



Case Report

Frugal innovation in the cardiac catheter laboratory: Retrograde balloon mitral valvuloplasty using extra back-up guide catheter



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ARTICLE INFO

Article history:

Received 8 November 2018
 Received in revised form 9 April 2019
 Accepted 20 May 2019

Keywords:

Rheumatic heart disease
 Mitral stenosis
 Valvuloplasty

ABSTRACT

Conventional antegrade balloon mitral valvuloplasty is not possible or better avoided in certain clinical situations. Retrograde balloon mitral valvuloplasty is a purely arterial technique designed to avoid complications of atrial septal puncture. We report a case of rheumatic heart disease with severe mitral stenosis and large atrial septal aneurysm where balloon mitral valvuloplasty was performed retrogradely with innovative use of routinely available cardiac catheter laboratory hardware instead of specialised hardware required for such cases.

<Learning objective: Conventional antegrade balloon mitral valvuloplasty is not possible or better avoided in certain clinical situations. Retrograde balloon mitral valvuloplasty is a purely arterial technique designed to avoid complications of atrial septal puncture. The retrograde balloon mitral valvuloplasty using EBU (Extra Back-up, Medtronic Inc., Minneapolis, USA) guide catheter and Tyshak II balloon can be alternative to standard retrograde balloon mitral valvuloplasty technique whenever retrograde technique is chosen over antegrade technique.>

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Introduction

Balloon mitral valvuloplasty using conventional antegrade approach is an effective and established alternative to surgery in mitral stenosis. Retrograde non transseptal balloon mitral valvuloplasty was developed as a alternate procedure to avoid complications of septal puncture in antegrade balloon mitral valvuloplasty [1,2]. Studies have established the safety and efficacy [3,4] of this technique but one of limitation is requirement of special hardware which is not routinely available at most cardiac catheter laboratory centres in India. The aim of our presentation is to emphasise that small innovations in the cardiac catheter laboratory using routinely available hardware are not only possible but also lower the cost of the procedure.

Case report

A 28 year old female was referred to the department of cardiology for assessment regarding balloon mitral valvuloplasty.

She was a case of rheumatic heart disease with severe mitral stenosis (Table 1) and a large atrial septal aneurysm (Fig. 1A). Her echocardiography showed thickened rheumatic mitral leaflets with a mitral valve area of 0.5 cm² and a trans-valvular mean gradient of 19 mm of Hg. The aortic, pulmonary and tricuspid valves were unaffected. There was trace mitral regurgitation, moderate tricuspid regurgitation with a pulmonary artery systolic pressure of 55 mm of Hg. There was no pericardial effusion or vegetation. No intra-cardiac clot was seen. The interatrial septum was aneurysmal. Her electrocardiogram showed normal sinus rhythm with left atrial enlargement. As the patient was unwilling for any kind of open surgical intervention, we decided to proceed ahead with retrograde balloon mitral valvuloplasty after due consideration of the risk of complications that could possibly occur during septal puncture through the aneurysmal interatrial septum.

We used a 6F sheath with a 3.0 curved EBU (Extra Back-up, Medtronic Inc., Minneapolis, USA) guide catheter to enter the left ventricle from the aorta and with subsequent manipulation, the catheter tip was oriented towards the mitral valve opening. In right anterior oblique and lateral view, the tip of EBU catheter was oriented in posterior direction pointing towards LA (Fig. 2). Preventive manoeuvres were performed to avoid damage to sub

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Table 1 Pre- and post-procedure echocardiographic and hemodynamic data.

Parameter	Pre-procedure	Post-procedure
Echocardiographic data		
Mitral regurgitation	Trace	Trace
Mitral valve area (cm ²)	0.5	1.5
Mitral gradient (mmHg)	19	6
Hemodynamic data		
Pulmonary artery pressure (mmHg)	55	35
Pulmonary capillary wedge pressure (mmHg)	28	16

valvular apparatus with counter clock wise rotation of catheter in LV apical level. Subsequently J shape soft tip 0.035 Terumo wire was advanced in LA and figure of 8 configuration was achieved (Fig. 2) to provide maximum stability to the subsequent advancement of balloon. A partially inflated Swan-Ganz catheter was

passed up to LA to ensure safety of sub mitral apparatus. The femoral sheath and EBU were exchanged with a Tyshak II 18 × 60 mm (NuMed Canada Inc.) balloon which was advanced directly over the wire and positioned at the mitral valve. Two inflations were given. Post inflation hemodynamic and echocardiography parameters suggested (Table 1, Fig. 1B – 3 E) successful balloon mitral valvuloplasty.

Discussion

Retrograde balloon mitral valvuloplasty may be useful in conditions where the risk of complications during trans-septal puncture is high as seen in patients with previous cardiac surgery with patch closure of ASD (atrial septal defect), atria septal aneurysm, chest wall deformity, inferior vena cava/superior vena cava malformation or procedural failure in septal puncture. In the original technique a steerable left atrial catheter was used to enter

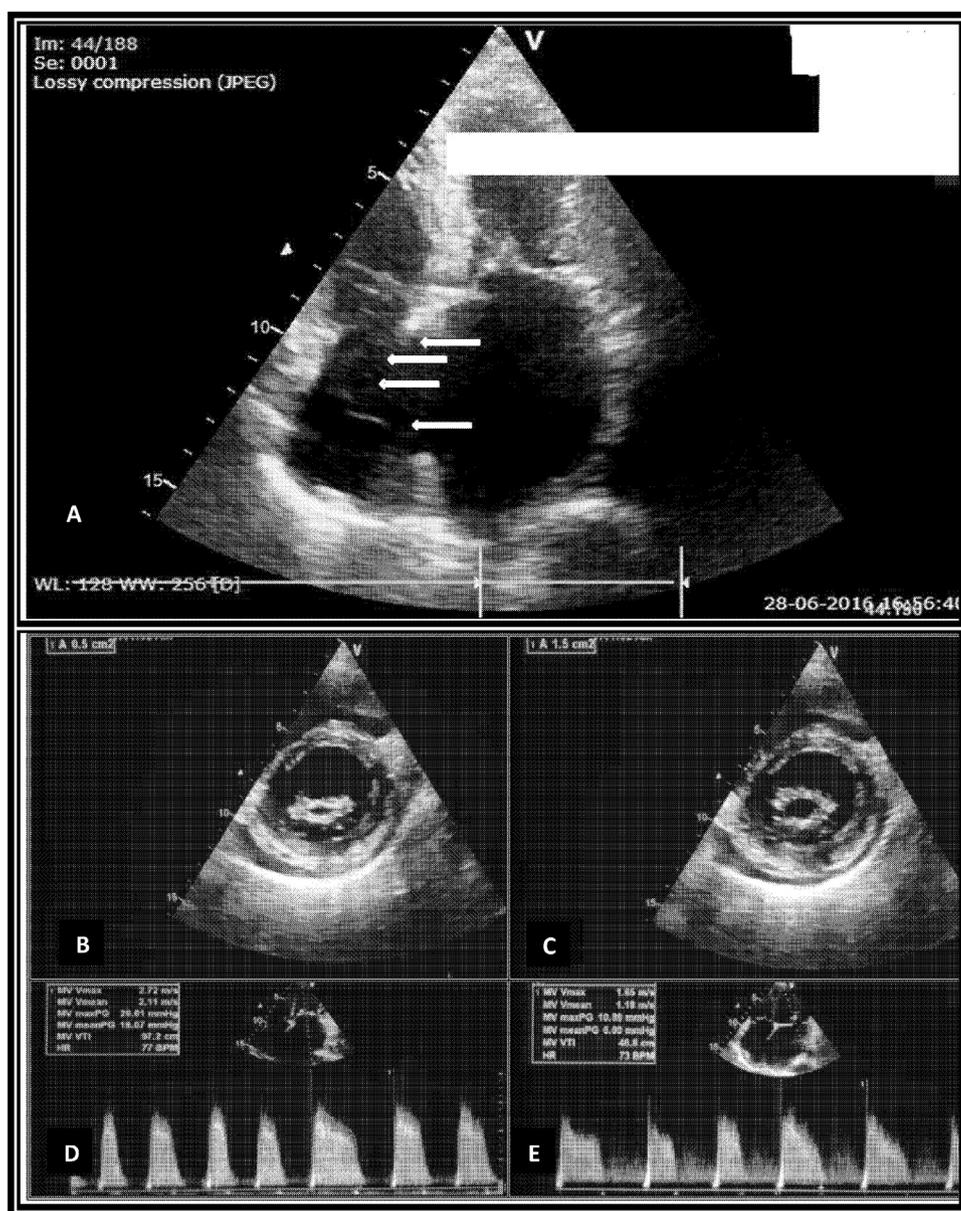


Fig. 1. (A) Echocardiography showing large atrial septal aneurysm (white arrows), (B and C) Echocardiography images showing pre- and post- procedure mitral valve area by planimetry respectively. (D and E): Continuous wave Doppler images showing pre- and post- procedure trans-mitral valve gradient respectively.

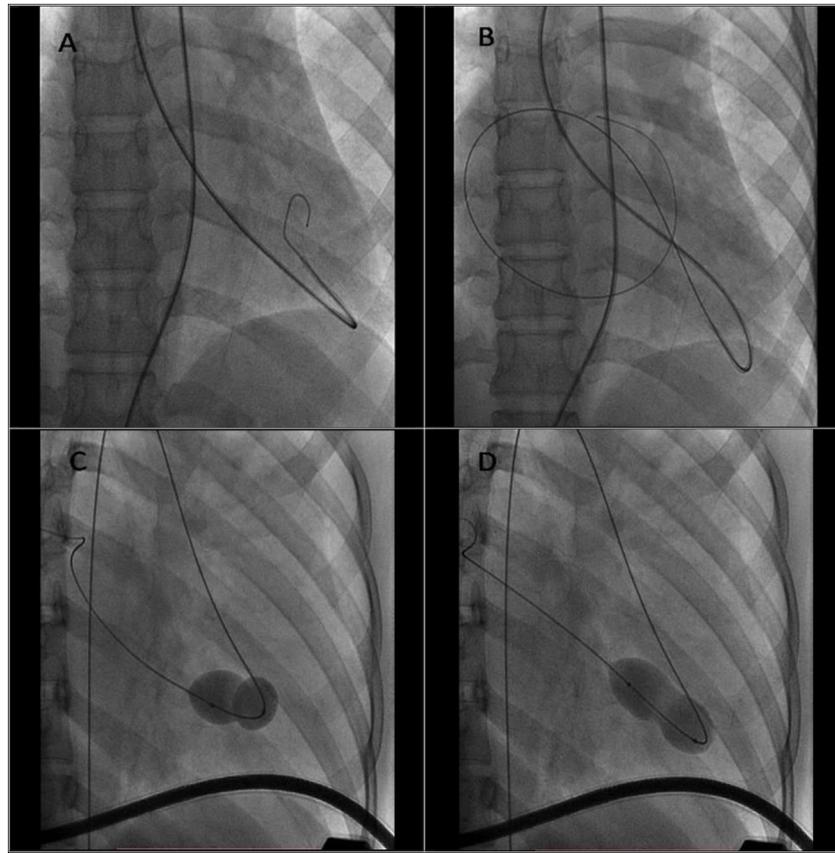


Fig. 2. (A) EBU catheter tip positioned below mitral valve. (B) Extra stiff 0.035 terumo guidewire parked in left atrium in figure of 8 configuration. (C) Tight waist at objectives.

the left atrium (A 9F arterial sheath was required) and a specialised balloon (Mansfield balloon, Boston Scientific Corp. Inc.), requiring 14/16F femoral artery access sheath, was used to cross the mitral valve with subsequent dilatation [3]. The steerable left atrial catheter was actually a modification of standard guiding catheters (right Judkins or Ablatz) with a teflon-coated stainless-steel wire (0.014 in.) passing through the lumen and attached to the catheter tip (Fig. 3). After advancing the steerable left atrial catheter into the left ventricle, a curve was formed on the catheter tip close to the apex of the left ventricle by retracting the stainless-steel wire. A counter clockwise rotation followed by retraction of the catheter aligns the curved catheter tip directly below the anterior mitral leaflet allowing unobstructed passage of a J wire through the catheter lumen into the left atrial cavity. In our case we used a 3.0 EBU catheter which readily prolapsed into the left ventricle from the aorta and the primary curve of this catheter made it easy to align its tip below the mitral valve opening. One concern was the possibility of ventricular arrhythmias while manipulating the EBU catheter within the left ventricle which did not occur in our case. Once the J wire has entered the left atrium and a figure of 8 configuration was achieved, support and stability is adequate for passage and deployment of the Tyshak II balloon. A safety concern while using the Tyshak II balloon was a possible injury to the subvalvular apparatus. The likelihood of this injury was minimised by the unobstructed movement of the partially inflated Swan-Ganz catheter up to the left atrium indicating that it had not become

entangled in the subvalvular apparatus and had passed correctly through the left ventricular in-flow tract.

By successfully performing the mitral valvuloplasty using the more easily available Tyshak II balloon, we were able to overcome the hurdle of lack of availability of the specialised Mansfield balloon in our country. Other techniques of retrograde balloon mitral valvuloplasty that have been successfully described include using an Inoue balloon catheter modified by elongation of the catheter shaft, the twin-balloon (bifoil) technique, the double-balloon bifemoral technique and the right brachial artery approach technique [4]. The technique described by us here has the following advantages over previously described techniques. Firstly, specialised hardware is not required and it can be accomplished using routine hardware available. Secondly, the vascular access was only 6F/8F as compared to 14/16F access required in conventional retrograde technique. The selection of balloon size and consequently the arterial access site may be varied. In case of larger size adults, larger tyshak II (up to diameter of 24–26) can be used, in which case arterial access may be up to 9F diameter. Our patient was a small statured lady with a height of 136 cm and we used inter commissural distance on 2D echocardiography as a guide to balloon size selection. Thirdly, our technique is simple, safe and low cost. Lastly, injury to sub mitral apparatus and consequent mitral regurgitation can be minimized by passage of partially inflated Swan-Ganz catheter up to left atrium.

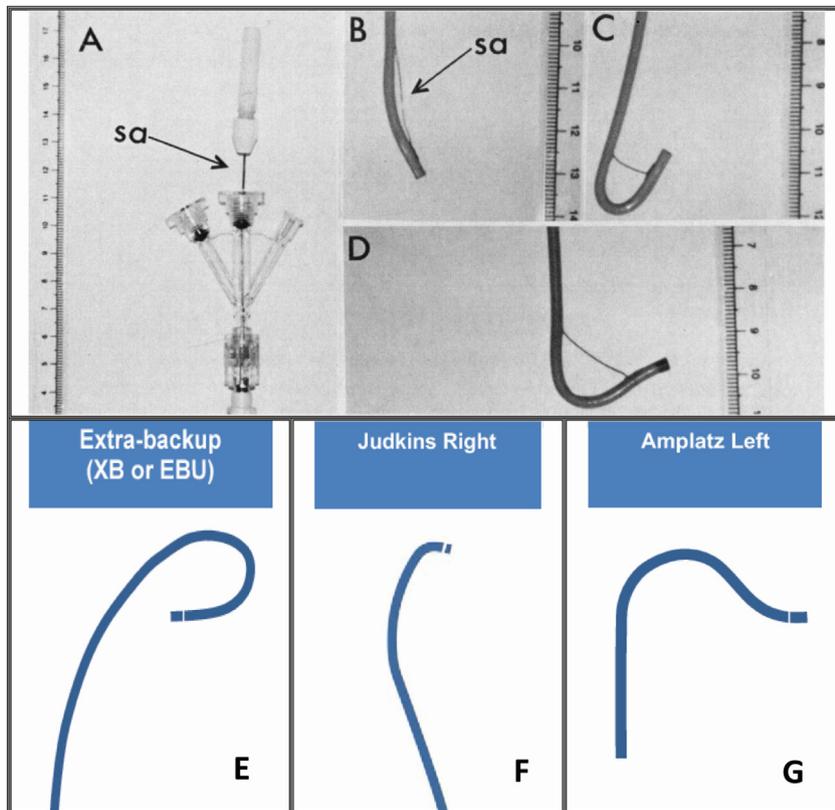


Fig. 3. (A–D) Photographs of the steerable guiding catheter used for retrograde left atrial catheterization by Stefanadis et al. [3]. (E) Extra-backup Catheter, (F) Judkins right catheter and (G) Amplatz left catheter may be used as alternatives.

Conclusion

The retrograde balloon mitral valvuloplasty using an EBU guide catheter with a Tyshak II balloon can be an alternative to standard retrograde balloon mitral valvuloplasty technique whenever retrograde technique is chosen over antegrade technique. This technique is safe, simple and can be performed using routinely available hardware. Additional benefits include a lower cost and a smaller vascular access size.

Conflict of interest

None to declare.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.jccase.2019.06.004>.

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