwent a repeat PBMV due to mitral re-stenosis. They reported a successful PBMV in 84.1% patients with prior PBMV and in 65.4% patients with prior surgical commissurotomy. They found comparable and significant increase in MVA, decrease in pulmonary artery systolic pressure, decrease in LA mean pressure, and decrease in trans-mitral gradient in both groups.

Pathan *et al.*[10] reported repeat PBMV in 36 patients having undergone a previous PBMV and compared it with 33 patients who underwent MVR having undergone a previous PBMV as the control arm to compare both interventions in patients with mitral valve re-stenosis. They reported a successful procedural outcome with repeat PBMV in 75% of patients and at 3-year follow-up, good functional results without subsequent MVR or death were obtained in 47% of patients.

Our patient is a unique case in undergoing a successful PBMV after having undergone a previous PBMV and having an associated LA thrombus type Ia. Studies evaluating PBMV in mitral re-stenosis have not included patients with LA clots. Ansari *et al.*[11] has shown that PBMV, in addition to giving symptomatic relief; improves LA appendage performance over a period of 6 months by structural remodelling, in the form of better LA appendage fractional area change and LA appendage tissue doppler velocity; thus conferring protection from thromboembolism.

Conclusions

Rheumatic MS is a pathology very much rampant in developing countries. Poor socio-economic conditions and limited health care accessibility often brings patients in late stages of the disease with significant morbidity. In patients with low-to-intermediate echo score, repeat PBMV should be the procedure of choice despite challenges such as re-stenosis and LA thrombus. PBMV was safely performed in this case with LA clot Type Ia. Modified septal puncture technique and over-the-wire technique can be used for PBMV to avoid entry into LA appendage or manipulation above the fossa ovalis.

Lead author biography

Dr Kamal Sharma MD; DNB(MED); DM(CARD); DNB(CARD); MNAMS; FACC; FSCAI, FESC Interventional Cardiologist and Associate Proffesor in Cardiology at U. N. Mehta Institute of Cardiology, B.J. Medical College, Civil Hospital, Ahmedabad.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with committee on publication ethics guidance.

Conflict of interest: None declared.

Funding: This work was supported by U. N. Mehta Institute of Cardiology and Research Centre itself and received no specific grant from any funding agency, commercial or not for profit sectors.

Appendix

Wilkins score criteria

Score	Leaflet mobility	Leaflet thickening	Leaflet calcification	Sub-valvar apparatus
1	Highly mobile valves with restriction of leaflet tips only	Leaflets near normal (4–5 mm)	Calcification at a single spot	Minimal thickening of chordae just below the valve
2	Mid-portion and base of leaflets have restricted mobility	Mid-leaflet and margin thickening	Scattered areas of calcification confined to leaflet margins	Thickening of chordae upto one-third of chordal length
3	Valve leaflet move forward in diastole mainly at base	Thickening extends through entire leaflets (5–8 mm)	Calcification extending to mid-portion of leaflets	Thickening extending to distal third of chordal length
4	No, or minimal, forward movement of base in diastole.	Pronounced thickening of all leaflet tissue (>8–10 mm)	Extensive calcification through most of the leaflet tissue.	Extensive thickening and shortening of all chordae down to the papillary muscles

References

1. Vahanian A, Beyersdorf F, Praz F, Milojevik M, Baldus S,Bauersachs J, Capodanno D, Conradi L, Bonis M, Paulis R, Delgado V, Freemantle N, Gilard M, Haugaa K, Jeppsson A, Juni P, Pierard L, Prendergast B, Sadaba J, Tribouilloy C, Wojakowski W. 2021 ESC/EACTS guidelines for the management of valvular heart disease: developed by the task force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J* 2022;**43**:561–632.
2. Davison G, Greenland P. Predictors of left atrial thrombus in mitral valve disease. *J Gen Intern Med* 1991;**6**:108–112.
3. Srimannarayana J, Varma RS, Satheesh S, Anilkumar R, Balachander J. Prevalence of left atrial thrombus in rheumatic mitral stenosis with atrial fibrillation and its response to anticoagulation: a transesophageal echocardiographic study. *Indian Heart J* 2003;**55**: 358–361.
4. Manjunath CN, Srinivasa KH, Ravindranath KS, Manohar JS, Prabhavathi B, Dattatreya PV, Sridhar L, Dhanalakshmi C. Balloon mitral valvotomy in patients with mitral stenosis and left atrial thrombus. *Catheter Cardiovasc Interv* 2009;**74**:653–661.
5. Manjunath CN, Srinivasa KH, Panneerselvam A, Prabhavathi B, Ravindranath KS, Rangan K, Dhanalakshmi C. Incidence and predictors of left atrial thrombus in patients with rheumatic mitral stenosis and sinus rhythm: a transesophageal echocardiographic study. *Echocardiography* 2011;**28**:457–460.
6. Shaw TR, Northridge DB, Sutaria N. Mitral balloon valvotomy and left atrial thrombus. *Heart* 2005;**91**:1088–1089.
7. Iung B, Cormier B, Ducimetiere P, Porte JM, Nallet O, Michel PL, Acar J, Vahanian A. Functional results 5 years after successful percutaneous mitral commissurotomy in a series of 528 patients and analysis of predictive factors. *J Am Coll Cardiol* 1996;**27**: 407–414.
8. Meneguz-Moreno RA, Costa JR, Gomes NL, Braga SL, Ramos AI, Meneghelo Z, Maldonado M, Ferreira-Neto A, Franca J, Siqueira D, Esteves C, Sousa A, Sousa J, Abizad A. Very long term follow-up after percutaneous balloon mitral valvuloplasty. *JACC Cardiovasc Interv* 2018;**11**:1945–1952.
9. Sharma KH, Jain S, Shukla A, Bohora S, Roy B, Gandhi GD, Ashwal A. Patient profile and results of percutaneous transvenous mitral commissurotomy in mitral restenosis following prior percutaneous transvenous mitral commissurotomy vs surgical commissurotomy. *Indian Heart J* 2014;**66**:164–168.
10. Pathan AZ, Mahdi NA, Leon MN, Lopez-Cuellar J, Simosa H, Block PC, Harrell L, Palacios I. Is redo percutaneous mitral balloon valvuloplasty (PMV) indicated in patients with post-PMV mitral restenosis? *J Am Coll Cardiol* 1999;**34**:49–54.
11. Ansari B, Siddiqui S, Barge V, Dash PK, Ansari B, Siddiqui S. Study of immediate and late effects of successful PTMC on left atrial appendage function in patients with severe rheumatic mitral stenosis IN SINUS rhythm. *Indian Heart J* 2020;**72**: 179–183.