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## Case Report

# *A Novel Over-the-Curved Spring Wire Technique Simultaneously With the Reverse-Loop Entry Technique in a Challenging Percutaneous Transvenous Mitral Commissurotomy*

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## ABSTRACT

Percutaneous transmitral commissurotomy (PTMC) for treating severe mitral valve stenosis with the Inoue balloon is an interventional procedure performed worldwide. Percutaneous transvenous mitral commissurotomy is the preferred treatment for rheumatic valvular mitral stenosis if the valve has a suitable anatomy. Following trans-septal puncture, entry into the left ventricle is challenging, particularly in patients with large atria. We herein describe a 61-year-old woman with mitral stenosis. Having failed to cross the mitral valve with the standard technique, we utilized a novel over-the-curved spring wire simultaneously with the reverse-loop entry technique to cross the mitral valve. We succeeded in performing a valvotomy with no complications. PTMC, still the preferred treatment for isolated mitral stenosis, consists of 2 steps: trans-septal puncture and balloon crossing into the left ventricle. Nonetheless, an altered left atrial and septal anatomy can make the latter step challenging. High operator experience and various maneuvers and techniques can increase the procedural success rate, even in difficult cases. ***(Iranian Heart Journal 2023; 24(4): 76-78)***

**KEYWORDS:** Curved spring wire, Mitral stenosis, Difficult PTMC

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A 61-year-old woman suffering from long-standing exertional dyspnea due to mitral stenosis was referred to our cardiology department for further evaluation. The patient had New York Heart Association (NYHA) functional class III dyspnea despite a maximal dose of medical therapy. [1] She underwent 2D transthoracic echocardiography, which revealed severe mitral stenosis (mitral valve area by planimetry = −1/2 $cm^2$ and Pisa = −1/1 $cm^2$) without significant mitral regurgitation. The Wilkin score [2] was 8-10/16, and the left atrium was enlarged (the left atrial volume index = 69 $mL/m^2$). The patient also had mild to moderate tricuspid regurgitation and mild pulmonary hypertension.

A decision for percutaneous transmitral commissurotomy (PTMC) was taken after informed consent was received from the patient. Both femoral arterial and venous accesses were obtained, and a 6-Fr pigtail catheter was placed in the aortic root to guide trans-septal puncture. Due to her unusual anatomy, it took 3 attempts to perform a septostomy under fluoroscopic guidance. Body weight-adjusted intravenous heparin was administered, and a 26 mm Inoue balloon was used to dilate the mitral valve and advance the balloon over the

carved spring wire into the left atrium. Afterward, a stylet (Fig. A) was introduced into the balloon to shape it and cross it over the valve. Nevertheless, multiple attempts, including reshaping the stylet and using various techniques (sliding, direct, vertical, and reverse loops), failed to help cross the balloon via the mitral valve. Further attempts were then made to advance the balloon and complete the passage from the interatrial septum. However, the balloon had to be retracted so that another septostomy could be performed to readvance the balloon into the left atrium. Subsequently, the stylet was exchanged with a curved spring wire (Fig. B), which was introduced into the balloon. Through the use of various techniques (sliding, direct, and vertical loops), the balloon was successfully crossed over the curved spring wire via the reverse-loop entry technique (Fig. C). The balloon was inflated in the mitral valve to perform a balloon commissurotomy. Hemodynamic measurements confirmed the success of the commissurotomy (Table 1 & Fig. D). The mitral valve area was increased to 1.9-2.1 $cm^2$ without complications. The procedure time was approximately 1 hour due to the challenging nature of the case. The patient was discharged the next day with warfarin and a low-dose β-blocker.

**Table 1:** Hemodynamic measurements before and after PTMC

| Hemodynamic Variable | Pre-PTMC | Post-PTMC |
|---|---|---|
| LA pressure (mean) | 21 mm Hg | 8 mm Hg |
| LVEDP | 0-10 mm Hg | 0-10 mm Hg* |

LA: left atrium; PTMC: percutaneous transmitral commissurotomy; LVEDP: left ventricular end-diastolic pressure

**Figure A:** The image shows the stylet used.

**Figure B:** The image shows the curved spring wire utilized.

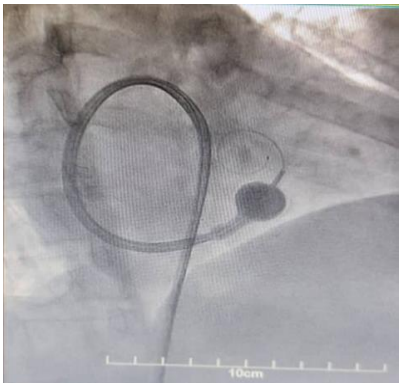

**Figure C:** The image demonstrates the use of the curved spring wire simultaneously with the reverse-loop entry technique.

**Figure D:** The image illustrates the success of the percutaneous transmitral commissurotomy.

## DISCUSSION

PTMC is the preferred treatment for isolated rheumatic valvular mitral stenosis if the valve has a suitable anatomy. The procedure is done in 2 steps: septal puncture and crossing into the left ventricle. The standard technique consists of placing the balloon in the left atrium and introducing a preshaped stylet into the balloon tip to guide the balloon into the left ventricle. Various modifications of the standard technique have been described for difficult left ventricle entry, such as the reverse-loop technique, the double-loop technique, and the vertical approach. An over-the-curved spring wire in tandem with the reverse-loop entry technique, which we used for this PTMC case, is a novel technique.

Dani et al [3] used the over-the-wire single-balloon technique for the first time in cases where it was difficult to enter the balloon through the mitral valve. Vijayvergiya [4] presented a case of PTMC successfully performed with the double-loop technique to cross the mitral valve. Deora et al [5] reported that an AR-1 diagnostic catheter with a 0.035-inch hydrophilic wire could facilitate left ventricle entry. The hydrophilic wire was then exchanged for a 0.035-inch Amplatz Super-Stiff Guidewire, which was twisted in the laboratory to form small loops of its floppy portion. This extra-stiff wire provided sufficient support to track the Inoue PTMC catheter into the left ventricular cavity, and the small loops did not cause any arrhythmias during the procedure. These techniques can help make a venoarterial loop or place the wire tip at the descending aorta. [6]

## CONCLUSIONS

PTMC remains the preferred treatment for isolated mitral stenosis. It is performed in 2 steps: trans-septal puncture and balloon crossing into the left ventricle. Difficult balloon entry into the left ventricle due to an altered left atrial and septal anatomy can be challenging. Still, high operator experience and various maneuvers and techniques can increase the procedural success rate, even in problematic cases.

### Conflict of Interest

The authors declare that they have no conflicts of interest.

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