

# Inoue-Balloon Percutaneous Transvenous Mitral Valvuloplasty through the Left Femoral Vein in Anomalous Inferior Vena Cava

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Inoue-balloon percutaneous transvenous mitral valvuloplasty is conventionally performed via the right femoral vein. However, atrial transseptal access can be technically challenging. Herein, we describe a 54-year-old male who had balloon mitral valvuloplasty performed via the left femoral vein because of an anomalous inferior vena cava course, including the technical issues encountered using this approach.

**Key Words:** Anomalous inferior vena cava • Left femoral vein approach • Mitral valvuloplasty

## INTRODUCTION

Inoue-balloon percutaneous transvenous mitral valvuloplasty (PTMV) is conventionally performed through the right femoral vein. Alternative approach routes, however, have been described in the past. Josef et al. used right jugular vein access for PTMV, and left femoral vein access has been utilized in two patients with right femoral vein thrombosis.<sup>1-3</sup> In this report, we described a case of Inoue-balloon PTMV performed successfully with the use of left femoral vein approach in a patient with an anomalous inferior vena cava (IVC) course, and a description of technical nuances in atrial transseptal access.

## CASE REPORT

Inoue-balloon PTMV was performed in a 54-year-old

male with severe rheumatic mitral stenosis after informed consent. Diagnostic right and left heart catheterization with left ventriculography were done via the right femoral artery and vein, using a 6 Fr Swan-Ganz and a 6 Fr pigtail catheter, respectively. The Swan-Ganz catheter was advanced to the right atrium without any resistance and without fluoroscopic guide.

Atrial trans-septal access via the right femoral vein approach was initiated with placement of a 0.025" J-tip guide wire to the superior vena cava without any resistance encountered and with fluoroscopic guidance only when the guide wire was being advanced to the superior vena cava. When a 7 Fr dilator and Mullins sheath set was advanced over the guide wire, a strong resistance was encountered. Fluoroscopy revealed an unusual catheter course. The dilator sheath was removed, and contrast venography with contrast injection through the Mullins sheath revealed an anomalous IVC course with the right iliac vein draining into the former at almost a right angle (Figure 1A).

The right femoral vein approach was abandoned and the left femoral vein was accessed instead. Subsequent advancement of the dilator/Mullins assembly was uneventful (Figure 1B). After removing the guide wire, the Brockenbrough needle was inserted into the dilator catheter in the usual manner. The needle/ca-

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theter assembly was maneuvered cautiously in an attempt to position its tip at the optimal puncture site, as previously defined.<sup>4</sup> However, the latter exercise was not possible and the needle was withdrawn, and its distal and more proximal segments had to be repeatedly reshaped before optimal transseptal puncture was successful (Figures 1C-E; Figure 2, white arrow).

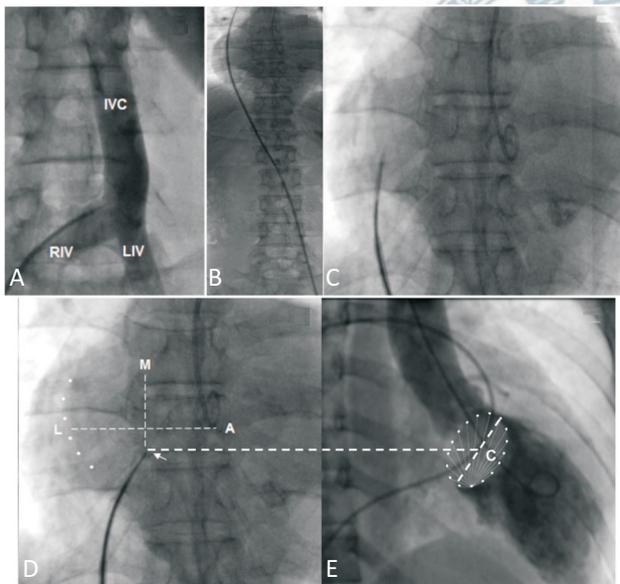
Thereafter, Inoue-balloon PTMV was successfully performed in the usual manner with the stepwise dilatation technique.<sup>5,6</sup> There was no resistance encountered during manipulation of the balloon catheter. The mean mitral gradient was reduced from 18 mmHg to 4 mmHg, and the mitral valve area measured using echocardiographic planimetry method increased from 0.9 to 2.0 cm<sup>2</sup> with no evidence of significant mitral regurgitation. The patient tolerated the procedure well and was dis-

charged on the second day in a stable condition.

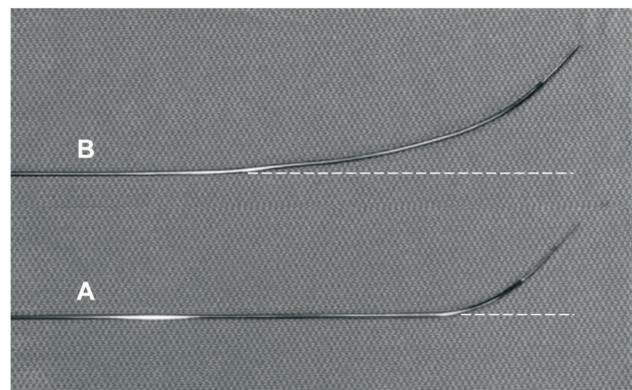
## DISCUSSION

For this case, it was necessary to perform PTMV from the left femoral vein because the right iliac vein was draining almost perpendicularly into the IVC. The anomaly was not recognized initially because the relatively flexible Swan-Ganz catheter and the J-tip guide wire, inserted from the usual right femoral venous route, had free access to the right atrium and superior vena cava, respectively. When a strong resistance was encountered during advancement of the stiff dilator/Mullins sheath assembly, venography disclosed the IVC anomaly.

In the previously reported 2 cases of left femoral vein access for Inoue-balloon PTMV, the procedure was performed using left femoral vein access because of right femoral vein thrombotic occlusion. The acute angle at the junction of the left iliac vein and IVC prevented entry of the stiff dilator and Brockenbrough needle into the IVC. This was resolved by pre-shaping the needle,<sup>2</sup> and by a “telescoping” technique, i.e., simultaneous gentle push of the needle while pulling the Mullins dilator.<sup>3</sup> In contrast, in our case there was no resistance encountered during passage of transseptal puncture set or the slenderized Inoue-balloon catheter because the path to the right atrium was not hampered as described previously. The challenge faced was in setting the transseptal catheter/needle tip at the optimal interatrial septal puncture site. This was solved by pre-shaping of the distal segment of the Brockenbrough needle.



**Figure 1.** (A) Frontal-view venogram, obtained with contrast medium injected in RIV, through Mullins sheath, showing anomalous IVC course, with RIV drainage into IVC at an acute angle. (B) Fluoroscopic frontal composite view showing guide wire and needle assembly, inserted through LIV to superior vena cava. (C) Frontal view showing transseptal assembly set in right atrium. (D) Tip of dilator catheter/needle (white arrow) at optimal puncture site, namely crossing site of vertical M line and horizontal C line; M line indicates vertical line, intersecting midpoint of horizontal AL line. Point A indicates tip of pigtail catheter in contact with non-coronary sinus of Valsalva and Point L, left atrial lateral silhouette (white dotted line); (E) 30° right anterior oblique view, showing horizontal line crossing center of mitral annulus (white dotted line). IVC, inferior vena cava; LIV, left iliac vein; RIV, right iliac vein (Refer to text and reference 2 for detail).



**Figure 2.** Shaping of Brockenbrough needle. (A) Unshape needle. (B) After shaping (refer to text for detail).

## CONCLUSIONS

This case illustrated that transseptal puncture and Inoue-balloon PTMV can be accomplished safely and successfully through the left femoral vein approach in patients with an unusual vascular anatomy, namely that of an anomalous IVC, although there were some technical modifications.

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