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Case Report

Transseptal Triumph: Overcoming the Challenges of Balloon Mitral Valvotomy in a Rigid Interatrial Septum: A Case Report

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ABSTRACT

Background: Balloon mitral valvotomy (BMV) is a well-established, commonly performed interventional procedure for the treatment of rheumatic mitral stenosis, offering symptomatic relief and improved hemodynamics. Despite its routine nature, certain anatomical variations and pathological changes can present significant procedural challenges, occasionally escalating to life-threatening complications if not managed appropriately. One such challenge is the presence of a thickened and fibrotic interatrial septum (IAS), which can complicate the critical step of transseptal puncture required to access the left atrium for balloon crossing.

Case Presentation: We report the case of a 67-year-old man with severe rheumatic mitral stenosis who underwent BMV complicated by dense fibrotic thickening of the IAS. This abnormality posed considerable difficulty during the transseptal puncture and subsequent passage of the valvotomy balloon catheter. To overcome this obstacle, a novel approach utilizing a percutaneous transluminal angioplasty (PTA) balloon to dilate the fibrotic septum was employed, facilitating successful transseptal access and completion of the valvotomy.

Conclusion: This case highlights the importance of assessing patient-specific anatomy when performing BMV. When the atrial septum is fibrotic, adjunctive techniques such as PTA balloon dilatation can facilitate transseptal access. Identifying these challenges early and adjusting the approach accordingly may improve procedural efficiency and clinical outcomes. ***(Iranian Heart Journal 2026; 27(3): 71-75)***

KEYWORDS: BMV; IAS; TEE; PTA balloon

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Balloon mitral valvotomy (BMV) has evolved since its introduction by Inoue in 1984.[1] BMV is a commonly performed interventional procedure for rheumatic mitral stenosis (MS). BMV improves the valve orifice by splitting the fused commissures. In addition, it results in fracture of nodular calcium within the leaflet structure. BMV has largely replaced surgical closed mitral valvotomy for pliable MS. It is associated with challenging steps, such as transseptal puncture, and rarely, life-threatening complications, such as cardiac

tamponade due to left atrial or left ventricular perforation.

Case Report

A 67-year-old man with rheumatic heart disease and MS who underwent BMV in 2021 presented with complaints of dyspnea on exertion, gradually progressive to New York Heart Association (NYHA) functional class III over 2 years. On clinical evaluation, he was diagnosed with severe mitral restenosis with moderate pulmonary hypertension. Echocardiography confirmed severe MS with a mitral valve orifice area of 0.7 cm^2 and a gradient across the mitral valve of 16 mm Hg (Figure 1). There was mild tricuspid regurgitation with moderate pulmonary hypertension (right ventricular systolic pressure, 48 mm Hg). With a favorable Wilkins score, he was considered for BMV. From the right femoral venous access, a Teflon wire (0.032" × 150 cm) was placed in the left innominate vein. Using a Mullins sheath with a dilator and septal puncture needle, transseptal puncture was attempted under fluoroscopic guidance. Nonetheless, there was difficulty in puncturing the interatrial septum (IAS) using a Brockenbrough needle, for which the patient was planned for transesophageal echocardiography (TEE)-guided transseptal puncture.

Under general anesthesia, TEE was performed, and transseptal puncture was done after confirming the position in the anteroposterior, right anterior oblique 40°, and lateral views. Nevertheless, after crossing the septum and placing the guidewire in the left atrium, there was difficulty in crossing the Inoue balloon because of inadequate interatrial septal dilatation. To dilate the IAS, a Road Runner guidewire (0.018" × 145 cm) was utilized to cross the IAS. An Armada percutaneous transluminal angioplasty (PTA) balloon (Abbott; 5 × 60 mm) was placed over the wire, and balloon dilation was performed at 10 atm (Figure 2).

The balloon and Road Runner wire were removed. A coiled guidewire was introduced into the left atrium. The Inoue balloon was positioned across the mitral valve under fluoroscopic guidance, and 3 successive balloon dilations at 23 mm, 24 mm, and 25 mm were performed, leading to an anterolateral commissure split. After BMV, the mitral valve area was 1.5 cm^2, and the mean gradient across the mitral valve was 7 mm Hg.

It is unusual to have such marked fibrotic thickening of the IAS, which poses a procedural challenge in the form of difficulty in transseptal puncture and in passing the valvotomy balloon across the IAS. In our case, a peripheral balloon was used to overcome this challenge, and BMV was completed successfully.

Several challenges were encountered during this BMV procedure. First, the IAS was markedly thickened, which posed difficulty in performing the transseptal puncture. Second, after successful transseptal puncture, advancing the valvotomy balloon across the thickened IAS was challenging. To overcome this resistance, a peripheral balloon was employed to dilate the septum, after which BMV was completed successfully. Postprocedurally, the mitral valve area improved to 1.5 cm^2, with a mean gradient of 7 mm Hg across the mitral valve.

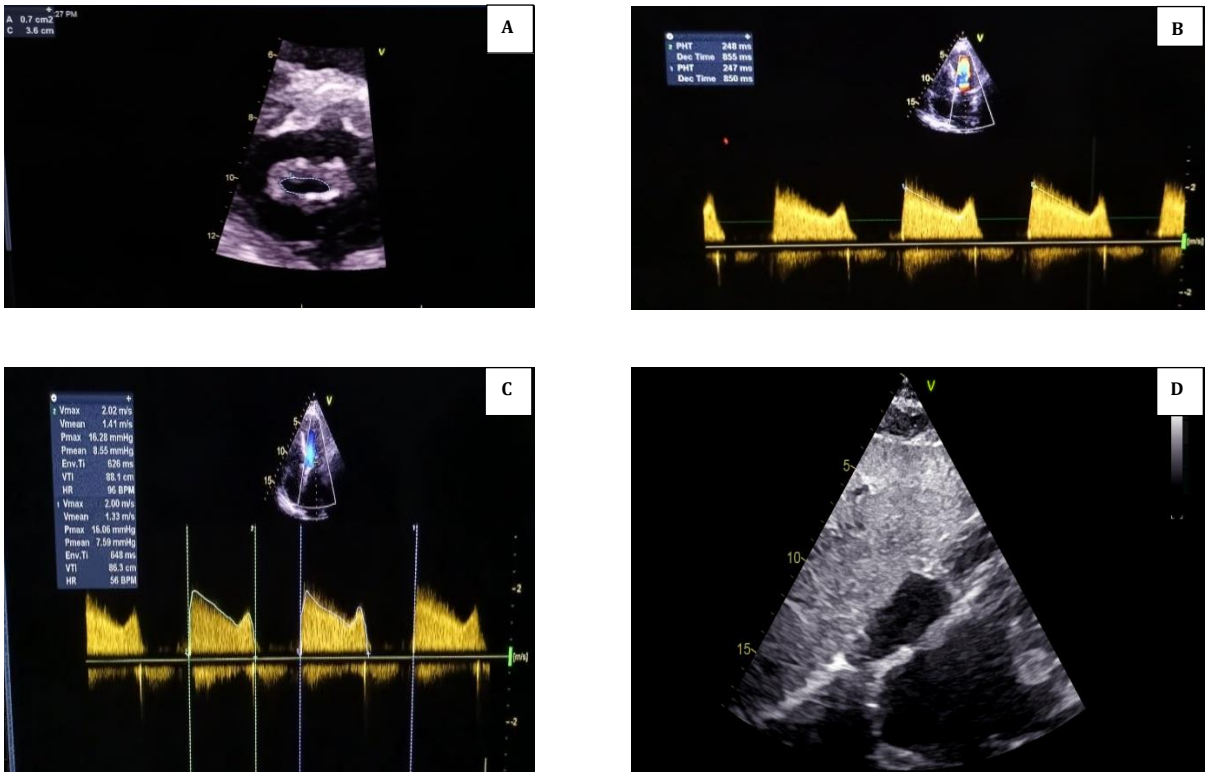

Figure 1. A, Two-dimensional echocardiographic image showing mitral valve area and severe mitral stenosis. B, Continuous-wave Doppler image across the mitral valve showing pressure half-time. C, Gradient across the mitral valve. D, Thickened interatrial septum in the subcostal view.

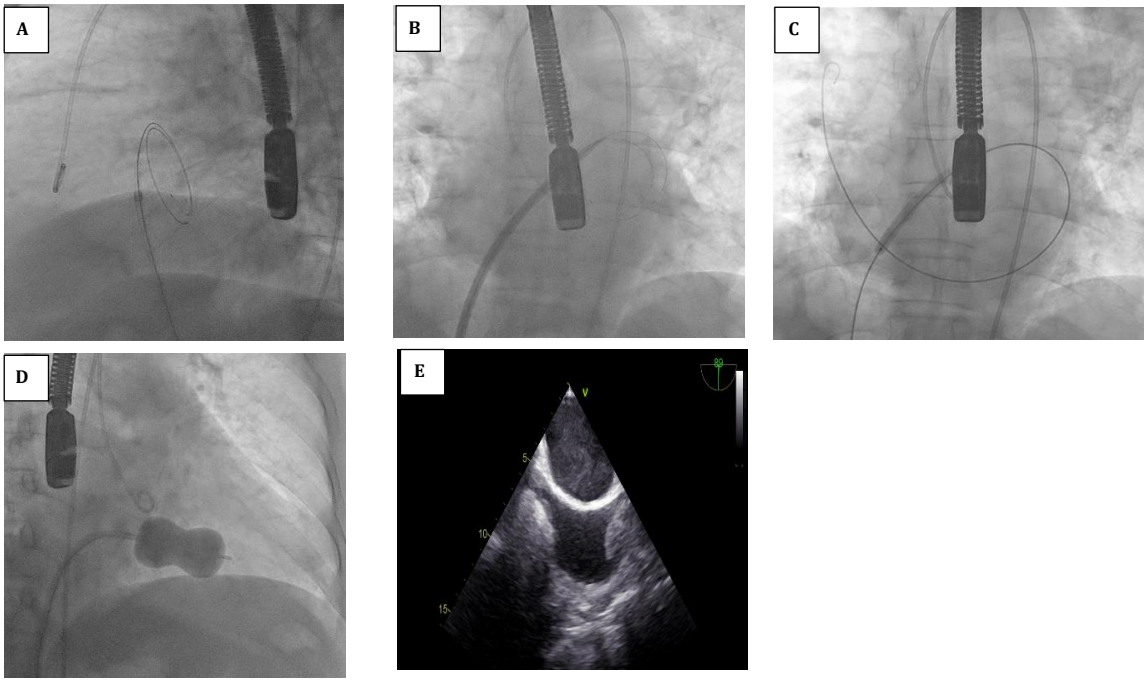

Figure 2. A, Under fluoroscopic guidance, difficulty crossing the Inoue balloon during balloon mitral valvotomy. B, Transseptal dilator used for dilatation of the septum. C, Armada percutaneous transluminal angioplasty balloon used to dilate the thickened interatrial septum. D, Successful inflation of the Inoue balloon. E, Thickened, fibrotic interatrial septum on transesophageal echocardiography.

Following the procedure, the patient's symptoms improved, and he was discharged successfully. At follow-up, the patient had better functional capacity.

DISCUSSION

In the presented case, transseptal puncture posed a significant technical challenge because of a markedly thickened, fibrotic IAS, which measured approximately 8 mm. This degree of septal thickening is well beyond the typical range and significantly hinders safe and effective transseptal puncture. This finding is also supported by a study by Qadir, Faisal, et al,[2] in which the mean IAS thickness was 2.56 mm in the anterior region and 2.95 mm in the posterior region.

When transseptal puncture is difficult and manipulation of large balloons is risky, PTA balloons may assist with safer crossing and predilatation. Although rare, a PTA balloon can be useful to initially open a fibrotic IAS or facilitate crossing of the mitral valve after a previous surgical or BMV procedure.

Despite the rapidly increasing number of interventional procedures that rely on transseptal access—such as BMV, left atrial appendage closure, atrial fibrillation ablation, and transcatheter mitral or tricuspid interventions—IAS thickness assessment has not received adequate emphasis in routine preprocedural planning. This is surprising given the pivotal role of the IAS in determining access feasibility and safety.

Conventionally, transseptal puncture is achieved using the Brockenbrough needle and a Mullins sheath under fluoroscopic or echocardiographic guidance. Nevertheless, in patients with severely thickened or fibrotic IAS, particularly because of previous interventions, older age, or congenital structural alterations, traditional mechanical force may not suffice. In such scenarios, alternative approaches become essential to facilitate transseptal puncture and minimize the risk of complications such as cardiac perforation, tamponade, or procedural failure.

One established adjunct is the application of surgical electrocautery at the hub of the Brockenbrough needle, which allows enhanced penetration through fibrotic tissue by localized heating and tissue ablation. Another advanced tool is the use of radiofrequency (RF) transseptal needles, which deliver focused energy to facilitate septal crossing with greater ease and reduced mechanical stress.[3, 4] These techniques not only improve procedural success but also reduce the need for excessive force, thereby improving safety.

Evaluation of the IAS can be performed effectively using several imaging modalities. Transthoracic echocardiography offers a noninvasive initial assessment, although it may be limited in resolution.[5] TEE provides superior spatial resolution and allows dynamic visualization of septal anatomy, including the presence of lipomatous hypertrophy, fibrosis, or aneurysmal segments.[6] Cardiac computed tomography and magnetic resonance imaging confer detailed anatomic insights and tissue characterization, especially in complex or repeat cases.[6, 7] Intracardiac echocardiography is particularly valuable during the procedure, allowing real-time intraprocedural guidance for septal puncture, especially in difficult anatomic scenarios.[8]

A focused pre-BMV assessment of IAS thickness can guide procedural planning, aid in tool selection (standard vs RF needle), predict technical difficulty, and potentially prevent complications. Despite this, septal thickness is rarely quantified in routine practice or mentioned in procedural checklists. Therefore, a paradigm shift is warranted, wherein systematic evaluation of the IAS anatomy, including thickness, composition, and morphology, should become a standard part of preinterventional assessment, especially in procedures requiring

transseptal access. Doing so could enhance procedural planning, optimize outcomes, and reduce the incidence of adverse events associated with difficult septal puncture.
From the patient's perspective, after the procedure he now has an improved quality of life and minimal symptoms.

Informed Consent: Informed written consent was obtained from the patient and his relatives.

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