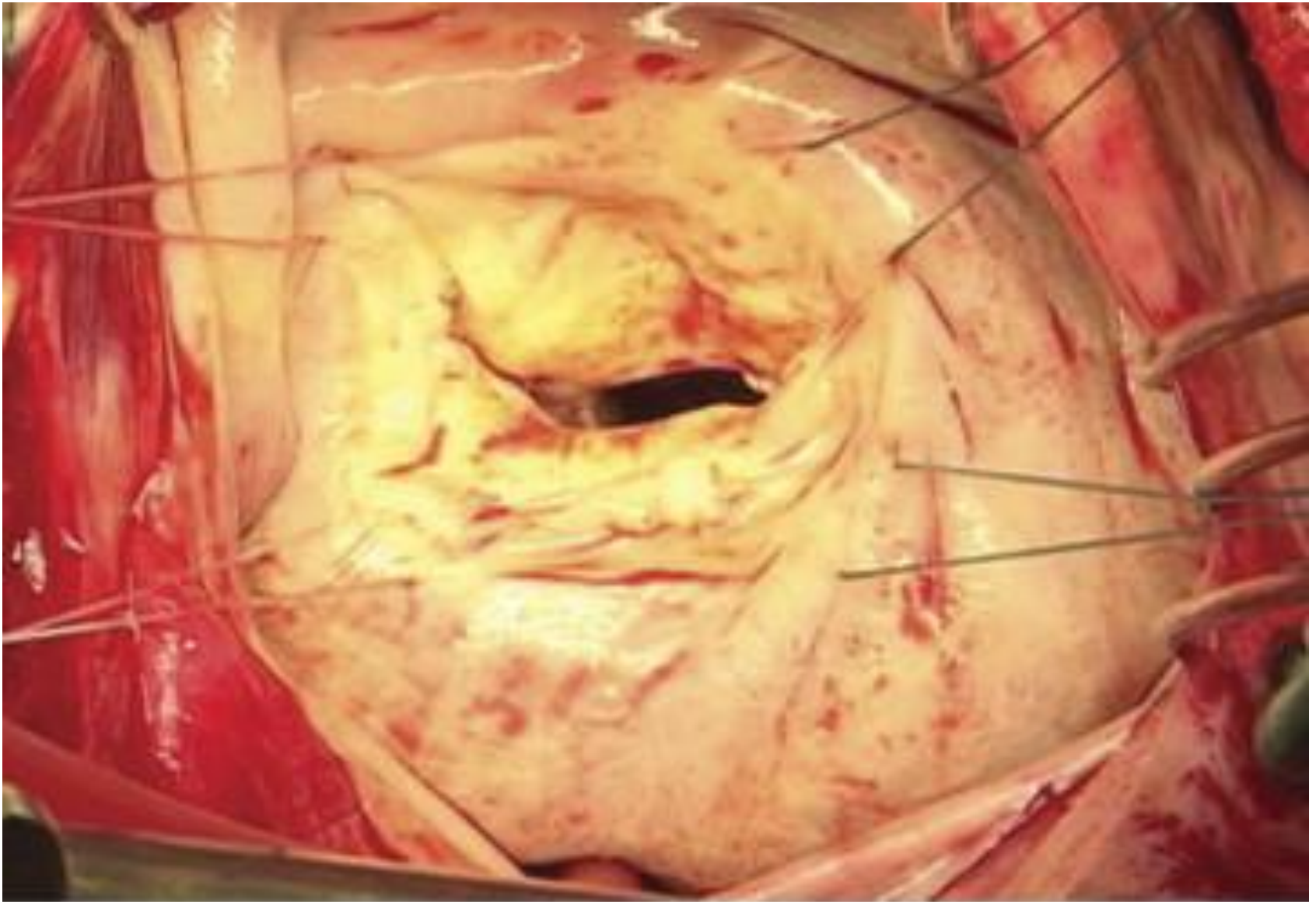


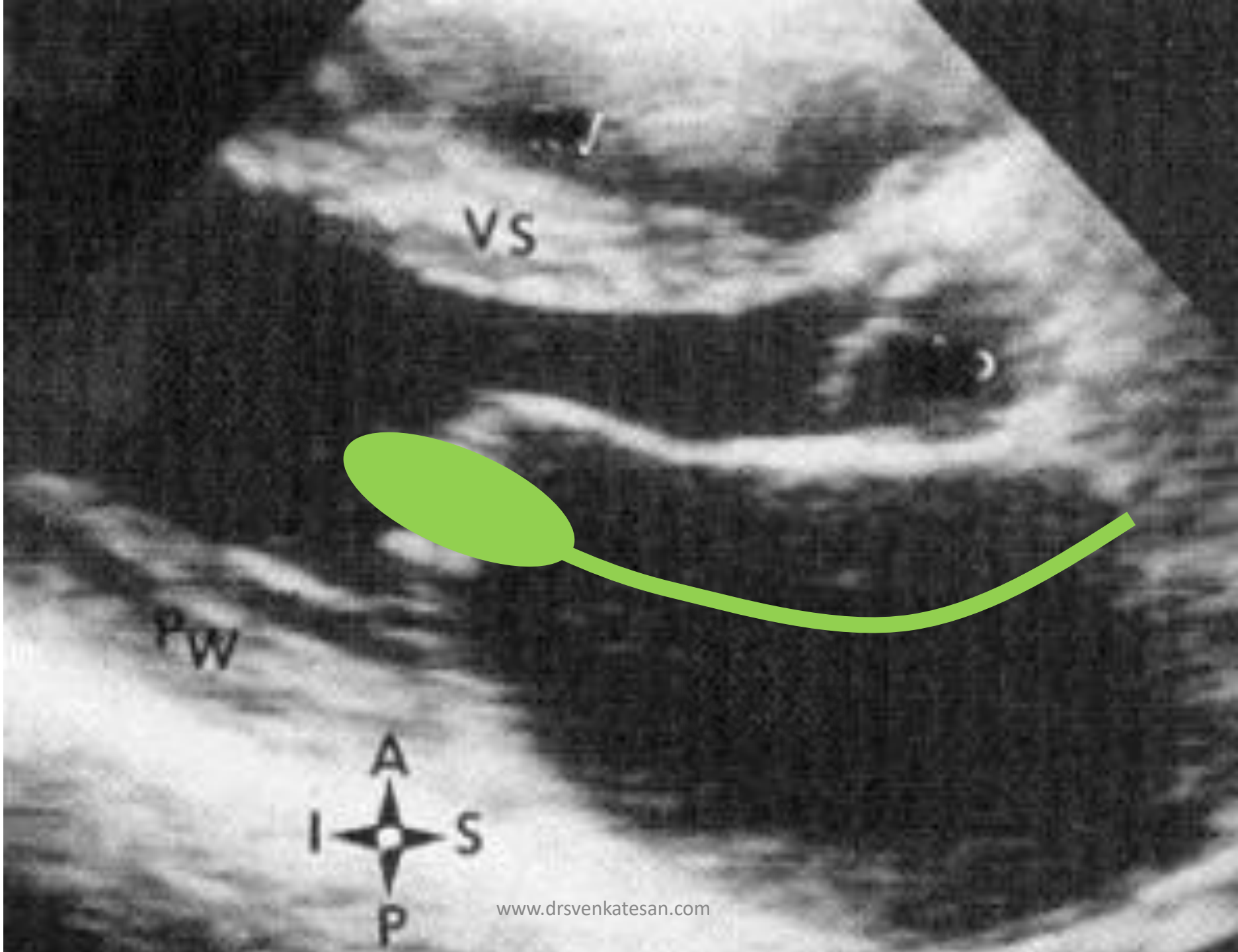
# Mitral valve crossing



**Dr.S.Venkatesan MD.DM**

**Cardiologist.Madras medical college**

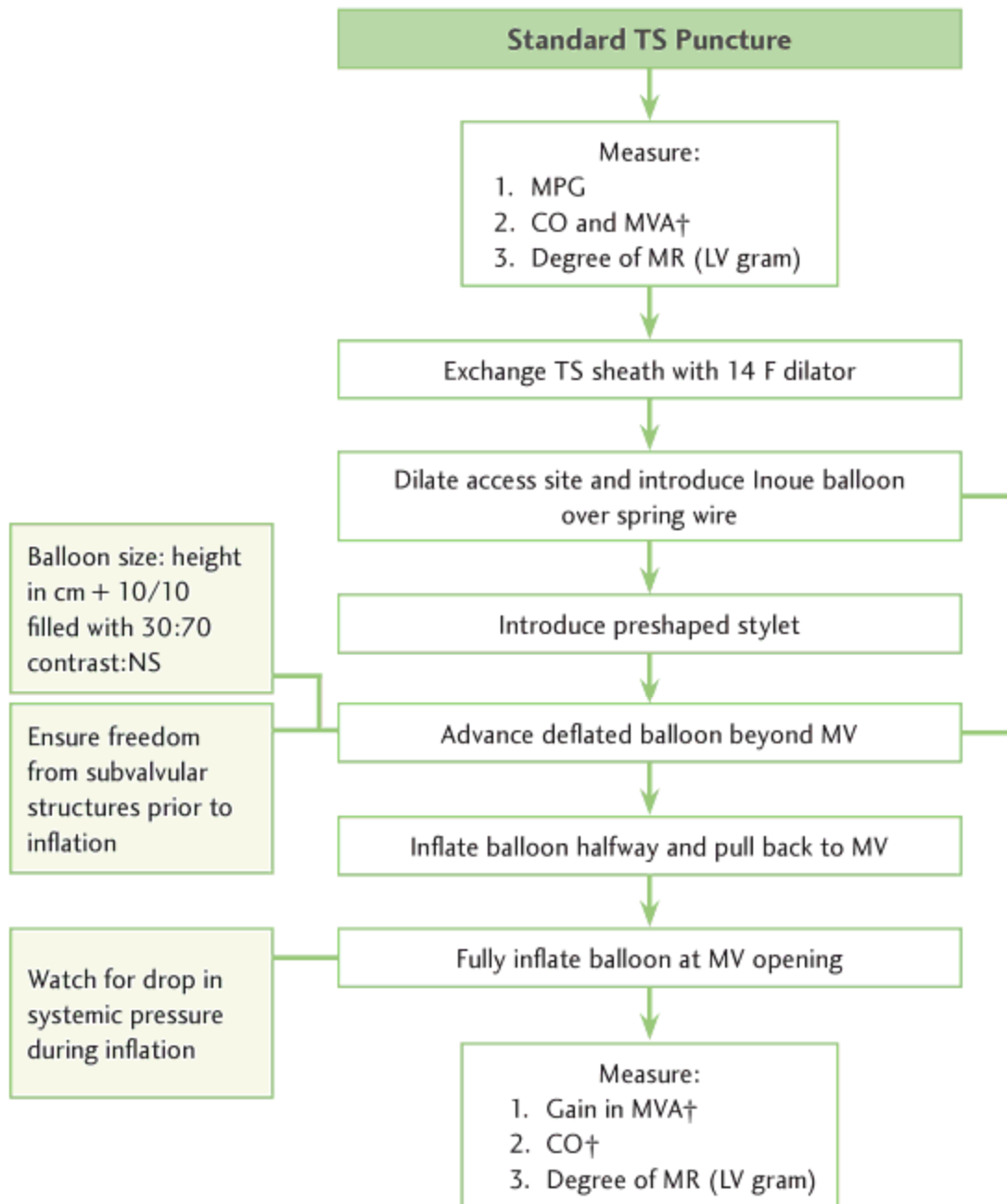




VS

PW





# Factors influencing mitral valve crossing

## Lesion morphology

- Valve orifice
- Valve morphology
- Sub-valvular anatomy

## Hardware –balloon sizing

## Operator expertise

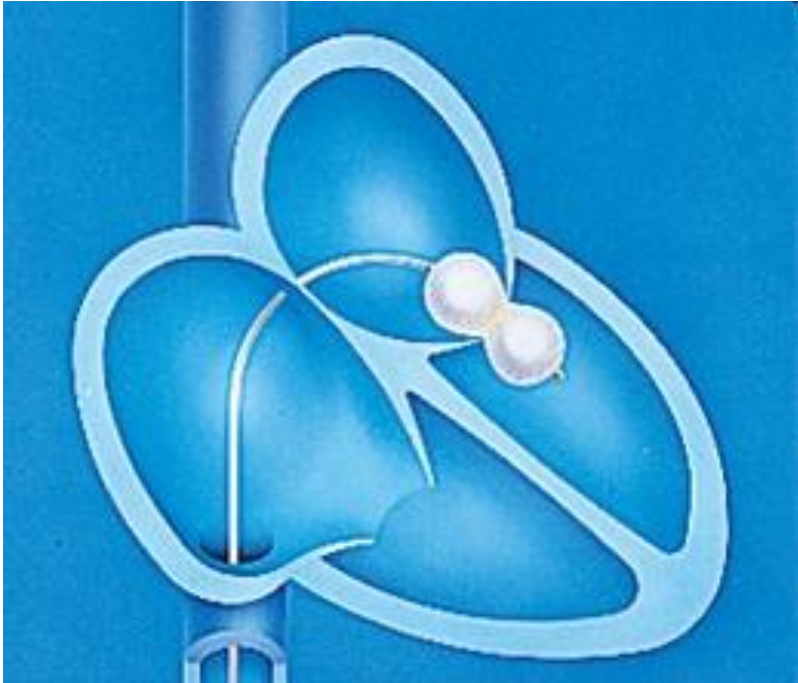


**A deflated Innoue balloon will be 4mm size A critical MS (.6cm<sup>2</sup>) has diameter can be only a fraction more !**

# Issues in the septum that make crossing difficult

- Site of puncture
- Septal catch and friction

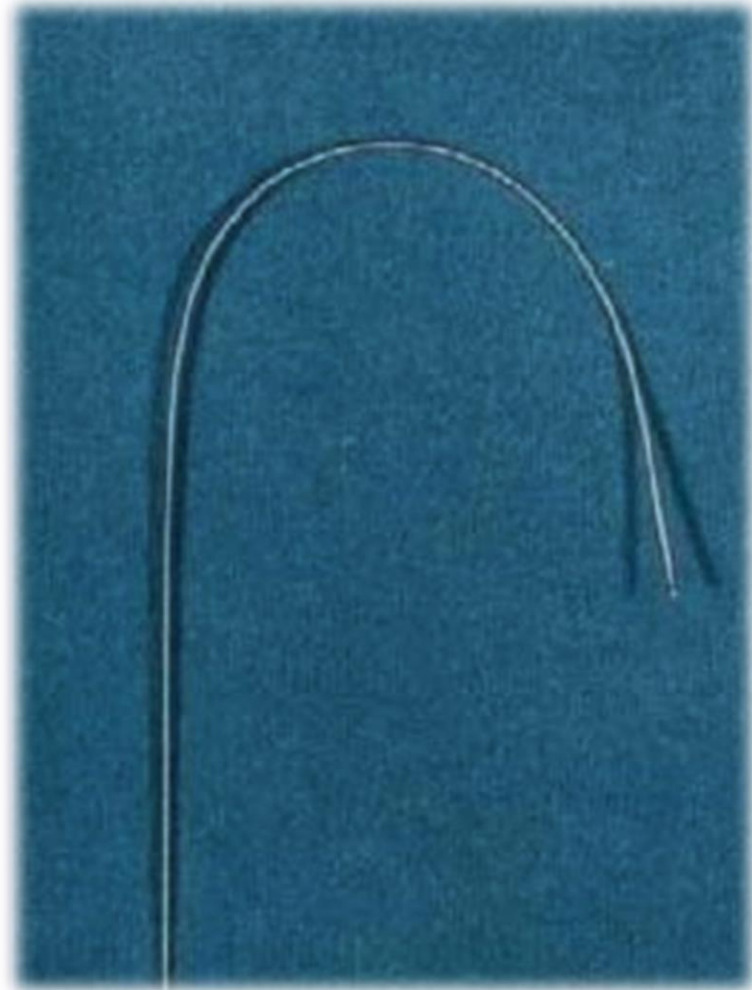
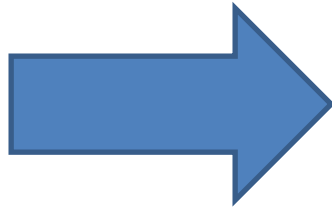
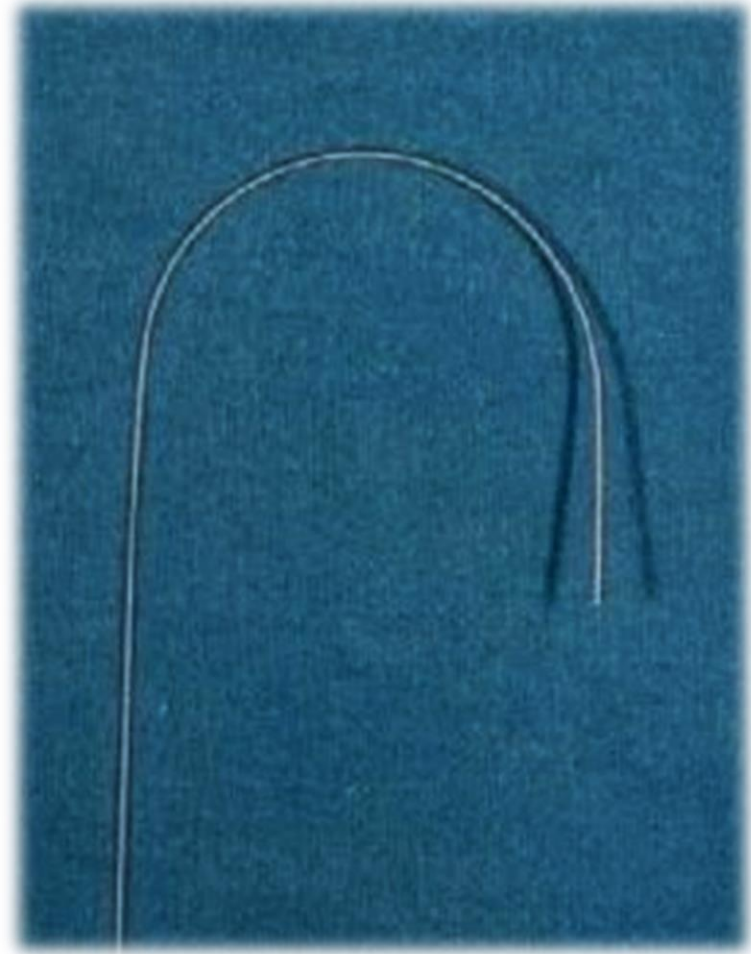
# Relationship between puncture site and stylet shaping for crossover

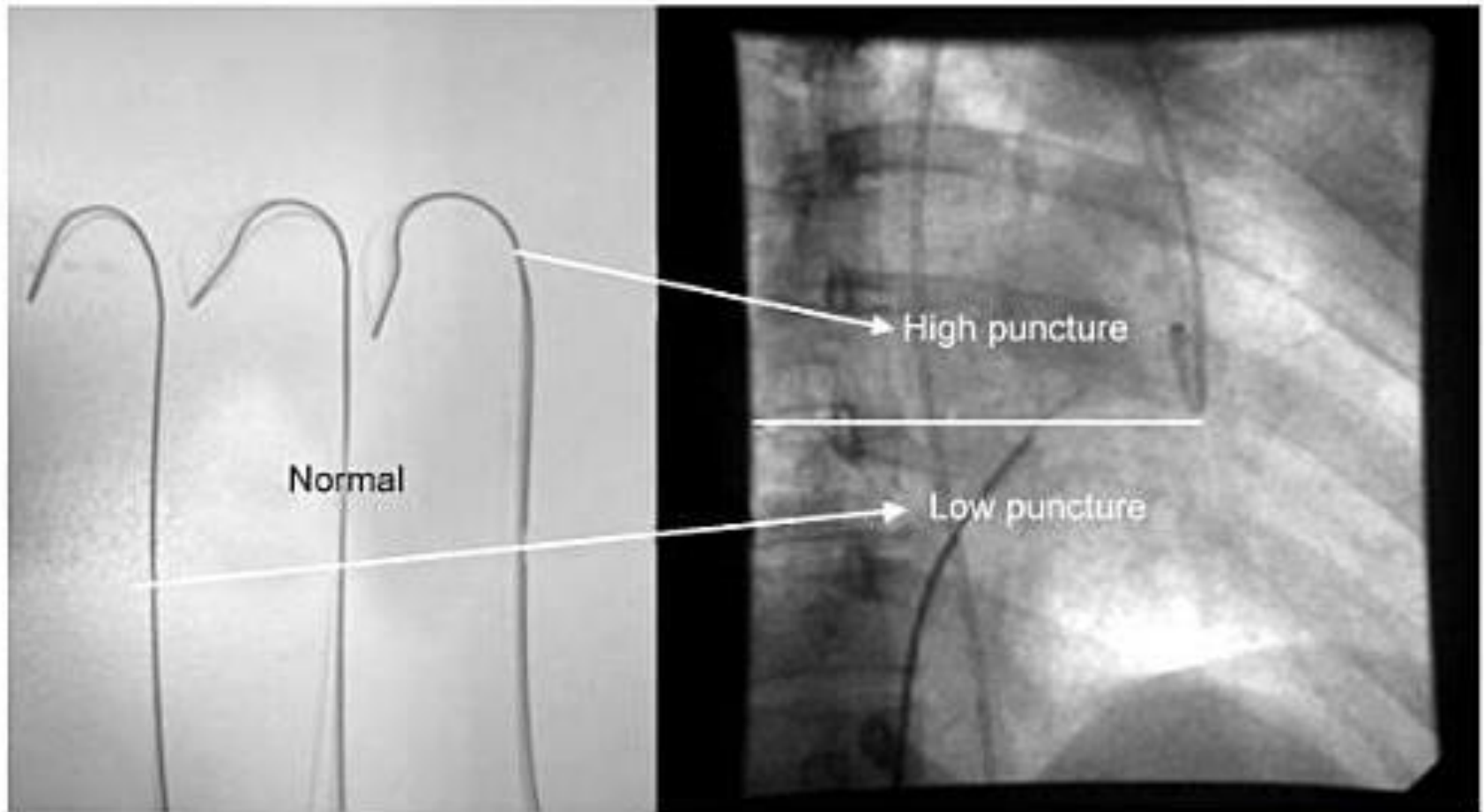


- Caudal (Low ) –Giant LA
- Cranial ( high ) –Small LA
- Medial /lateral
- Anterior /posterior

**Septum to Mitral valve distance /Angulation /**







**Fig. 43.8:** Changing the shape of the stylet to facilitate crossing the **mitral** valve



Normal



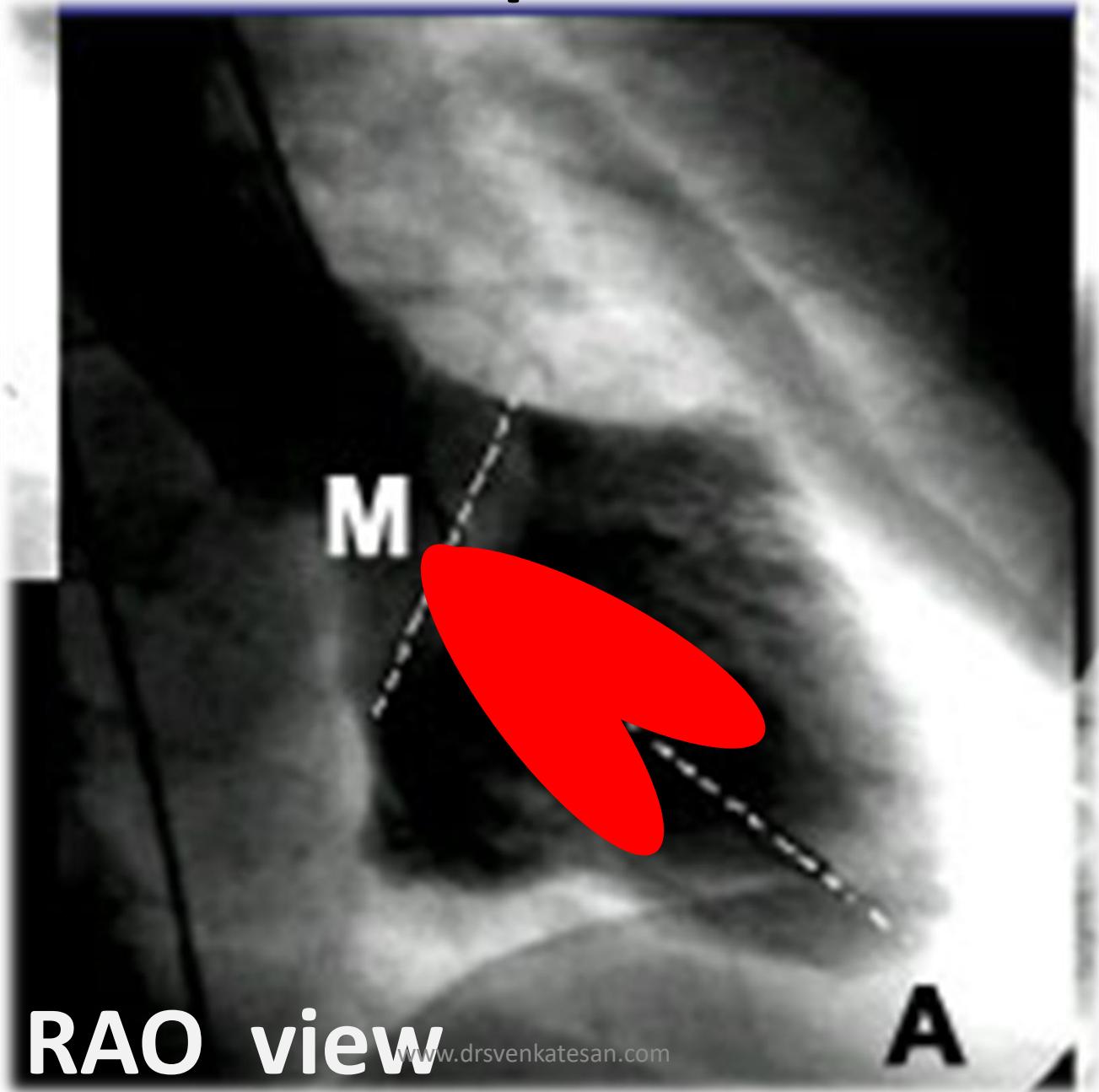
Normal

## BALLOON CATHETER STUCK AT SEPTUM—“SEPTAL CATCH”

After the removal of the pigtail shaped LA wire and the straightener, while trying to advance across the septum, the balloon may get stuck at the septum and not track forward towards the valve (Fig. 43.5). This situation is encountered not very infrequently.



# Orifice Apex axis



# Hand -Eye –mind coordination



# Mitral valve crossing

- **Standard methods**
- **Alternate methods**
- **Very unusual situations**

# Standard method

Insert the spring guide wire into the left atrium. Pass dilator over the wire and expand septal puncture.





Introduce stretched balloon over the guide wire and cross septium.



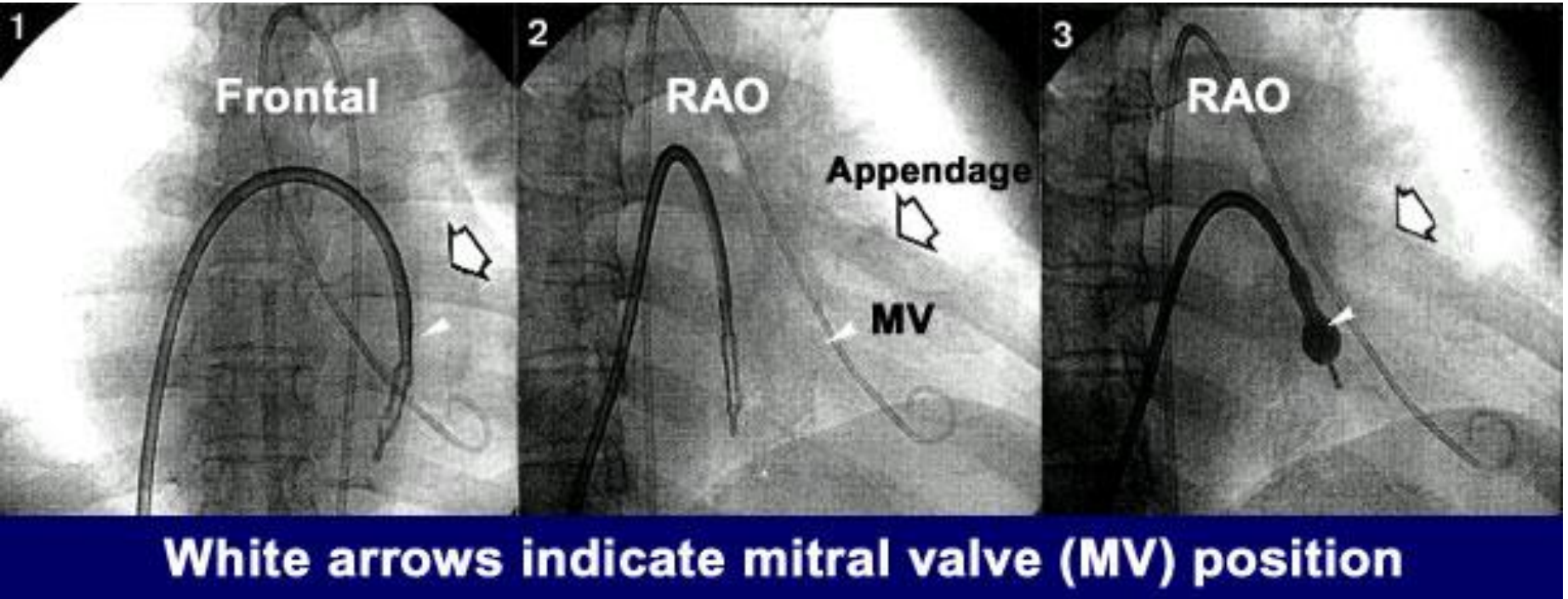
# Initial steps

After crossing the septum

Deep catheter placement

Frontal view to RAO 30 degrees

# Step One : Deep catheter placement



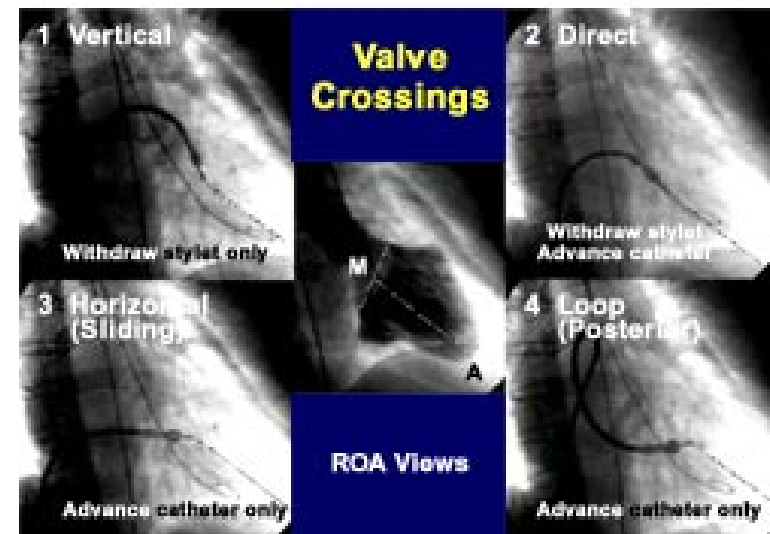
## Crossing the Mitral Valve

The conventional approach employed in crossing the valve is the direct method, whereas the alternative approach is the posterior loop method. Subsequently, 2 other approaches have evolved: the sliding and the vertical methods. Currently, we attempt valve crossing using 4 methods in the order of: 1) the vertical; 2) the direct; 3) the sliding; and 4) the posterior loop method (Fig. 1). The vertical method is the most frequently successful crossing method.

After deep catheter placement in the left atrium under a fluoroscopic frontal view, the crossing is conducted under a 30° right anterior oblique view, which displays the left ventricular long axis in profile (broken lines in Fig. 1). In patients with giant left atria, additional use of a lateral fluoroscopic view may be needed to facilitate crossing of the valve.

During crossing manipulations, the catheter balloon position can be controlled as the operator wishes because the vertical balloon position is adjusted by withdrawing or advancing the catheter with the left hand, while its horizontal or axial movement is controlled by a counterclockwise or clockwise twist to the stylet using the right hand (in a right-handed operator).

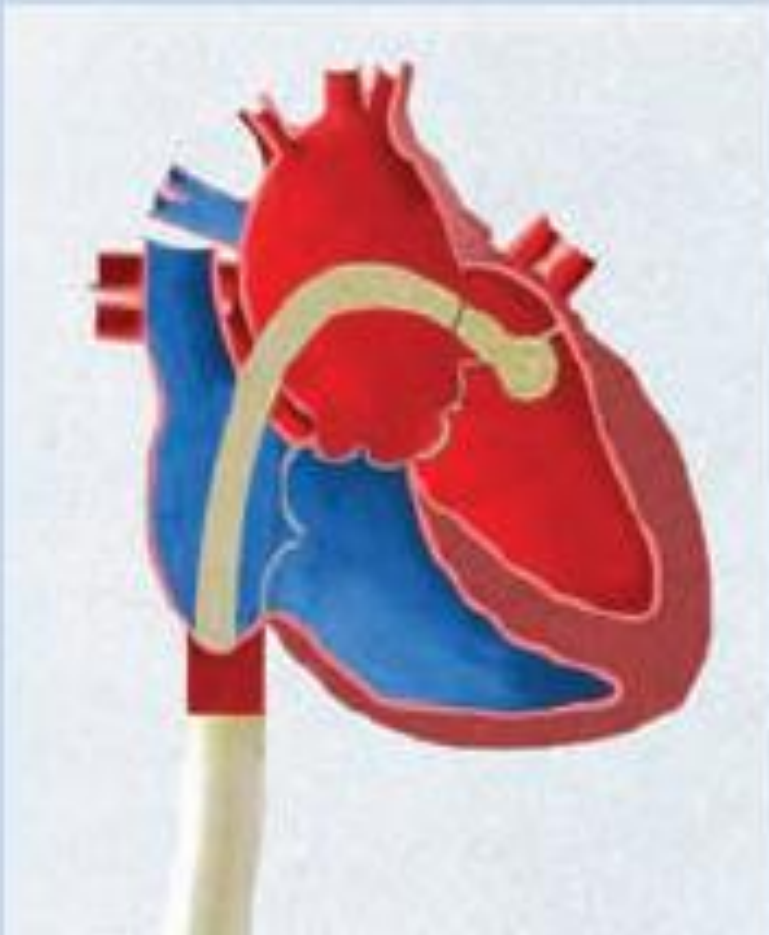
**Figure 1**  
**Four Methods of Valve Crossing**



[Click To View Larger Image](#)

Remove stretching tube and guide wire with balloon in LA. Introduce stylet and steer balloon to cross-mitral valve.





**Inflate distal end of balloon, pull back slightly to place balloon waist across valve opening.**



**Inflate the balloon fully to dilate the valve to pre-determined size.**

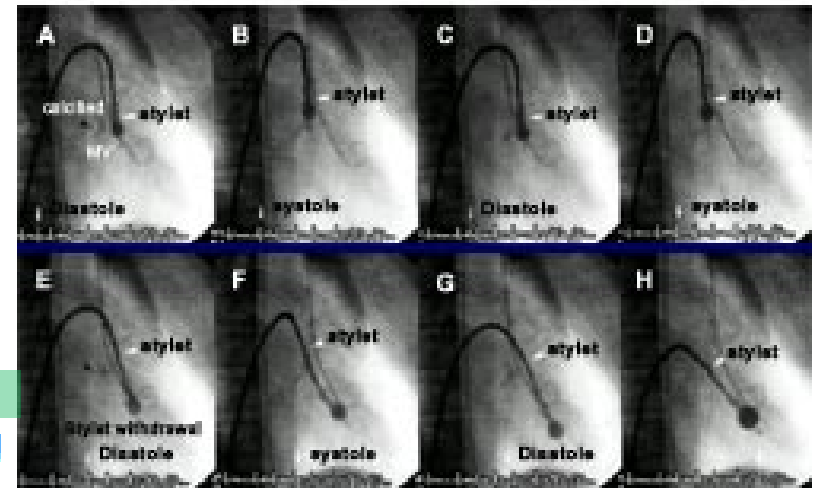
## Valve Crossing

### 1. The Vertical Method (Fig. 3)

The catheter is withdrawn until a horizontal bobbing motion of the balloon is noted, indicating close proximity of the balloon to the mitral valve.

Upon further slight retraction of the catheter, the balloon is observed to move in (during diastole at A and C) and out (during systole) of the left ventricle (B and D) even though the catheter is not aligned with the orifice-apex axis. Coincident with diastole, only the stylet is withdrawn (E), permitting the balloon to enter into the left ventricle (F). To accomplish this, the operator must carefully watch the rhythmic motion of the heart. This allows the distal segment of the catheter to take on a more horizontal orientation to cross the valve and enter deep into the left ventricle. If the distal portion of the catheter is still vertically oriented and points to the inferior wall of the left ventricle (G), the catheter is carefully retracted to align it with the orifice-apex axis (H). During the process, the distal balloon may need to be inflated further to prevent it from popping out of the ventricle.

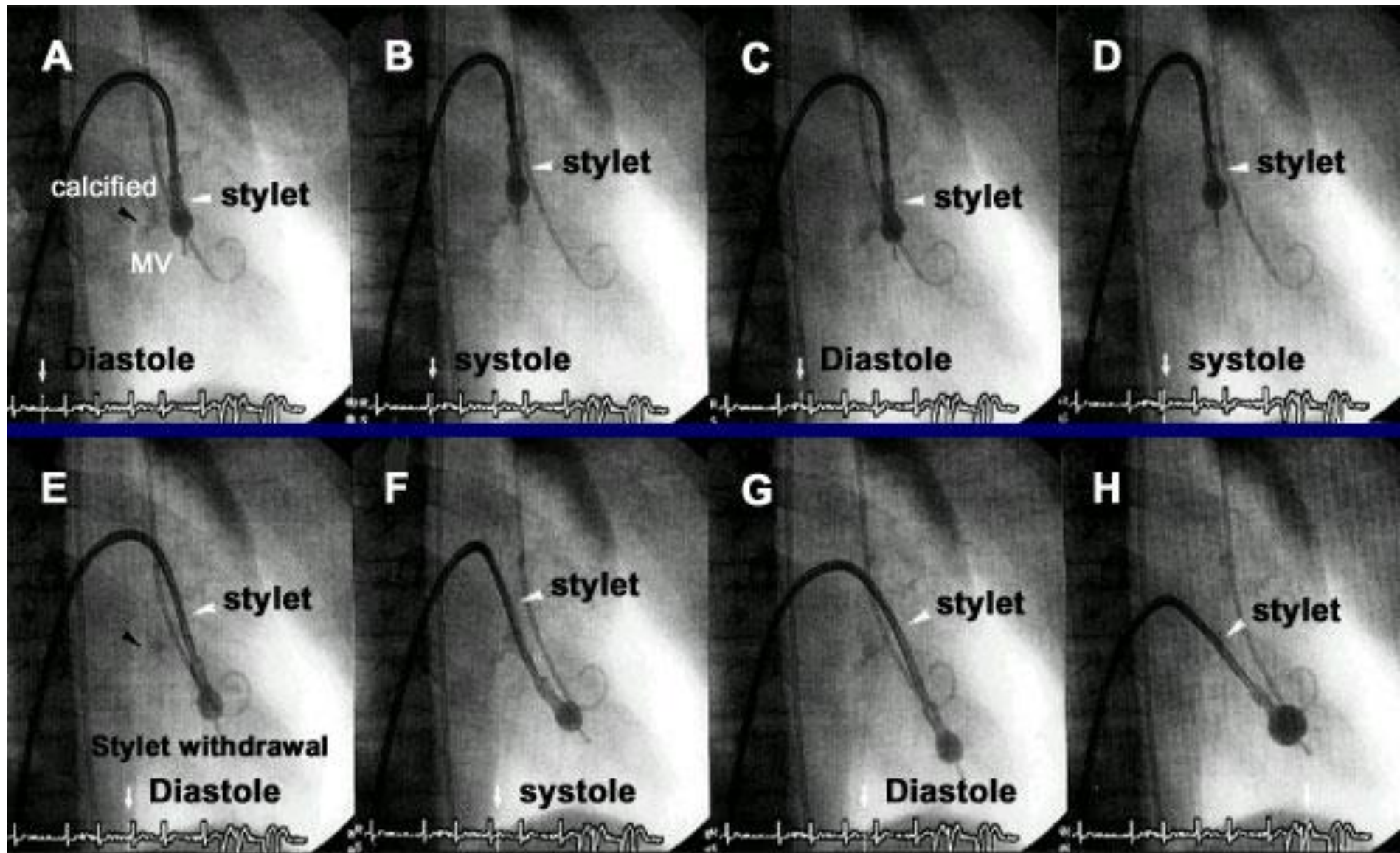
Figure 3  
Vertical Method



[Click To View Larger Image](#)



# Vertical method



# Crossing tricks

- Diastole
- Stylet – Pull – Balloon Push (**Automatic**)
- Tachycardia /AF

# **Mitral valve crossing : potential injury**

- **La appendage**
- **Pulmonary vein**
- **LA roof**
- **Chordal**

# Hand - Eye –mind co-ordination Critical



# Other methods of crossing

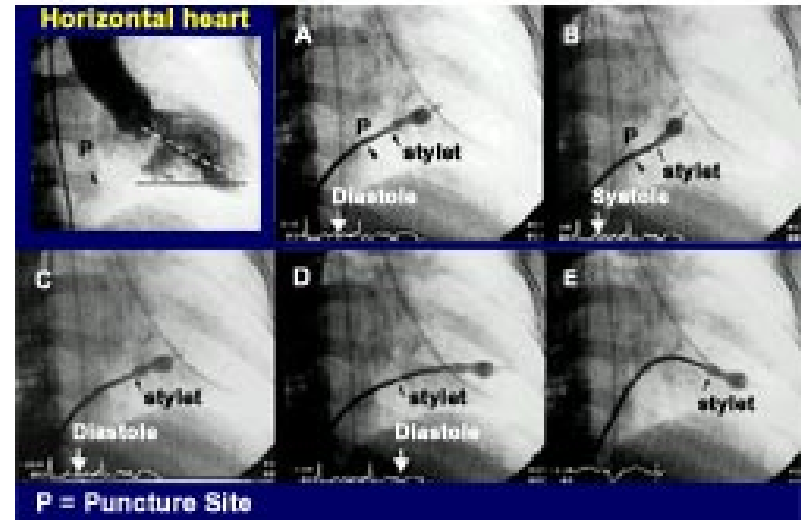
- Sliding

- Posterior

### 3. The Catheter Sliding Method (Fig. 4)

When the vertical or direct method fails, the catheter is withdrawn to make the distal segment more horizontal. The distal catheter is then made more flexible by withdrawing the stylet clear out of the balloon segment (A). Once the slightly inflated balloon is at the mitral orifice, cardiac contractions will cause the balloon segment to tilt upwards during systole (B). In diastole, the balloon segment aligns with the catheter shaft (A and C). This indicates proper positioning of catheter tip at the mitral orifice. With the operator carefully watching the rhythmic motion of the cardiac cycle, only the catheter is advanced forward (with the stylet kept fixed) during diastole (C) to cross the valve (D). It is important to note that forceful advancement of the catheter should be avoided, because if the balloon misses the valve orifice, the balloon may enter the left atrial appendage. After successful catheter crossing of the valve, the stylet is then advanced to help align the catheter with the orifice-apex axis (E).

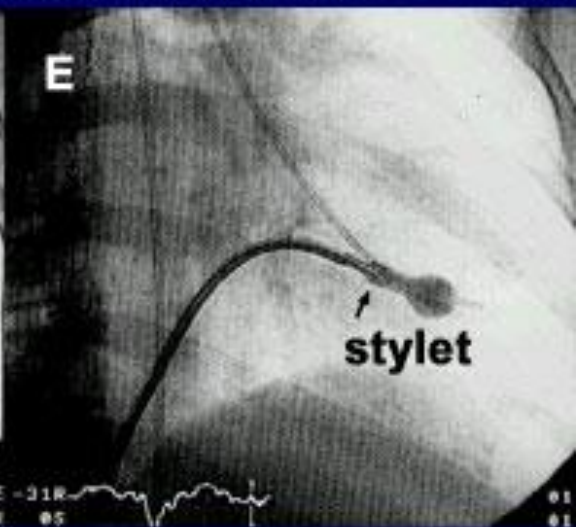
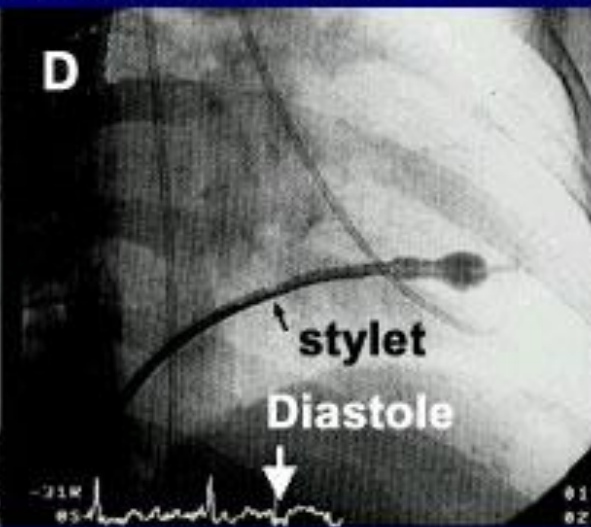
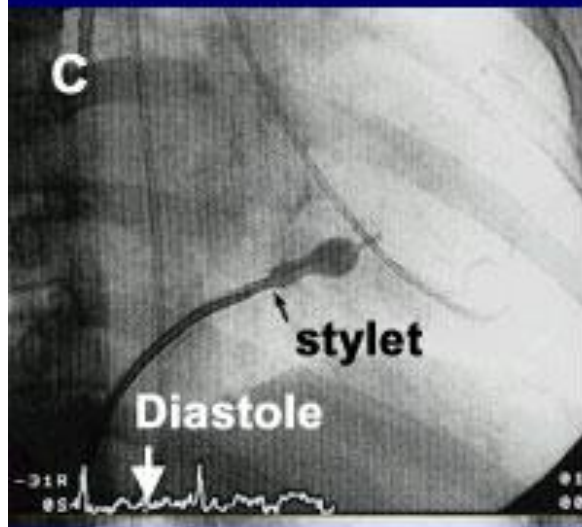
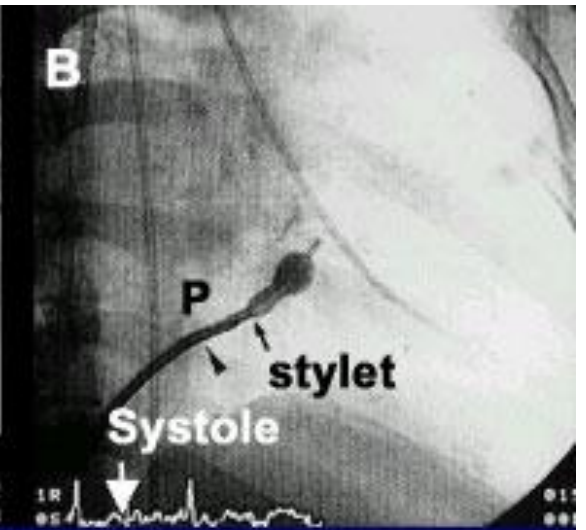
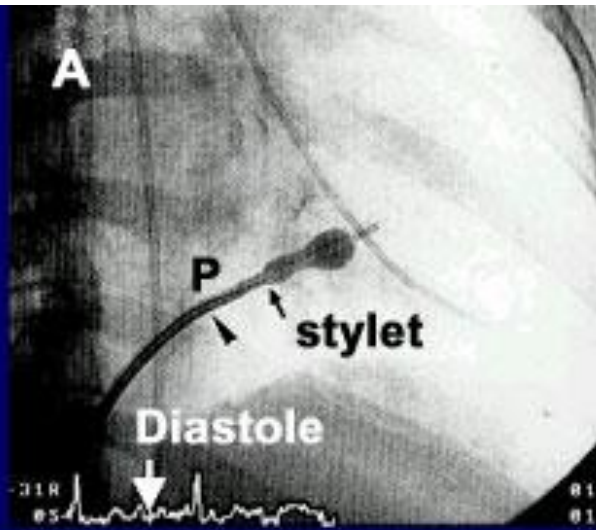
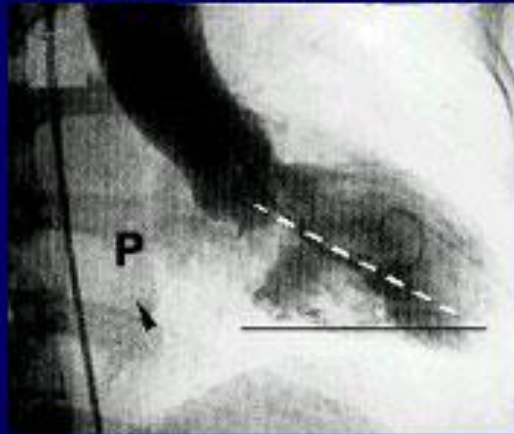
Figure 4  
Horizontal (sliding) Method



[Click To View Larger Image](#)

The sliding method has proved to be effective in cases when the septal puncture is made too caudally and/or the left ventricle takes a more horizontal orientation (Fig. 4, top left panel).

# Horizontal heart



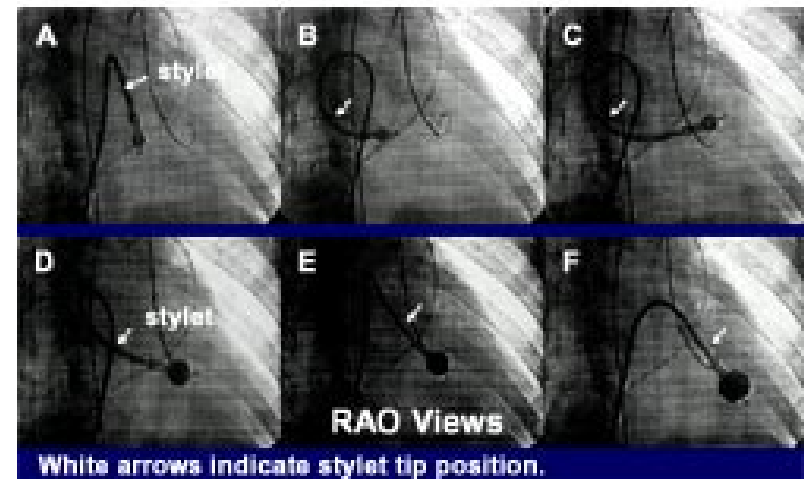
**P = Puncture Site**

#### 4. The Posterior Loop Method (Fig. 5)

Balloon catheter insertion across the mitral orifice is particularly difficult when the transseptal puncture is made too cephalic or too anteriorly (closer to the mitral valve). The loop method is useful in such cases, and also in patients with giant left atria. This method is infrequently used in our experience.

First, the balloon catheter is inserted far into the left atrium to a site near the mitral valve to make a large catheter loop (A). Then, the stylet is inserted to a point 2 to 3 cm proximally to the balloon segment. With the stylet twisted clockwise, the balloon tip is brought toward the posterior and inferior wall of the left atrium. Then the catheter forms a loop in the left atrium (B). With the stylet held firmly, only the balloon catheter is advanced, allowing the balloon to move forward to the mitral orifice. In this way, the balloon catheter can be easily inserted across the mitral orifice (C). When the balloon enters the left ventricle by this method, its tip may point upward (C). The loop is then reduced by carefully withdrawing the catheter and slightly advancing the stylet the balloon (D) to align the distal catheter with the long axis of the left ventricle (E). Before dilating the valve, one has to be certain that the balloon has not strayed among tendinous chords by observing its free movement in the left ventricle (F).

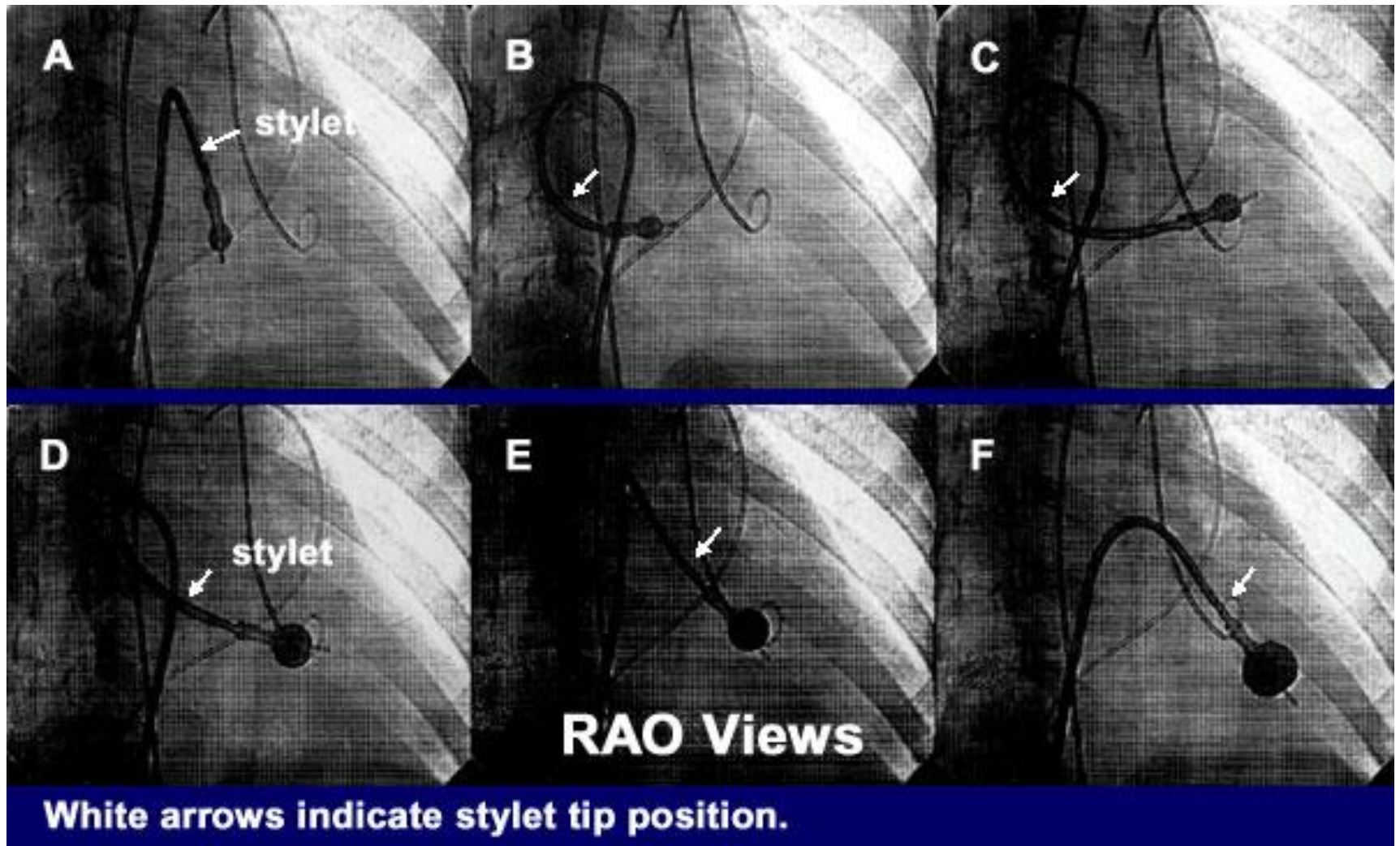
Figure 5  
Posterior Loop Method



[Click To View Larger Image](#)



# Posterior loop method



# Why Routine LV crossing and over the wire is not popular ?

Some centers prefer it . Inoue is made specifically to avoid wire in LV

## Advantage

Help cross very difficult lesions (.032 wire and below)

## Disadvantage

**Steerability**

**Subvalvular trapping common**

**Controlled balloon inflation is not possible**

# Tough crossings

*Brief Report*

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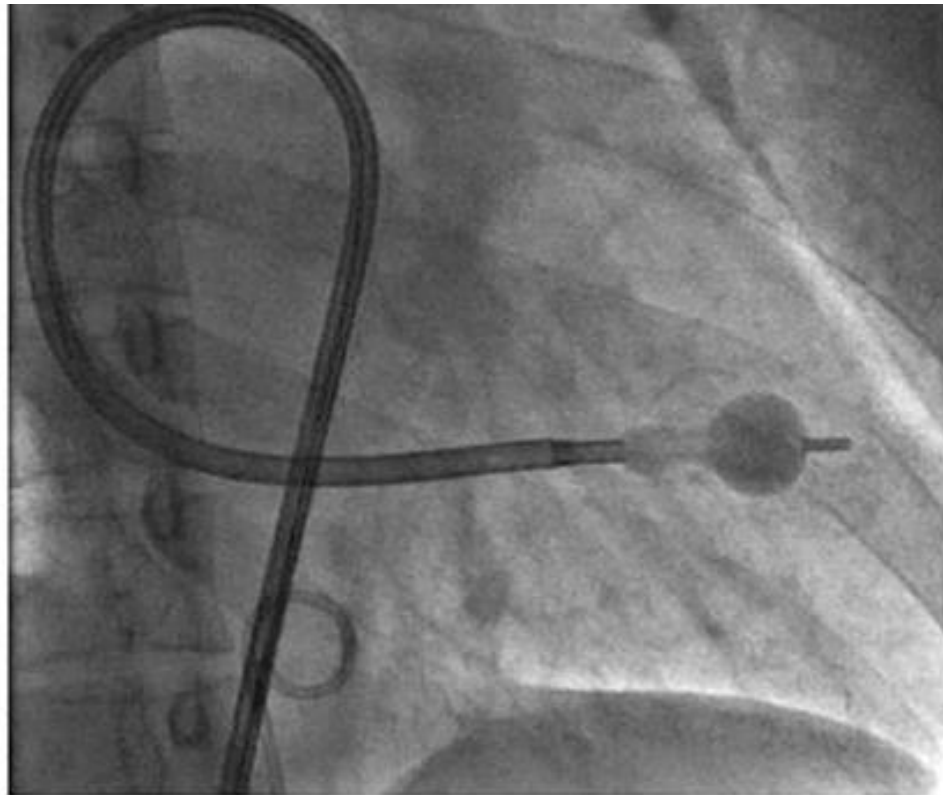
## **Difficult Percutaneous Transvenous Mitral Commissurotomy: A New Technique for Left Atrium to Left Ventricular Entry**

**Vijay Trehan, Vimal Mehta, Saibal Mukhopadhyay, Jamal Yusuf, UA Kaul**  
*Department of Cardiology, GB Pant Hospital, New Delhi*

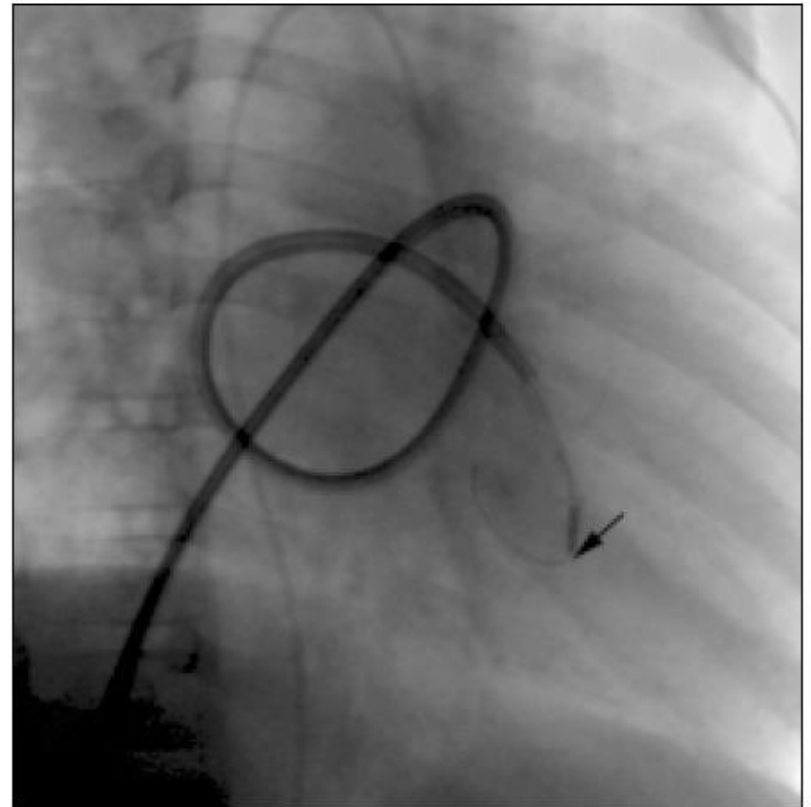
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Percutaneous transvenous mitral commissurotomy using Inoue balloon is an effective procedure for the management of patients with juvenile mitral stenosis. Inability to cross the mitral valve by the Inoue balloon catheter is one of the important reasons for failure of the procedure. We describe a new technique, facilitating left atrium to left ventricular entry using double loop of Inoue balloon catheter in a child with small left atrium. **(Indian Heart J 2004; 56: 158-162)**

## Reverse loop



## Double loop



# **After crossing : Once Inside LV**

**Assure Free Balloon Movement in Left Ventricle**

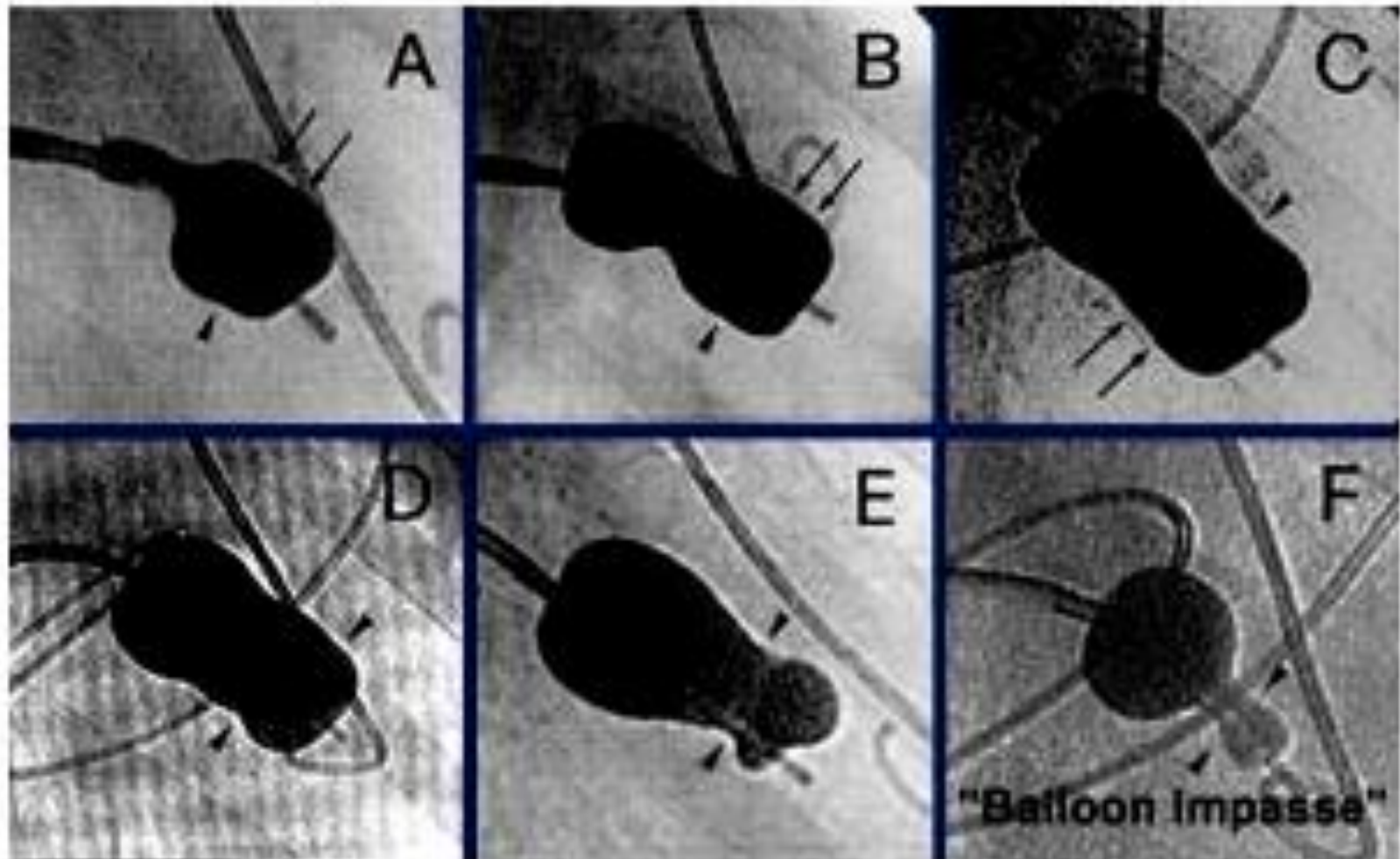
**Chordal straying to be avoided**

**Sub-valvular status Reassessment**



# Figure 9

## Balloon Compression Signs (Severe Subvalvular Lesions)



# CATHETERIZATION & CARDIOVASCULAR INTERVENTIONS

Original Study

---

**“Balloon impasse”: A marker for severe mitral subvalvular disease and a predictor of mitral regurgitation in inoue-balloon percutaneous transvenous mitral commissurotomy**

Kean-Wah Lau MBBS, Jui-Sung Hung MD\*

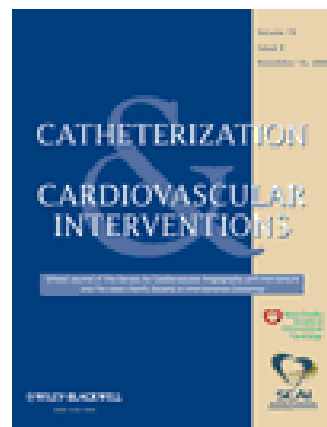
Issue

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Article first published online: 26 OCT 2005

DOI: 10.1002/ccd.1810350407

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Catheterization and  
Cardiovascular Diagnosis  
Volume 35, Issue 4, pages  
310–319, August 1995



**How long one can be within LV ?**

**Criteria for successful PTMC**

**Echo / Hemodynamic / Clinical**

# Some real technical issues

- **Accura vs Innoue**
- **LV over the wire crossing**
- **TEE guiding**

# **Newer navigation methods ?**

**Corporate interest low**

**Imaging 3D RT**

**TEE guiding**

**Retrograde crossing –popular ?**



# Journal of the American Society of Echocardiography

Volume 18, Issue 9, September 2005, Pages 964–969

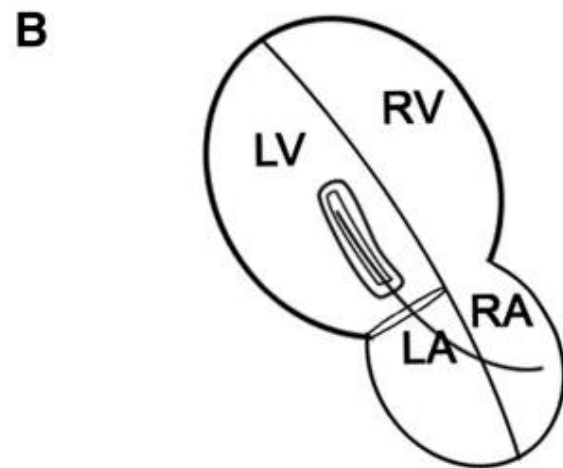
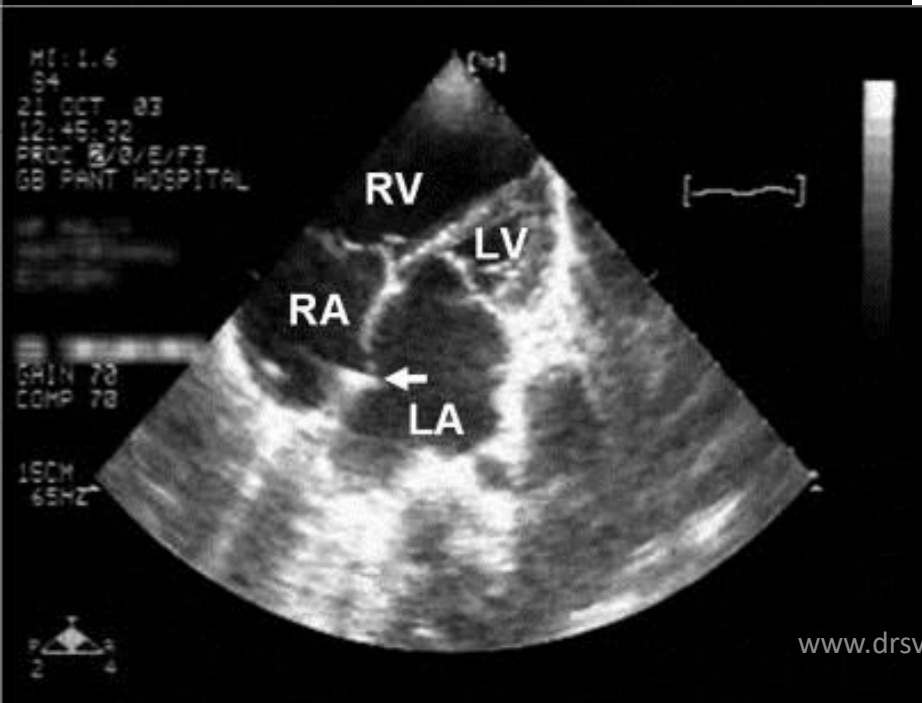
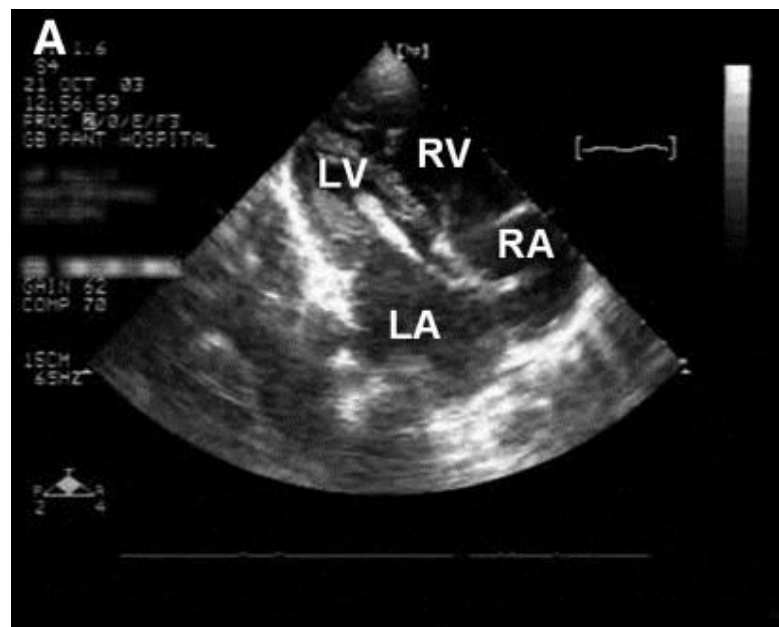


Original article

## Mitral Valvuloplasty by Inoue Balloon Under Transthoracic Echocardiographic Guidance

Vijay Trehan, DM, Saibal Mukhopadhyay, DM  , Arima Nigam, MD, Jamal Yusuf, DM, Vimal Mehta, DM, Mohit Dayal Gupta, MD, MP, Meenahalli Palleda Girish, Sanjay Tyagi, DM

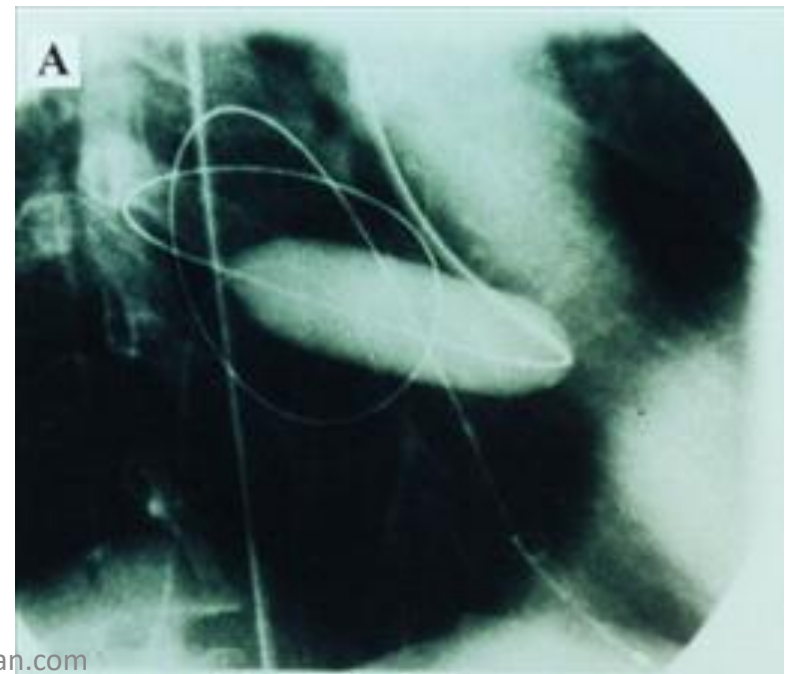
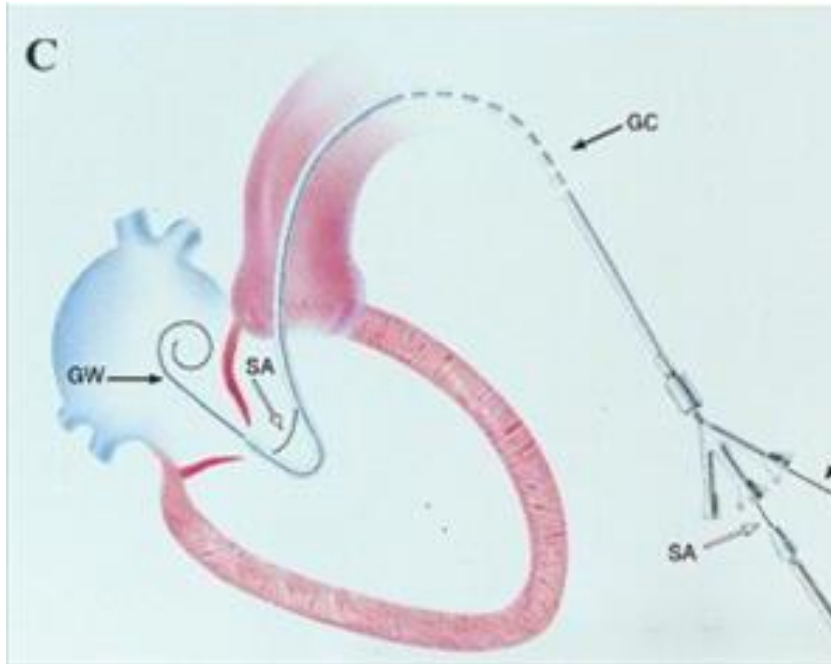
**Year 2005/ 75 patients / 90 %  
Success**



## **Balloon mitral valvotomy: comparison between antegrade Inoue and retrograde non-transseptal techniques**

**V. K. Bahl, S. Chandra, D. K. Jhamb, K. C. Goswami, R. Juneja, D. Thatai, K. K. Talwar and H. S. Wasir**

*Department of Cardiology, Cardiothoracic Sciences Center, All India Institute of Medical Sciences, New Delhi, India*



# Final words

Crossing the mitral valve is *not a blind* procedure

Good knowledge about the *anatomy & the hardware*

Eye, hand and of course mind **co-ordination**

Master *two methods* of crossing .

A near **100 % success** with negligible risk.



**Thank you**

[www.drsvenkatesan.com](http://www.drsvenkatesan.com)