Percutaneous balloon mitral valvuloplasty (BMV) in severe mitral stenosis with giant, aneurysmal left atrium (LA) using modified hairpin loop entry — challenges and technical considerations

Authors: Santosh Kumar Sinha, Mahmadula Razi, Puneet Aggarwal, Nishant Kumar Abhishek, Ramesh Thakur

DOI: 10.5603/FC.a2019.0023

Article type: Case Reports

Submitted: 2017-10-08

Accepted: 2017-11-06

Published online: 2019-03-27

This article has been peer reviewed and published immediately upon acceptance. It is an open access article, which means that it can be downloaded, printed, and distributed freely, provided the work is properly cited.
Percutaneous balloon mitral valvuloplasty (BMV) in severe mitral stenosis with giant, aneurysmal left atrium (LA) using modified hairpin loop entry — challenges and technical considerations

Balloon mitral valvuloplasty in giant, aneurysmal left atrium using modified hairpin loop entry

Santosh Kumar Sinha, Mahmadula Razi, Puneet Aggarwal, Nishant Kumar Abhishek, Ramesh Thakur

Department of Cardiology, LPS Institute of Cardiology, G.S.V.M. Medical College, Kanpur, India

Address for correspondence: Santosh Kumar Sinha MD, FAESC, Asst. Professor, Department of Cardiology, LPS Institute of Cardiology, G.S.V.M. Medical College, G.T. Road, Kanpur, Uttar Pradesh 208002, India, fax +91 0512 255 61 99/255 65 21, e-mail: fionasan@rediffmail.com

Abstract
Percutaneous balloon mitral valvuloplasty (BMV) using an Accura balloon is an effective procedure for the management of patients with rheumatic mitral stenosis. The inability to cross the mitral valve is one of the prime reasons for procedural failure. Here, we describe the case of a 24 year-old male with severe mitral stenosis with a giant, aneurysmal left atrium (left atrium 12.3 × 10.4 cm) where the traditionally described technique of mitral valve entry failed. BMV was successfully performed by a U-shape modification of hairpin loop entry (the modified hairpin entry method), expanding the mitral valve area from 0.8 cm$^2$ to 1.9 cm$^2$.

Key words: aneurysmal left atrium; hairpin loop entry; mitral stenosis; percutaneous balloon mitral valvuloplasty

Introduction
Percutaneous balloon mitral valvuloplasty (BMV), introduced in 1984 by Inoue et al, has ushered in a new dimension in the treatment of patients with symptomatic mitral stenosis (MS) with suitable valve anatomy, as it provides sustained hemodynamic improvement [1]. In the presence of a left atrial clot or left atrial appendage clot, a redo-BMV in a calcified valve is associated with increased complications and incomplete success [2]. Another challenging substrate is a giant left atrium (LA) when patients present very late because of an interatrial septal bulge to the right which makes septal puncture and crossing the mitral valve difficult. Traditionally four methods: vertical, direct, sliding, and posterior loop, have been described to cross the mitral valve from left atrium to left ventricle. These techniques require some modifications in difficult and atypical situations such as an aneurysmal left atrium.

Case report

A 24 year-old male presented with exertional dyspnoea — New York Heart Association (NYHA) class II - of six years’ duration, progressing to class III for the past two years. Transthoracic echocardiogram revealed severe mitral stenosis with mitral valve area of 0.8 cm² by planimetry, and Wilkin’s score of 8/16 (M₂, C₂, T₂, S₂). Mean gradient across the mitral valve was 28 mm Hg by pressure half time (PHT). His LA was aneurysmally dilated with the size being 12.3 × 10.4 cm. His height was 154 cm. Transoesophageal echocardiography was performed to look for a left atrial clot, the degree of mitral regurgitation (MR), and his suitability for BMV. BMV was planned after procedural consent. Femoral artery and vein were accessed with a 6F and an 8F sheath respectively. A Mullins sheath was parked over the 0.035” guidewire in the left brachiocephalic vein. As the LA was giant, the curvature of the Brockenbrough needle was increased. Wire was removed and the Brockenbrough needle was inserted into the sheath. Interatrial septum was punctured with the Brockenbrough needle after making a gradual descent and subsequently the septum was dilated in a left atrial oblique (LAO) 30° view (Figure 1A). After septal puncture, the Mullins sheath was advanced over the needle and contrast was injected through the sheath following removal of the needle which opacified the left atrium showing its aneurysmal dilatation (Figure 1A). Looped LA wire was parked in left atrium (Fig. 1B). Accura balloon (Vascular Concepts, UK) was sized to 25.5 mm based on Hung’s formula. Preprocedure LA pressure was 39/22 mm Hg (mean = 29 mm Hg). Following a standard trans-septal puncture and dilation with a 12-F dilator, an Accura balloon was placed in the LA. Because of the giant LA, we were not able to cross through the mitral valve, even after improvising the J-shaped
metallic stylet. The balloon loop was pushed to touch the left atrial roof until the tip of the balloon hit the floor of the LA near the mitral valve (Figure 2A) and a gentle anticlockwise twist was applied to the balloon to give a partial hairpin turn (Figure 2B). The Accura balloon was further pushed against the LA roof while maintaining the anticlockwise twist to give it a U-shape (Figure 3A, B). Metallic stylet was gradually pulled while a little more anticlockwise twist was applied (Figure 4A), and once the stylet was sufficiently pulled, the Accura balloon was pulled to align against the mitral valve (Figure 4B). Once the bobbing movement of the Accura balloon had been noted, it was pushed into the left ventricle through the mitral valve (Figure 5A). The balloon was inflated in its distal part and pulled back to anchor it at the mitral valve and inflated further to achieve its full dilatation (Figure 5B). BMV was performed successfully, thereby bringing the LA mean pressure to 7 mm Hg. The post BMV mitral valve area was 1.9 cm².

Discussion

In a developing country like India, where patients with rheumatic mitral stenosis often present very late, we regularly encounter a giant, aneurysmal left atrium. This may lead to some technical difficulties while performing the procedure. The conventional direct method of Inoue balloon entry across the mitral valve is difficult, time consuming, and has a high failure rate in patients with a giant LA. In a giant, aneurysmal LA, the septum bulges into the right atrial side, making the puncture difficult. The septum bulges anteriorly and inferiorly so that the puncture becomes even more technically challenging. Whenever it is tried, the needle will go through the septum and will dissect it, and may not enter the LA because of the vertical lie of the septum. Such a situation can be circumvented by either increasing the curvature of the Brockenbrough needle or probing the LA entry. In the probing the LA entry technique, the needle tip is kept inside the tip of the Mullins sheath, and the whole assembly is used to probe the septum at the region of the fossa ovalis. This is done by tenting the septum and the LA is entered.

In a situation of giant LA, the vertical, sliding and direct methods often fail. Mitral valve can be entered using a posterior loop or reverse loop entry. Here, the balloon shaft makes a loop in anticlockwise fashion and crosses the mitral valve from the floor of the mitral valve. A reverse loop is better suited to a small LA because in the case of an aneurysmal LA, the whole length of the balloon catheter may be consumed inside, making negotiation of the valve difficult.
In our case, a balloon loop was pushed against the roof of the LA, thus bringing the tip of the balloon to the floor of the LA near the mitral valve. It was further pushed up while giving an anticlockwise twist which further pushed the tip of the balloon near the valve (Figure 3A, B). Metallic stylet was gradually pulled while a little more anticlockwise twist was applied which brought the tip posteriorly near the mitral valve. Once the stylet was pulled, it facilitated its entry into the left ventricle through the mitral valve. This is a modification of the classic hairpin loop entry used in the hairpin loop method; it is pushed until the shaft touches the LA roof. In our method, when the stylet was withdrawn, the balloon took an angulation and entered the mitral valve.

Usually, the balloon is negotiated in a RAO view as this profiles the left ventricular long axis. In a situation of giant LA, a lateral view (90 degrees) may sometimes be better. Other improvisations could include non-ideal puncture sites such as more cephalad, leftward (closer to mitral valve), and very low punctures, changing the shape of the stylet, and different techniques of balloon entry such as the over the wire technique [3, 4] and floating a Swan Ganz catheter into the left ventricle [5]. Another novel method is veno-arterial looping, as described by Nanjappa et al [6], for difficult BMV. However, the potential problem with this technique is that all the manipulations need to be gentle because an arteriovenous loop can cut through the valve and aorta unless it is protected by a catheter, especially when there is a critical mitral stenosis situation needing sufficient pull and push, cardiac perforation, ventricular arrhythmias, tear of mitral valve, and stroke. Our method was a modification of the existing technique, thus turning a complex situation into a simple one.

**References**


**Figure 1.** Giant left atrium, outlined by contrast through Mullins sheath (A — white arrow); the loop of left atrial wire (B)

**Figure 2.** Balloon loop was pushed to touch the left atrial roof until the tip of the balloon hit the floor of the LA (A); gentle anticlockwise twist was applied to the balloon to give a partial hairpin turn (B)

**Figure 3.** Accura balloon was further pushed against the LA roof (A) while maintaining the anticlockwise twist to give it a U-shape (B)

**Figure 4.** Metallic stylet was gradually pulled while a little more anticlockwise twist was applied (A); the Accura balloon was pulled to align against the mitral valve once the stylet was sufficiently pulled (B)

**Figure 5.** Accura balloon into left ventricle after crossing the mitral valve (A); successful dilatation of mitral valve (B)