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## **Importance of Veno-arterial (VA) loop in Percutaneous Transvenous Mitral commissurotomy (PTMC)**

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## **Importance of Venous-arterial (VA) loop in Percutaneous Transvenous Mitral commissurotomy (PTMC)**

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### **Abstract**

Percutaneous trans-mitral commissurotomy (PTMC) using Accura balloon is an effective procedure for management of patients with rheumatic mitral stenosis. Following trans-septal puncture, negotiating the balloon catheter from left atrium (LA) to left ventricle sometimes becomes difficult especially in the background of large left atrium. Over-the-wire technique is one of the methods to bail out in such a situation. Here, we report a case of 10-year old boy suffering from critical rheumatic mitral stenosis in which LA was large (9cm x 8cm) where the mitral valve could not be negotiated with standard technique. Making a reverse loop of partially inflated Accura balloon, 0.014" coronary angioplasty wire was introduced into left ventricle (LV) which was further pushed and parked into ascending aorta, thereby establishing a venous-arterial (VA) loop. The balloon was deflated and gradually tracked over the wire across the mitral valve to enter into LV cavity. Once into the cavity, the loop was straightened and mitral valvuloplasty was successfully performed in standard fashion. Thus, this technique is helpful in bailing out in situations of "difficult LV entry" in critically stenosed valve.

**Key words:** Large left atrium; Venous-arterial Loop; Percutaneous Transvenous Mitral commissurotomy, Critical mitral stenosis

### **Introduction**

Percutaneous trans-mitral commissurotomy (PTMC) is the gold standard treatment for suitable isolated rheumatic mitral stenosis [1]. In patients with large left atrium (LA), usual landmarks for trans-septal puncture may sometimes change. Furthermore, left ventricle (LV) entry across the mitral valve, a key step following a successful atrial septal puncture, becomes difficult as balloon usually floats into LA. The standard technique of placing Accura balloon in the LA and advancing it into left ventricle (LV) often becomes challenging as a result of low or medial position of septal puncture, altered left atrial geometry, severe sub-

valvular disease or critical mitral stenosis. Several modifications of classical Inoue technique to circumvent this problem have been described [2, 3].

### **Case report**

A 10-year-old boy presented with gradually progressive dyspnoea — New York Heart Association (NYHA) class II for past six months. Trans-thoracic echocardiogram revealed pure mitral stenosis (Mitral valve area by planimetry — 0.9 cm<sup>2</sup>; and 0.8 cm<sup>2</sup> by pressure half time) and the mean gradient across the mitral valve was 28 mm Hg. The estimated right ventricular systolic pressure was 49 mm Hg. His Wilkin's score was 8/16 (M<sub>2</sub>C<sub>1</sub>T<sub>2</sub>S<sub>3</sub>), and left atrial was giant (9cm x 8cm). His height was 154 cm. PTMC was planned after obtaining informed consent. Femoral artery and vein were accessed with 6F and 9F sheath. After performing septostomy and dilating the septum in usual fashion, looped wire was placed into left atrium. Several attempts including reverse-loop and double-loop techniques to negotiate Accura balloon catheter across the mitral valve into the LV failed. The balloon catheter was partially inflated into LA and 0.014" percutaneous coronary angioplasty wire (runthrough wire; Terumo; Japan) was introduced into left ventricle (Fig. 1A, B). The wire was gradually pushed across the aortic valve to be parked as distally as possible. Once it reached into arch of aorta, the balloon catheter was gradually tracked over the wire (Fig. 2A, B). Once it reached into LV, a counter-clock twist was given to the balloon to straighten it (Fig. 3). Once it became straight, it was further pushed down into LV cavity.

26 mm Accura balloon (Vascular Concepts, Essex, UK) was chosen based on Hung's formula. Successful dilatation of the mitral valve was ensured with reduction of the mean left atrial pressure (mean pressure coming down to 8 mmHg from 35 mmHg) and the mean diastolic gradient with insignificant mitral regurgitation (Fig. 4). Mitral valve area was 1.7 cm<sup>2</sup> with mild mitral regurgitation on subsequent echocardiography. He was discharged next day with low dose diuretics, oral beta blocker and intramuscular penidure prophylaxis every three week.

### **Discussion**

In country like India, progression of mitral stenosis becoming critical is not uncommon. In such cases, left atrium becomes huge sometimes as a result of long standing obstruction. High left atrial pressure leads to bulging of septum into right atrium, thus making it flatter, which pushes the fossa ovalis further [3]. Septal puncture and balloon delivery across the mitral valve into left ventricle sometimes becomes challenging in such cases.

Difficulties are often encountered to facilitate the delivery of balloon catheter across the mitral valve in situations such as atypical site of trans-septal puncture, abnormal size of LA cavity (huge or small), and significant subvalvular thickening with an eccentric mitral orifice. In our case, huge LA and severe subvalvular disease were responsible for failure of conventional technique. These challenges can be overcome by modifying the standard technique which may be reverse loop technique, double loop technique, over the wire double-balloon technique, and vertical approach using left ventricular pressure as a guide for LV entry [4, 5].

An over-the-wire technique using bifoil or trefoil catheters with a long sheath or multitrack system support has been described but they don't address the problem of difficult LV entry [6, 7]. Furthermore, relative complexity and risk for left ventricular perforation have brought down the use of over-the-wire double-balloon technique (DBT) for mitral valvuloplasty in recent times.

Over-the-wire single-balloon technique (SBT) is a relatively easy technique which can be performed from both trans-femoral and trans-jugular route. This requires 0.020" J-tip back-up wire to cross the mitral valve and Judkins right (JR) diagnostic catheter introduced over it as described by Meier et al. [8]. Through the JR catheter, a 0.025" pigtail stainless-steel wire is introduced in the LV and then over this wire, the PTMC balloon catheter is introduced. Sometimes, one may use 0.035" Amplatz super-stiff guidewire. However, it involves multiple exchanges of hardware which increase procedural time, and radiation exposure.

Another technique by Mehan and Meier involves the use of a balloon flotation catheter (Swan-Ganz) to cross the mitral valve and placing it in the ascending aorta, through which a 0.021" long back-up guidewire passed to the descending aorta, and then the Inoue balloon was introduced over this wire [9]. This is a more challenging and cumbersome technique, as it involves crossing two valves. In our case, a simple 0.014", 190-cm long coronary angioplasty guidewire was used to facilitate the delivery of balloon dilatation catheter. Here, neither exchange of wire nor catheter was made. Furthermore, crossing both inflow and outflow valves with 0.014" wire was easy. It also highlights the fact that balloon can be easily tracked and delivered across the mitral valve over such wire.

What needed was to make a counter-clockwise loop of LA wire to give a better support to the balloon. It should be kept partially inflated as it directs itself towards the mitral valve orifice because of the blood flow. This maneuver helps in its negotiations across the mitral valve. Secondly, once it reaches into LV, it should be partially re-inflated so that it

could not come out of LV while redundant loop into LA is abolished by further pulling it back. Another point to note that in case of severe sub-valvular disease (score  $\geq 3$ ); one may opt for stepwise dilatation to prevent mitral regurgitation. If gradient fairly comes down in first dilatation, one may leave even if results are little sub-optimal as it is always better not to create more than moderate. Our case is a modification of the over-the-wire technique to cross the mitral valve in difficult cases of PTMC which should be reserved for difficult left ventricle entry during PTMC.

### **Conflict of interest**

None

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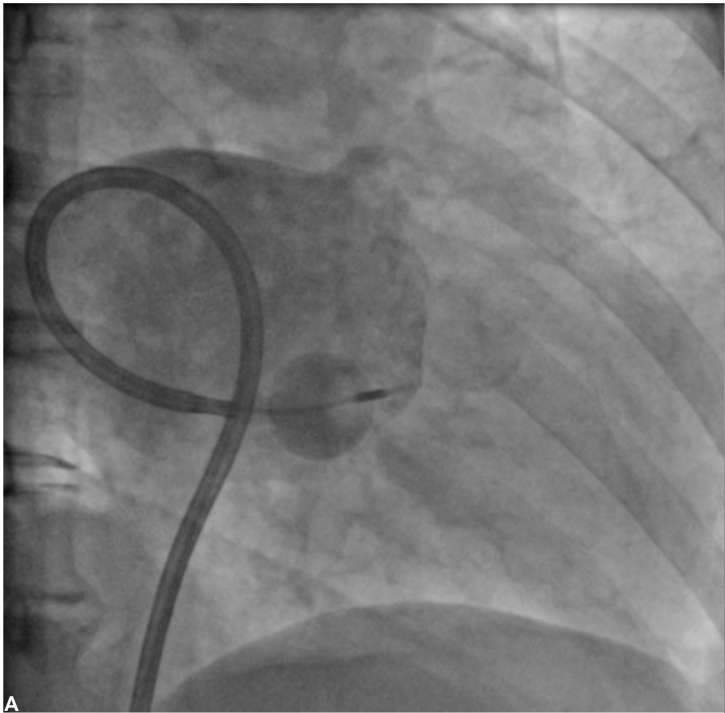
### **Figure legends**

**Figure 1.** Accura balloon catheter was partially inflated into LA (A); 0.014" percutaneous coronary angioplasty wire (runthrough wire; Terumo; Japan) was introduced into left ventricle (B)

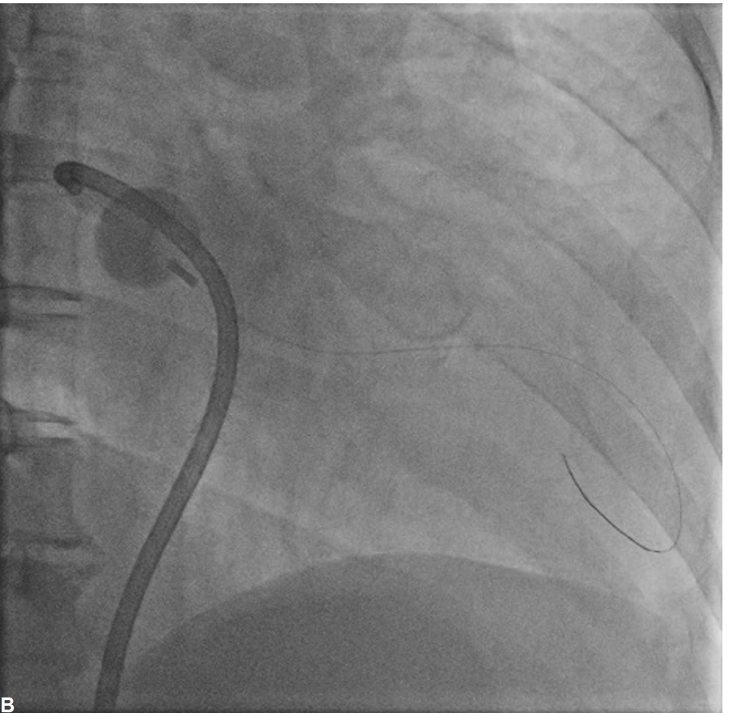
**Figure 2.** Accura Balloon being tracked over the runthrough wire (A); Once balloon reaches closer to mitral valve, wire was pushed further to cross the aortic valve (B)

**Figure 3.** Runthrough wire was parked distally (A); once balloon was inside the LV cavity, loop was negated by giving a counter-clock twist (B)

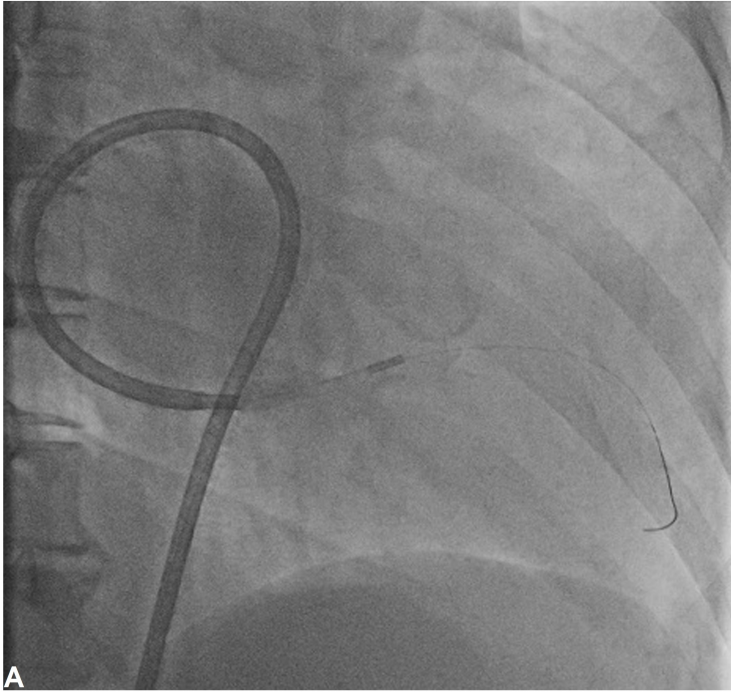
**Figure 4.** The balloon was inflated in its distal part and pulled back to anchor it at the mitral valve and inflated further to achieve its full dilatation



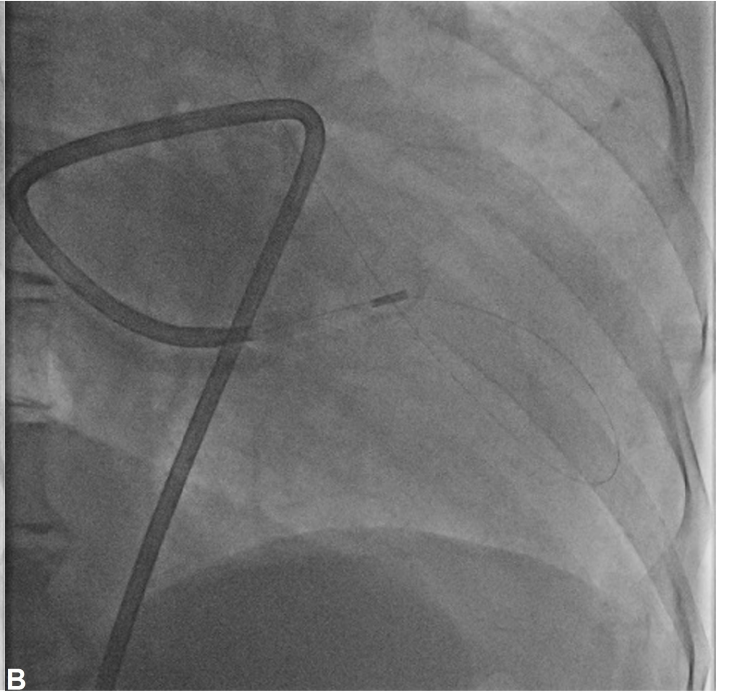
A



B



A



B



