

Percutaneous Mitral Valve Therapies- Update 2015

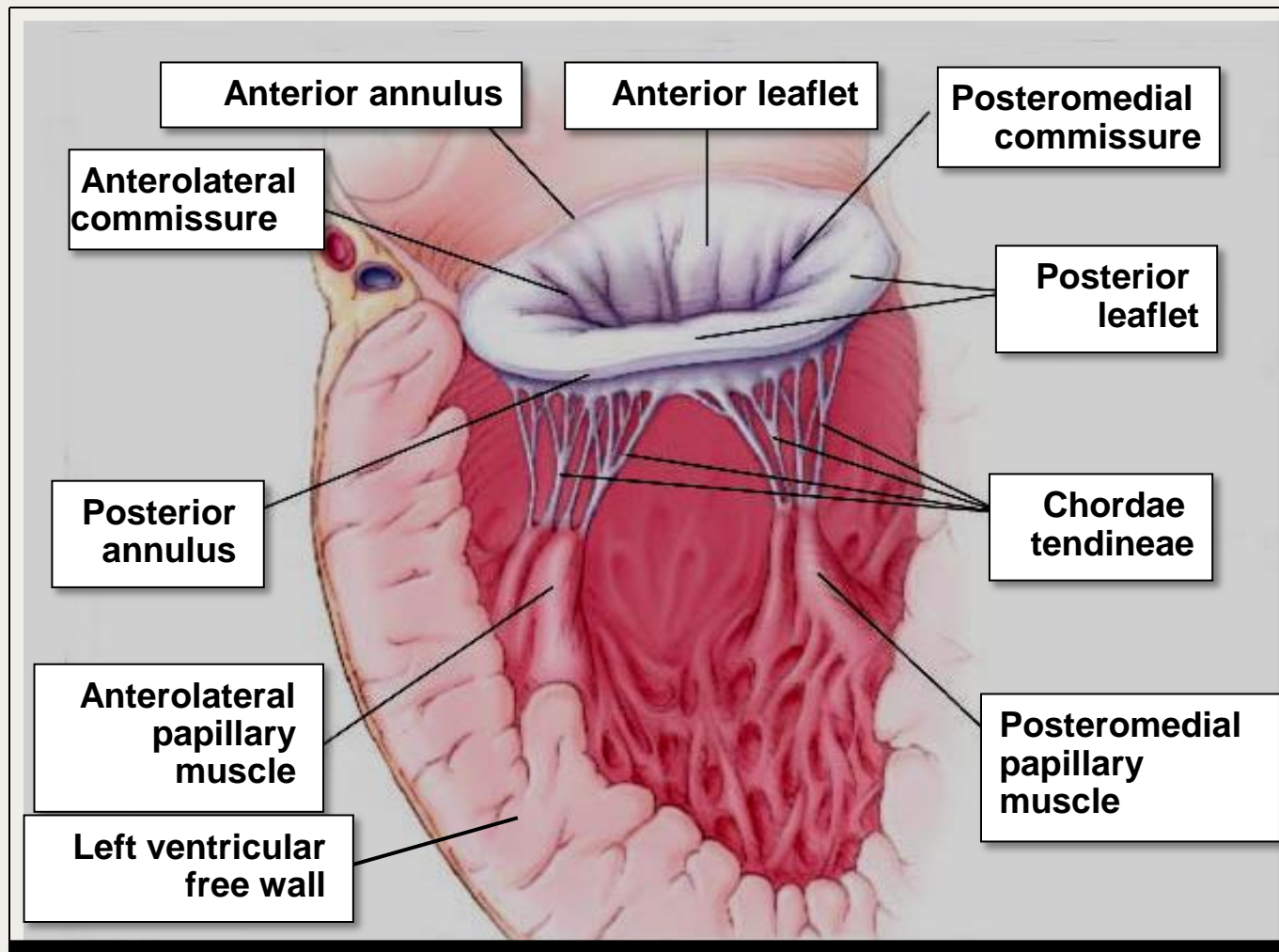
Marvin H. Eng MD FACC FSCAI

Structural Heart Disease Fellowship Director

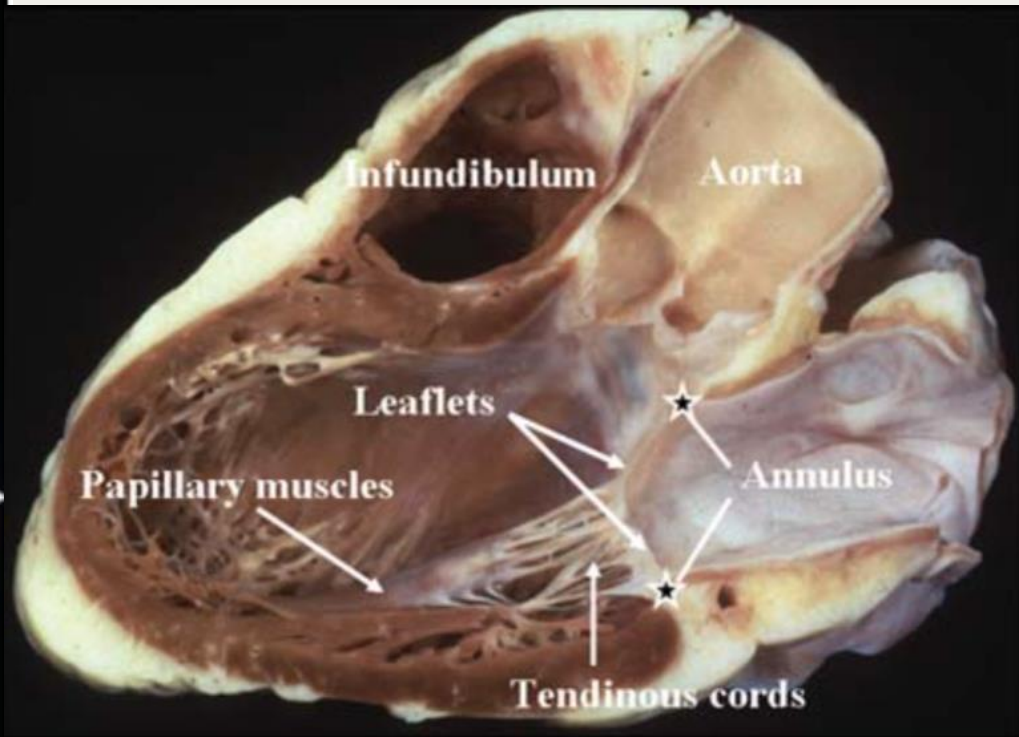
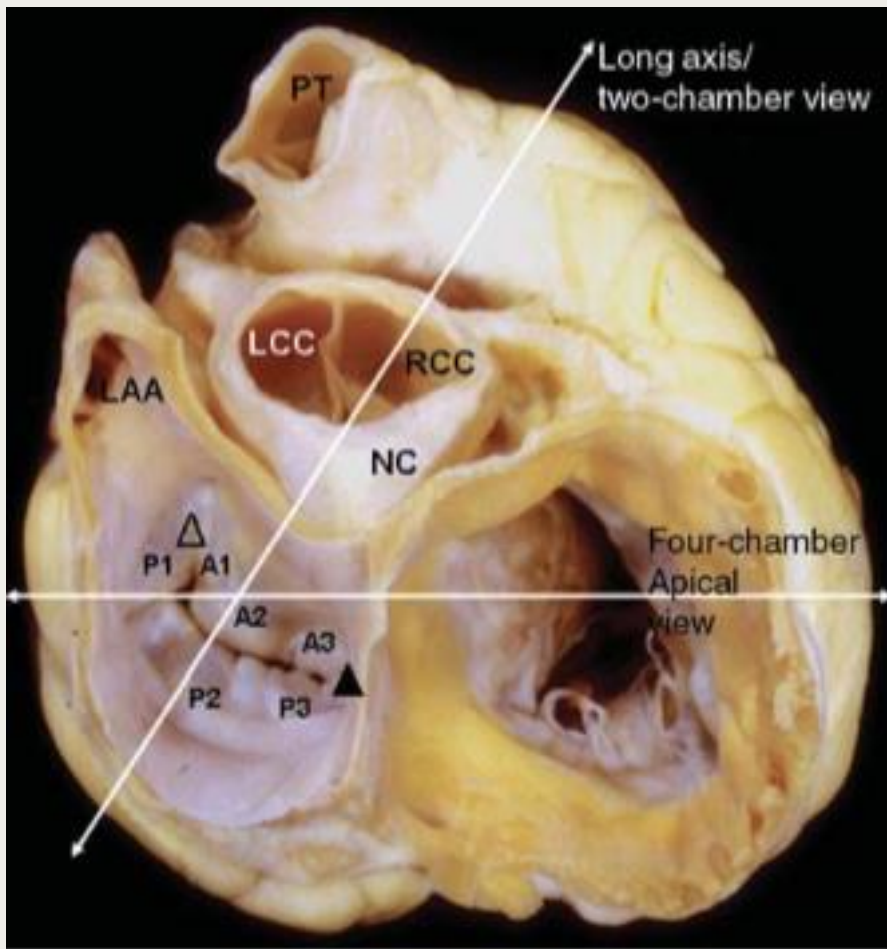
Henry Ford Hospital

Detroit, Michigan

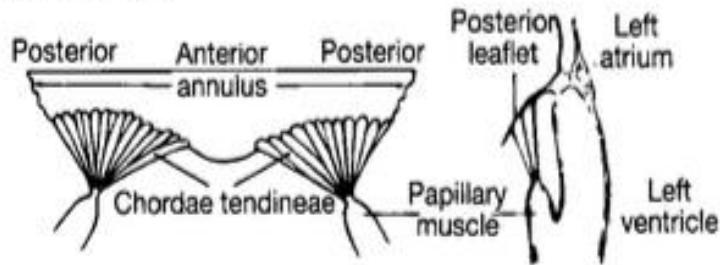




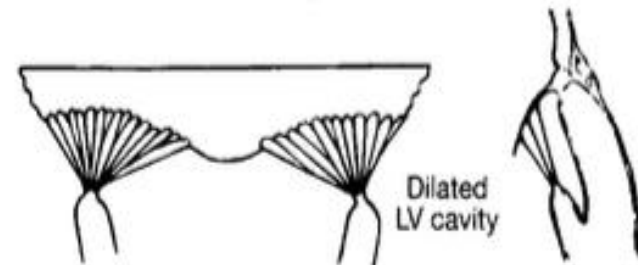
Mitral Valve Anatomy



Normal mitral valve

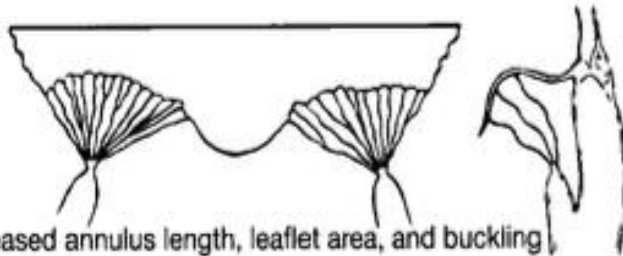


Idiopathic dilated cardiomyopathy

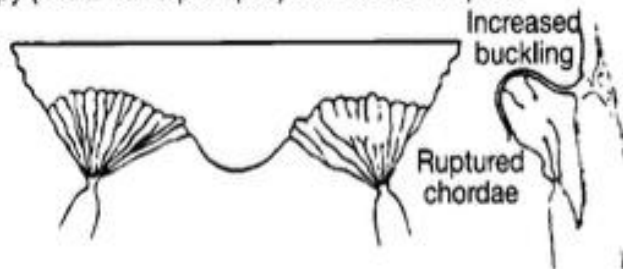


Malaligned papillary muscles in dilated ventricle

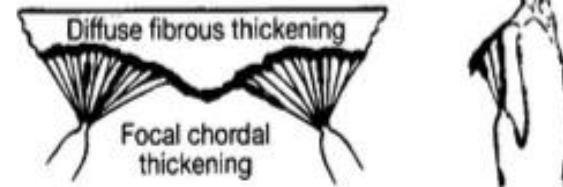
Floppy (mitral valve prolapse)



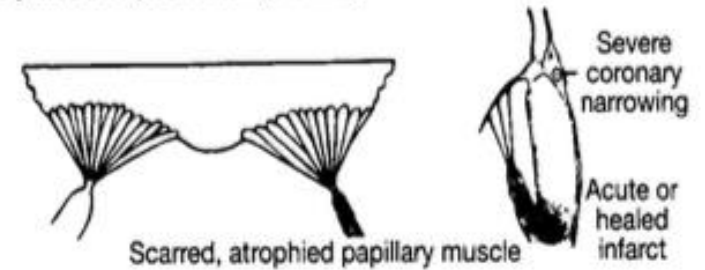
Floppy (mitral valve prolapse) with chordal rupture



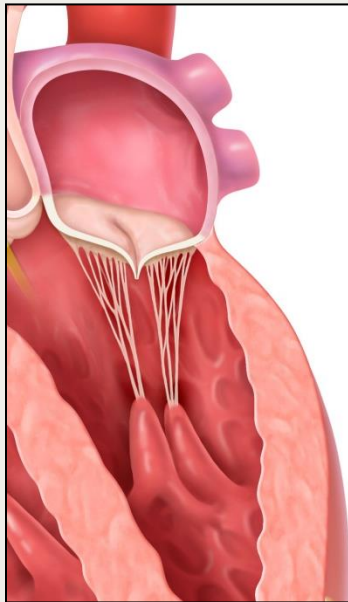
Rheumatic



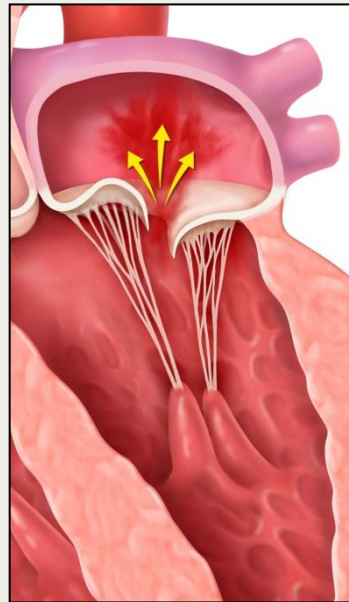
Papillary muscle dysfunction (coronary)



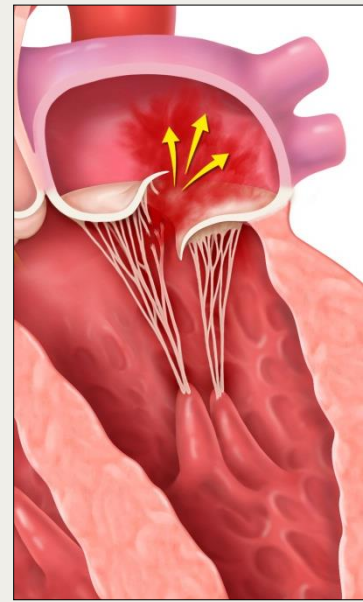
Mitral Regurgitation Simplified Classification



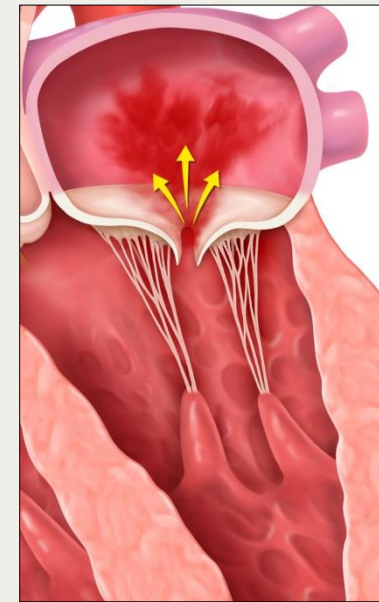
Normal



Prolapse



Flail



Functional MR

Prevalence Moderate-Severe Valvular Disease

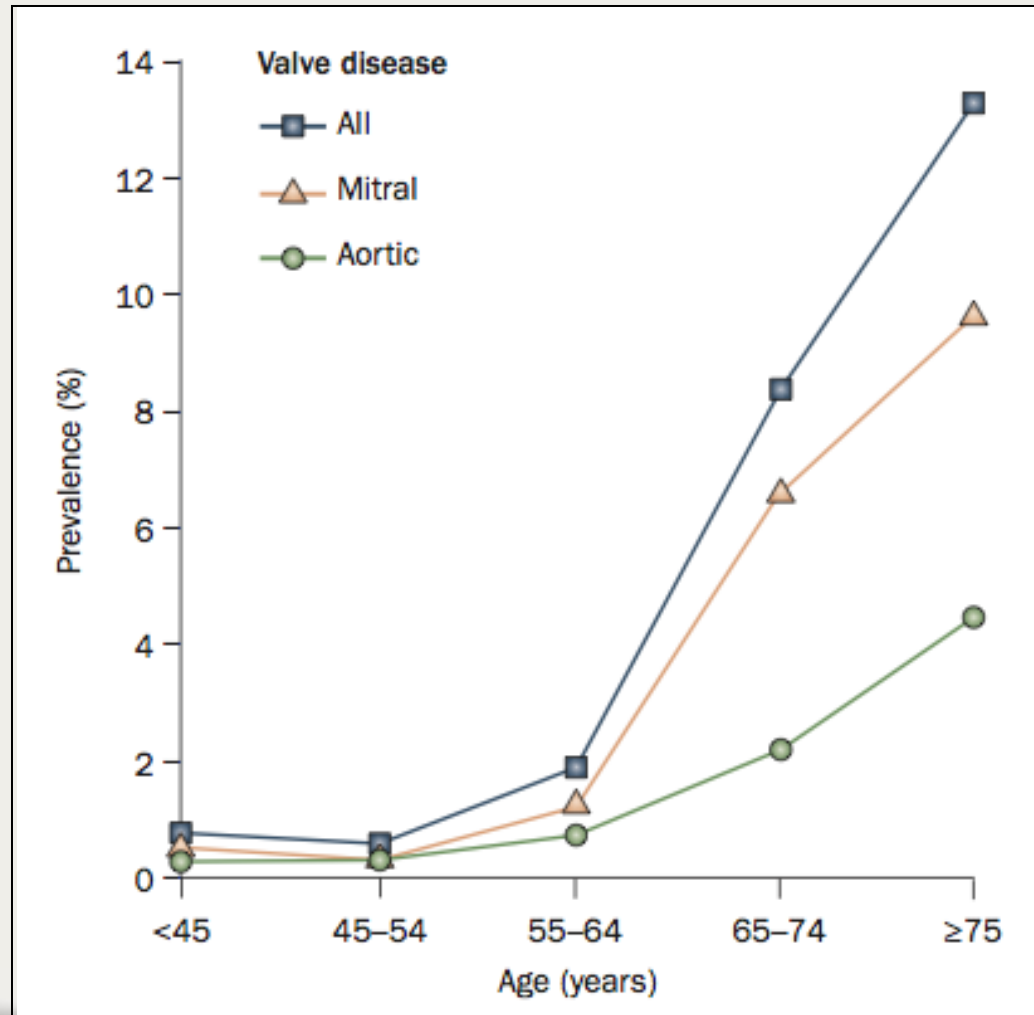
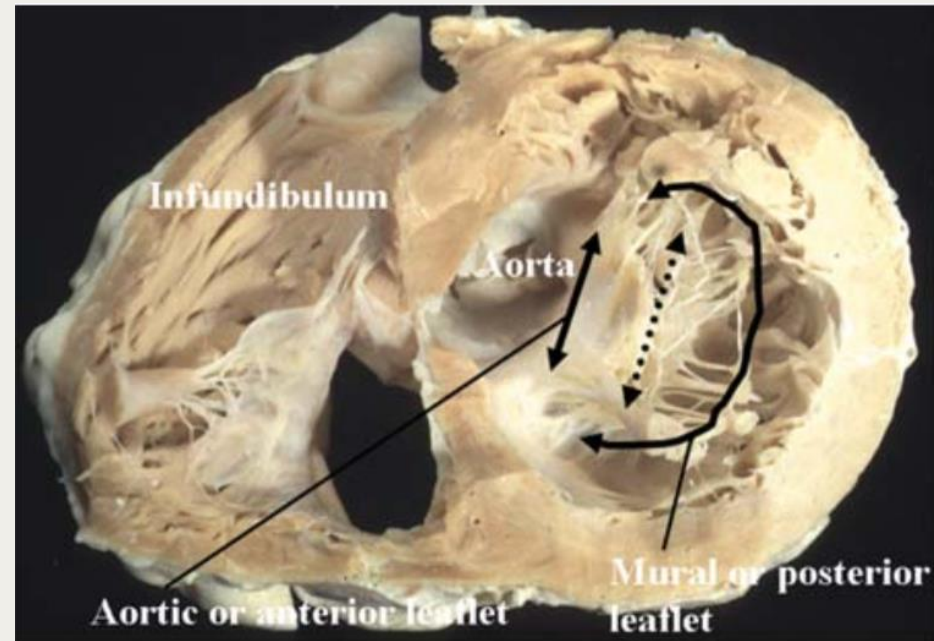


Table 5**Rationale by Which Mitral Valve Surgery Was Not Performed in 53 Unoperated Patients With Organic MR**

Rationale	n	Death	Cardiac Death	Interval to Cardiac Death (days)
Asymptomatic	9 (17%)	1	0	—
Stable LVEF, stable chambers	17 (32%)	3	3	186, 839, 855
MR improved on subsequent echocardiogram	6 (11%)	1	1	213
Comorbidities/risk	10 (19%)	7*	4	3, 5, 26, 43
Patient refused	4 (%)	2	2	3, 32
Died before planned evaluation	1 (%)	1	1	5
MR unrecognized	4 (%)	1†	0	—
MR ignored	2 (%)	1	1	232

Challenges to Percutaneous Therapies

- Complex anatomy
 - Saddle Shaped
 - D-shaped
- Fixation
- Sealing
- Annular-LV chordal interaction
- Adjacent Structures
 - LCx, CS, AV node, papillary muscles, LVOT
- Increased afterload/low LVEF
- Durability



Devices for addressing MR

- CS annuloplasty
 - Cardiac Dimension Carillon
 - Cerclage annuloplasty
 - ARTO System
- Direct Annuloplasty
 - Mitralign Bident
 - GDS Accucinch
 - ReCor (US)
 - Quantum Cor (RF)
 - Valtech Cardioband
- MitraClip
- Chordal shortening and other
 - Cardiosolutions
 - Mitra-Spacer
 - NeoChord
 - QuantumCore
 - Babic Leaflet Puncture
- MV replacement

MitraClip (Abbot Vascular)
Edge-to-edge repair



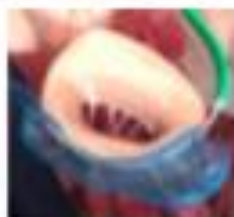
NeoChord (NeoChord DS1000)
Chordal repair



V-Chordal-Off Pump (Valtech)
Chordal repair



CARILLON (Cardiac Dimensions)
Indirect Annuloplasty



ValCare MV Repair (ValCare)
Direct annuloplasty



GDS Accucinch (GDS)
Direct Annuloplasty



Mitralign Bident (Mitralign)
Direct annuloplasty



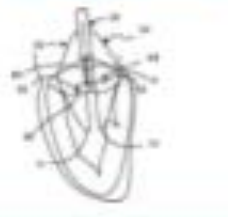
Cardioband TF (Valtech)
Direct annuloplasty



Millipede Ring (Millipede)
Direct annuloplasty



Cardica Mitral Repair (Cardica)
Edge-to-edge repair



Mitra-Spacer-Transapical (Cardiosolutions)
Enhanced coaptation



MISTRAL (Mitratrix)
Chordal repair



V-Chordal-Transfemoral (Valtech)
Chordal repair



Kardium MR (Kardium)
Direct annuloplasty



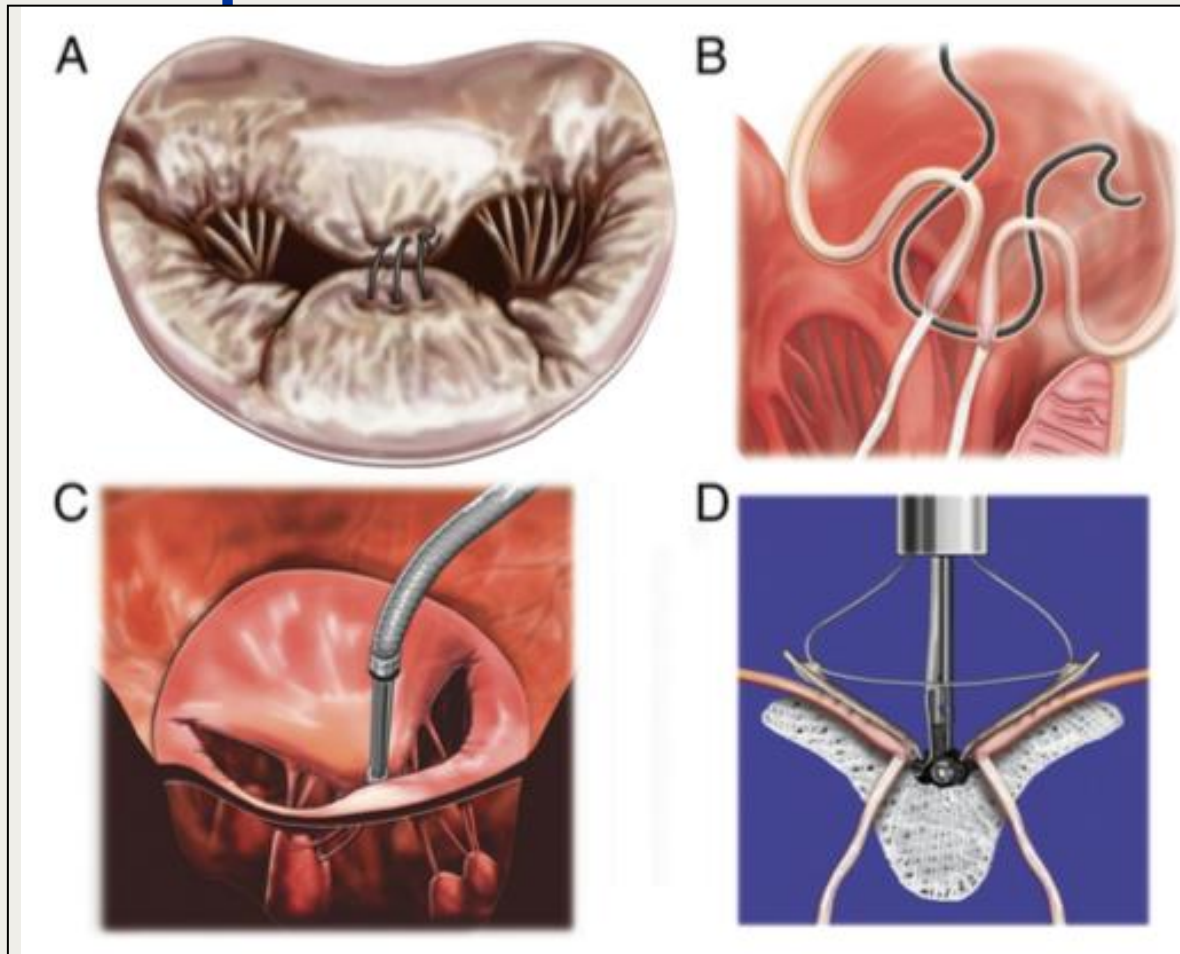
PS3 (MVRx)
Annuloplasty



MitraFlex (TransCardiac)
Edge-to-edge

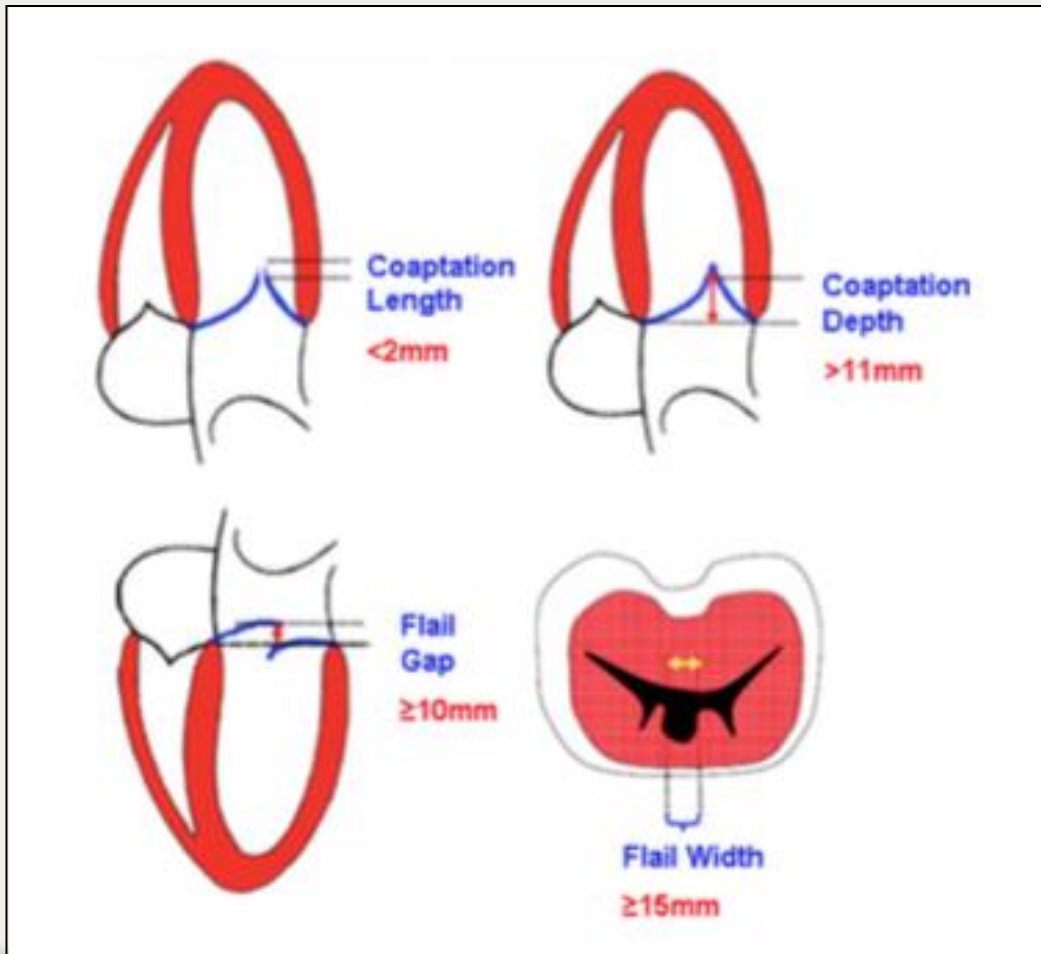


Alfieri Technique Mitral Clip



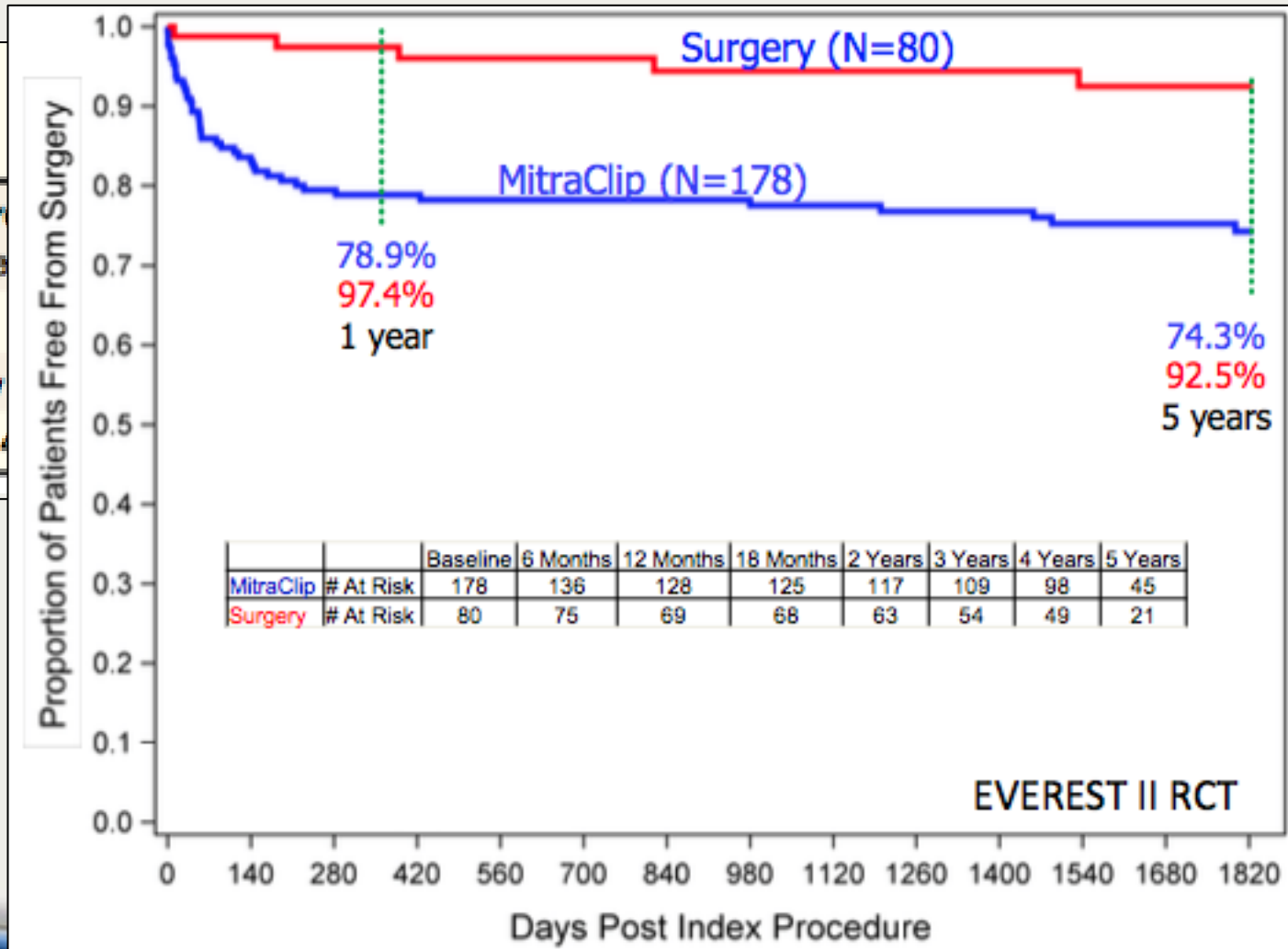
Mitra Clip

Anatomic Exclusions



- MVA $< 4 \text{ cm}^2$
- Leaflet Ca^{++}
- Severe retracted posterior leaflet

MitraClip EVEREST II



Freedom from
or reoperation
Death
MV surgery
MR 3+ or 4

p Value
0.070
0.914
<0.001
0.745



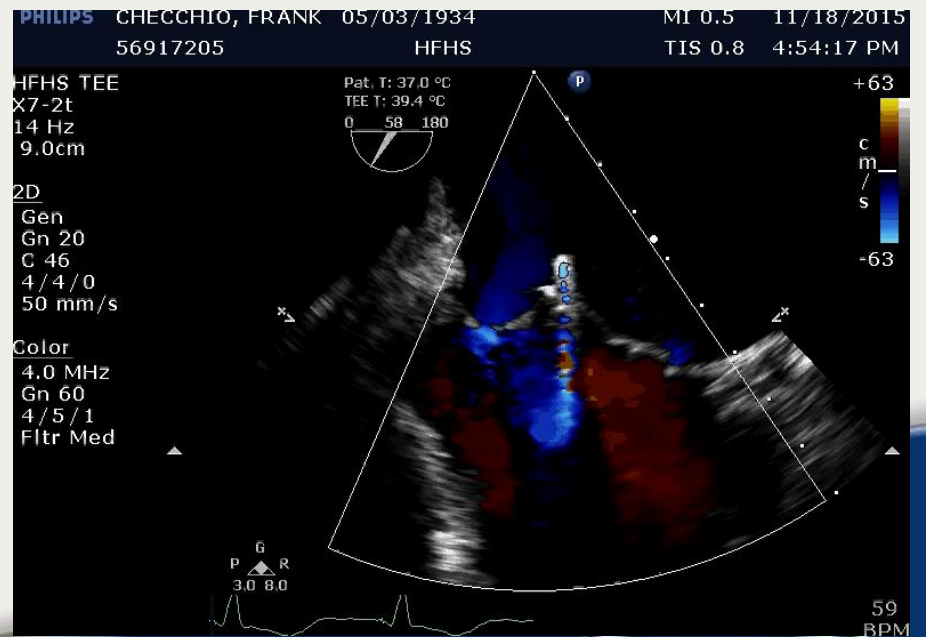
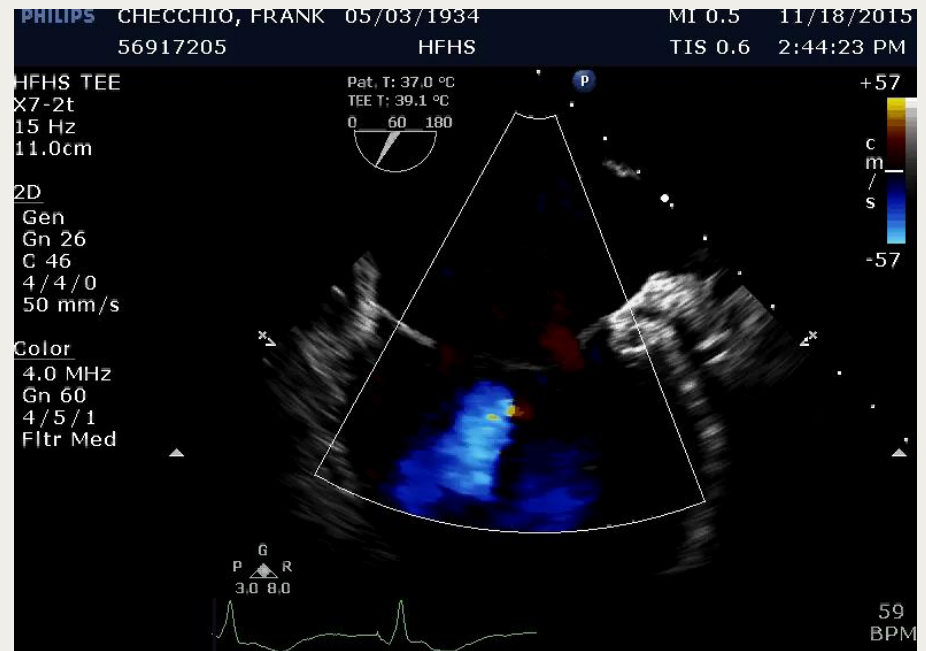
MitraClip High Risk Registry

TABLE 4 Clinical Results

■ 70% Functional MR

	Baseline	12 Months	p Value*
MR grade $\leq 2+$	14.2 (32/225)	83.6 (188/225)	<0.0001
NYHA functional class III to IV	82.1 (192/234)	17.1 (40/234)	<0.0001
SF-36 quality of life			
Physical component score	34.0 \pm 9.1 (191)	38.8 \pm 11.3 (191)	<0.0001
Mental component score	44.9 \pm 13.5 (191)	49.8 \pm 12.2 (191)	<0.0001
LV end-diastolic volume, ml	160.5 \pm 55.9 (203)	142.6 \pm 53.1 (203)	<0.0001
LV end-systolic volume, ml	87.0 \pm 46.8 (202)	78.9 \pm 43.9 (202)	<0.0001
Ejection fraction, %	48.4 \pm 14.0 (202)	47.5 \pm 13.4 (202)	0.16





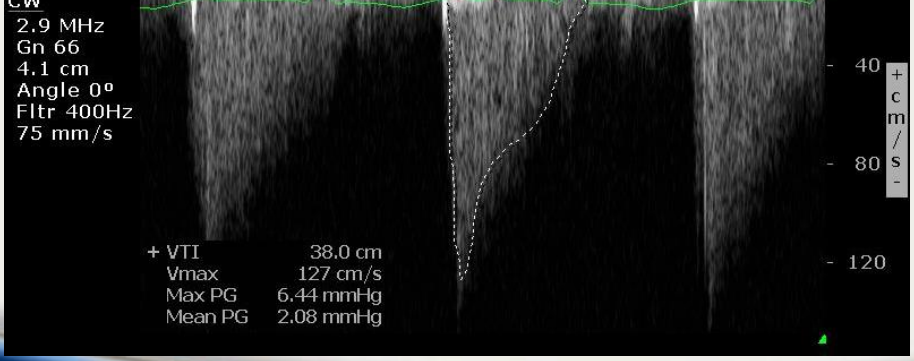
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 56917205 HFHS TIS 0.1 4:56:49 PM



HFHS TEE X7-2t 9.0cm VR 16Hz
 Pat. T: 37.0 °C TEE T: 39.8 °C
 0 58 180

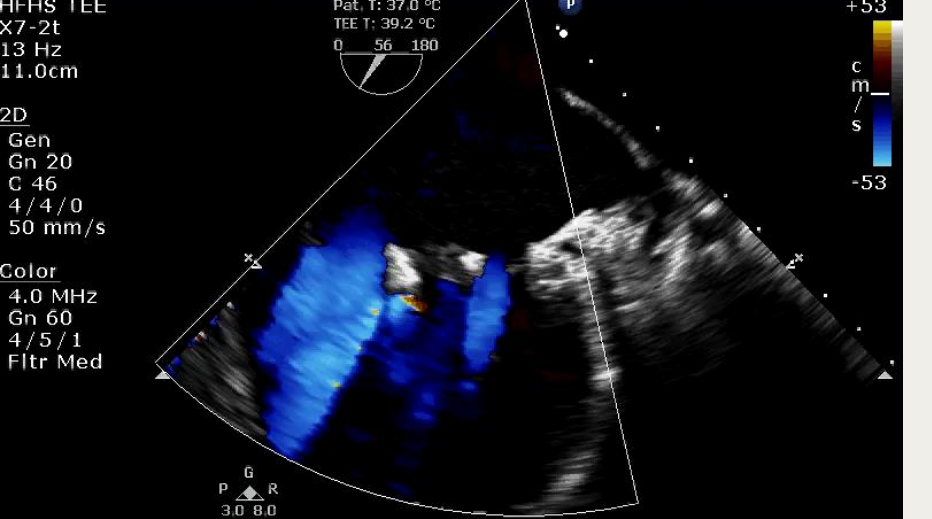


2D Gen Gn 0 C 46 4/4/1 50 mm/s



Live3D 4/3/1
 HFHS TEE X7-2t 10.0cm
 Pat. T: 37.0 °C TEE T: 39.4 °C
 0 156 180
 2D Gen Gn 20 C 46 4/4/1
 CW 2.9 MHz Gn 66 4.1 cm Angle 0° Filtr 400Hz 75 mm/s
 + VTI 38.0 cm
 Vmax 127 cm/s
 Max PG 6.44 mmHg
 Mean PG 2.08 mmHg

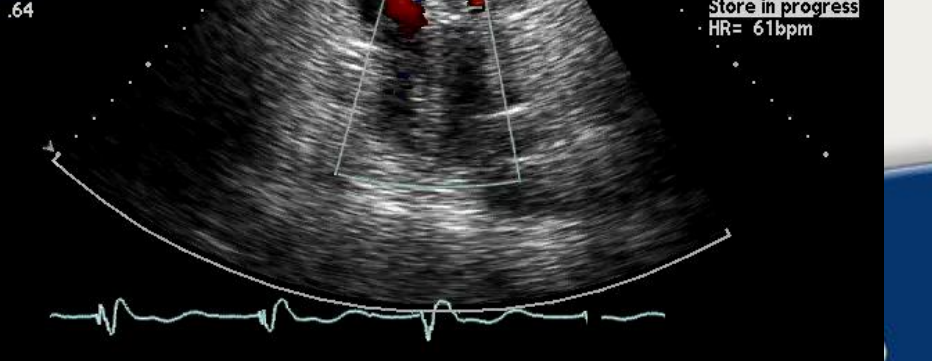
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 56917205 HFHS TIS 0.6 5:03:08 PM



HFHS TEE X7-2t 13 Hz 11.0cm
 Pat. T: 37.0 °C TEE T: 39.2 °C
 0 56 180
 2D Gen Gn 20 C 46 4/4/0 50 mm/s



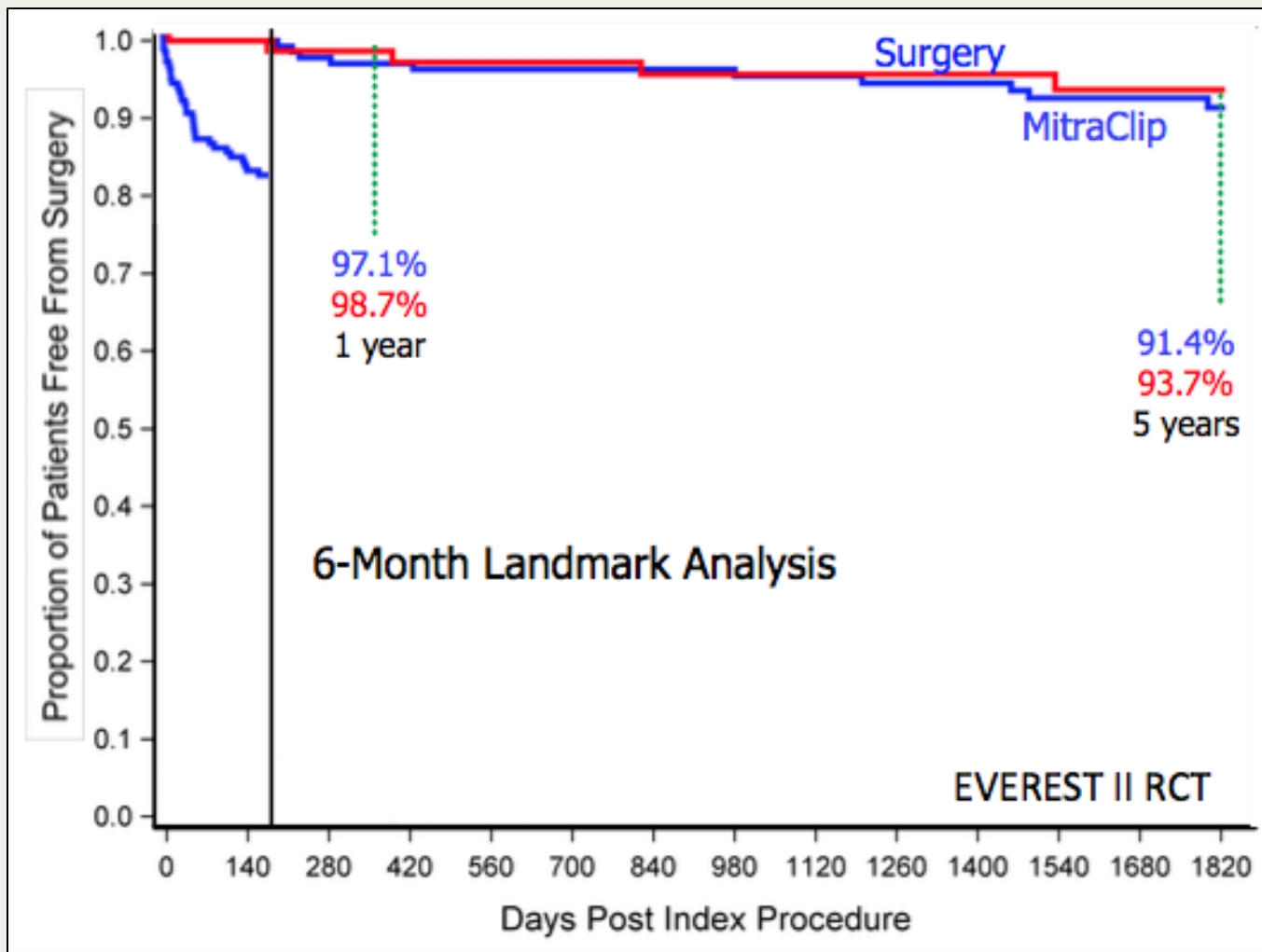
Color 4.0 MHz Gn 60 4/5/1 Filtr Med



CHECCHIO, FRANK: 56917205 Henry Ford Hospital
 19 Nov 15 10:38:26 am
 4V1c-S 19Hz H3.75MHz 200mm HFH Adult Cardiac General /V
 T1/-3/ 0/V:A 1/2 CD:2.0MHz CD Gain = 48
 Store in progress HR= 61bpm
 2D Pos/Width CD Pan Pos/Size

Limits to Alfieri Technique

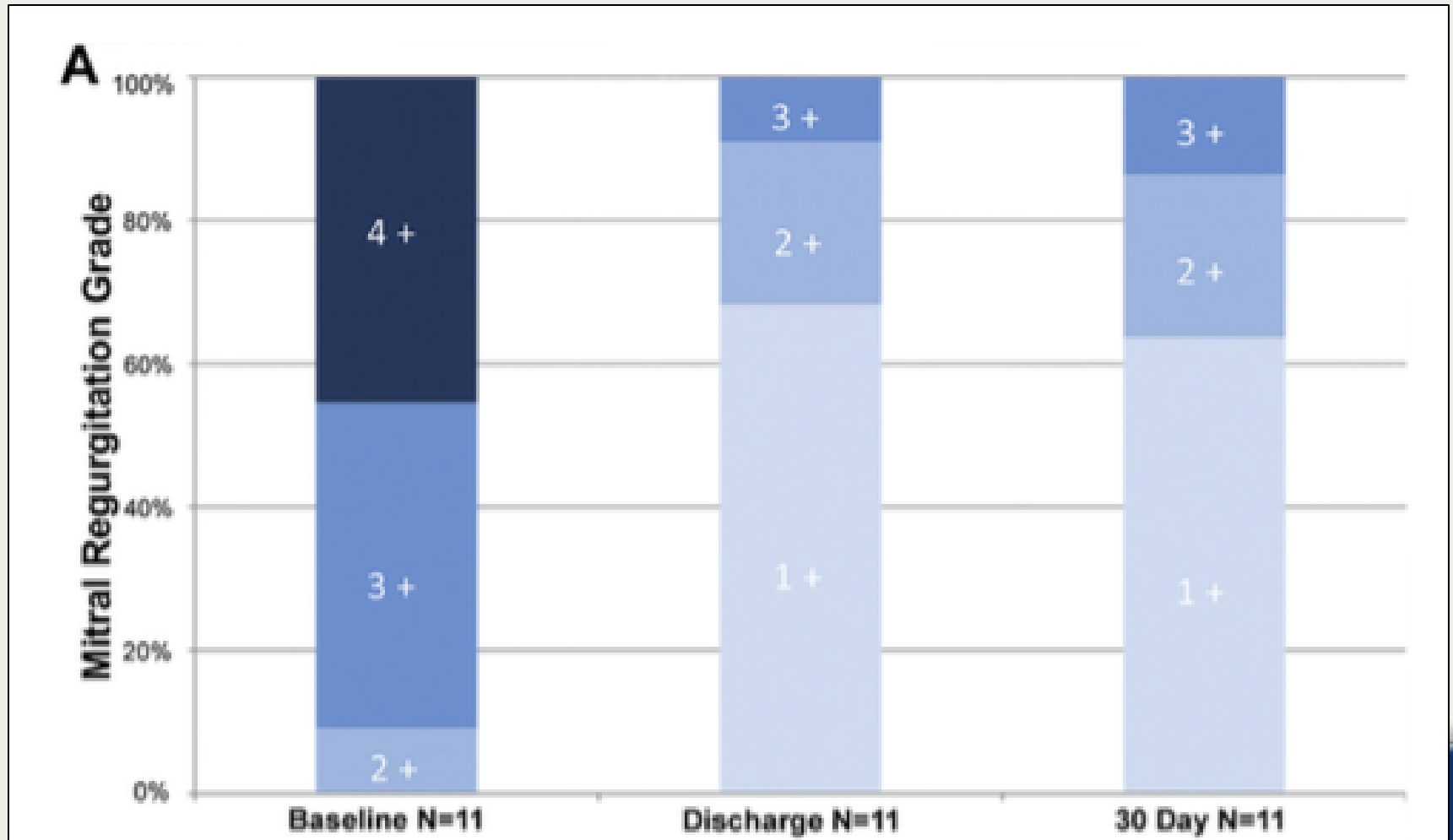
EVEREST DATA



Carillon Device Coronary Sinus Annuloplasty

	TITAN (n=53)		TITAN II (n=36)	
	30-Day Rate	Device Related	30-Day Rate	Device Related
Death	1.9%*	0.0%	2.8%	0.0%
MI	0%	0%	0%	0%
Cardiac Perforation	0%	0%	0%	0%
Device Embolization	0%	0%	0%	0%
Surgery or PCI Related to Device	0%	0%	0%	0%
MAE Rate	1.9%	0%	2.8%	0%

ARTO System

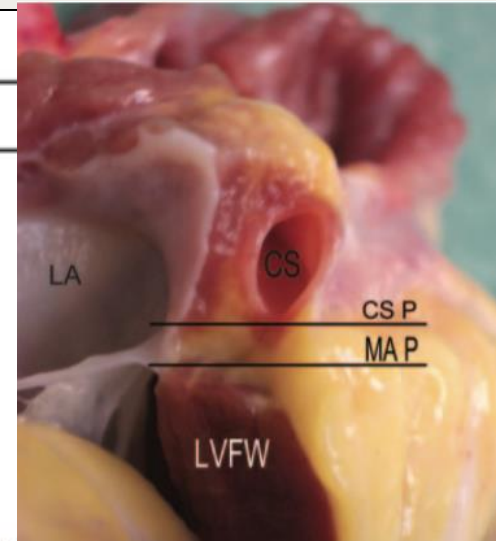


Coronary Sinus Relation to LCx

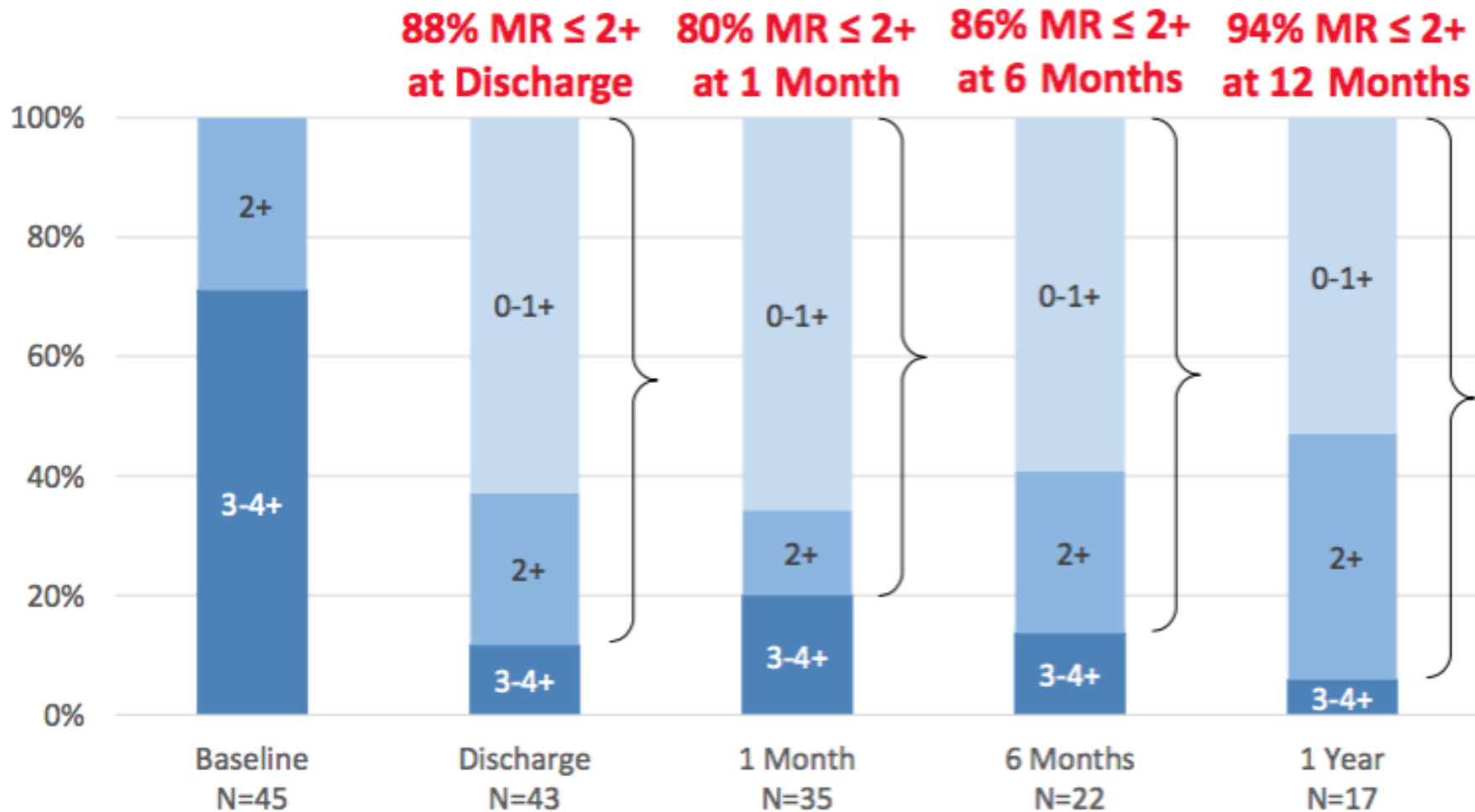
Anatomic Findings

Anatomic Findings

LM length, mm	8.3±3.7	
LAD deeper than crossing AIV, %	11.5	
DA and RB deeper than crossing AIV, %	16.4	
CS-to-MA distance at P3 level, mm	(range, 5–19; 9.7±3.2; median, 9)	
CS-to-MA distance at P2 level, mm	(range, 1–15; 5.7±3.3; median, 5)	
Risky AVNA, %	37.7	
CX crossing CS, %	Deeper, 63.9	Superior, 36.1
Diminutive type, %	2.5	0
Radial posterolateral type, %	2.5	0
Marginal type, %	79.5	91
Posterior type, %	7.7	9
Descending posterior type, %	7.7	0
CX branches >1-mm diameter, n	(0–4, 1.6±0.7)	(1–2, 1.4±0.7)



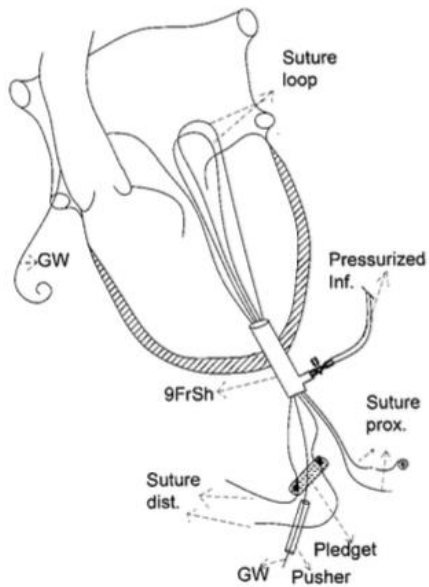
Cardioband Procedure - Step by Step



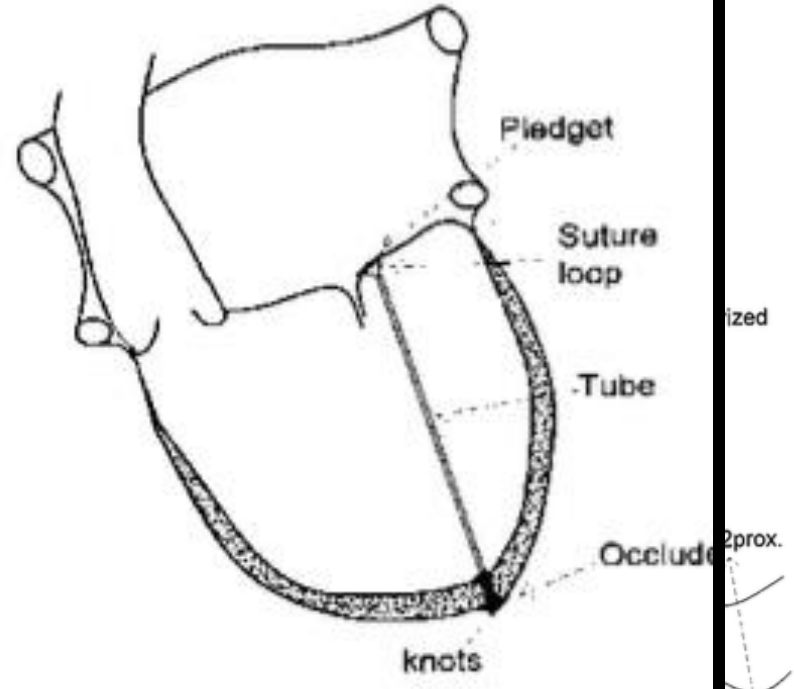
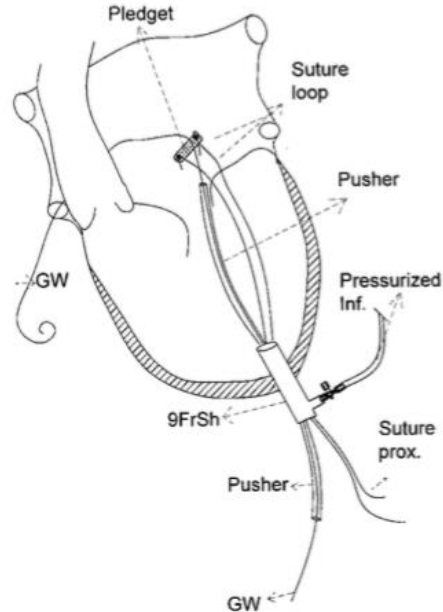
Artificial Chordae

Babic Leaflet Puncture

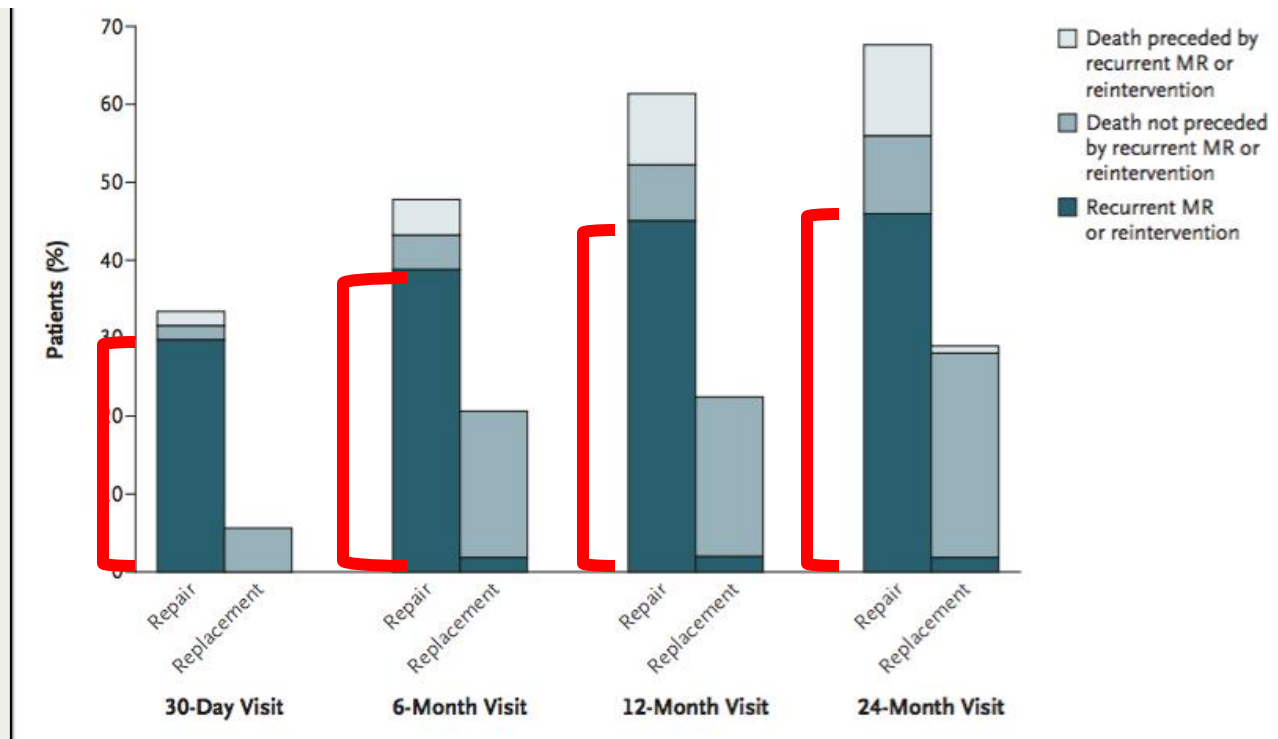
Two wires



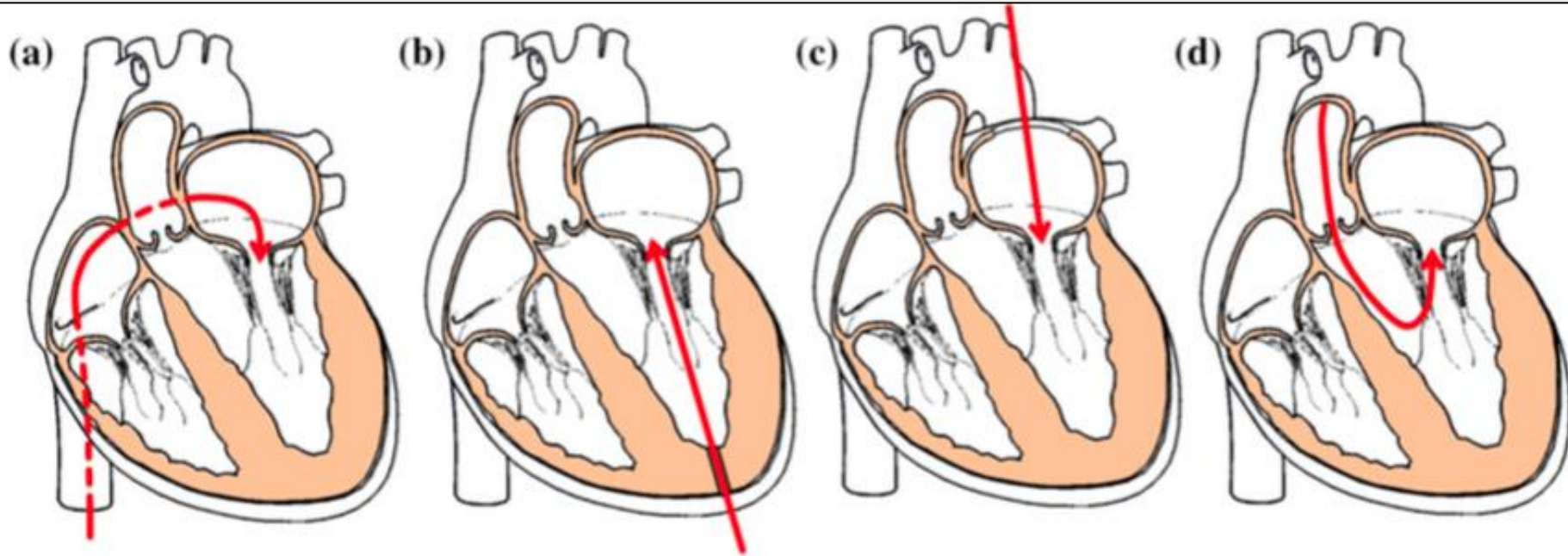
Pledget



Two-Year Outcomes of Surgical Treatment of Severe Ischemic Mitral Regurgitation

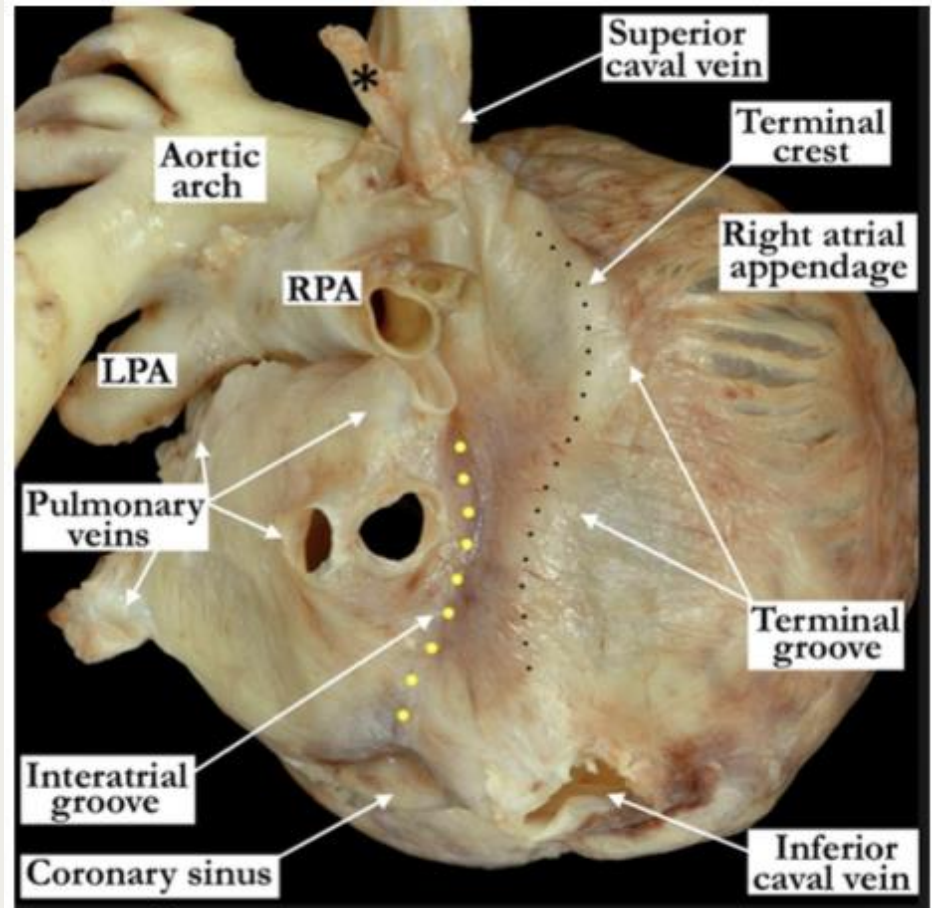
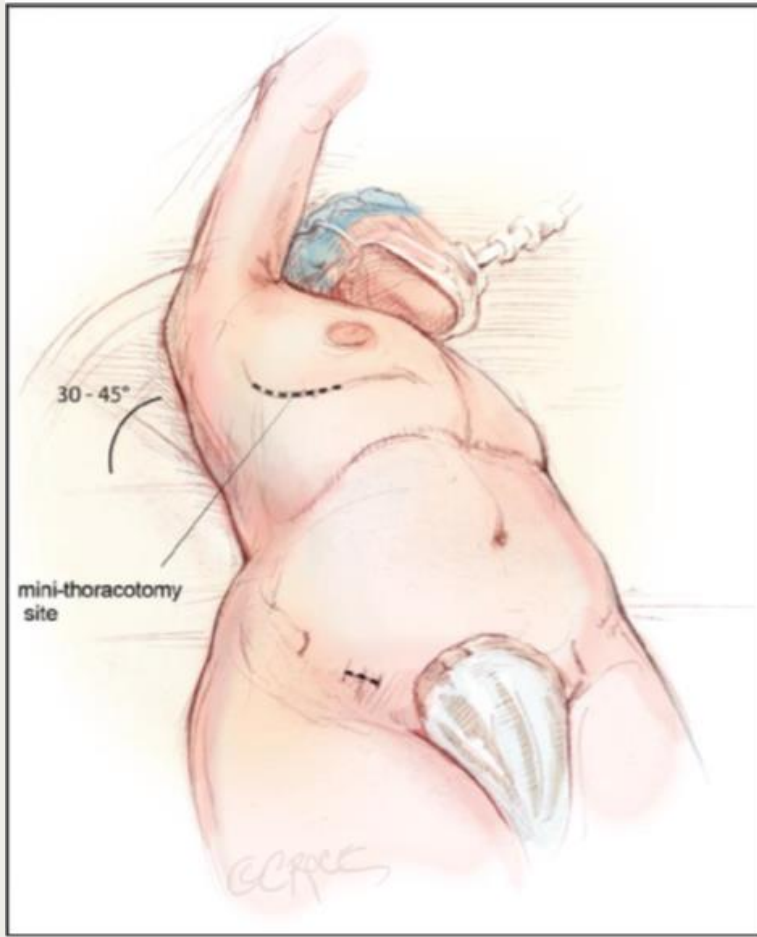


Mitral Valve Replacement Access Routes

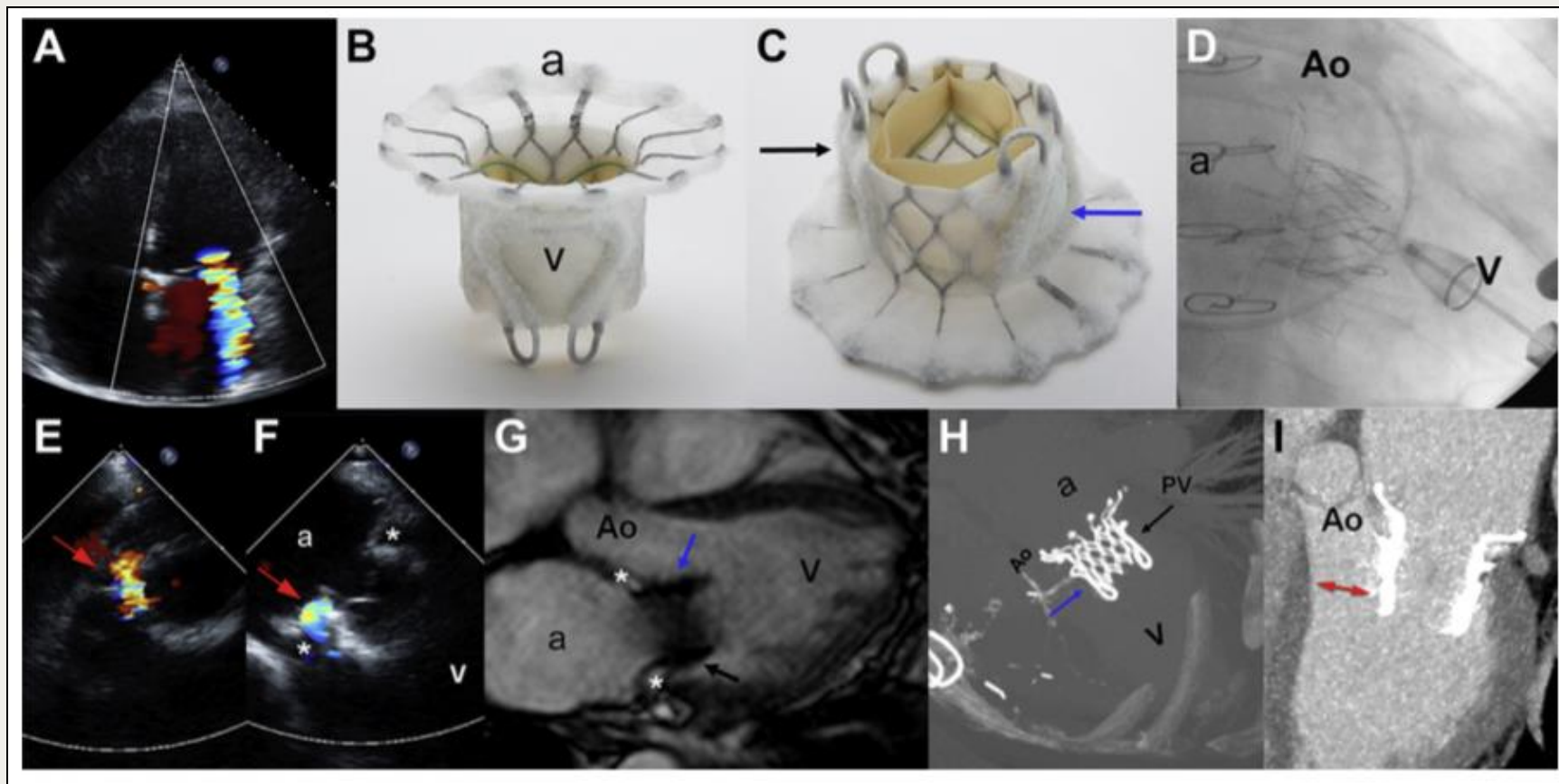


Mitral Valve Replacement

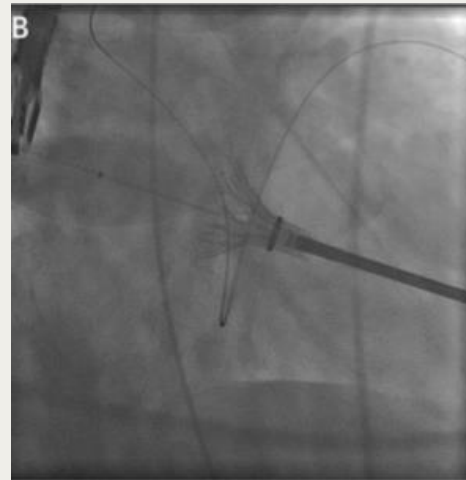
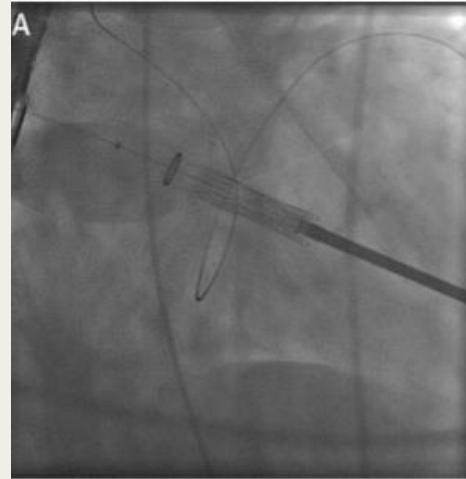
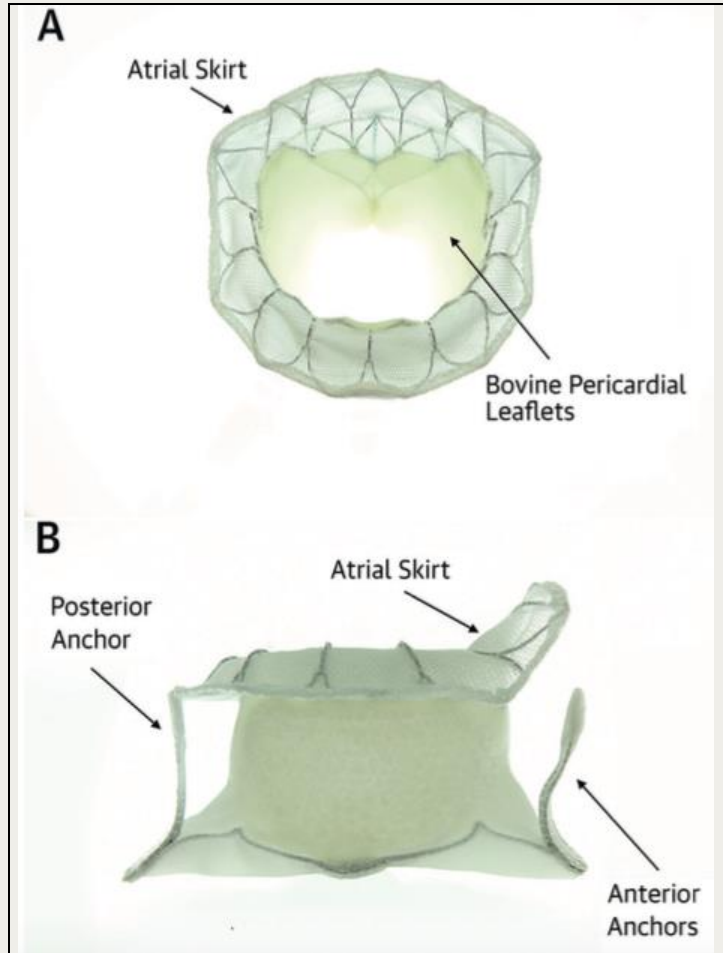
Transatrial access



Fortis



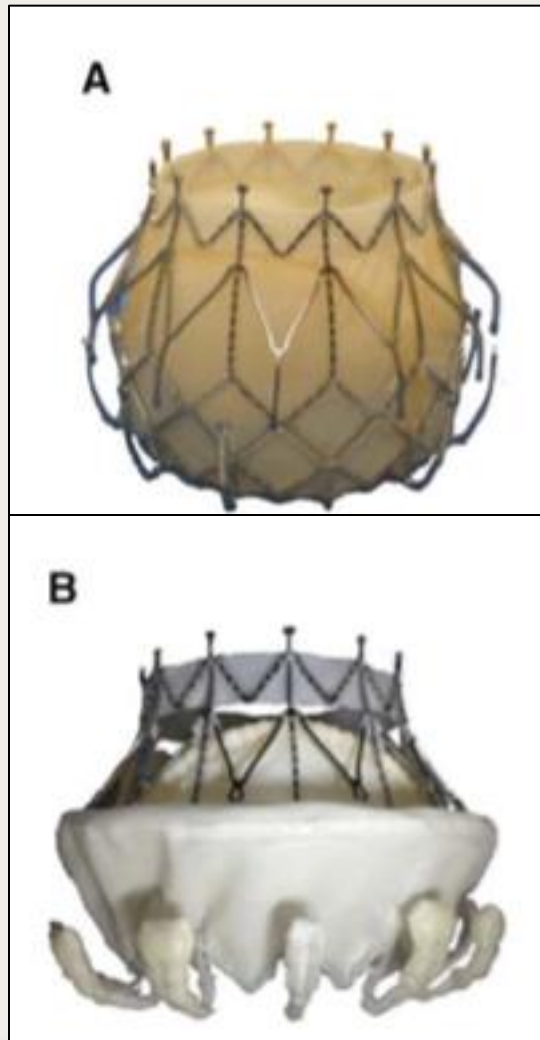
Tiara



Follow-up

#	LOS (days)	Days post Implant	MR Grade (Discharge)	Clinical Status
1	38	69 (expired) Heart/kidney failure	Trivial	End-stage heart and renal failure. Palliative care (functional prosthesis day 60)
2	5	599	None	NYHA II-III, BNP 822 to 482, Improvement in 6MWT
3	4	396	None	NYHA II, MLWHF 67 to 41 LVEDD 94 to 84mm
4	5	157 (expired) Pneumonia	None	NYHA II, Pacemaker for pre-existing SSS, recurrent CHF at 5 month (functional prosthesis day 150)
5	7	123	None	NYHA III, non-compliant with meds
6	6	81	Trivial	NYHA II, improvement in 6MWT
7	5	25	None	NYHA II

CardiAQ FIM 4 cases



Tendyne

- D-shaped self-expanding nitinol frame
- Porcine Tri-leaflet valve
- Tether to LV apex
- TA access
- Repositionable and retrievable
- No pacing needed



30 Day Outcomes

Patient	Device Embolization	Device Retrieval	Intra-Op PVL	Days Since Implant	30 Day Status	30 Day PVL	30 Day NYHA
1	No	No	Trace	330	Alive	Trivial / Mild	I
2	No	No	None	323	Alive	Trivial / Mild	II
3	No	No	None	308	Alive	None	I
4	No	No	None	296	Alive	None	III
5	No	No	None	245	Alive	None	I
6	No	No	None	216	Alive	None	I
7	No	Yes	NA	NA	Alive	NA	
8	No	No	None	260	Alive	None	I
9	No	No	None	139	Alive	None	II
10	No	No	None	126	Alive	None	I

TMV implants in humans

Device	CardiaQ	Tiara	FORTIS	Tendyne	Twelve
Manufacturer	Edwards	Neovasc	Edwards	Abbott	Medtronic
Access	TA/TV	TA	TA	TA	TA
Nitinol frame	+	+	+	+	+
Bovine Pericardial	+	+	+	+	+
Trileaflet valve	+	+	+	+	+
Symmetric leaflets	+	-	+	+	+
Assymmetric frame	-	+	+	+	-
Seal	Pericardial	Pericardial	Fabric	Pericardial	Pericardial

TMVI Anatomic Compatability

Device	CardiAQ	Tiara	FORTIS	Tendyne	Twelve
Required for Fixation:					
Posterior leaflet	-	-	+	-	-
Posterior ridge	-	+	-	-	-
Anterior leaflet	-	-	+	-	-
Suitable for:					
Functional MR	+	+	+	+	+
Degenerative	+/-	+/-	-	+	+

Summary

- Established Technologies
 - Mitral Clip
 - Coronary Sinus Annuloplasty
- Emerging Advances
 - Replacement
 - Mitral Repair
 - Chordal
 - Annular
- Anticoagulation

감사합니다.



TMVI Fixation

Device	CardiAQ	Tiara	FORTIS	Tendyne	Twelve
Atrial Flange	+	+	+	+	+
Apical Tether	-	-	-	+	-
Barbs	-	-	-	-	+
Clips/Tabs/Paddles	+	+	+	-	-
Radial Force	-	-	-	-	-