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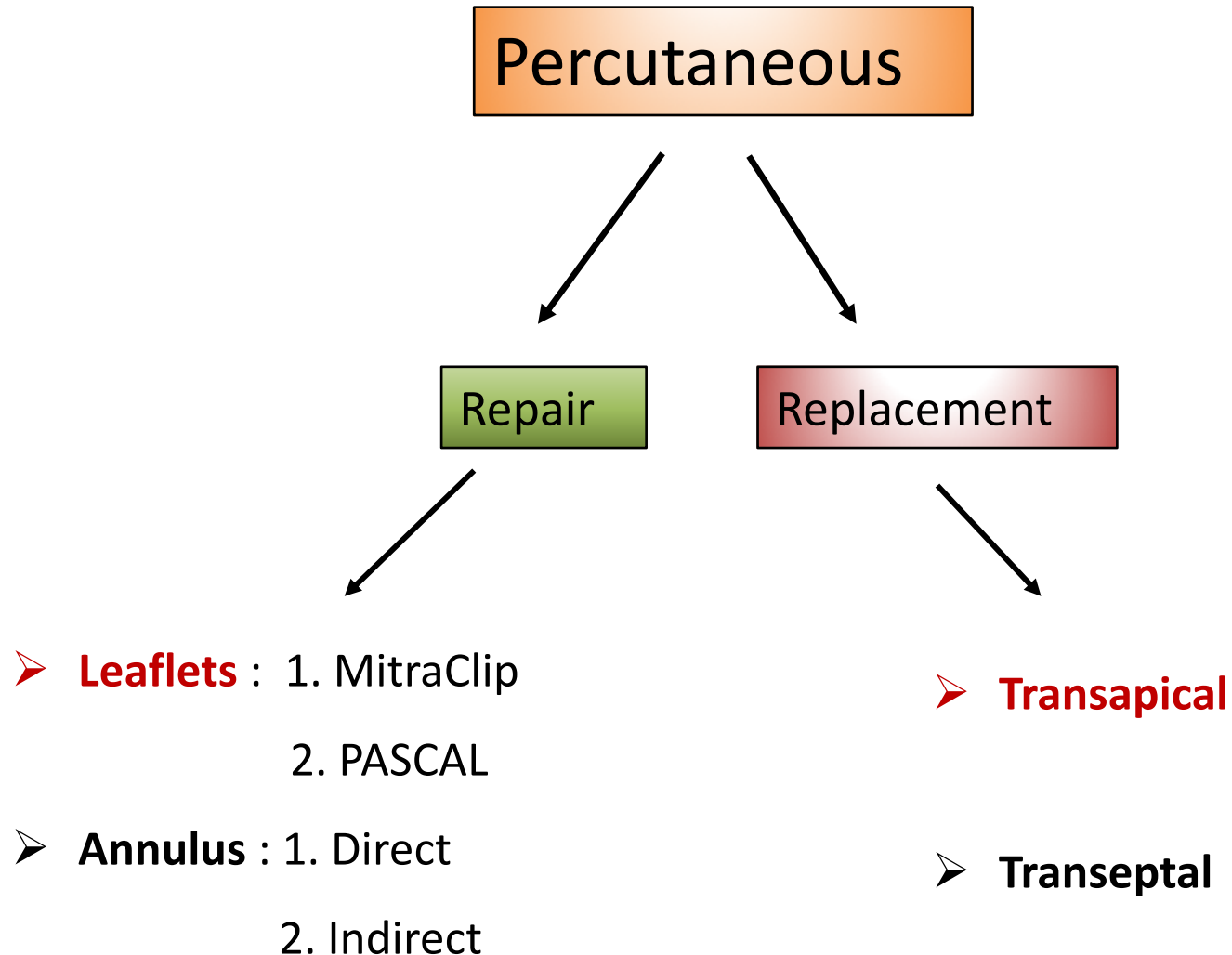
# Direct transeptal Mitral Mnnuloplasty; The First Choice for Functional Mitral Regurgitation

**Eustachio Agricola**

**Director of Echocardiography Laboratories**

**San Raffaele Hospital, IRCCS, Milano**

# Mitral Valve Procedures: Which Options



## SURGERY FOR ACQUIRED HEART DISEASE

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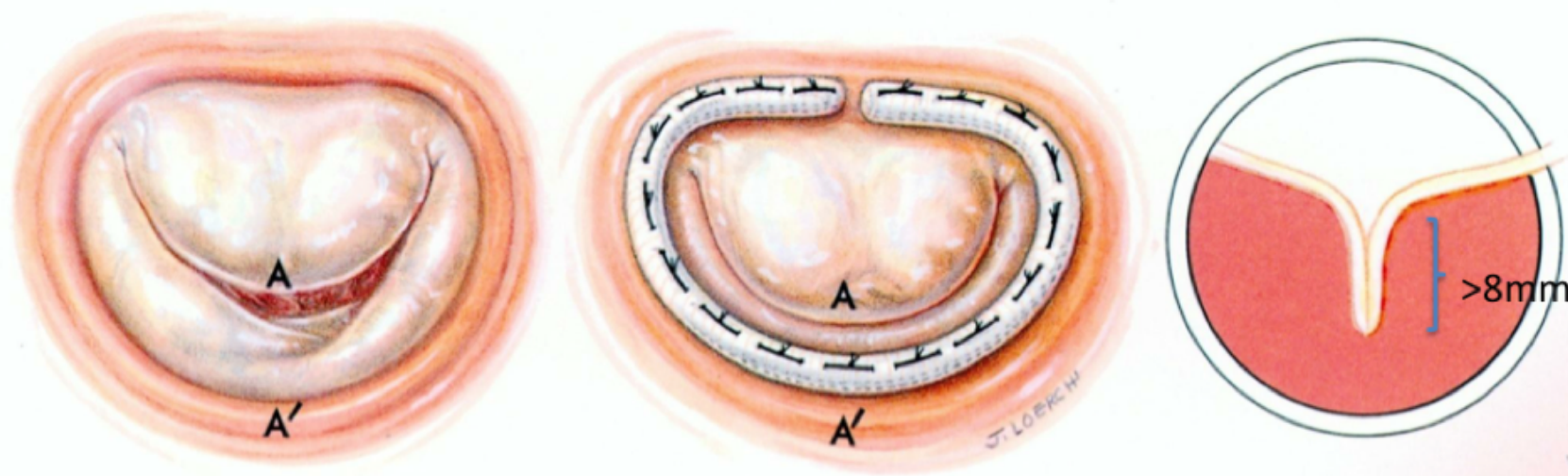
### EARLY OUTCOME OF MITRAL VALVE RECONSTRUCTION IN PATIENTS WITH END-STAGE CARDIOMYOPATHY

Uncontrollable severe mitral regurgitation is a frequent complication of end-stage cardiomyopathy, significantly contributing to heart failure in these patients, and predicts a poor survival. Although elimination of mitral valve regurgitation could be most beneficial in this group, corrective mitral valve surgery has not been routinely undertaken in these very ill patients because of the presumed prohibitive operative mortality. We studied the early outcome of mitral valve reconstruction in 16 consecutive patients with cardiomyopathy and severe, refractory mitral regurgitation operated on between June 1993 and April 1994. There were 11 men and five women, aged 44 to 78 years ( $64 \pm 8$  years) with left ventricular ejection fractions of 9% to 25% ( $16\% \pm 5\%$ ). Preoperatively all patients were in New York Heart Association class IV, had severe mitral regurgitation (graded 0 to 4+ according to color flow Doppler transesophageal echocardiography) and two were listed for transplantation. Operatively, a flexible annuloplasty ring was implanted in all patients. Four patients also had single coronary bypass grafting for incidental coronary disease. In four patients the operation was performed through a right thoracotomy because of prior coronary bypass grafting, and four patients also underwent tricuspid valve reconstruction for severe tricuspid regurgitation. No patient required support with an intraaortic balloon pump. There were no operative or hospital deaths and mean hospital stay was 10 days. There were three late deaths at 2, 6, and 7 months after mitral valve reconstruction, and the 1-year actuarial survival has been 75%. At a mean follow-up of 8 months, all remaining patients are in New York Heart Association class I or II, with a mean postoperative ejection fraction of  $25\% \pm 10\%$ . There have been no hospitalizations for congestive heart failure, and a decrease in medications required has been noted. For patients with cardiomyopathy and severe mitral regurgitation, mitral valve reconstruction as opposed to replacement can be accomplished with low operative and early mortality. Although longer term follow-up is mandatory, mitral valve reconstruction may allow new strategies for patients with end-stage cardiomyopathy and severe mitral regurgitation, yielding improvement in symptomatic status and survival. (J THORAC CARDIOVASC SURG 1995;109:676-83)

Steven F. Bolling, MD, G. Michael Deeb, MD, Louis A. Brunsting, MD, and David S. Bach, MD, *Ann Arbor, Mich.*

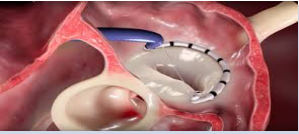
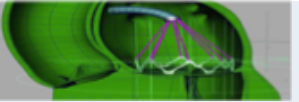


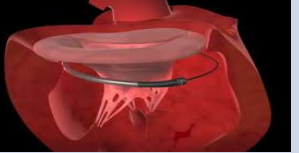
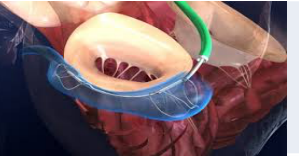
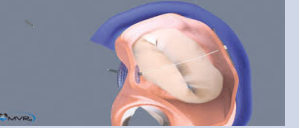
# The Reference

## UNDERSIZED ANNULOPLASTY

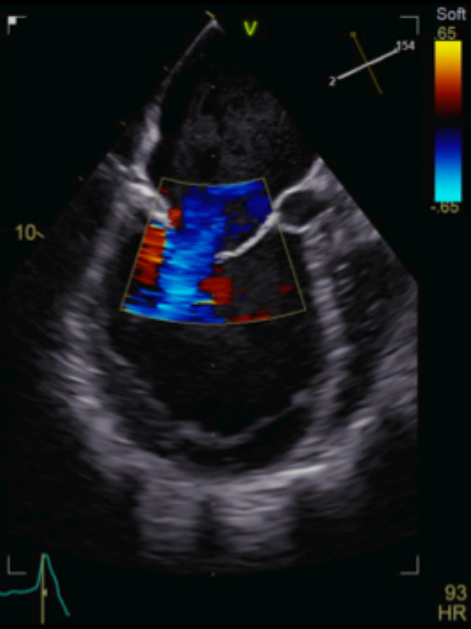
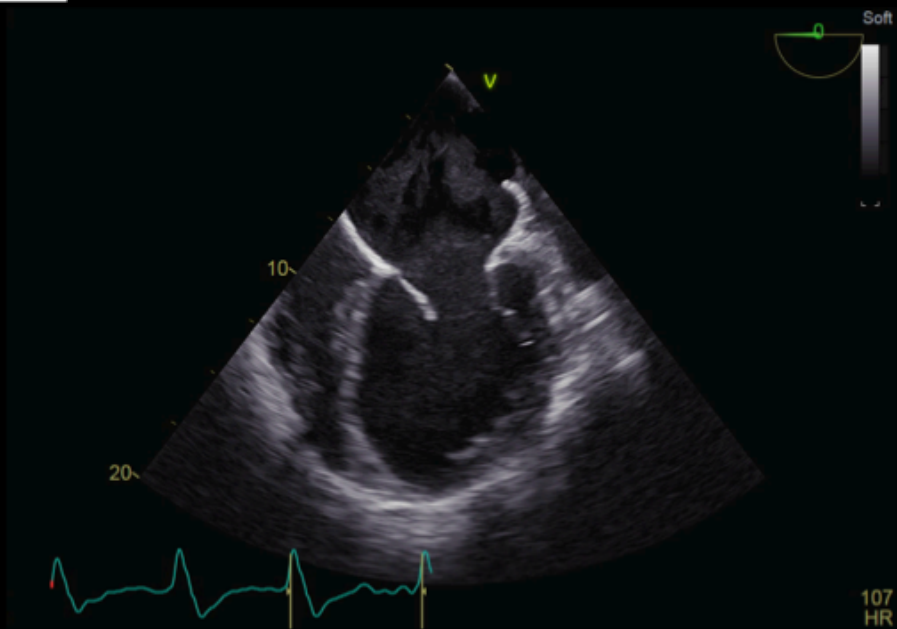


COMPLETE , RIGID , SHAPED RING, 2 Size Under

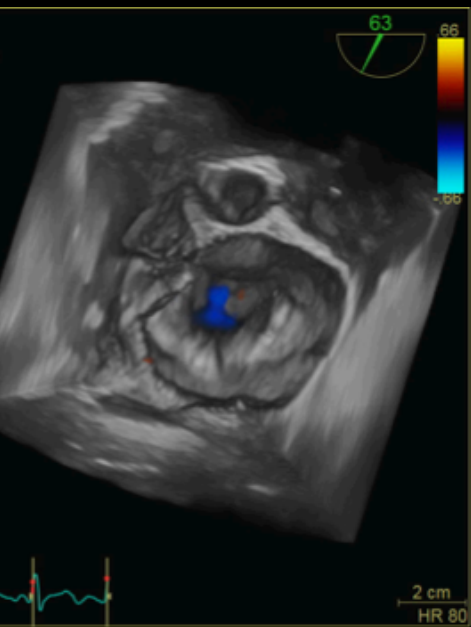
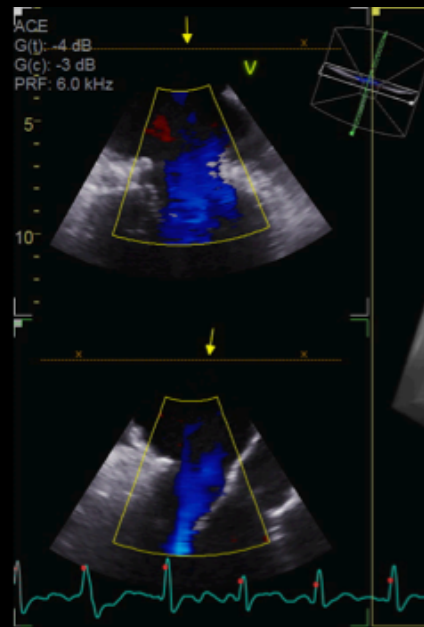
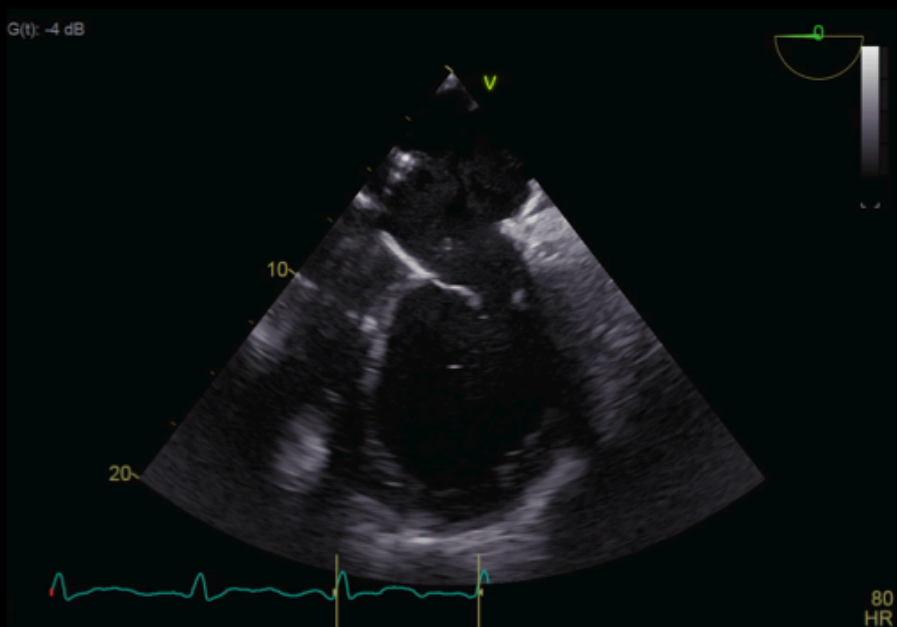


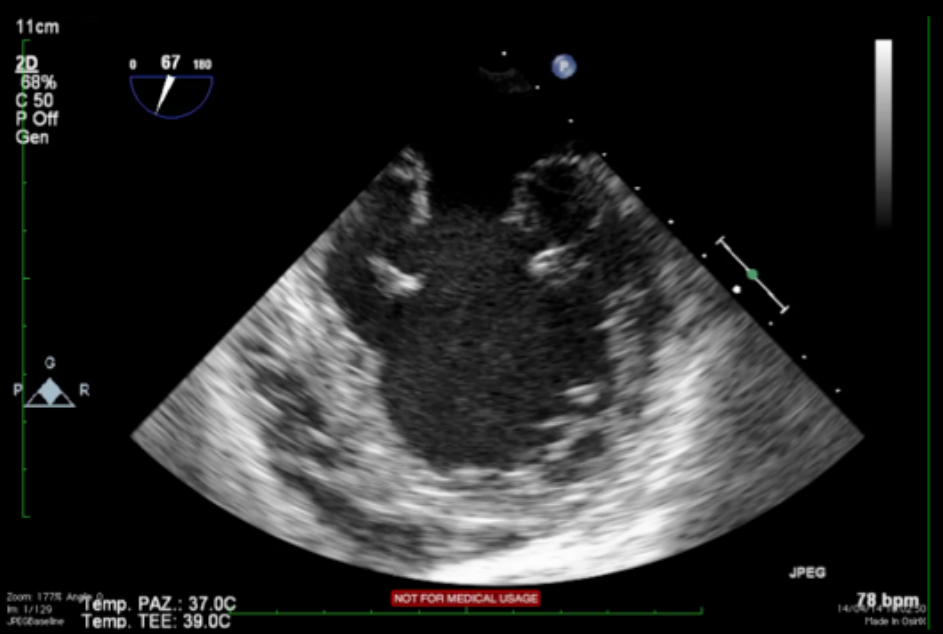
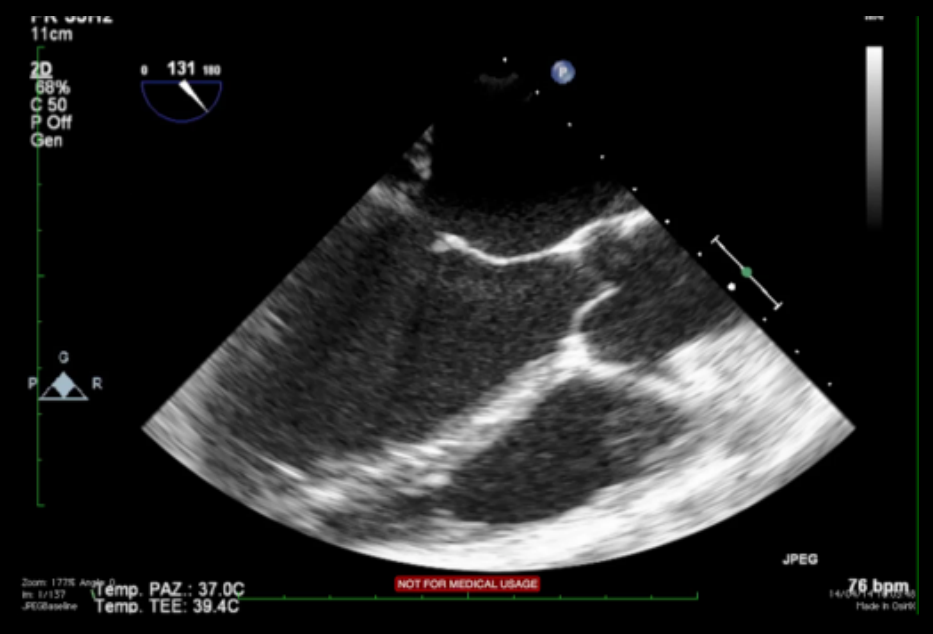
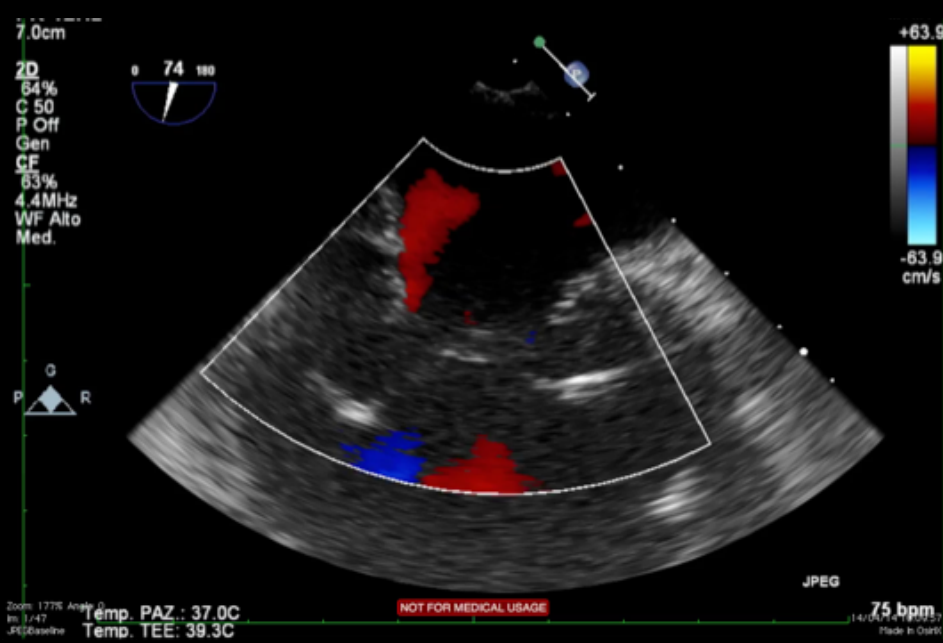
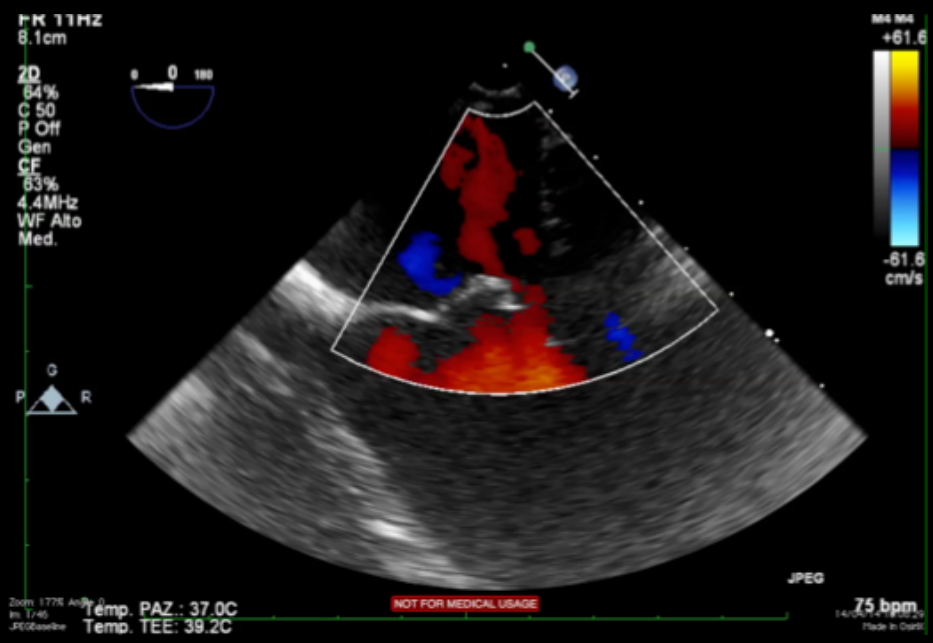
	Device Name	Delivery Access	Mechanisms	CE Mark
	Cardioband (Edwards)	Direct Annuloplasty (Transfemoral)	Adjustable Dacron band on atrial side of the annulus	Yes
	Iris Devis (Millipede, Inc.)	Direct Annuloplasty (Transfemoral)	Supra-annular complete semi-rigid ring	No
	Mitralign System (Mitralign)	Direct Annuloplasty (Transaortic)	Posterior annular plication trough pledgets delivery	Yes
	Amend (Valcare Medical)	Direct Annuloplasty (Transapical)	Semi-rigid D-shape ring with anchoring system to the annulus	No
	AccuCinch (Ancora Heart, Inc.)	Direct Annuloplasty (Transaortic)	Percutaneous ventricular repair. A series of anchors are placed into the LV wall below the MV	No
	Carillon Mitral Contour System (Cardiac Dimensions Europe GmbH)	Indirect Annuloplasty (Internal Jugular Vein)	Coronary sinus reshaping	Yes
	Arto System (MVRx, Inc.)	Indirect Annuloplasty (Transfemoral)	Atrial septal-coronary sinus bridge. Reduction of the valve's minor axis	No

Pre



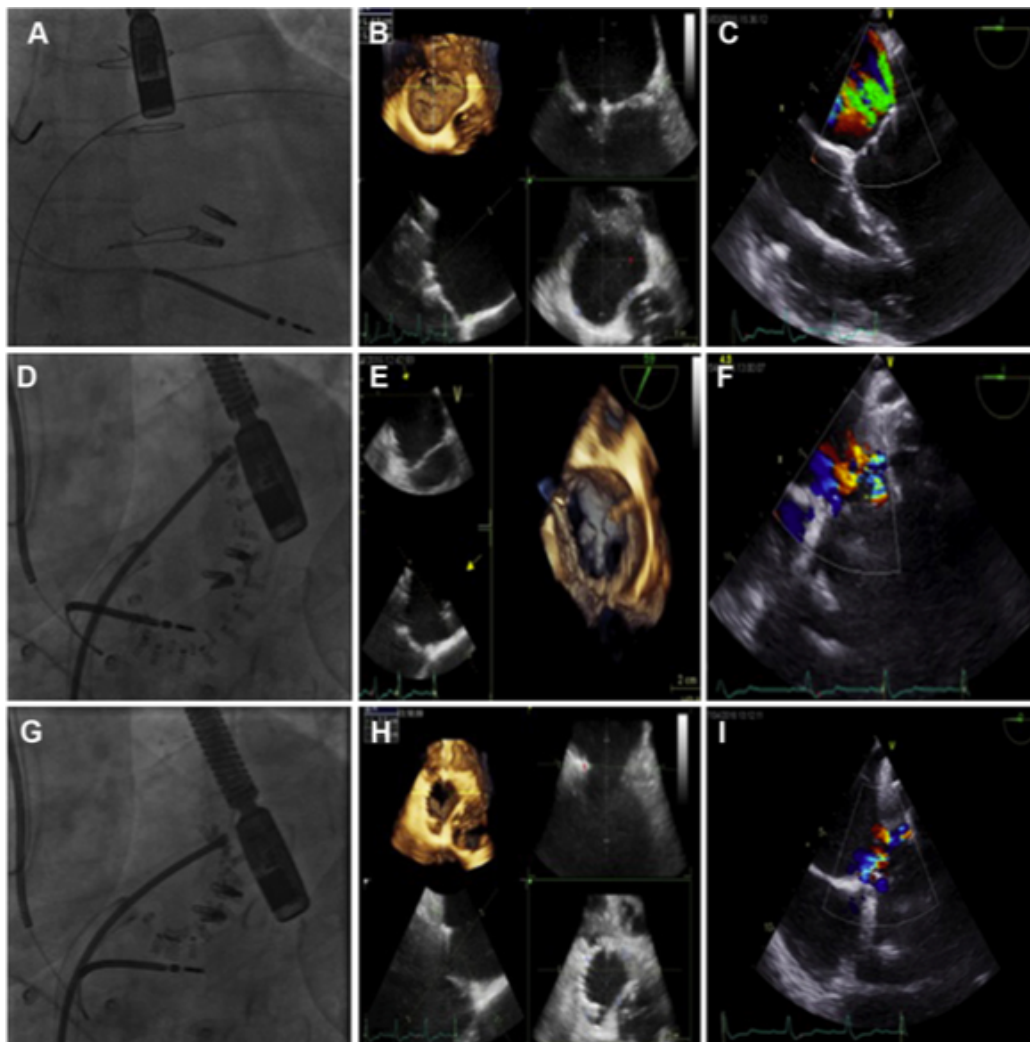
Post





# Percutaneous Direct Annuloplasty With Cardioband to Treat Recurrent Mitral Regurgitation After MitraClip Implantation

Azeem Latib, MBBC<sup>a,b</sup>, Marco B. Ancona, MD,<sup>b</sup> Luca Ferri, MD,<sup>b</sup> Matteo Montorfano, MD,<sup>b</sup> Antonio Mangieri, MD,<sup>b</sup> Damiano Regazzoli, MD,<sup>b</sup> Francesco Giannini, MD,<sup>b</sup> Fabrizio Monaco, MD,<sup>c</sup> Manuela Giglio, MD,<sup>d</sup> Stefano De Servi, MD,<sup>e</sup> Ottavio Alfieri, MD,<sup>f</sup> Antonio Colombo, MD,<sup>a,b</sup> Eustachio Agricola, MD<sup>b</sup>

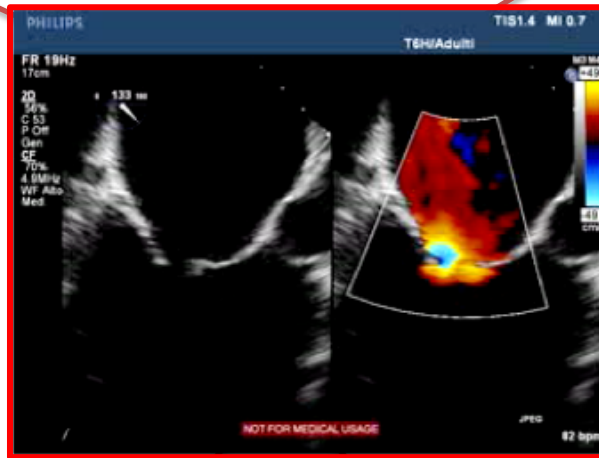




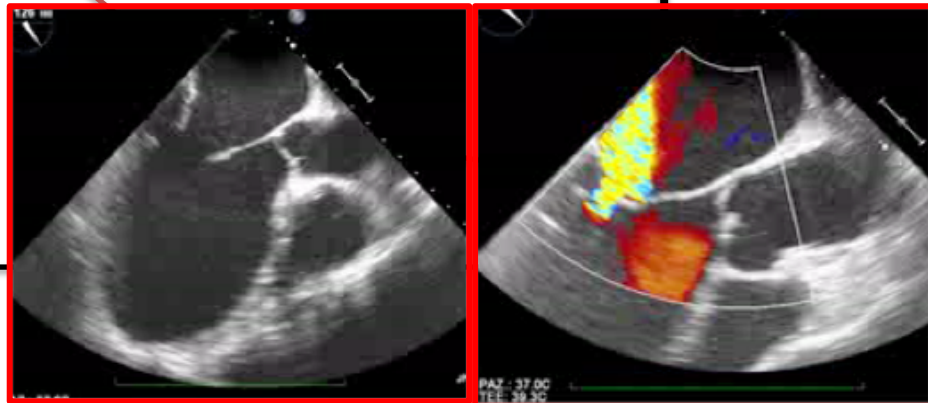
# Functional MR



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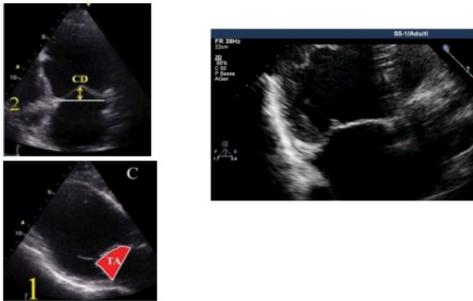
T  
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# Predictors of Failure of Undersized Annuloplasty

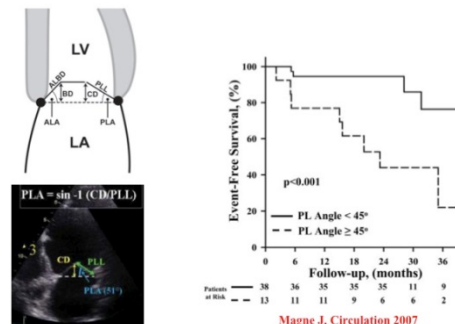
## Mitral Valve Deformation

Coaptation distance  $\geq 1$  cm  
Tenting area  $> 2.5-3$  cm<sup>2</sup>

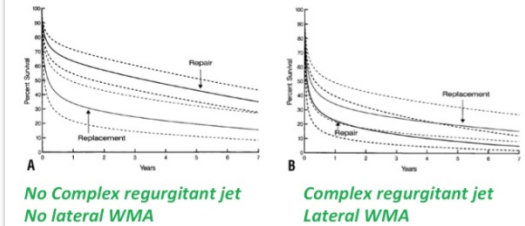


## Mitral Valve Deformation

Posterolateral angle  $> 45^\circ$

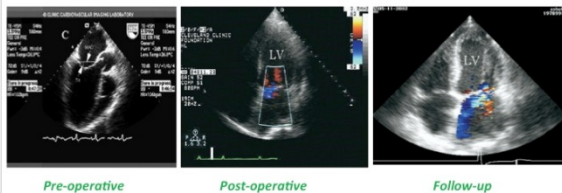


## Jet Characteristics

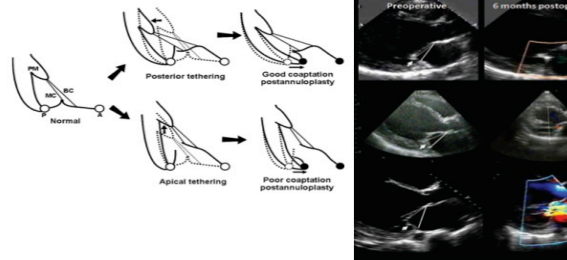


Gillinov M, J Thorac Cardiovasc Surg 2001

## Extreme Annular Dilatation



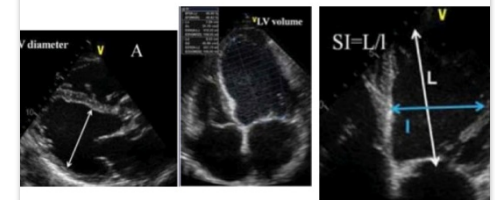
## Tethering Angle



Lee, A. P.-W. et al. Circulation 2009;119:2606-2614

## Degree of Ventricular Remodeling

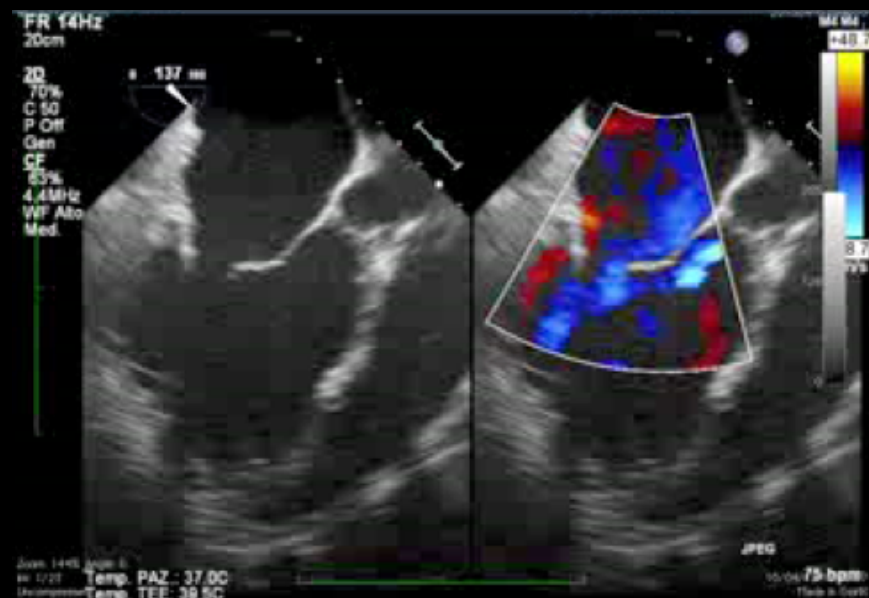
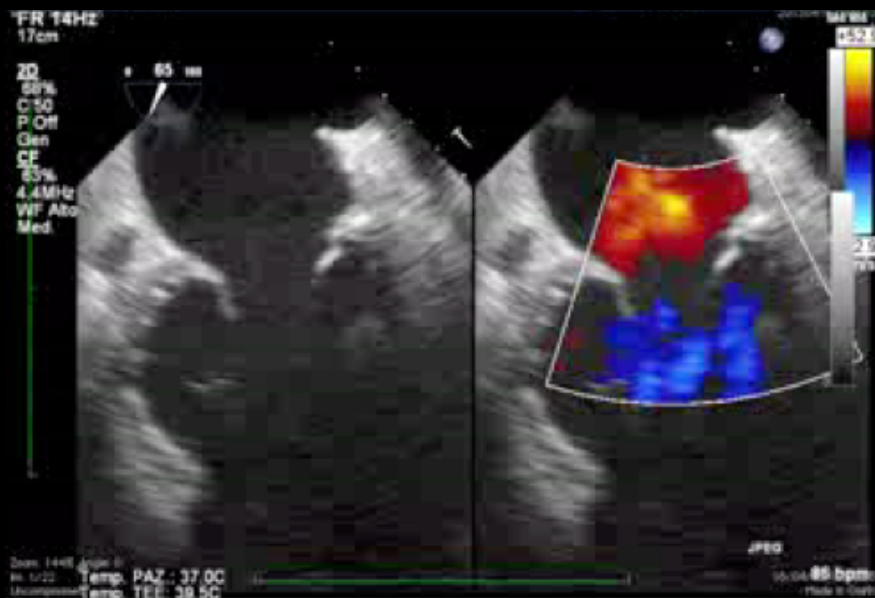
Global LV remodelling  
EDD  $> 65$  mm, ESD  $> 51$  mm (ESV  $> 140$  mL)  
Systolic sphericity index  $> 0.7$



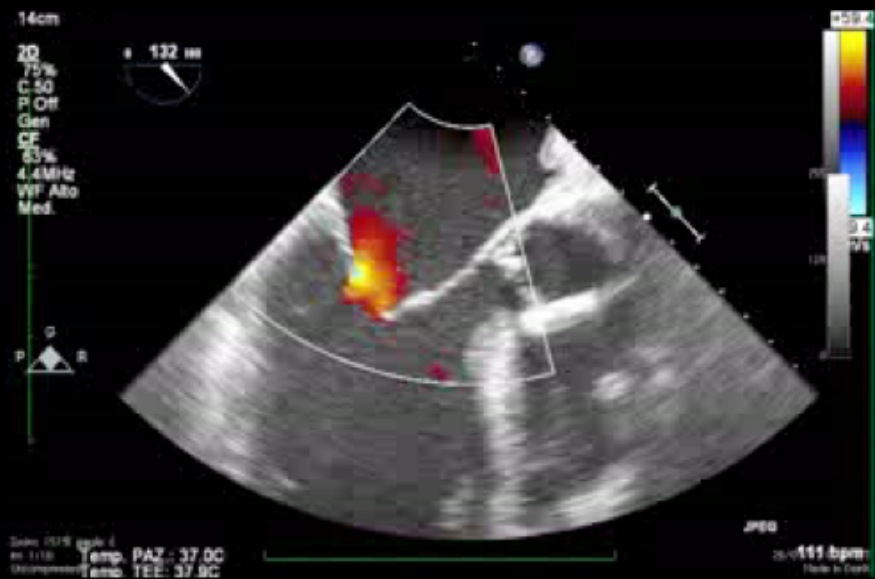
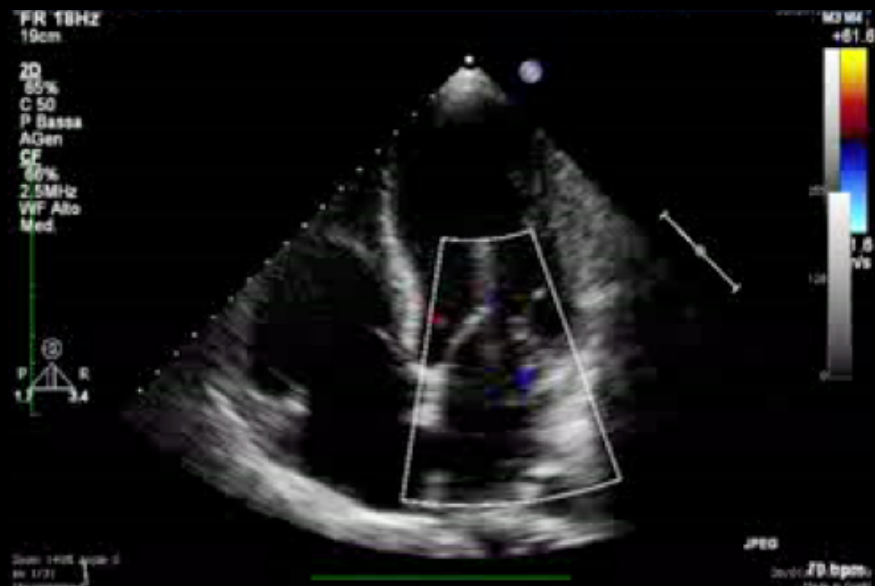
J Braun, Ann Thorac Surg 2008



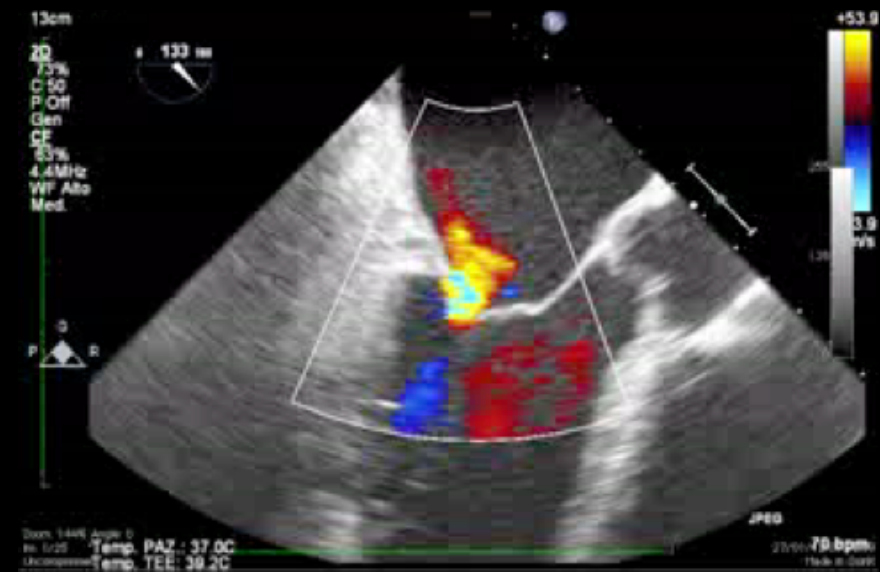
# Echocardiographic Phenotypes



# Echocardiographic Phenotypes

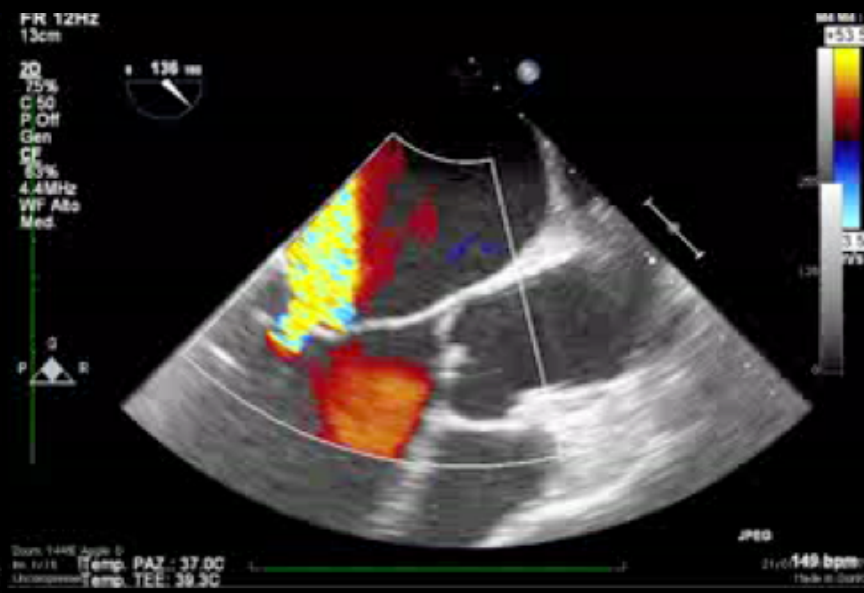
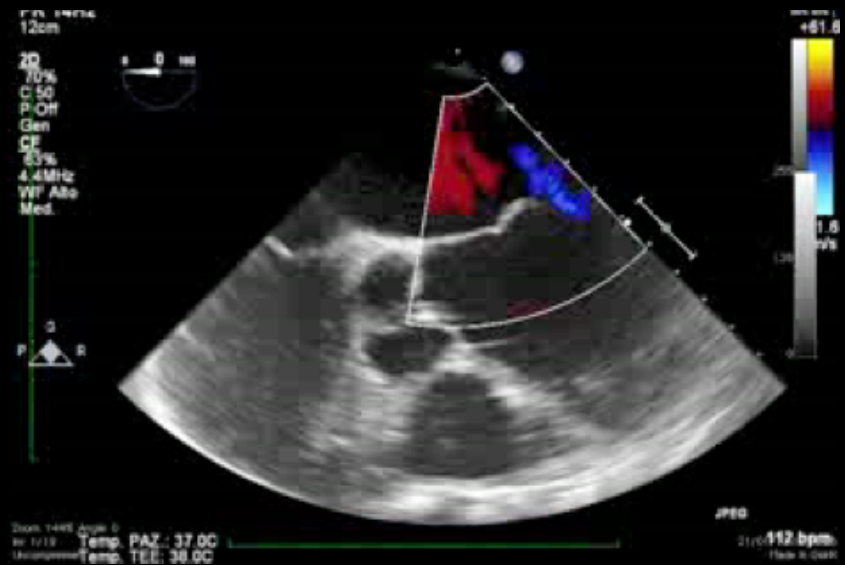


# Echocardiographic Phenotypes





# Echocardiographic Phenotypes

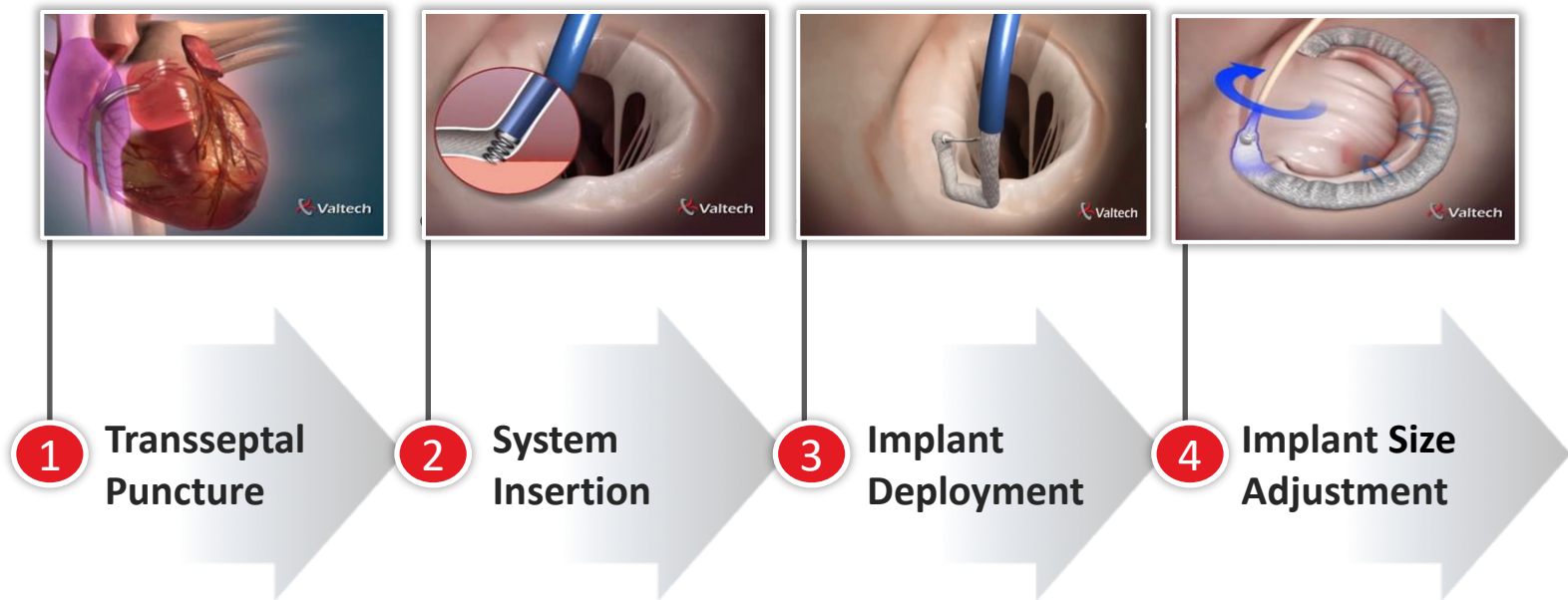


# Echocardiographic Phenotypes



# Direct Annuloplasty

## Cardioband System





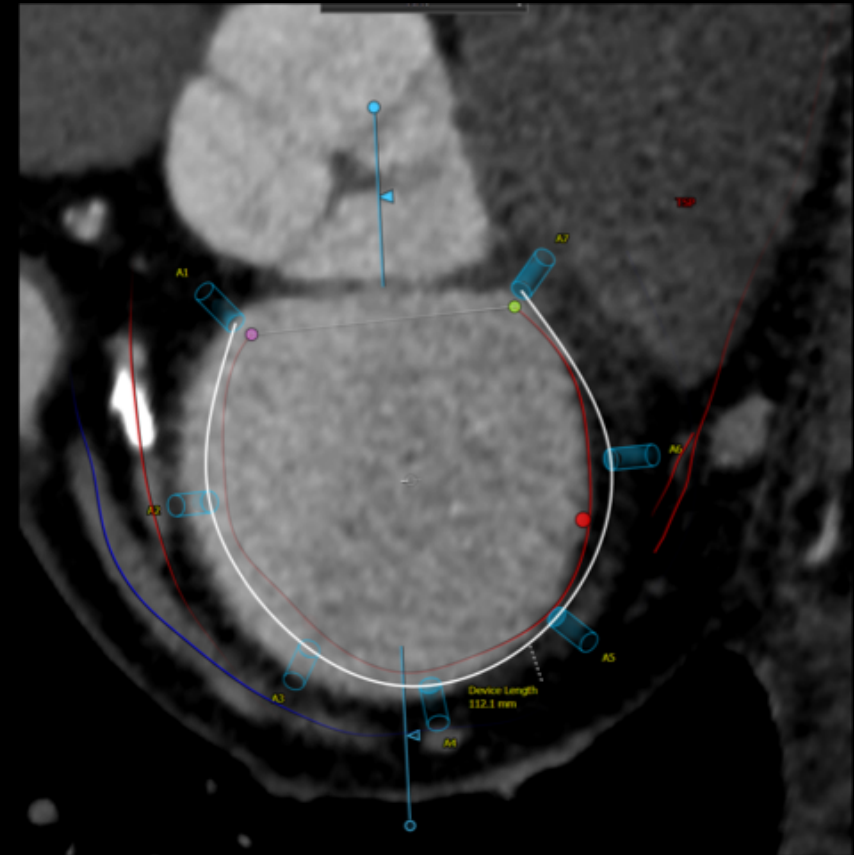
# Percutaneous Direct Annuloplasty

- **Strenghts**

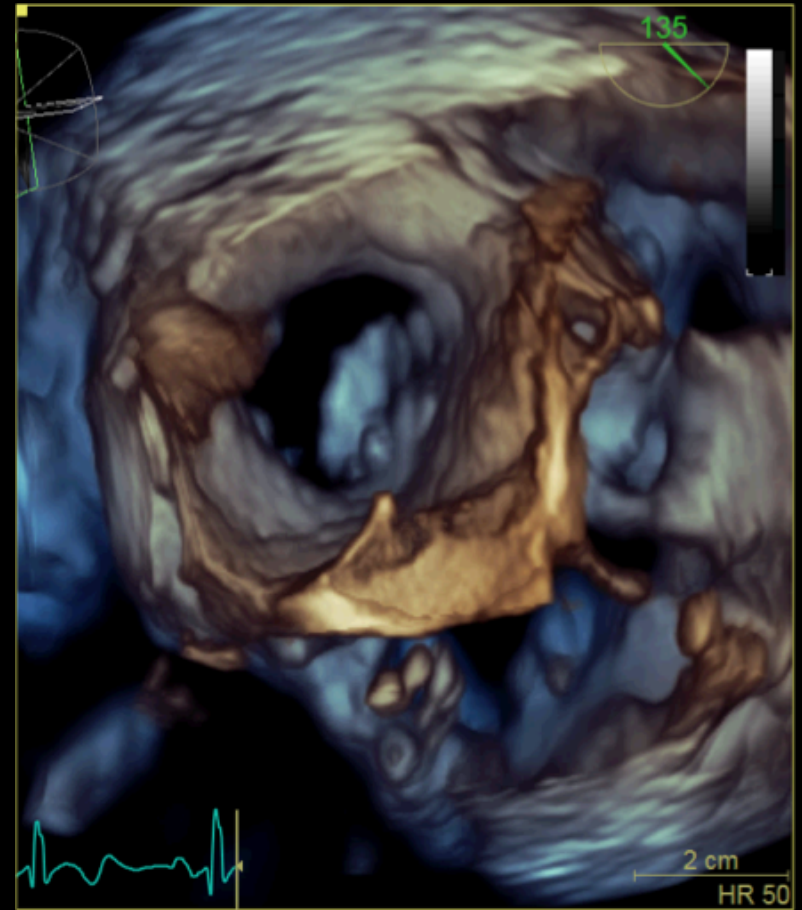
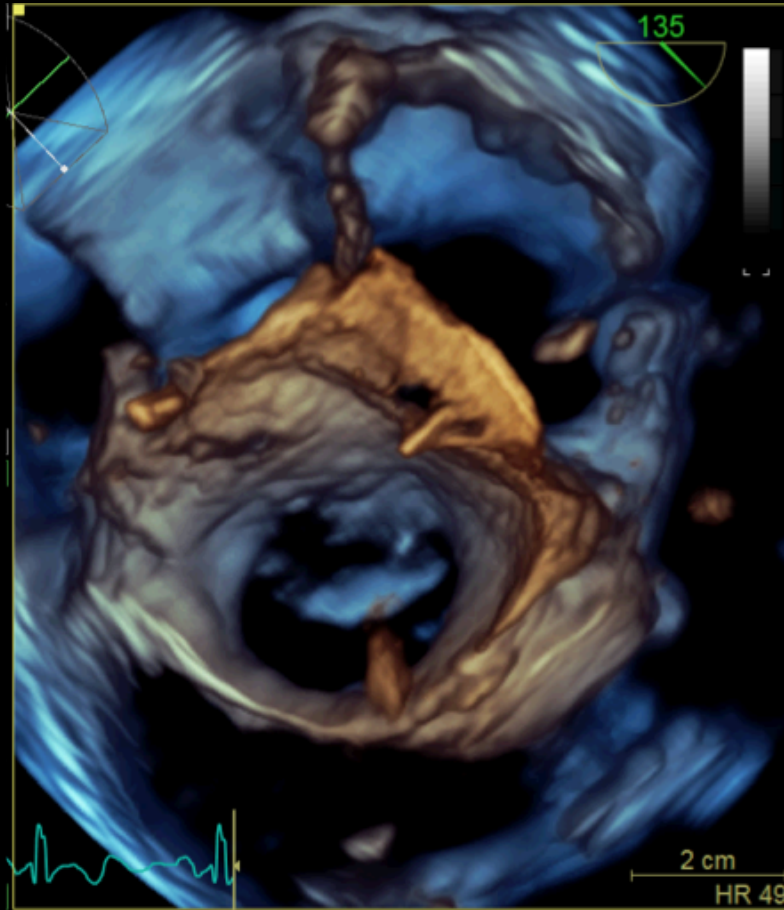
- ✓ Direct Anatomic Target (Annulus)
- ✓ Preserves the Functional Anatomy of MV
- ✓ The Results are More Predictable
- ✓ Relatively Independent from Anatomic Features (Feasibility)

- **Weaknesses**

- ✓ It is Still a Challenging procedure (Imaging)



# Transseptal Puncture



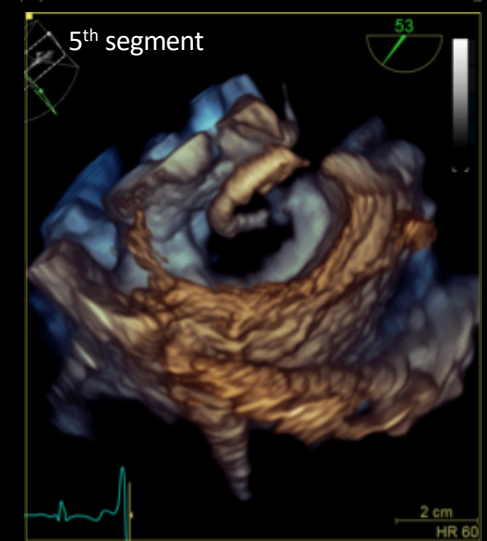
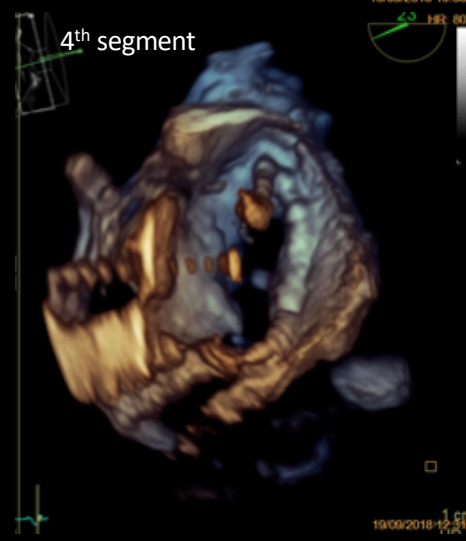
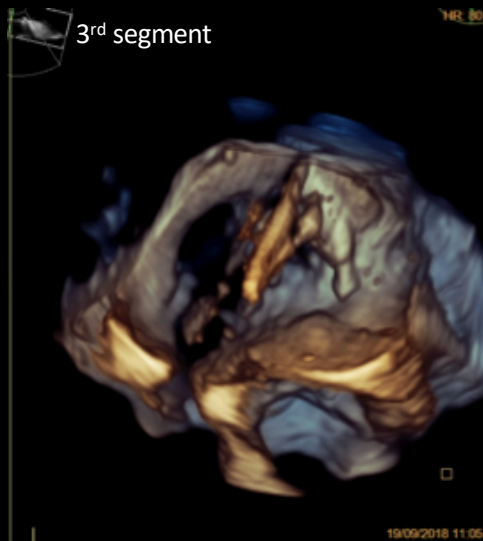
# Navigation and Implant



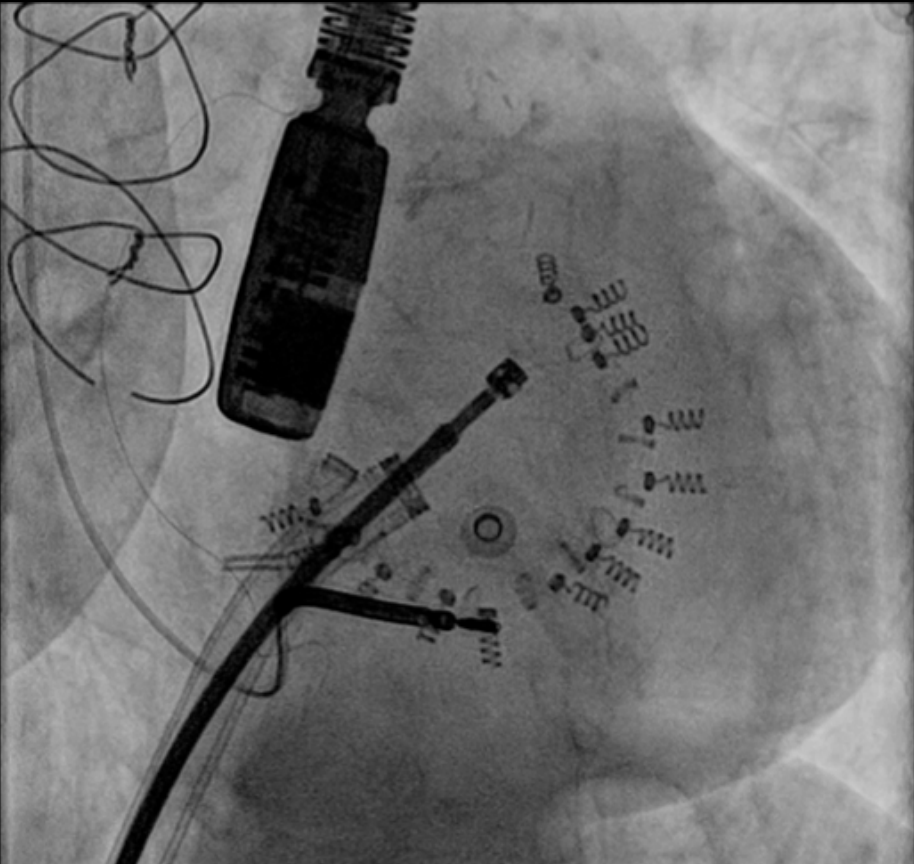
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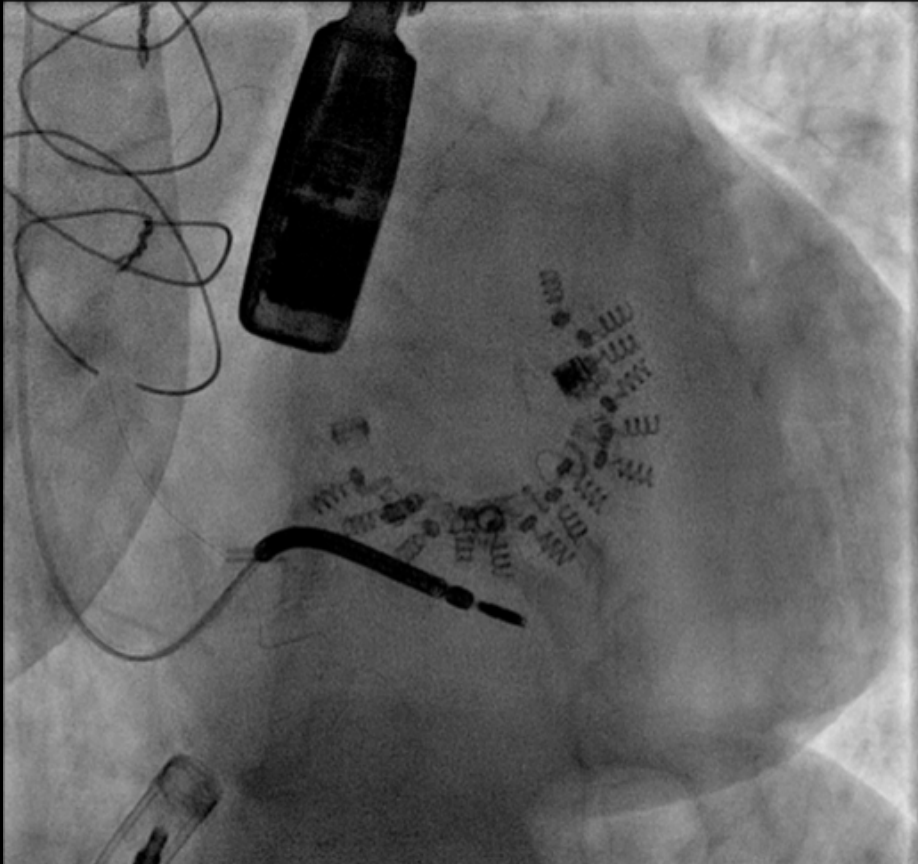
3



**Before Cinching**

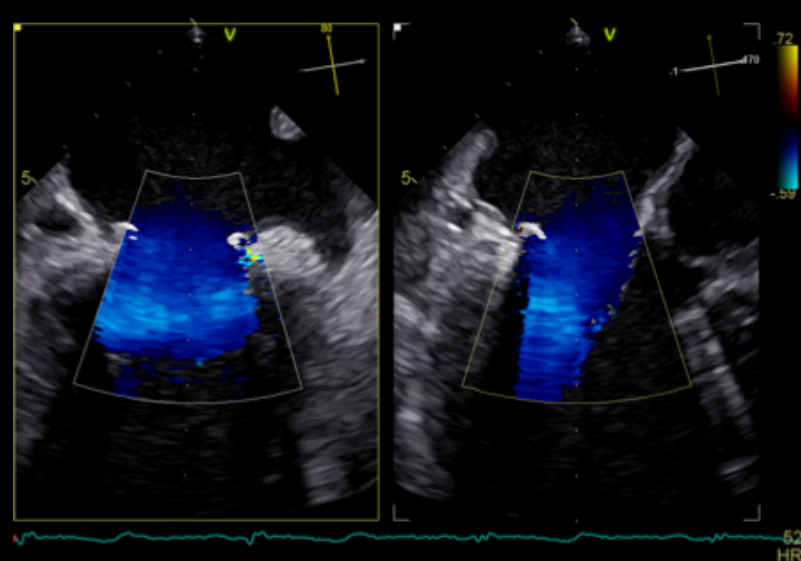
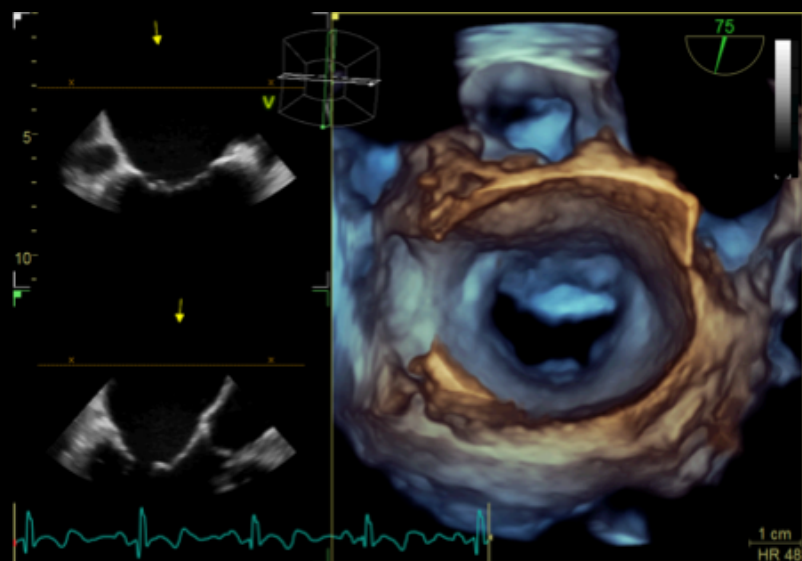
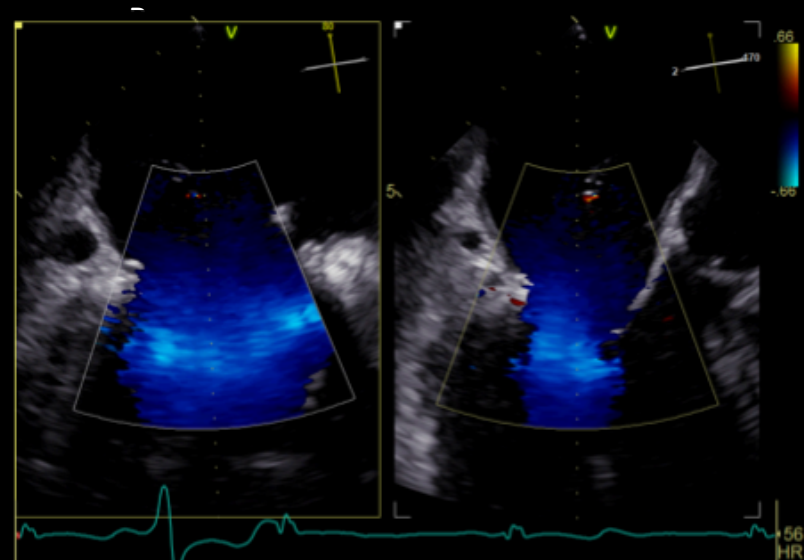
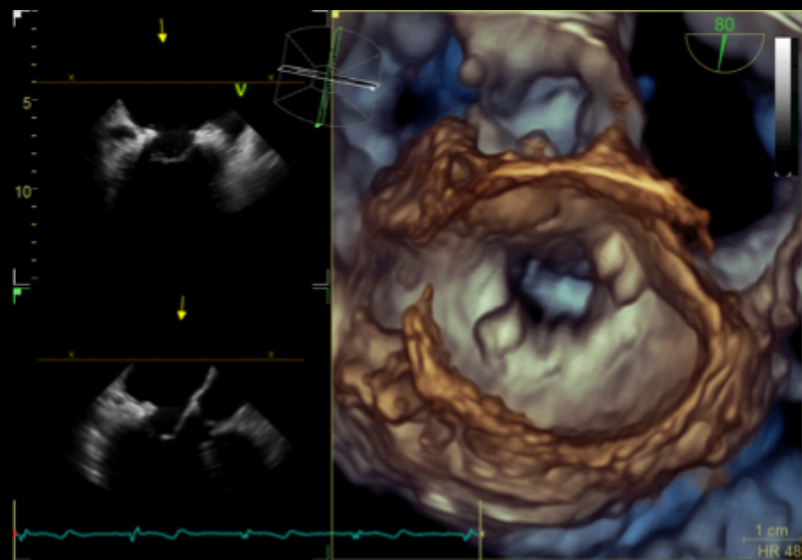


**After Cinching**





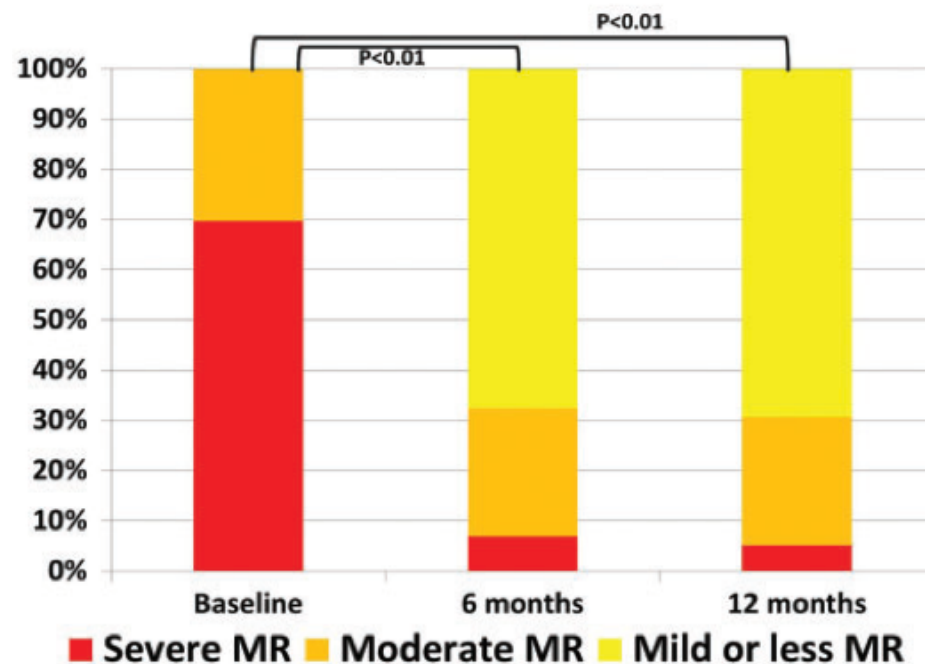
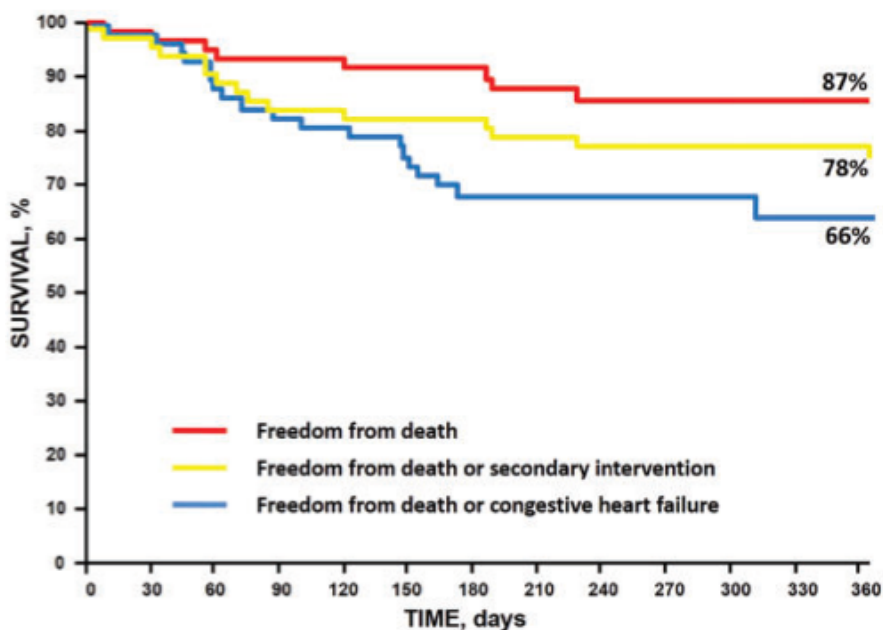
# Final Results





## Transcatheter mitral valve repair for functional mitral regurgitation using the Cardioband system: 1 year outcomes

David Messika-Zeitoun<sup>1,2,3,4\*</sup>, Georg Nickenig<sup>5</sup>, Azeem Latib<sup>6</sup>, Karl-Heinz Kuck<sup>7</sup>, Stephan Baldus<sup>8</sup>, Robert Schueler<sup>5</sup>, Giovanni La Canna<sup>6</sup>, Eustachio Agricola<sup>6</sup>, Felix Kreidel<sup>7</sup>, Michael Huntgeburth<sup>8</sup>, Michel Zuber<sup>9</sup>, Patrick Verta<sup>10</sup>, Paul Grayburn<sup>11</sup>, Alec Vahanian<sup>1,2,3</sup>, and Francesco Maisano<sup>9</sup>



# Conclusions

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**Etiology ≠ Functional Anatomy**



**Personalized evaluation of the MV**



**Tailored Therapeutic Approach**