A Pathologic Understanding of the Mitral Valve Complex

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TCTAP

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I have relevant financial relationships

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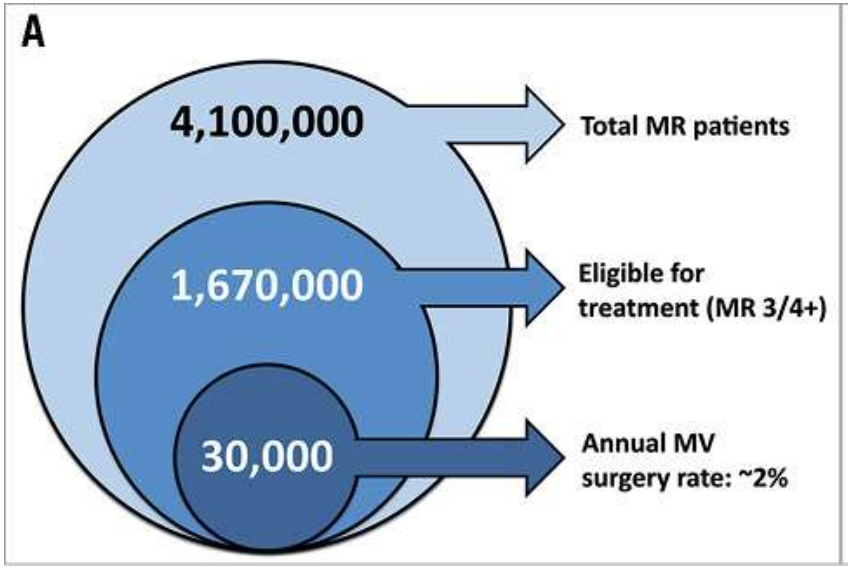
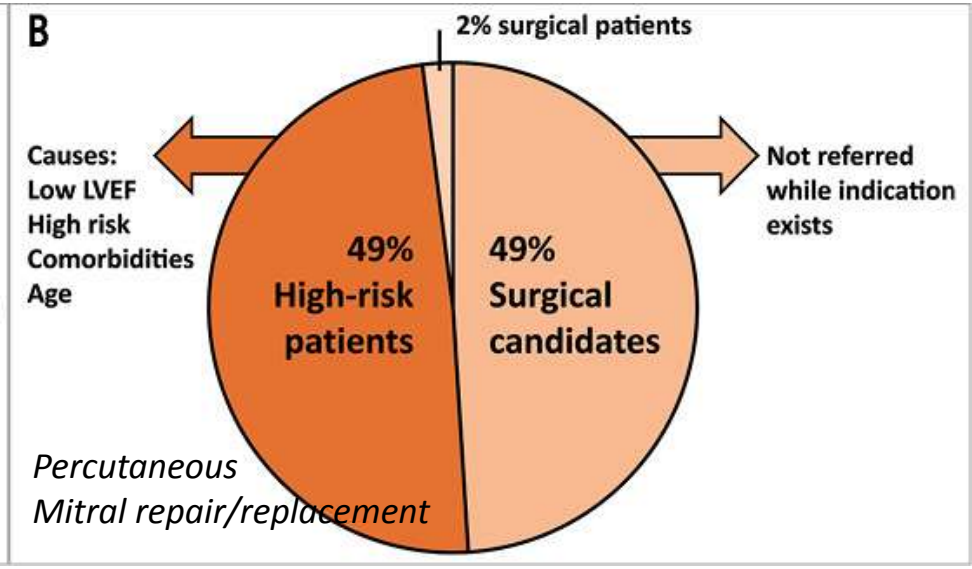
Patient Population with MR and Treatment Evaluation

Patient population with MR



United States data

Treatment Evaluation for MR



Approximations derived from the literature

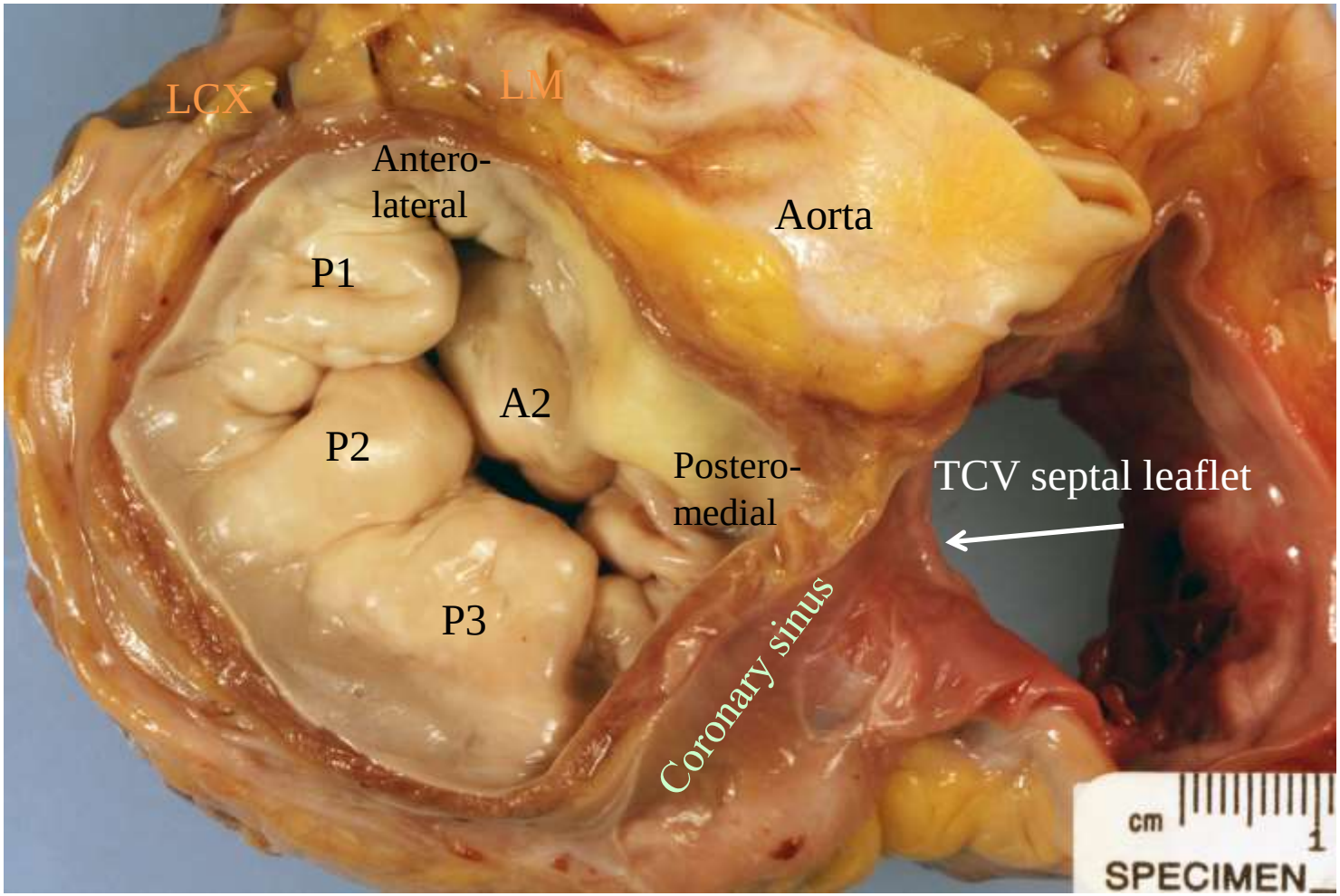
Head SJ, et al. EuroIntervention 2014;9:1133-1135

Mitral Valve Disease

- **Mitral Regurgitation**
  - Degenerative: Myxomatous degeneration (mitral valve prolapse), flail mitral leaflet
  - Functional
    - Ischemic mitral regurgitation (papillary muscle ischemia and infarction - 20%)
    - Mitral annular dilatation (dilated cardiomyopathy)
  - Infective endocarditis -2-5%
  - Rheumatic – 2-5%
  - Congenital disorders (cleft mitral valve)
  - Mitral annular calcification

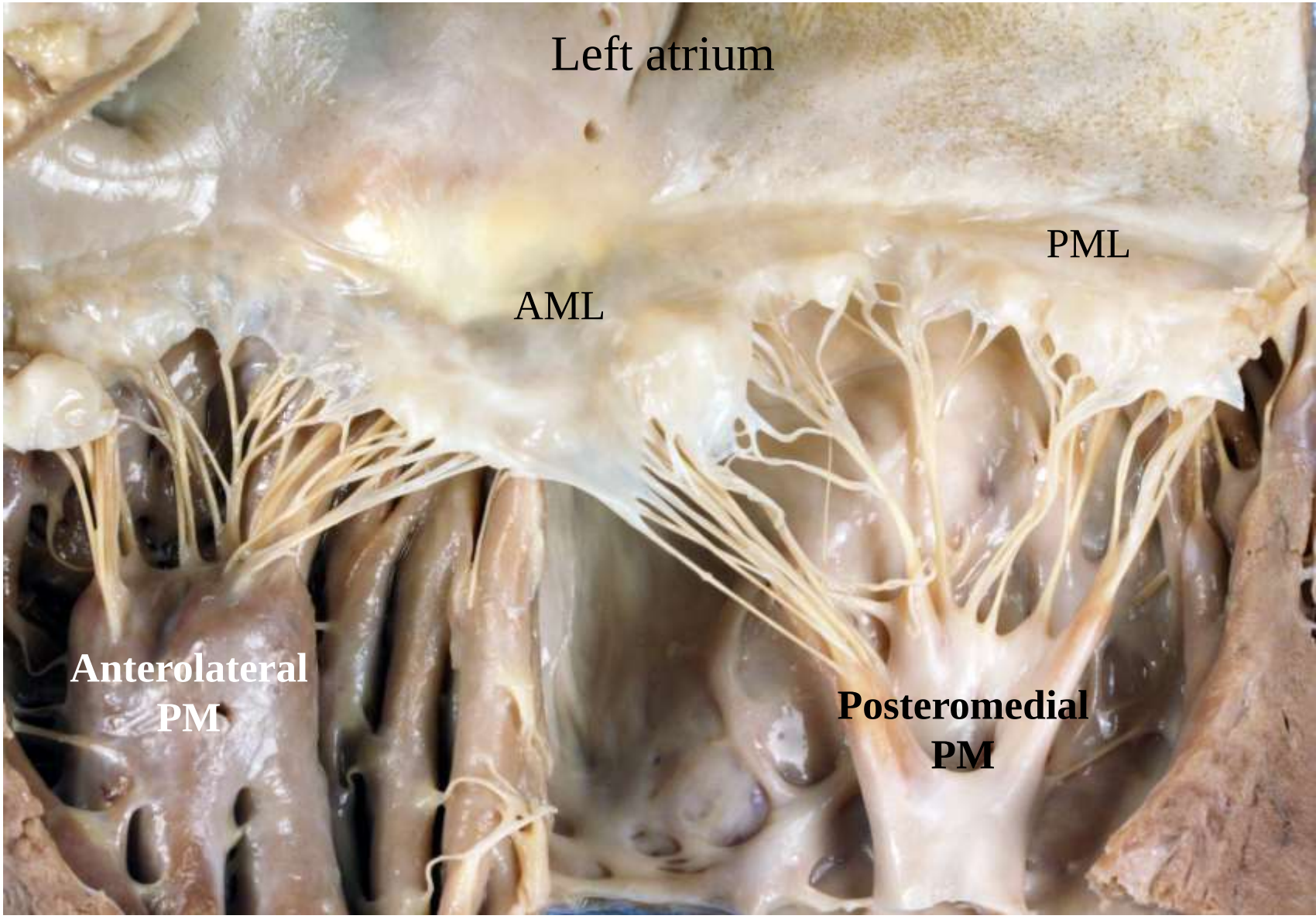
- Percutaneous approaches to repair depend on target of repair
  - Leaflets
  - Direct or indirect annuloplasty
  - Chamber remodeling

Degenerative mitral valve (MV Prolapse)



Ischemic MR

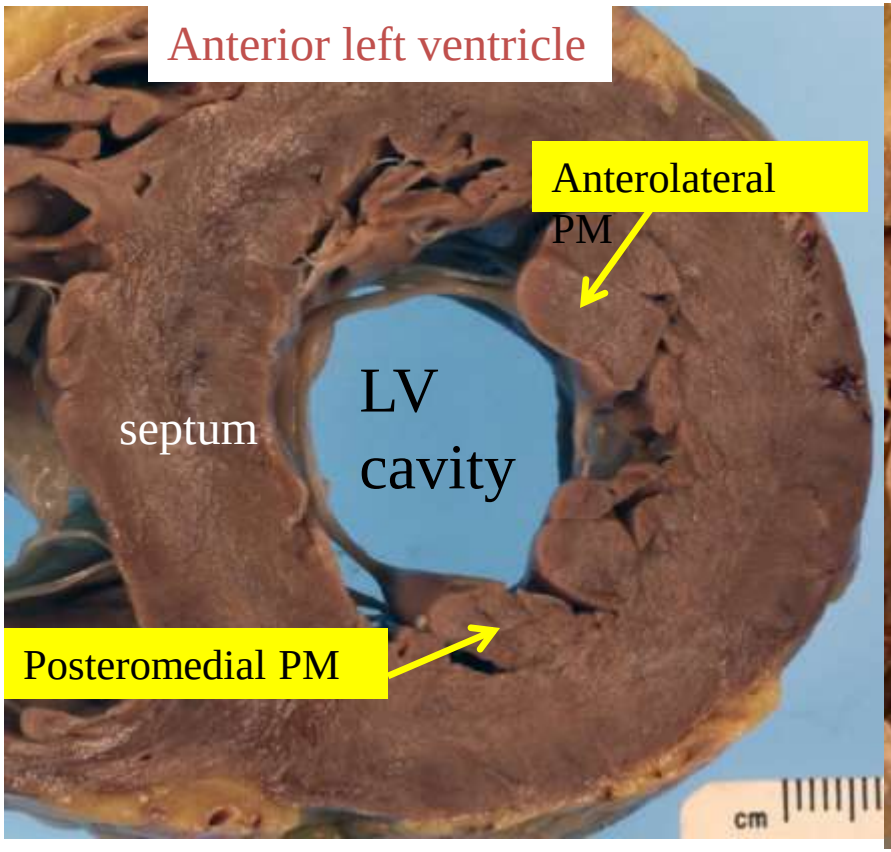
77-year-old male history of HTN, CAD, prior MI (posterior LV) with chronic total occlusion RCA

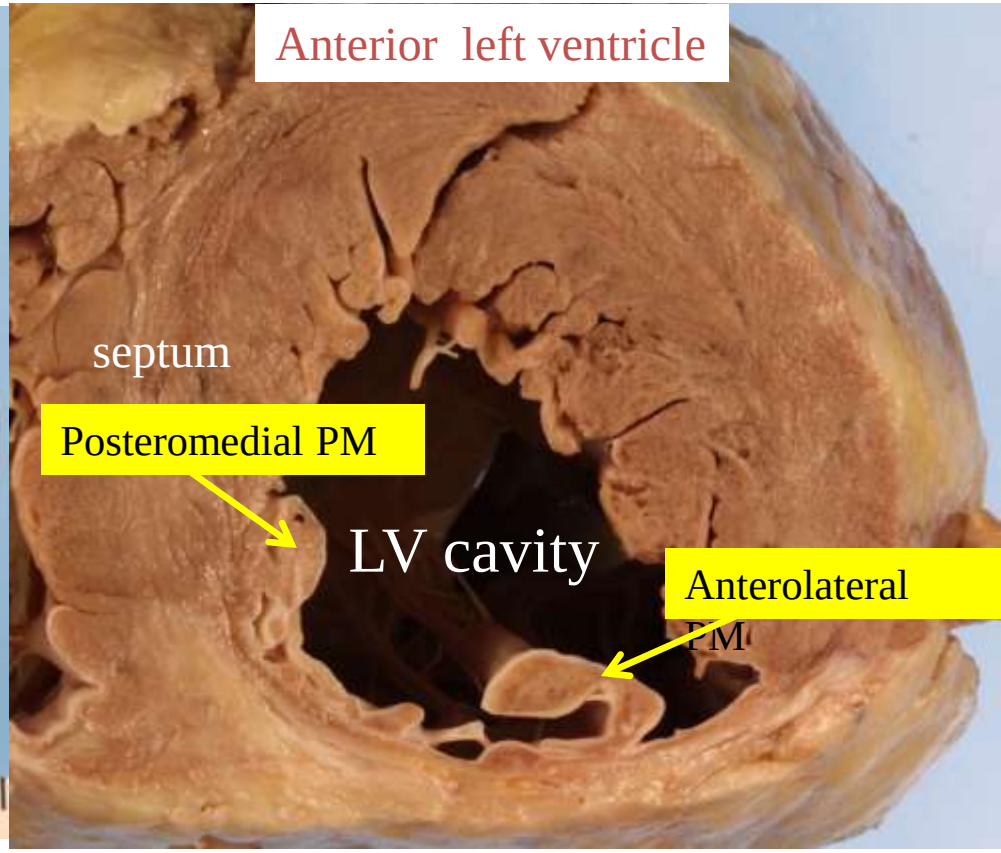


LV Remodeling in Ischemic MR

Normal heart
75-year-old male involved in MVA

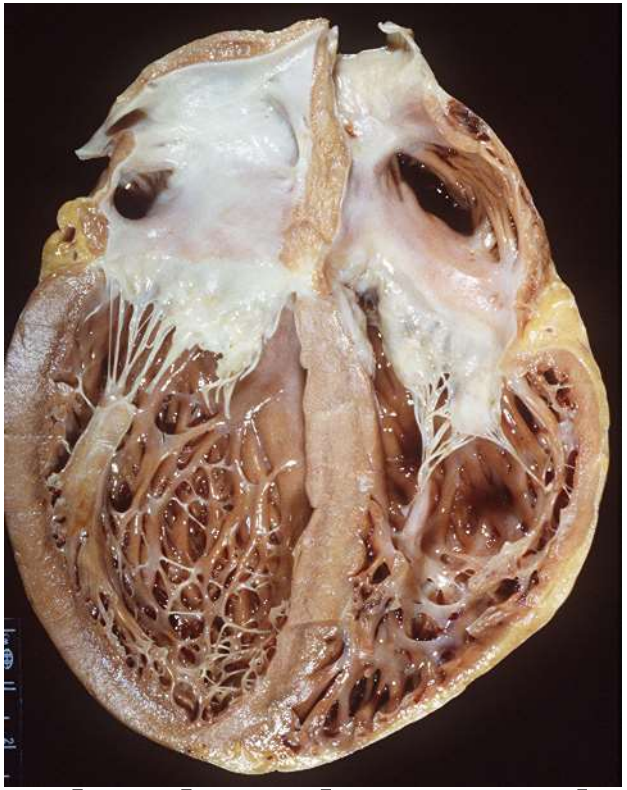
Ischemic MR
77-year-old male history of HTN, prior MI (posterior LV) total occlusion RCA



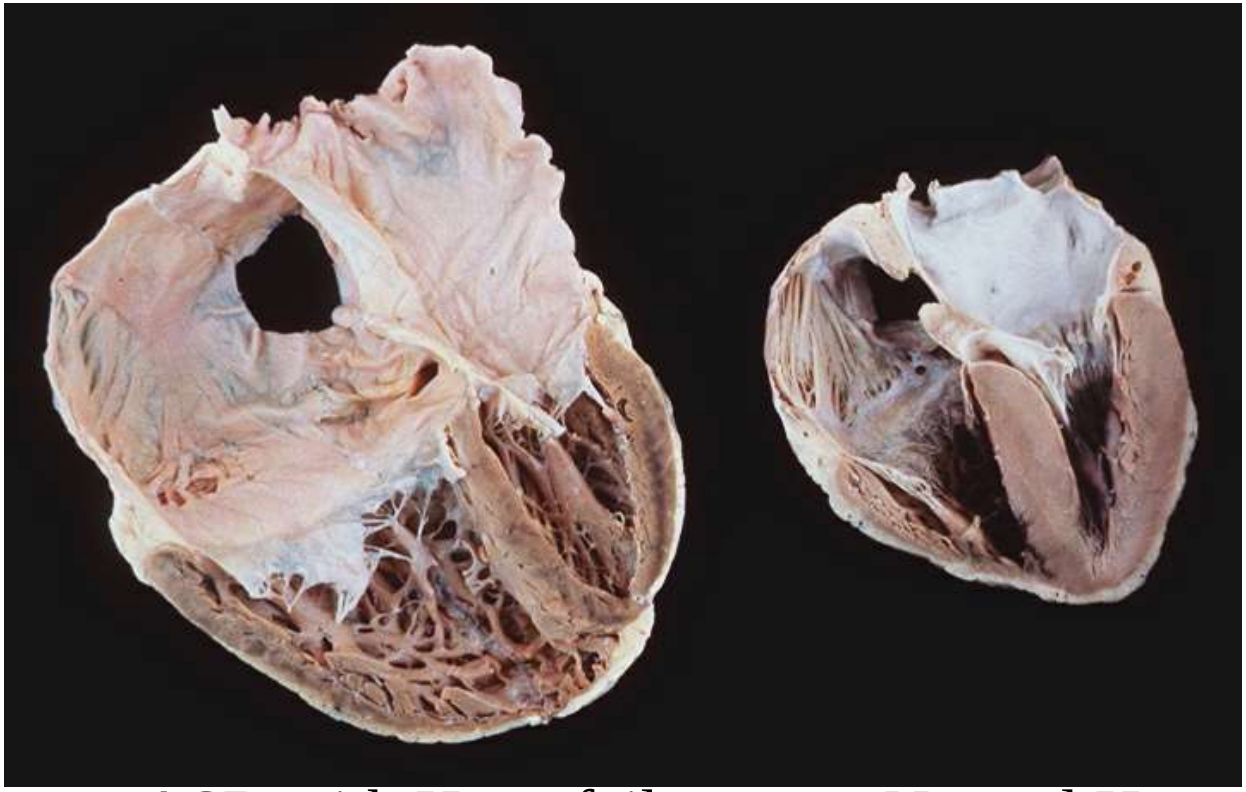


Pathologic sections depicting the Echo view

Congestive Heart Failure



Dilated Cardiomyopathy

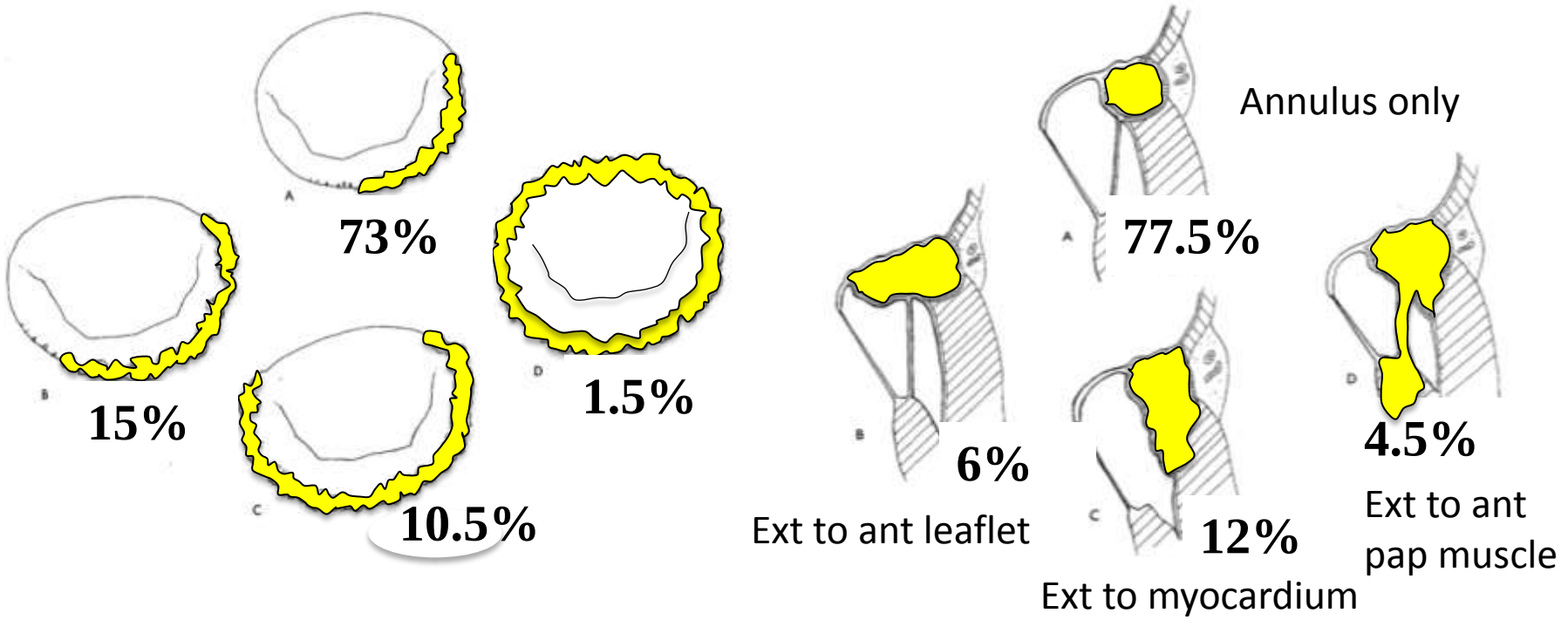


ASD with Heart failure

Normal Heart

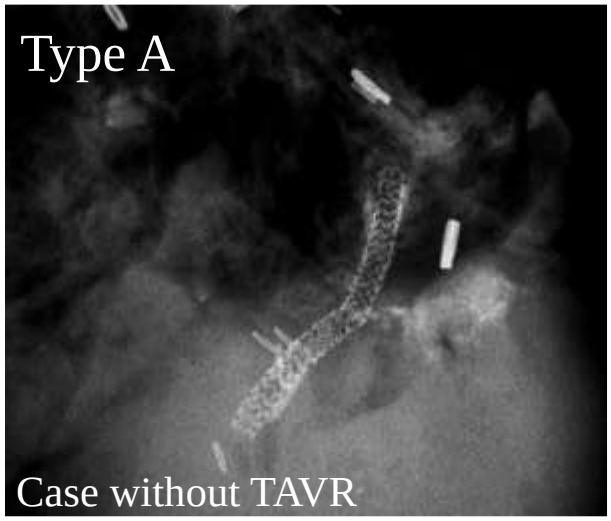
Extensive Calcification of the Mitral Annulus: Pathology

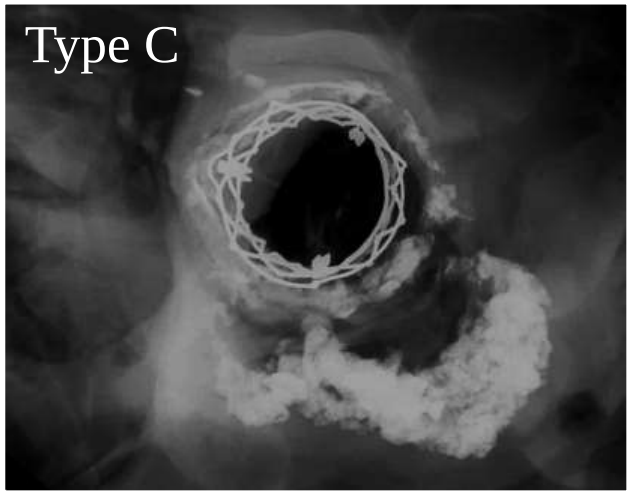
- Mitral Annular Calcification
- No. of Patients = 68; 51% M, 49% F; mean age 62, range 18-82 years; NYHA class I and II = 49%, III-IV =51%; sinus rhythm = 69%.

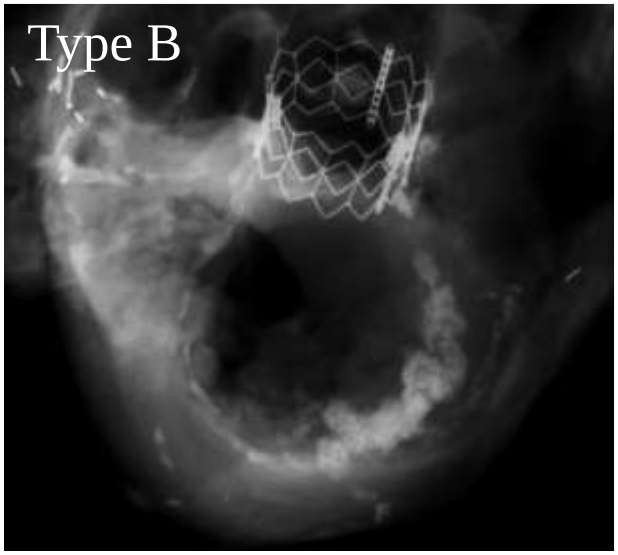


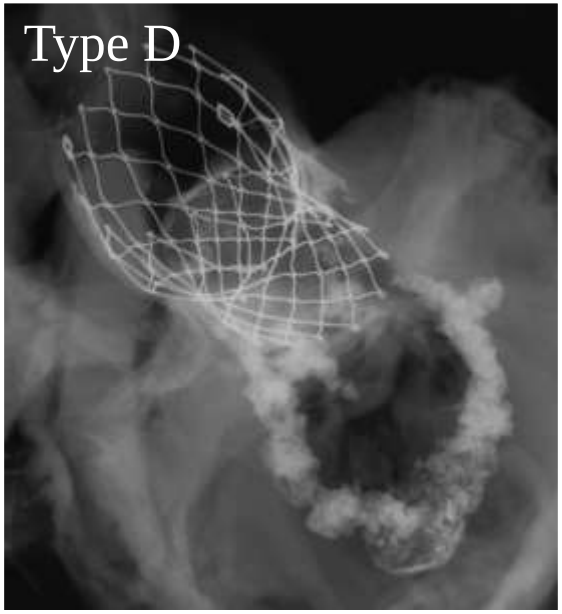
Carpentier AF et al. J Thorac Cardiovasc Surg 1996;111:718-30

In our Registry of TAVR the prevalence of Mitral Annular Calcification is as High as 50%

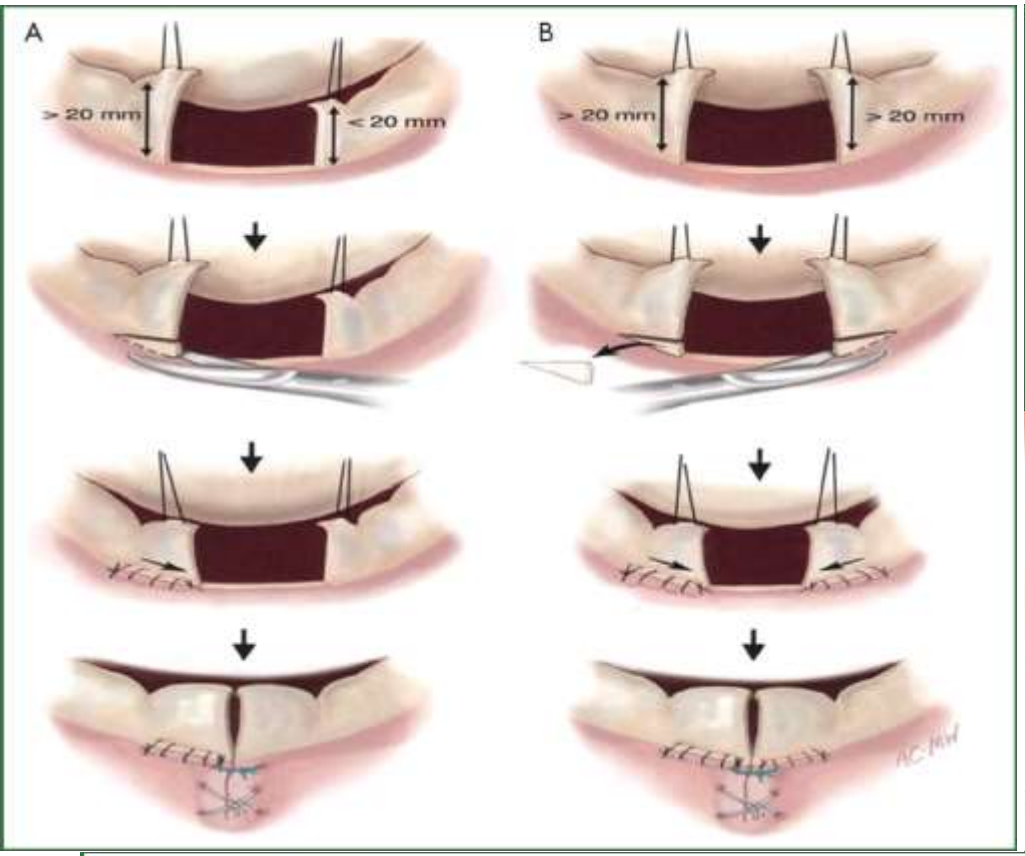


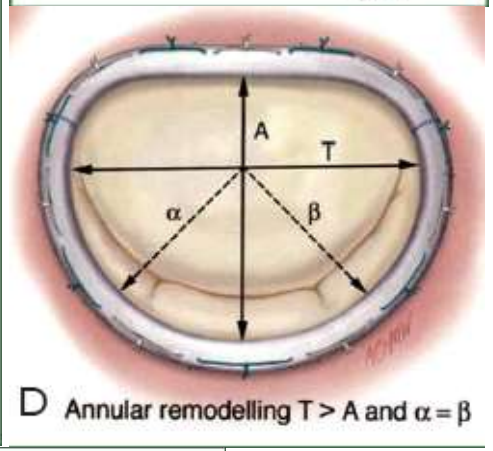


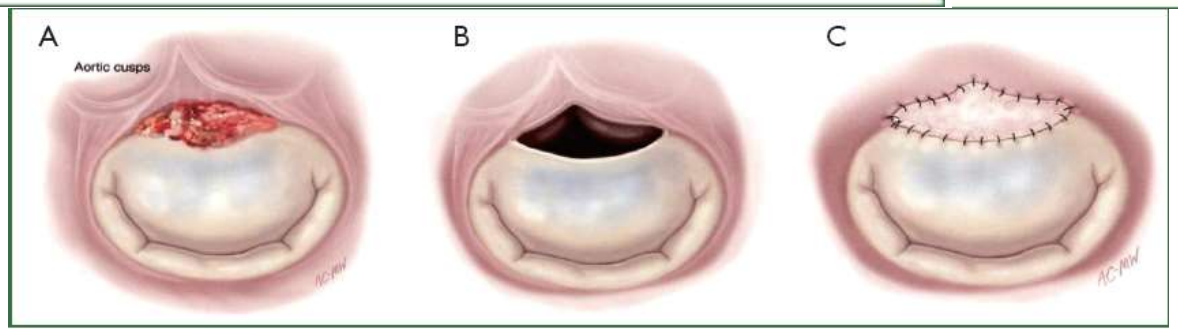




Surgical Repair of Mitral Valve Regurgitation from Degenerative disease is a very successful procedure







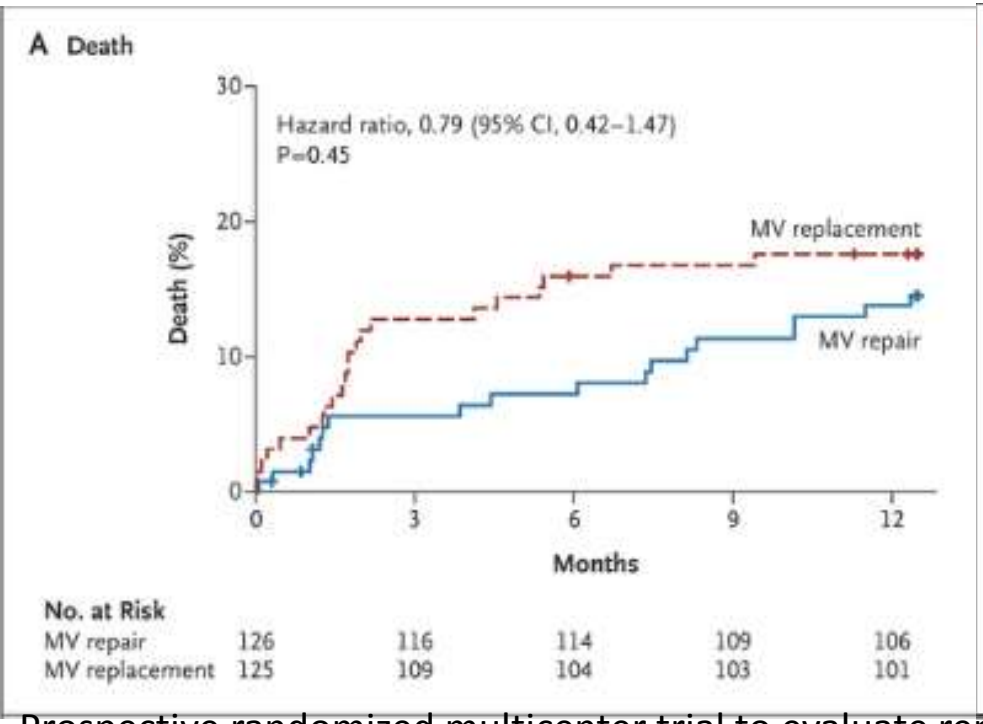
Surgery for DMR is very successful with less than 1% hospital mortality

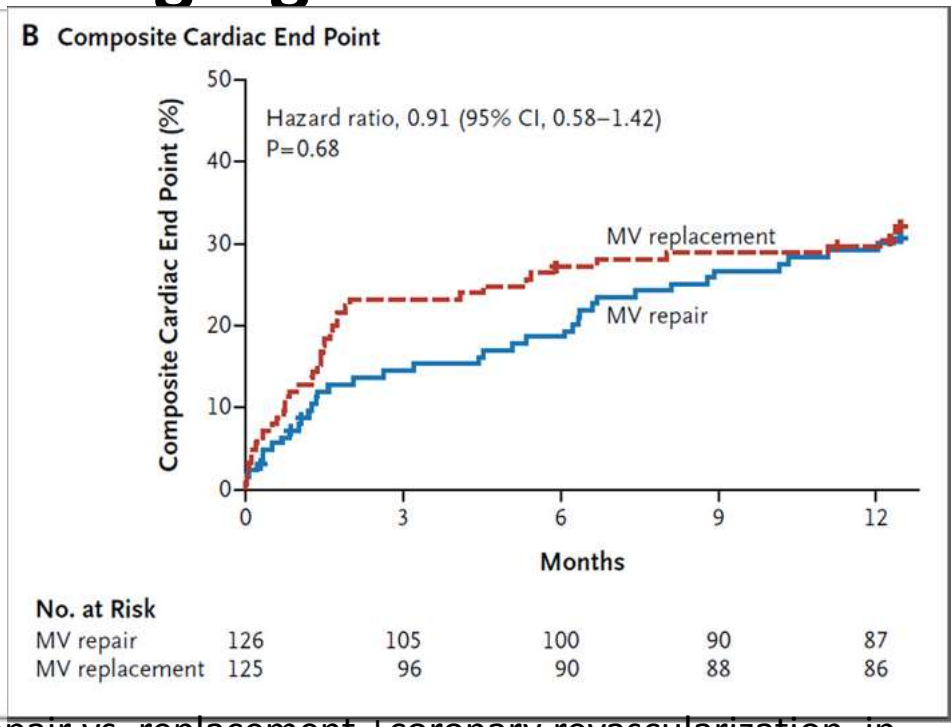
Long-term survival is 93.8% at 10-years

Surgery for functional MR (FMR) carries a higher risk compared to DMR; 25 to 30% recurrence of MR at mid-term.

Madesis A, et al. J Thorac Dis 2014;6(S1):S39-S51

Mitral-Valve Repair vs. Replacement for Severe Ischemic Mitral Regurgitation





Prospective randomized multicenter trial to evaluate repair vs. replacement ±coronary revascularization, in patients with severe MR (251 pts/22 centers)

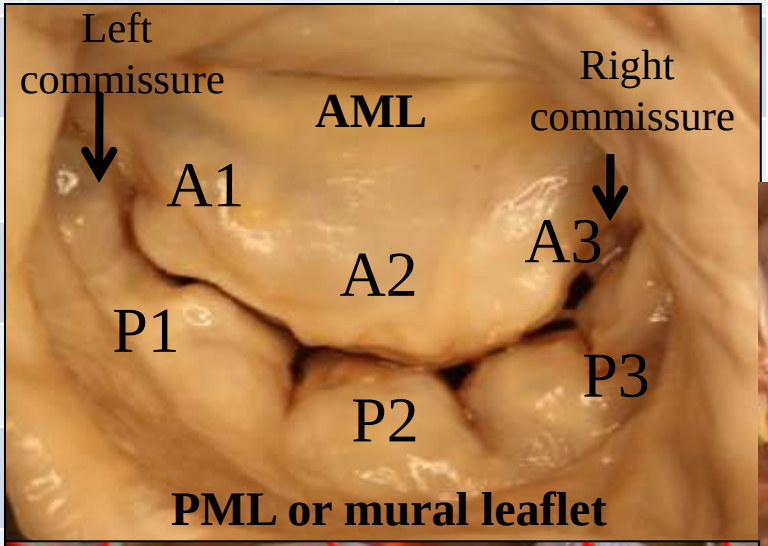
Primary endpoint: LV remodeling, assessed by LV end-diastolic volume indices performed 12 months after randomization

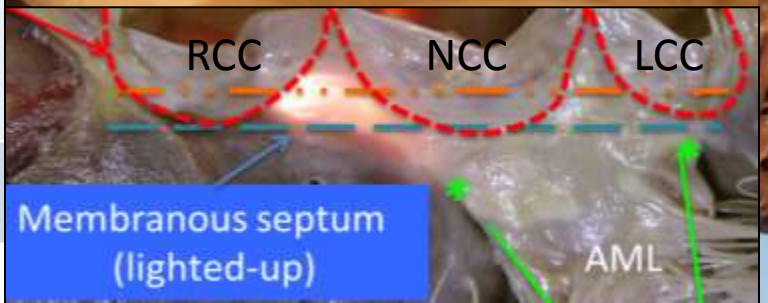
Secondary end point: mortality, a composite of MACCE (rate of death, stroke, subsequent surgery,Hospitalization for HF or increase in NYHA class of >1), serious adverse events, recurrent MR, quality of life and re-hospitalization

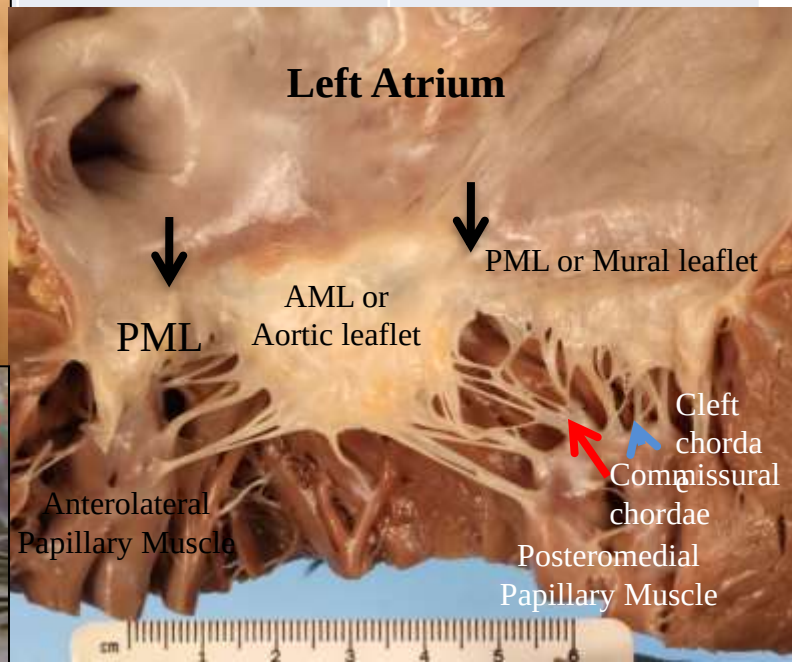
Acker MA, et al., New Engl J Med 2014:370:23-32

Transcatheter Mitral Valve Therapy

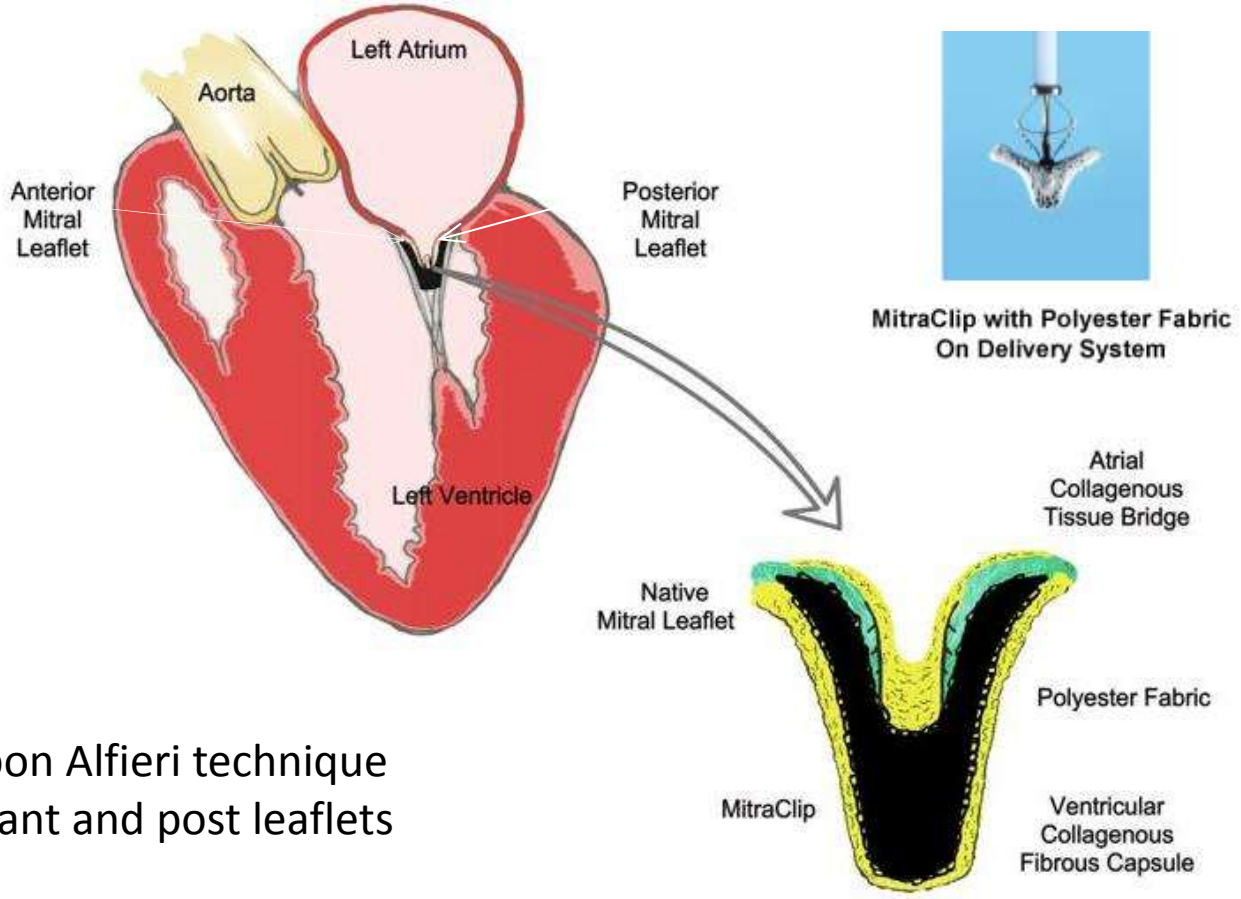
Annuloplasty	LV remodeling	Chordae	Leaflets	TMVR
Cardioband	ICoapsys	Neochord	MitraClip	Endovalve
Cardinal	BACE device	MitrFles	Mitra-Spacer	CardioAQ
Mitral Soutions		Mobius		Tendyne
MiCardia				Tiara
QuantumCor				Twelve Medical
MitraLign				Fortis
GDS				
Carillon				
PTMA				
MVSS KardiumMR				
PS3				





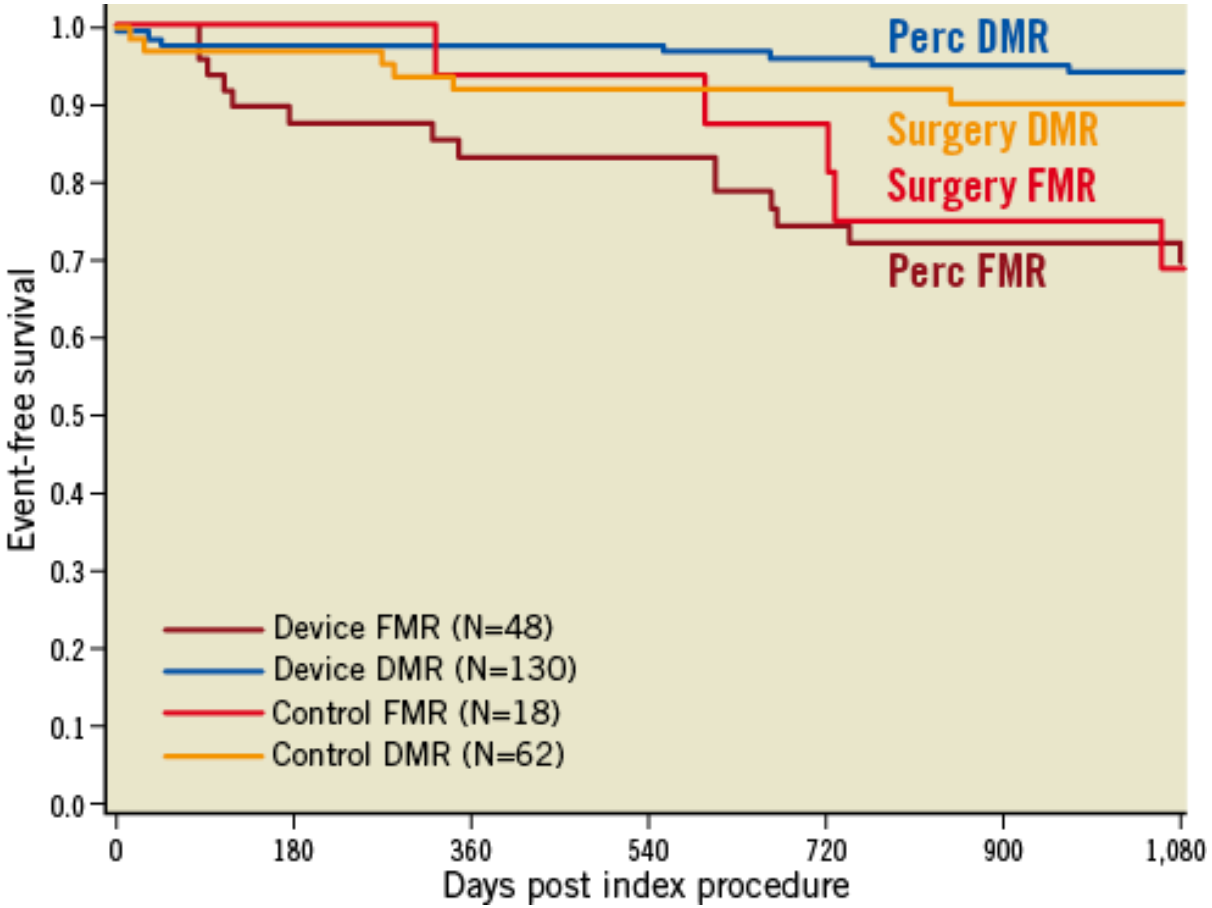


MitraClip Deployment and Healing



Based upon Alfieri technique
Bringing ant and post leaflets together

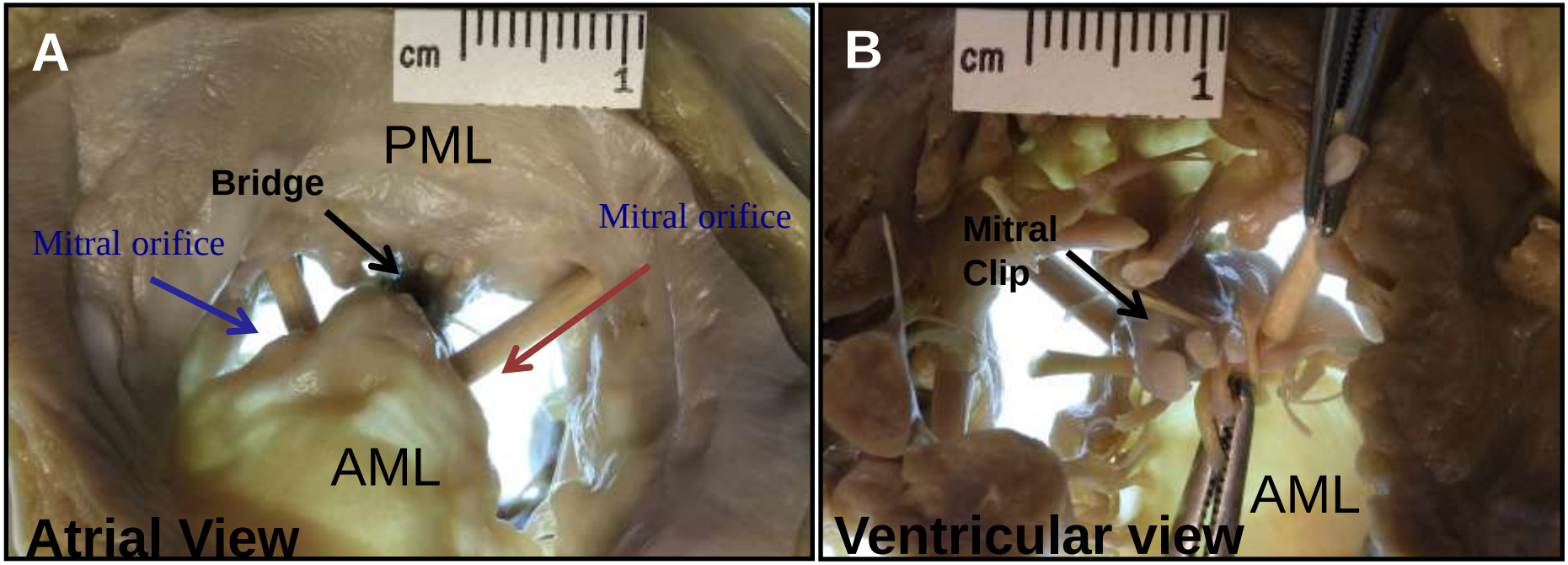
Kaplan-Meier freedom from mortality comparing functional (FMR) and degenerative (DMR)patients from Everest II randomized trial



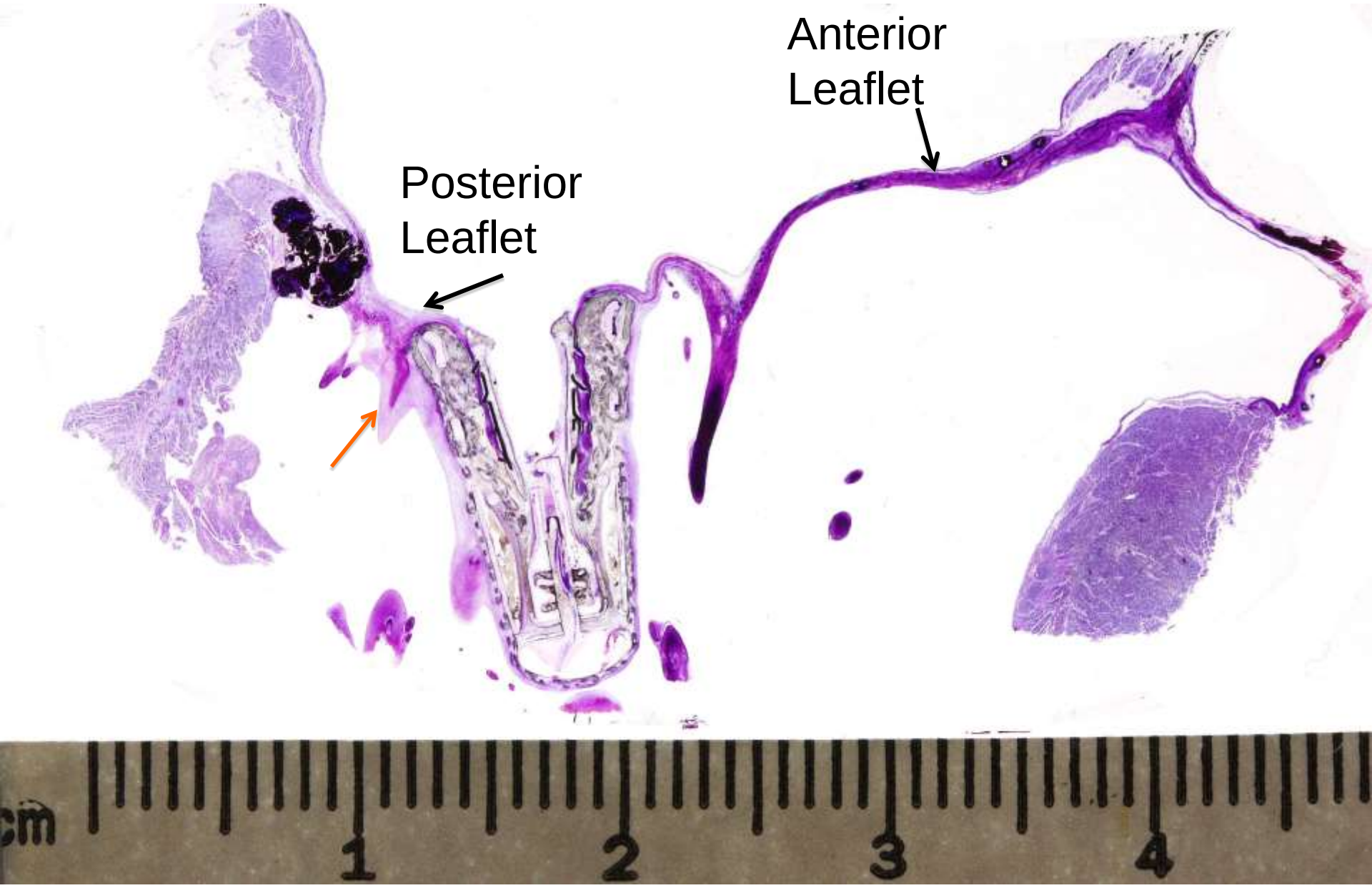
Despite the fact that MitraClip has CE mark approval and shows good results in secondary MR patients in large European registries, it only has FDA approval for the treatment of high surgical risk patients with primary MR in the U.S.

EuroIntervention 2013;9:S118-S123

Mitral Clip implanted for Functional MR

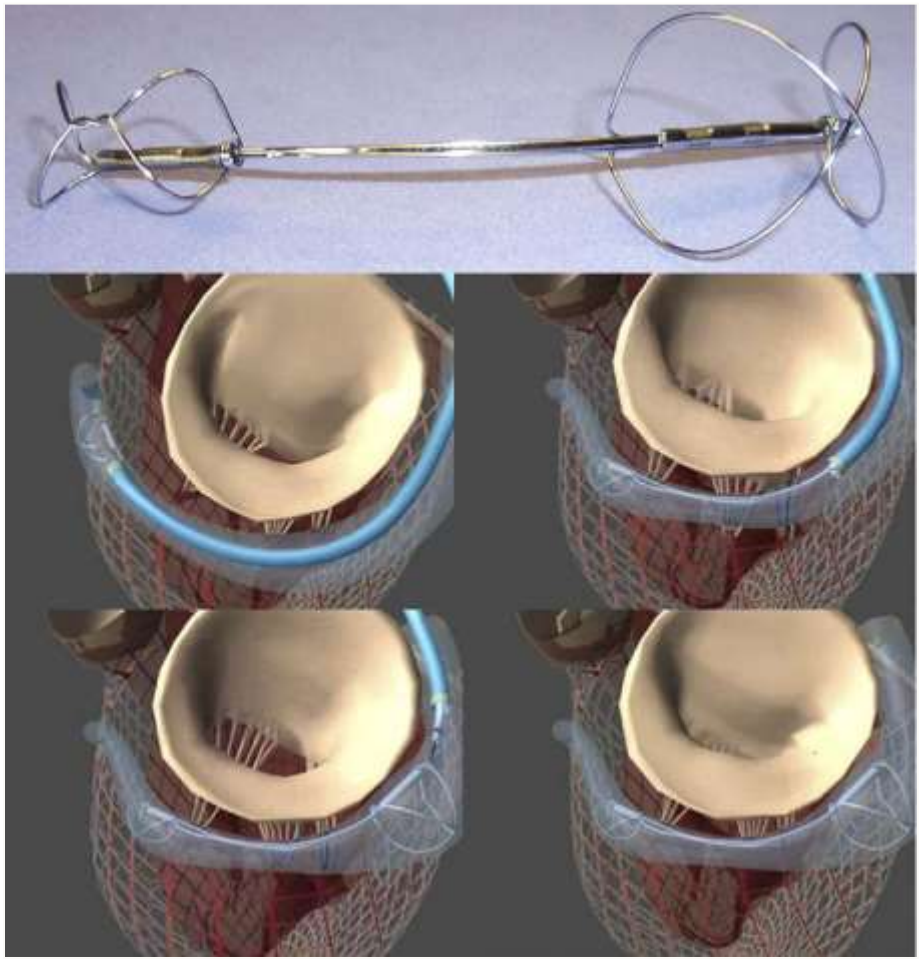


Implant duration 356 days

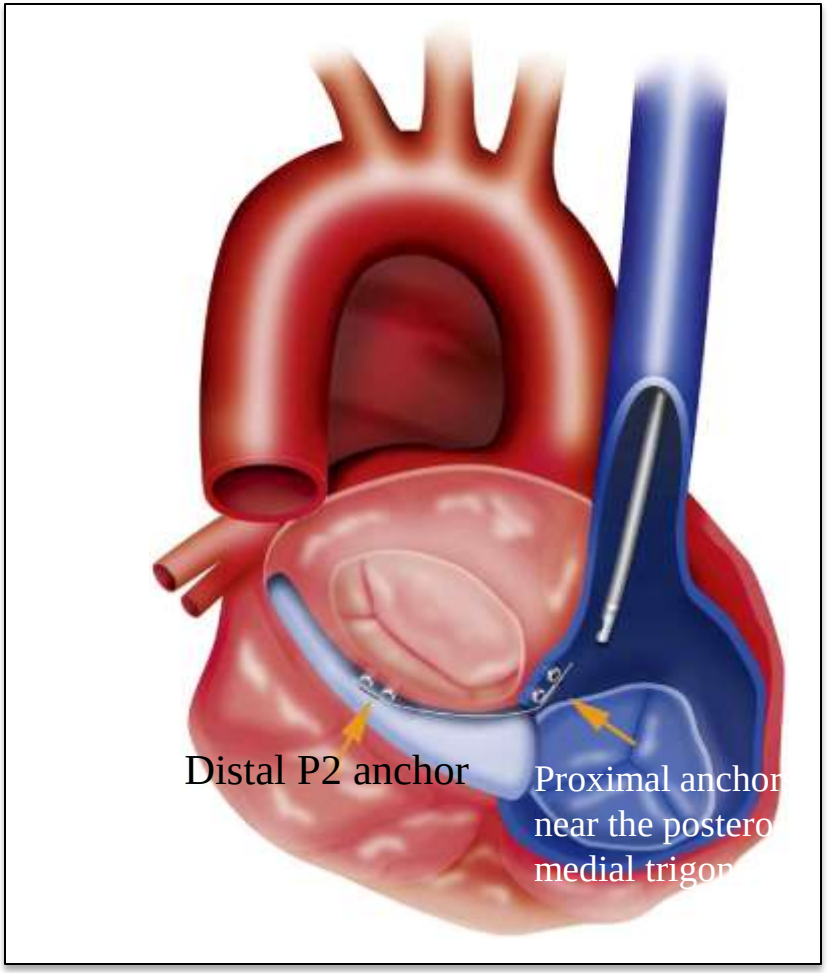

Anterior
Leaflet
Posterior
Leaflet
cm
1
2
3
4

Indirect Annuloplasty Approaches

Carillon Mitral Contour System
(Cardiac Dimension, Inc. Kirkland, WA)



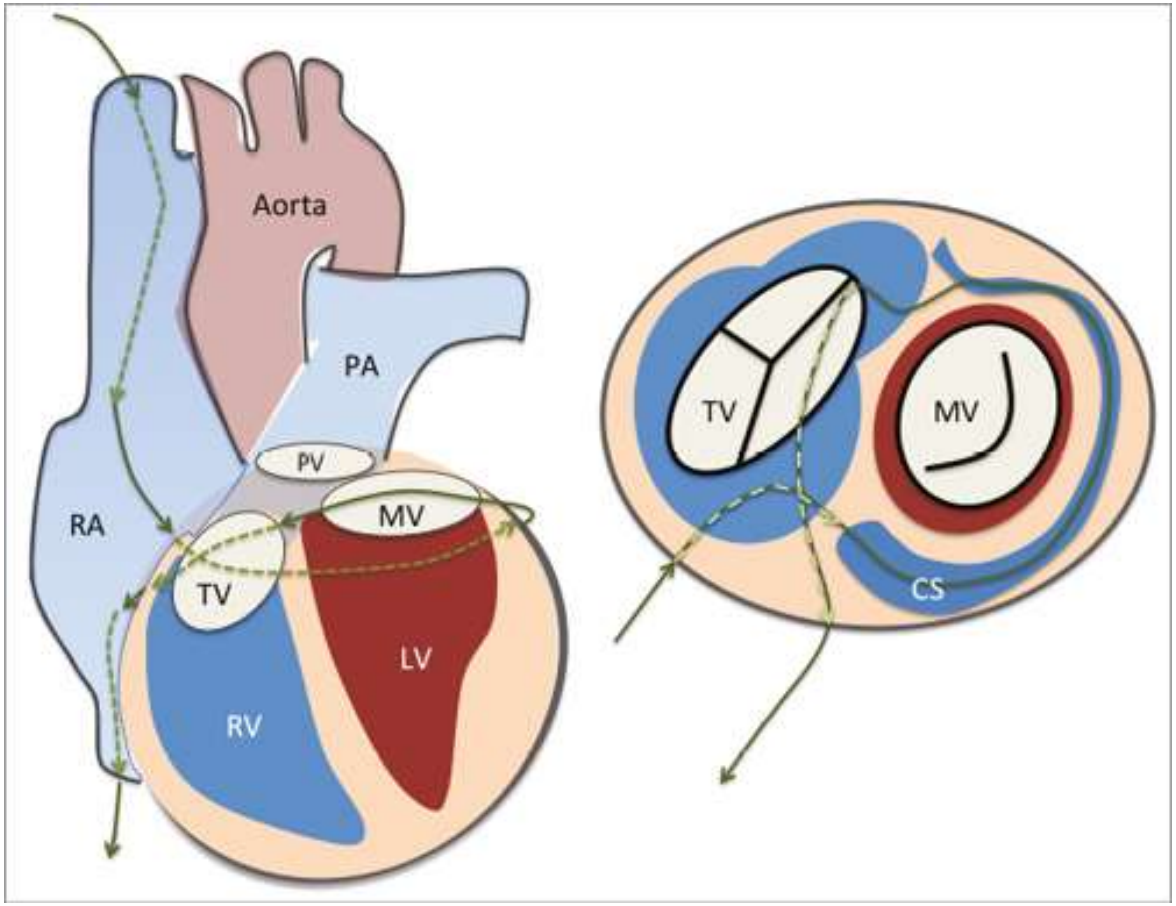
St. Jude Device
(St. Jude Medical, Minneapolis, Minnesota)



Device implants within coronary sinus with aim of pushing posterior annulus anteriorly thereby reducing annulus dimension

? About distance of the CS from the annulus

Mitral Cerclage

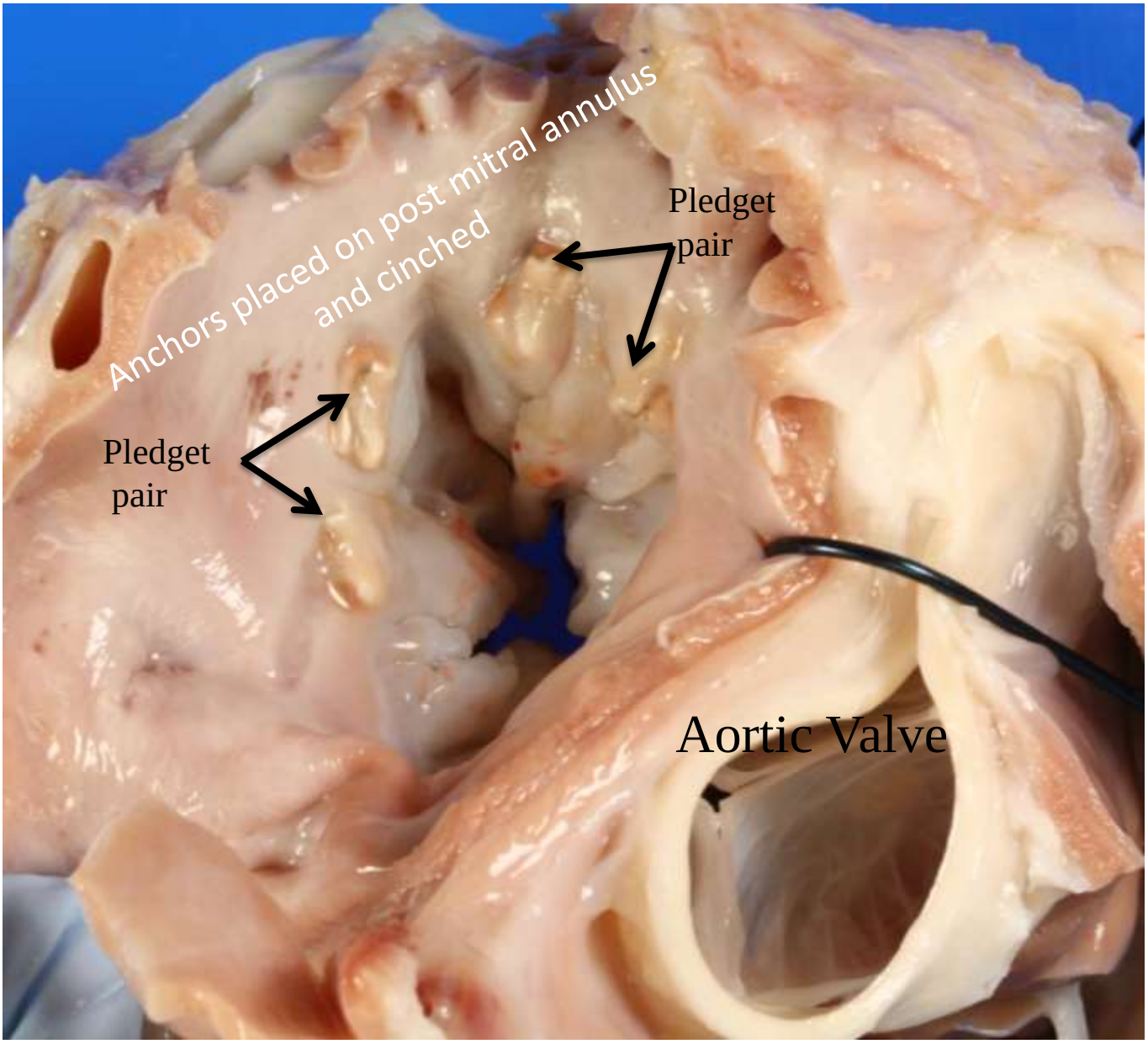


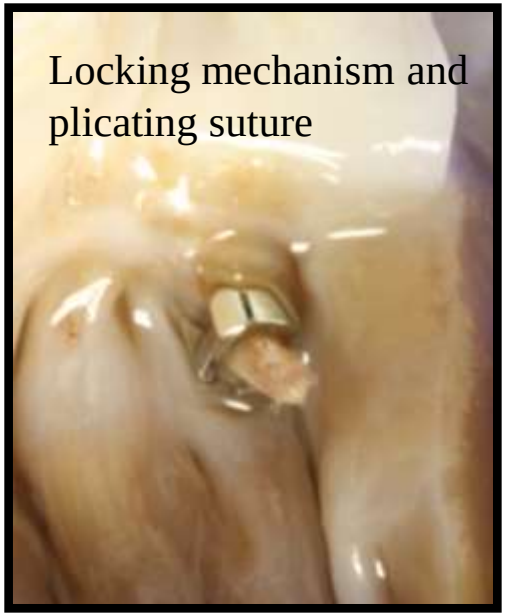
- Performed in porcine and cadaver studies
- Coronary sinus guidewire engages the basal septal perforator vein to re-enter the right heart where it is exchanged for a suture to introduce Cerclage tension around the annulus.

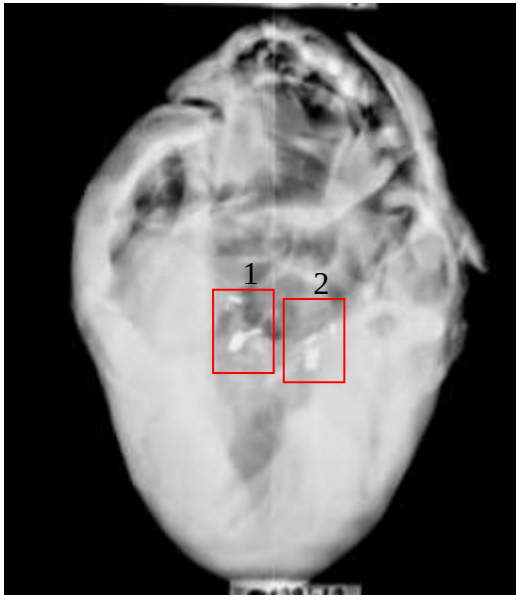
EuroIntervention 2015;11:W53-W57
Transcatheter direct mitral valve annuloplasty: a brief review

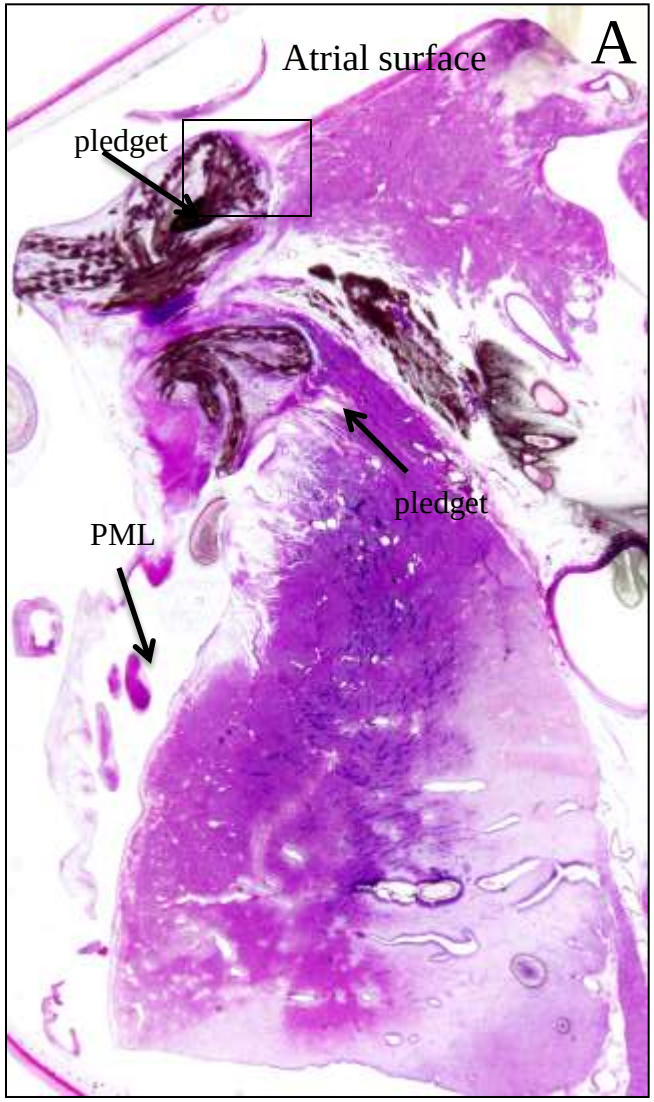
Direct Annuloplasty

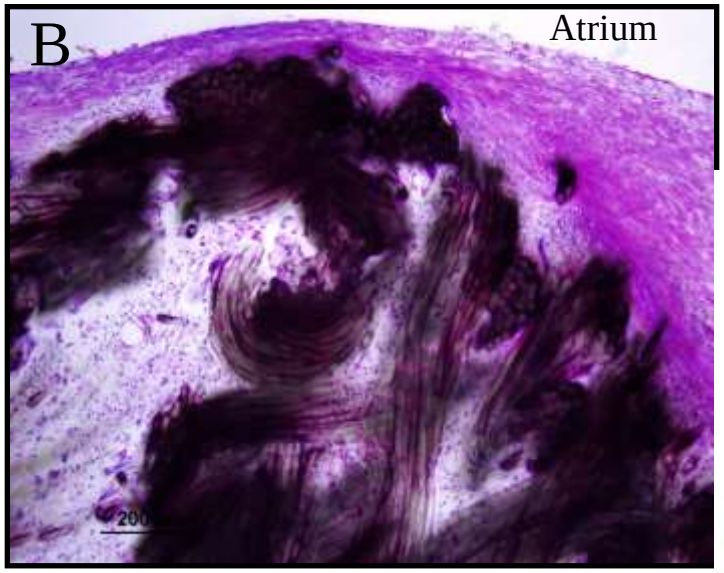
Mitralign 2x2 Annuloplasty System (30d porcine model)

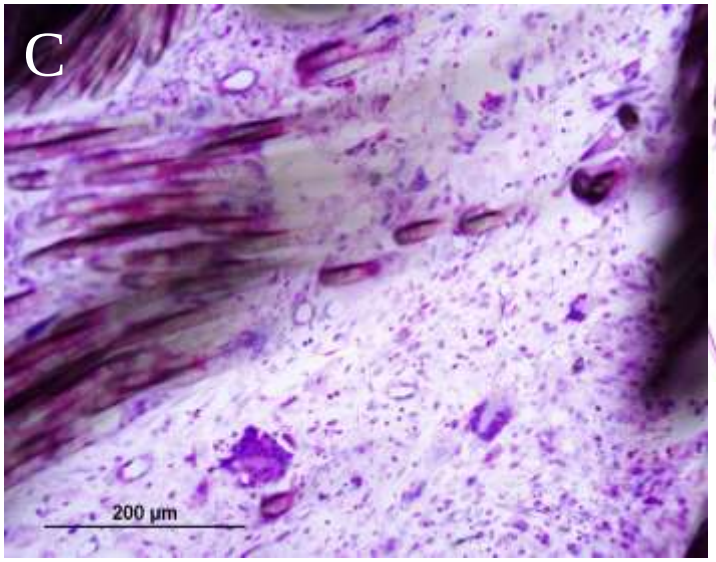


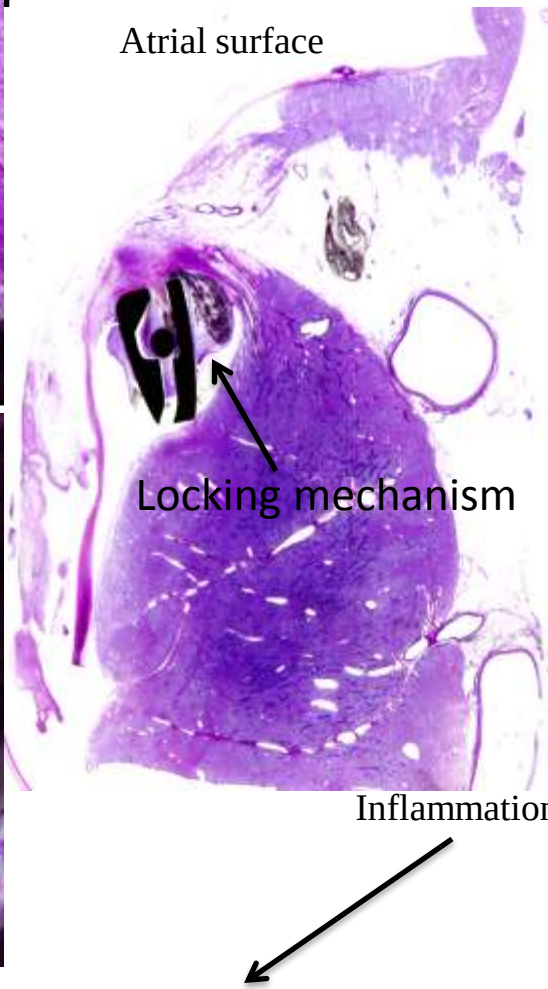






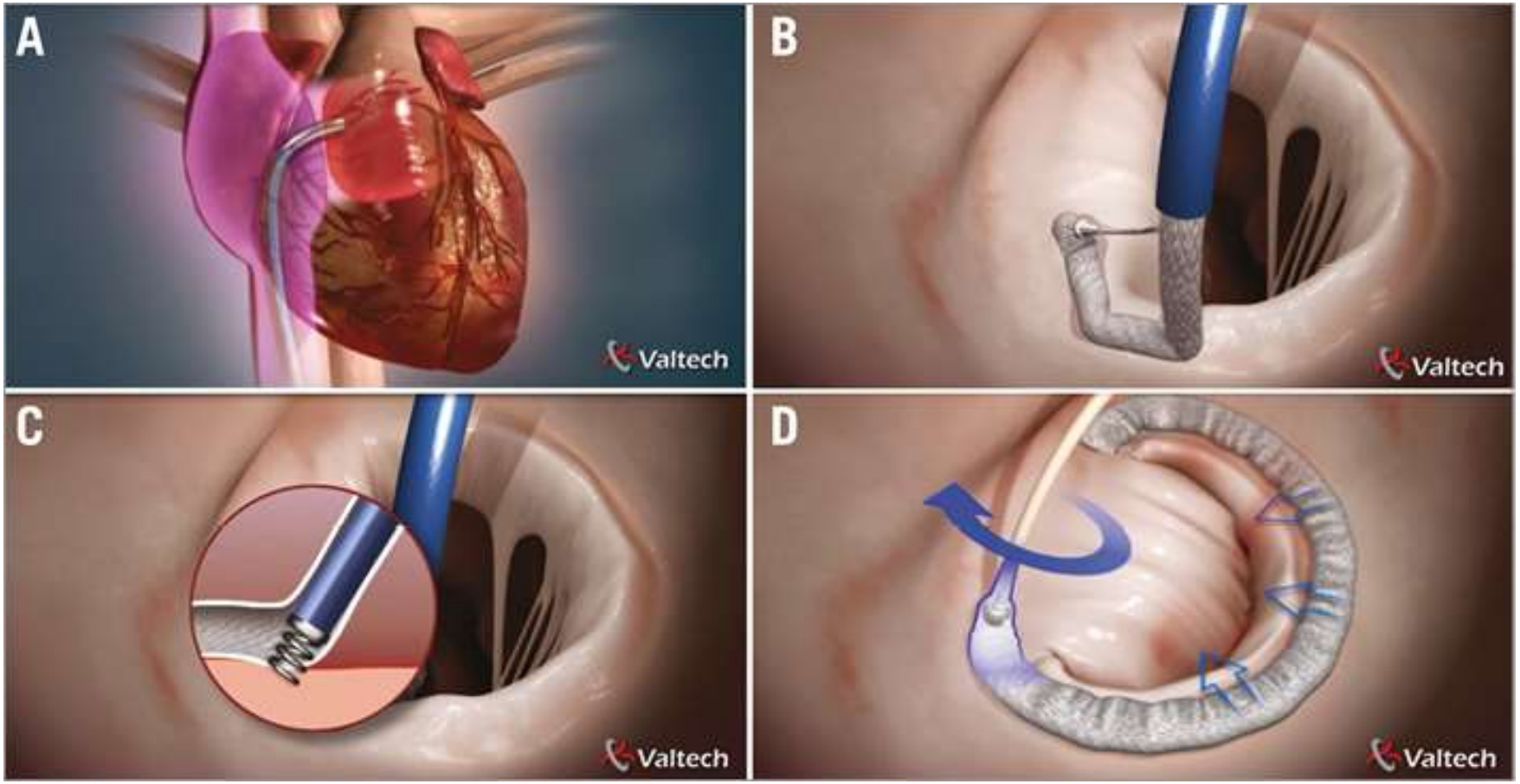






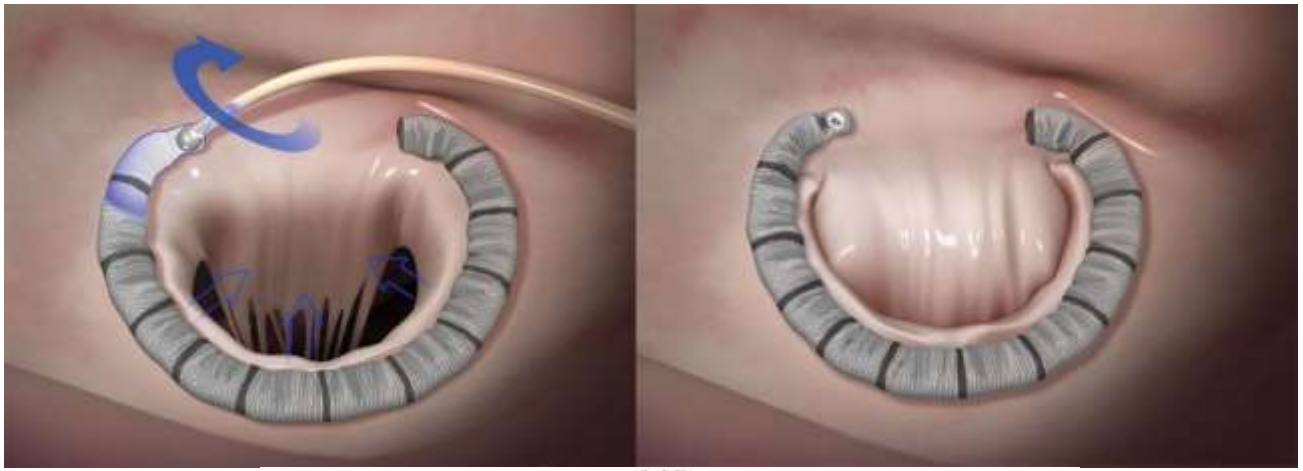
Histologic Sections of the Mitralign Device

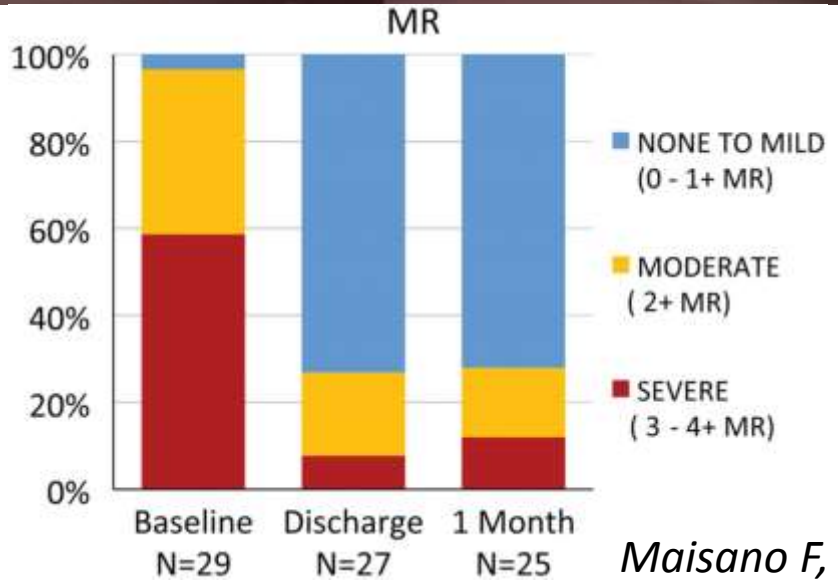
Cardioband Transcatheter Direct Mitral Valve Annuloplasty System



EuroIntervention 2015;11:W58-W59
The Cardioband transcatheter direct mitral valve annuloplasty system

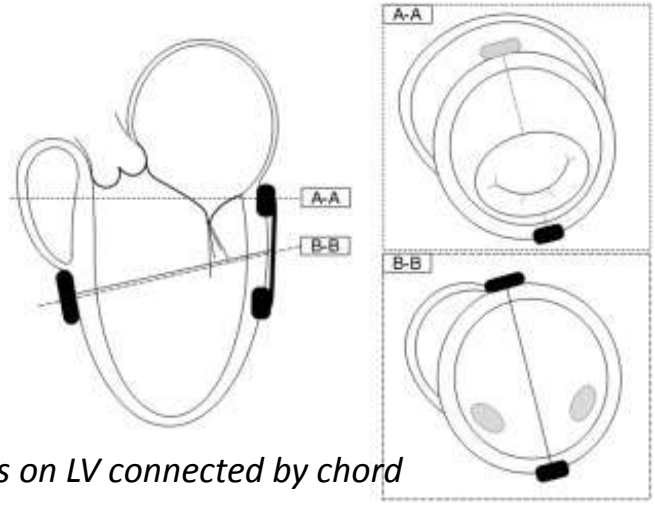
Cardioband, transcatheter surgical-like direct mitral valve annuloplasty system: early results of the feasibility trial



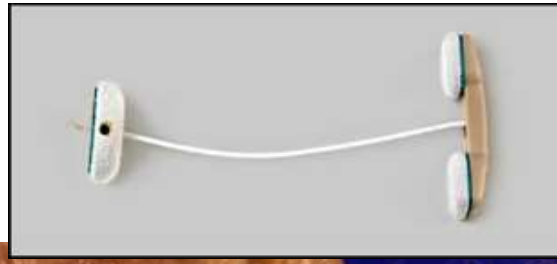


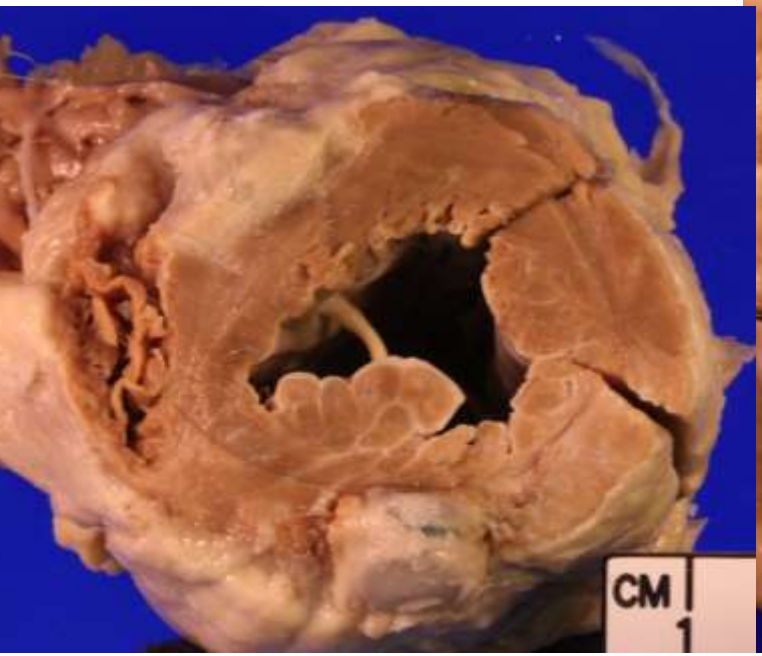
Maisano F, et al. Euro Heart J doi:10.1093

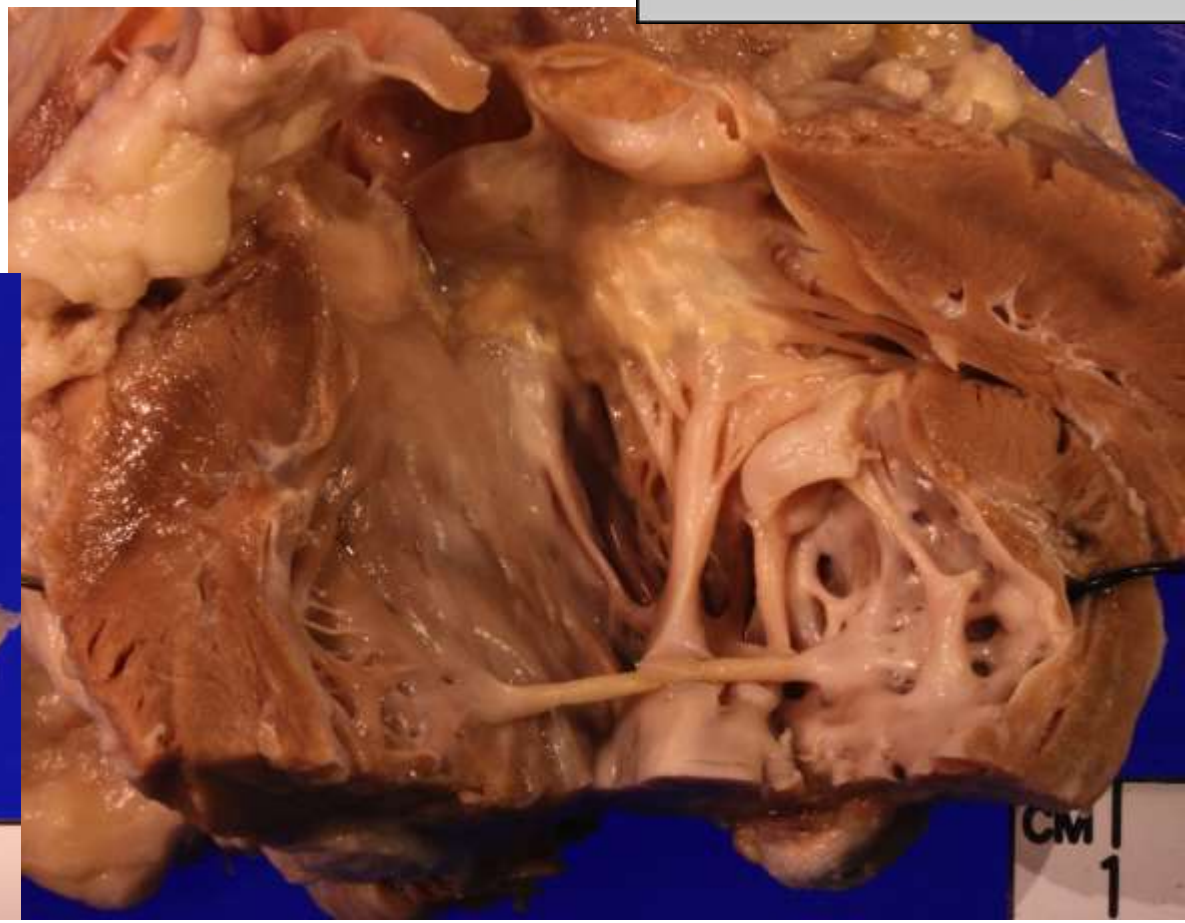
Left Ventricular Remodeling (Coapsys)



Pads on LV connected by chord





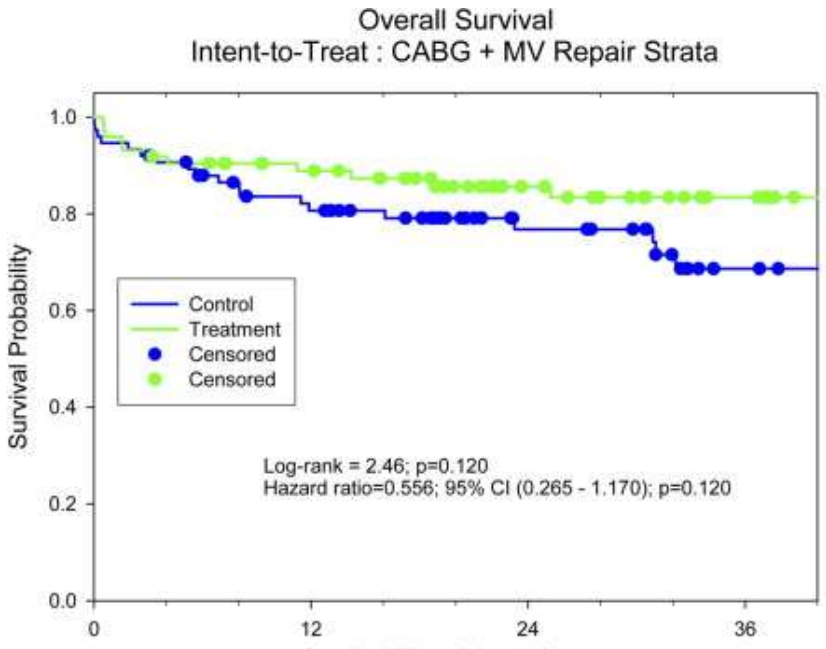


Device reduces MR by reducing the antero-posterior mitral annular diameter, thereby re-approximating the anterior and posterior mitral valve leaflets. This device includes an anterior and posterior epicardial pad connected and drawn together by a trans-ventricular chord that brings together intervening structures, such as the anterior and posterior mitral valve annulus.

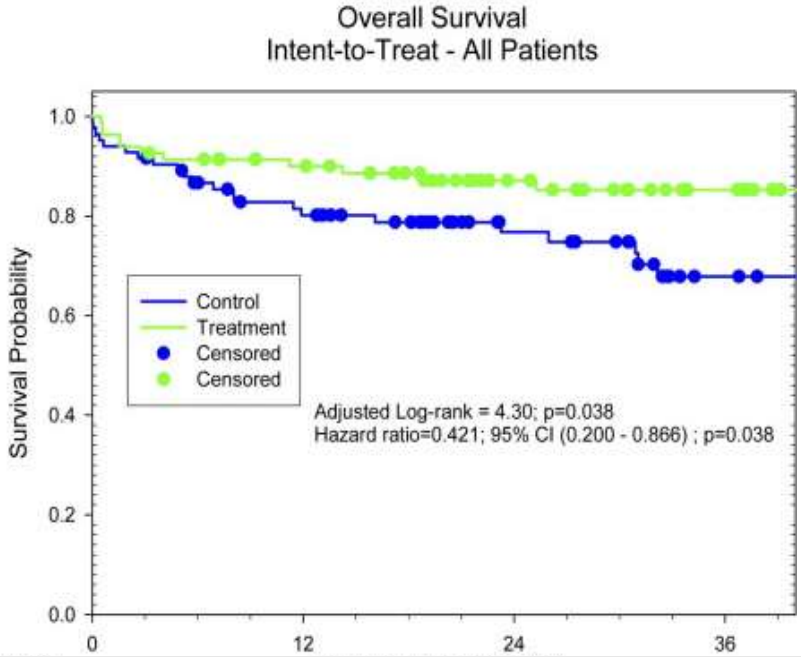
Outcomes of the RESTOR_MV trial (Randomized Evaluation of A Surgical Treatment for Off-Pump Repair of the Mitral Valve)

patients with FMR and coronary were stratified to the standard indicated surgery: either coronary artery bypass graft alone or coronary artery bypass graft with mitral valve repair. In each stratum, randomization was to either control (indicated surgery) or treatment (coronary artery bypass graft with Coapsys ventricular reshaping).

A



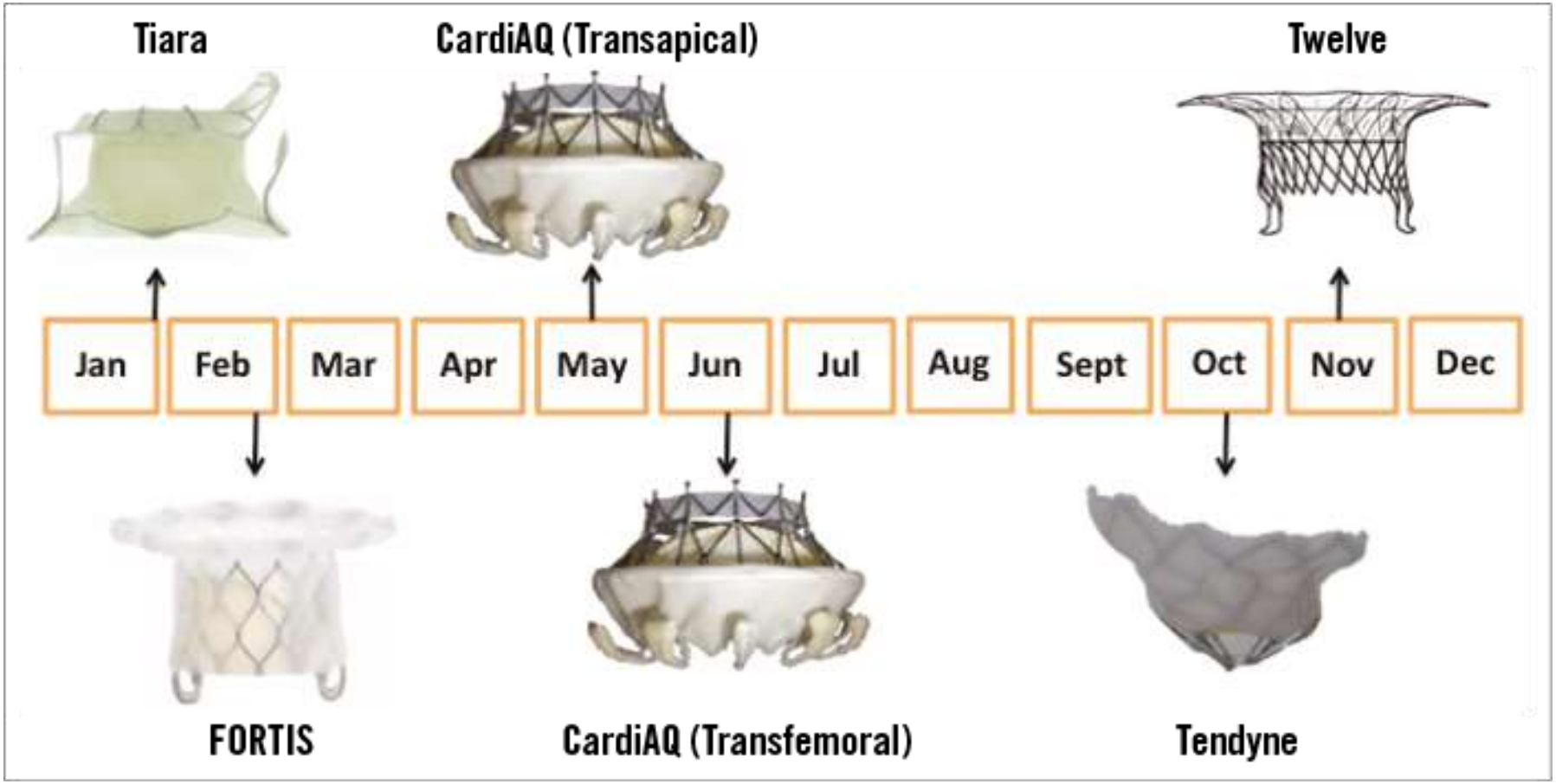
B



Number at risk					Number at risk				
Control	75	55	34	18	Control	83	61	394	22
Treatment	74	58	40	28	Treatment	82	67	48	36

Grossi EA, et al., J Am Coll Cardiol 2010;56:1984-93

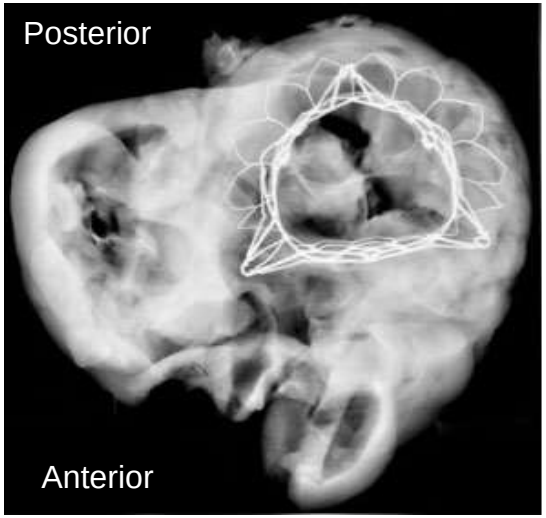
Percutaneous Transcatheter Mitral Valve Replacement Development



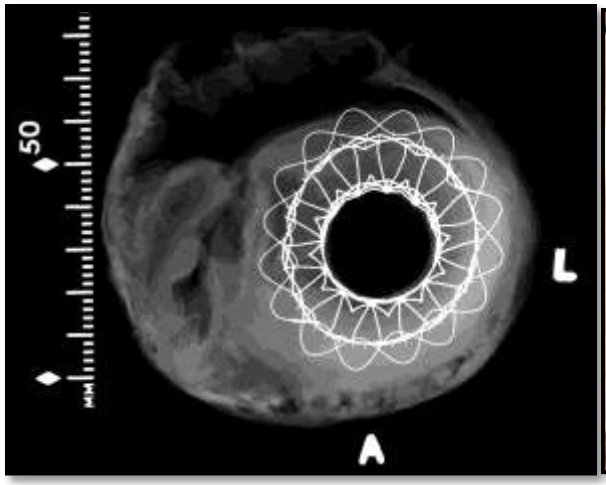
EuroIntervention 2015;11:W67-W70
Transcatheter mitral valve implantation: a brief review

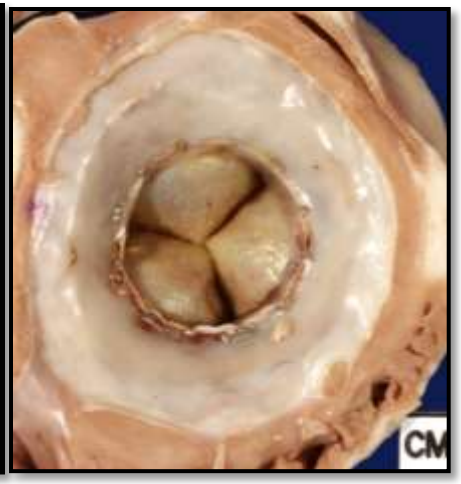
Signif. challenges: 1) asymetric shape of annulus, LV outflow obstruction, PVL

Tiara

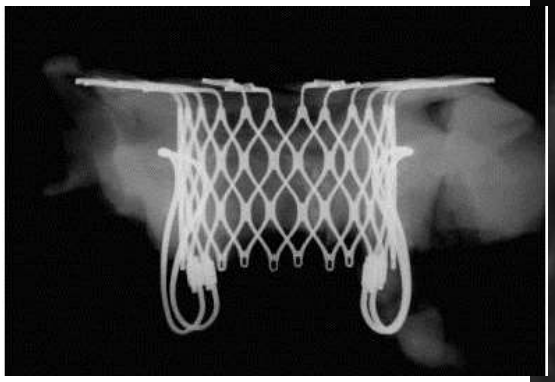


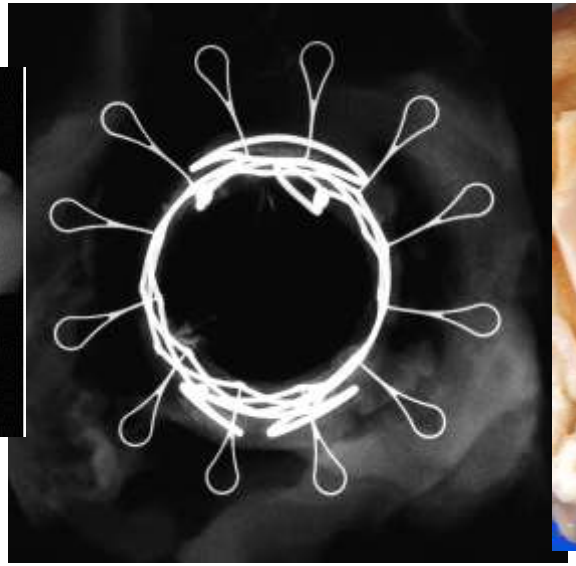
Twelve Medical

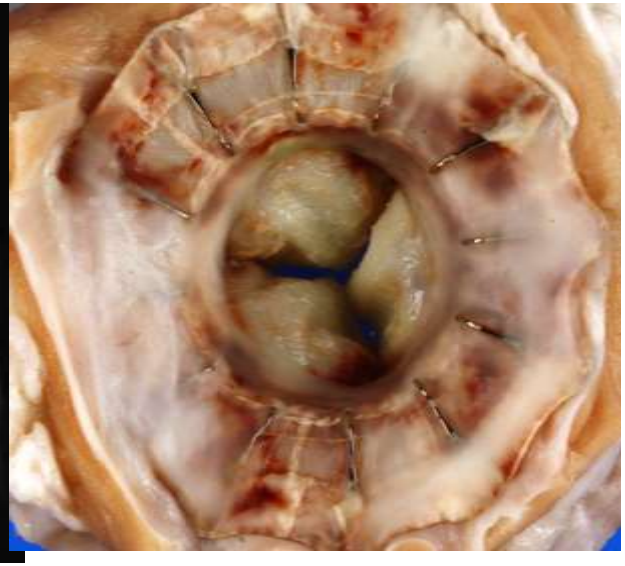




Fortis Mitral Vlave







MITRAL VALVE IS A COMPLICATED STRUCTURE; WILL REQUIRE MULTIPLE BUT SIMPLE SOLUTIONS for MR

- Repair of some sort – annuloplasty, chordal insertion, leaflet apposition, left ventricular remodeling (cinching) or combinations may work better than single procedure
- Too simple a procedure such as indirect annuloplasty may not achieve enough valve area reduction to be effective and safety is a concern because of LC artery compression
- Valve insertion may be too bulky in a complex native mitral apparatus; may work for a short time but less likely to be a long-term solution.

Following prosthetic mitral valve insertion there may be no surgical option. Valve-in valve may in an option