

Transcatheter Treatment of Mitral Regurgitation: Edge-to-Edge repair

Luis Nombela-Franco

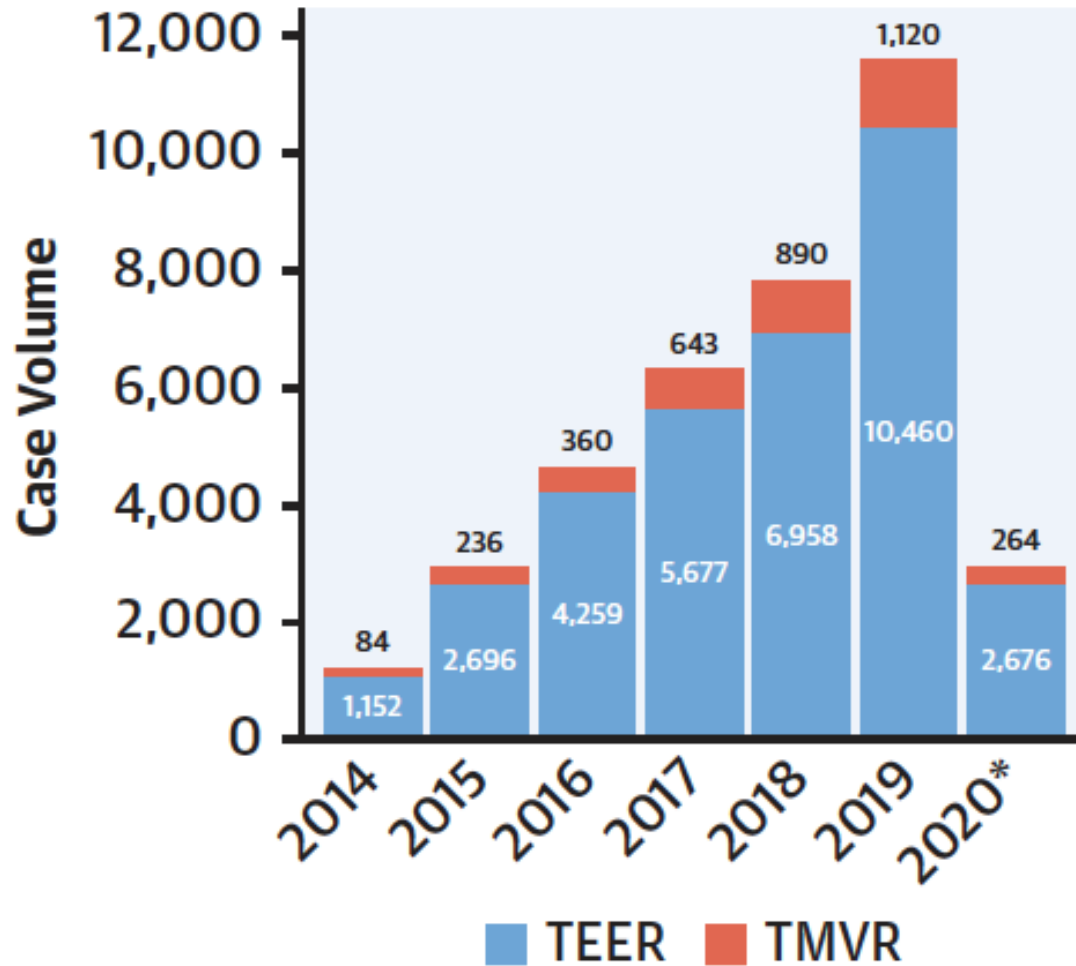
Hospital Clínico San Carlos, Madrid, Spain

Interventional Cardiologist / Structural Heart Interventions

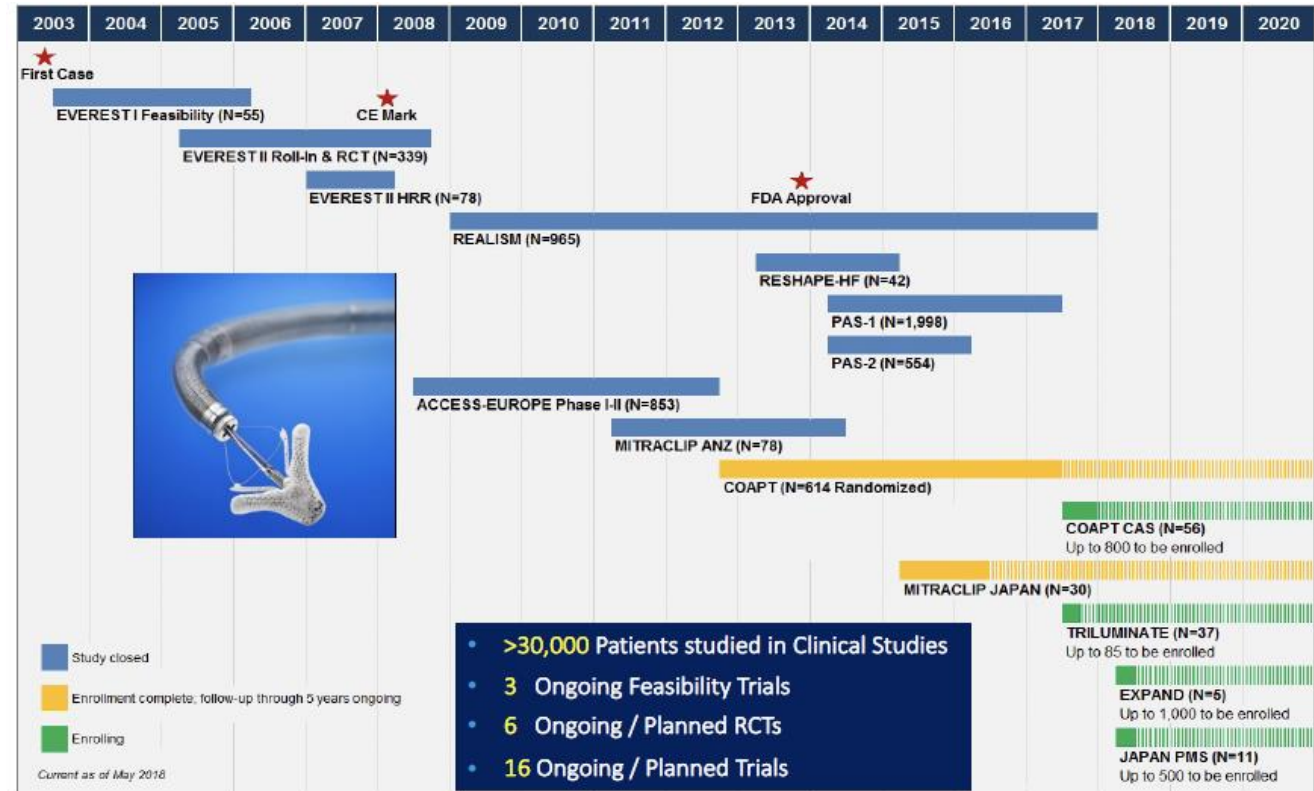


>150,000 Mitraclip Implanted Worldwide*

(*march-2021)

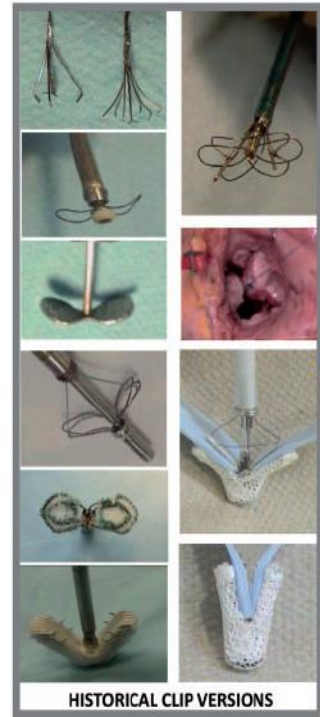


MitraClip™: >19 Years of Clinical Evidence



MITRACLIP

PASCAL P10/PASCAL ACE



FIRST IN MAN | CE-
 2003 | 2008

Abbreviations:
 CE - Communauté Européenne
 DMR - degenerative mitral regurg
 FDA - food and drug administrat
 SMR - secondary mitral regurgit

G4 NT
4 mm



G4 NTW
6 mm



G4 XT
4 mm

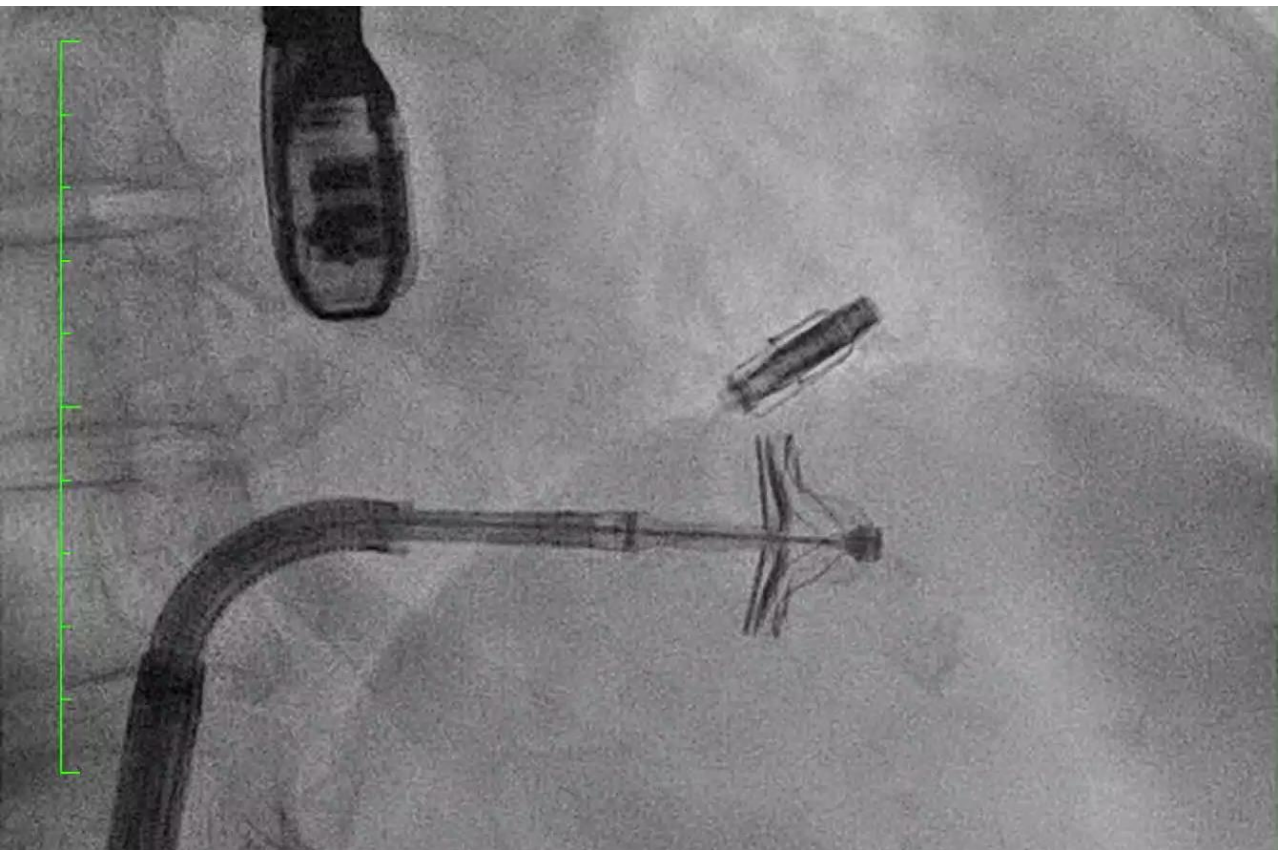


G4 XTW
6 mm



4th GENERATION

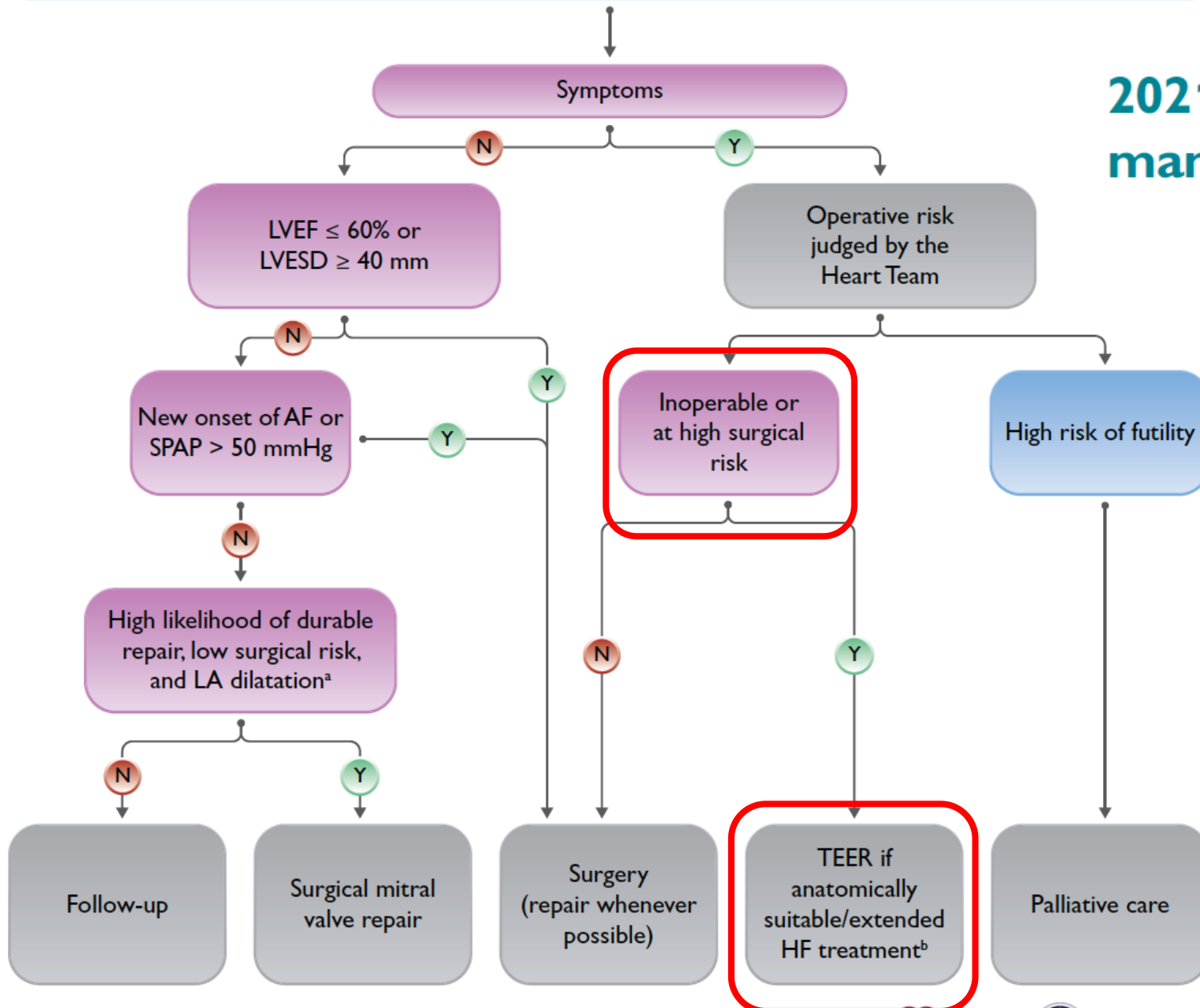




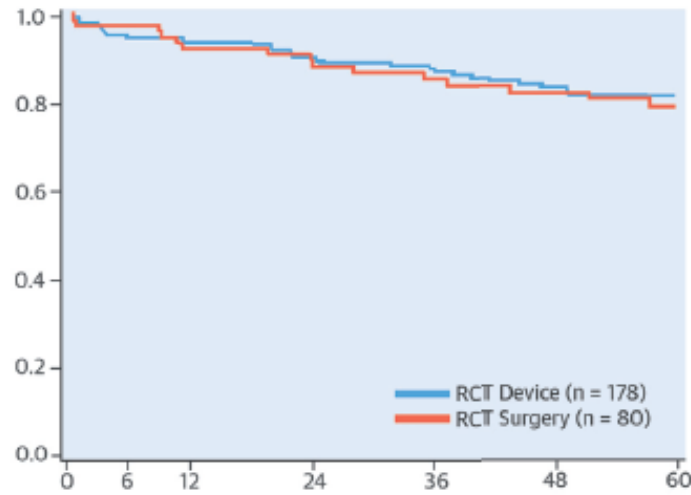
Overview in transcatheter edge-to-edge Mitral valve repair

- **Current indications**
- New evidence in TEER
- Patient selection
- Expanding the indications
- Mitraclip (gold standard) vs other devices

2021 ESC/EACTS Guidelines for the management of valvular heart disease

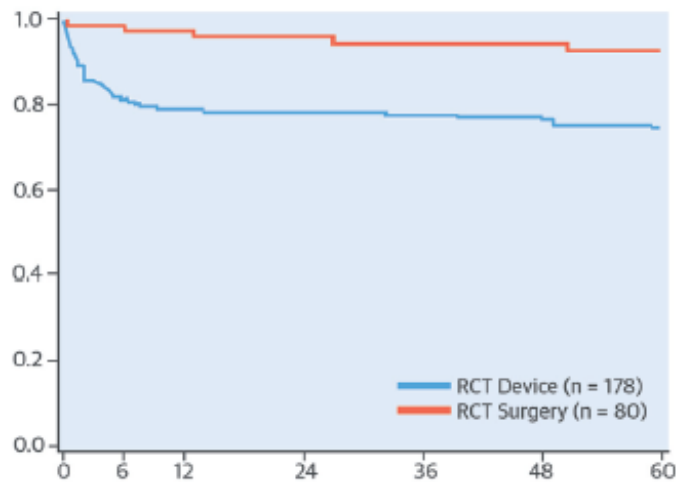


B. Freedom From Death



Patients At Risk		Months						
		0	6	12	24	36	48	60
Device Group	178	165	158	143	133	119	58	
Control Group	80	76	70	65	57	52	24	

C. Freedom From MV Surgery or Reoperation

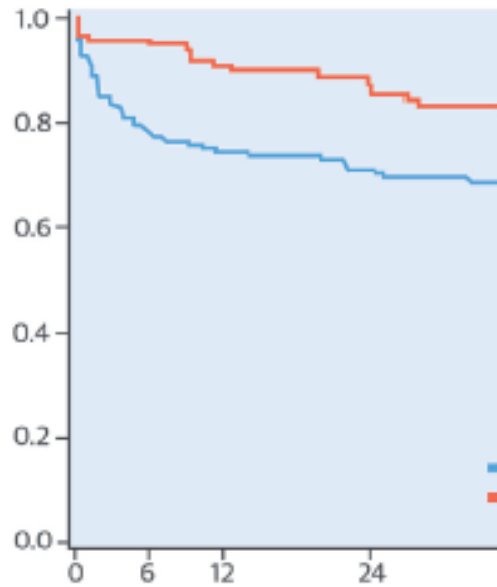


Patients At Risk		Months						
		0	6	12	24	36	48	60
Device Group	178	136	128	117	109	98	45	
Control Group	80	75	69	63	54	49	21	

Clip in primary MR

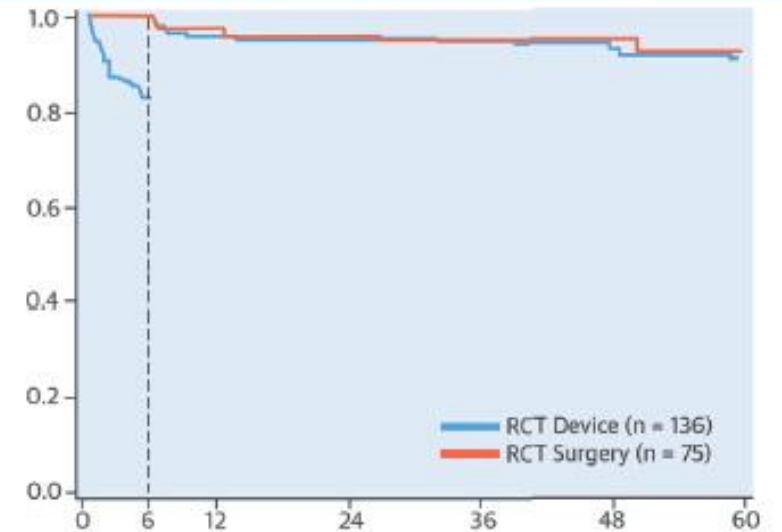
Everest trial 5 year

A. Freedom From Death, MV Su



Patients At Risk		Months			
		0	6	12	24
Device Group	178	136	128	117	
Control Group	80	75	69	63	

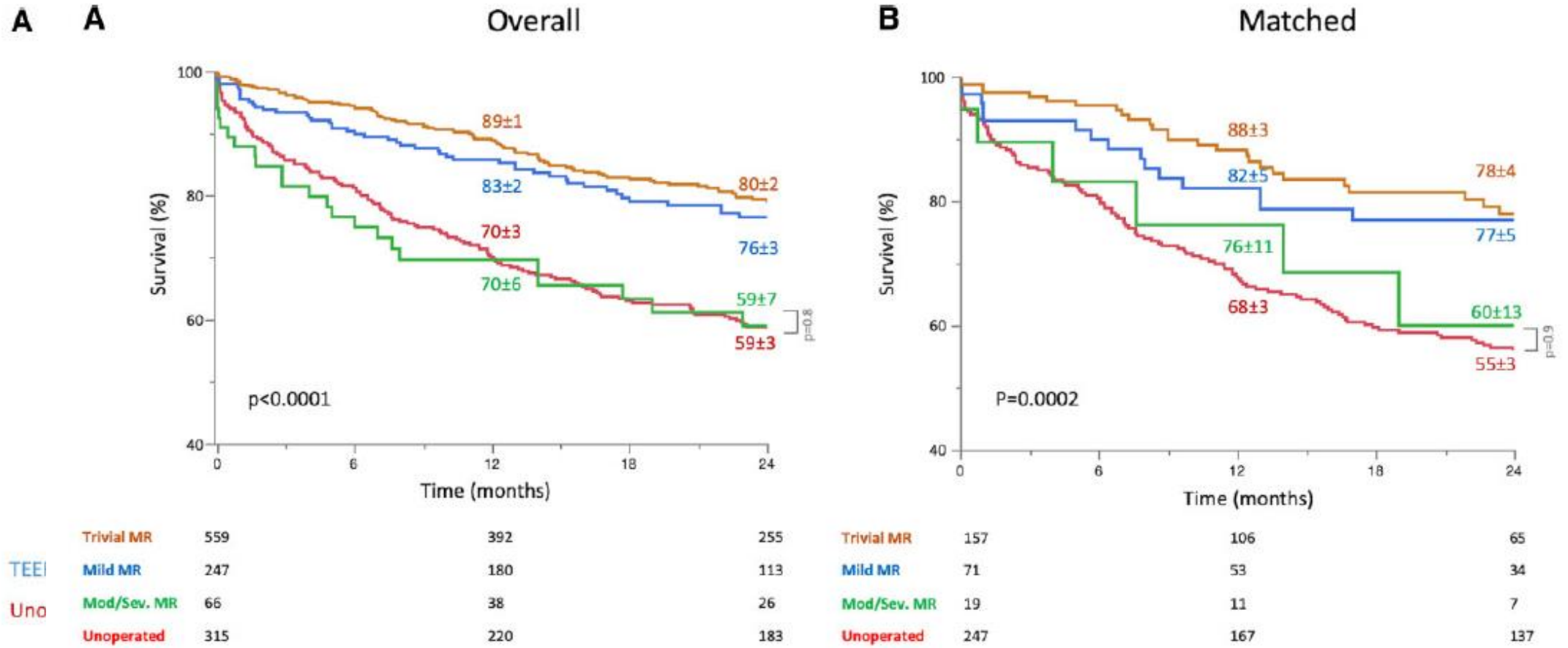
D. Landmark Analysis of Freedom From MV Surgery or Reoperation Beyond 6 Months



Patients At Risk		Months						
		0	6	12	24	36	48	60
Device Group	178	136	128	117	109	98	45	
Control Group	80	75	69	63	54	49	21	

Association of transcatheter edge-to-edge repair with improved survival in older patients with severe, symptomatic degenerative mitral regurgitation

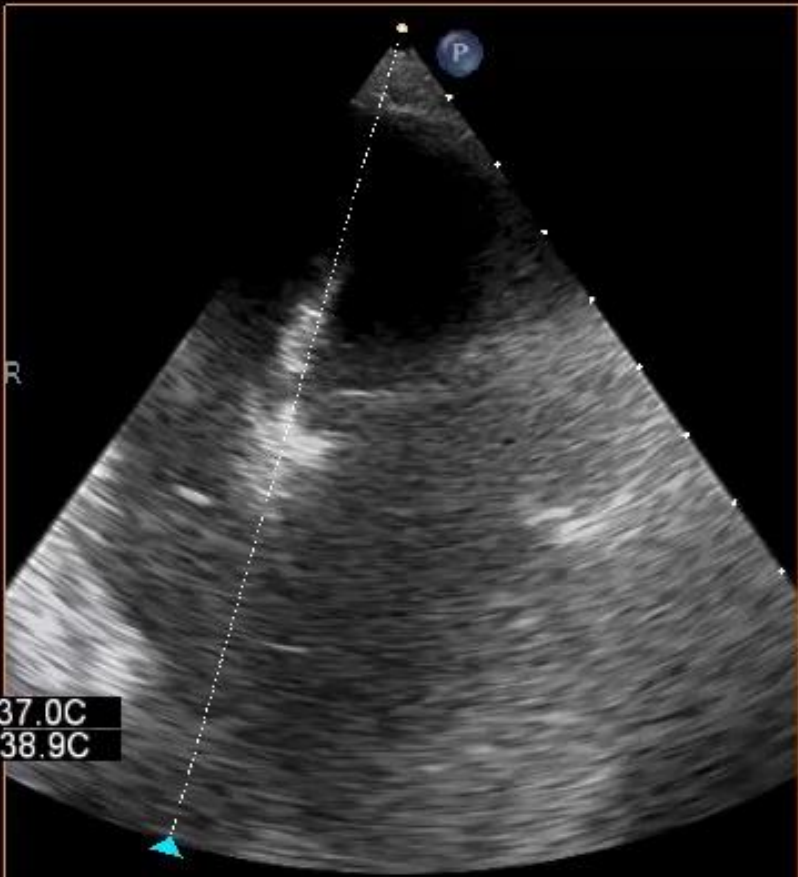
Clip in primary MR



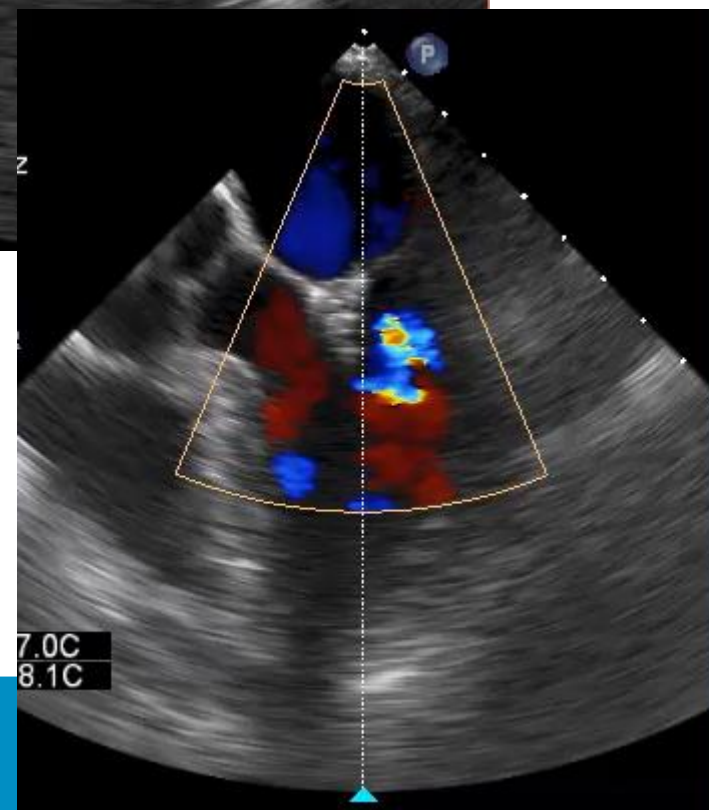


87yo woman

Clip in primary MR

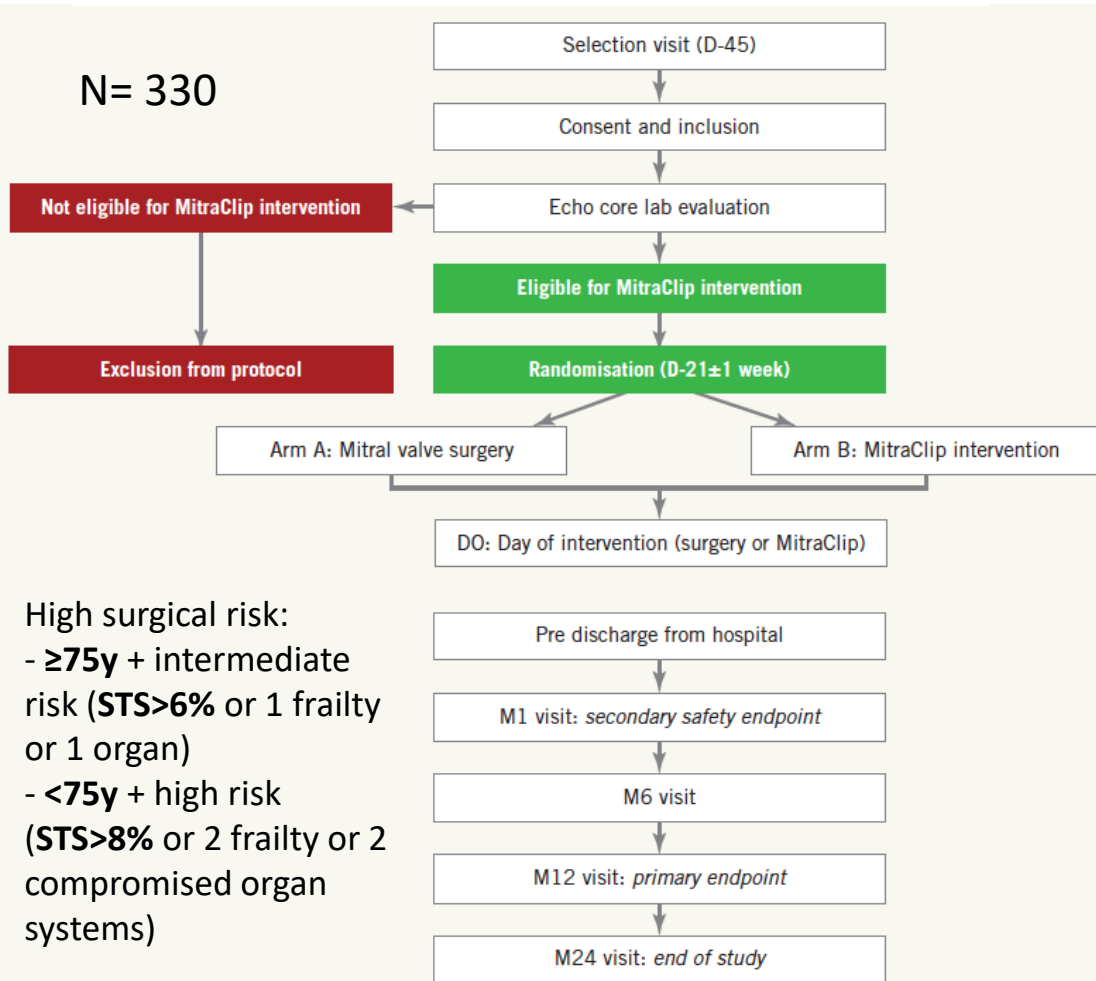


Mitraclip XT-W



The MITRA-HR study

N= 330



The REPAIR-MR study

N=500

Subject is at **moderate surgical risk** defined:

- ≥ 75 years of age,

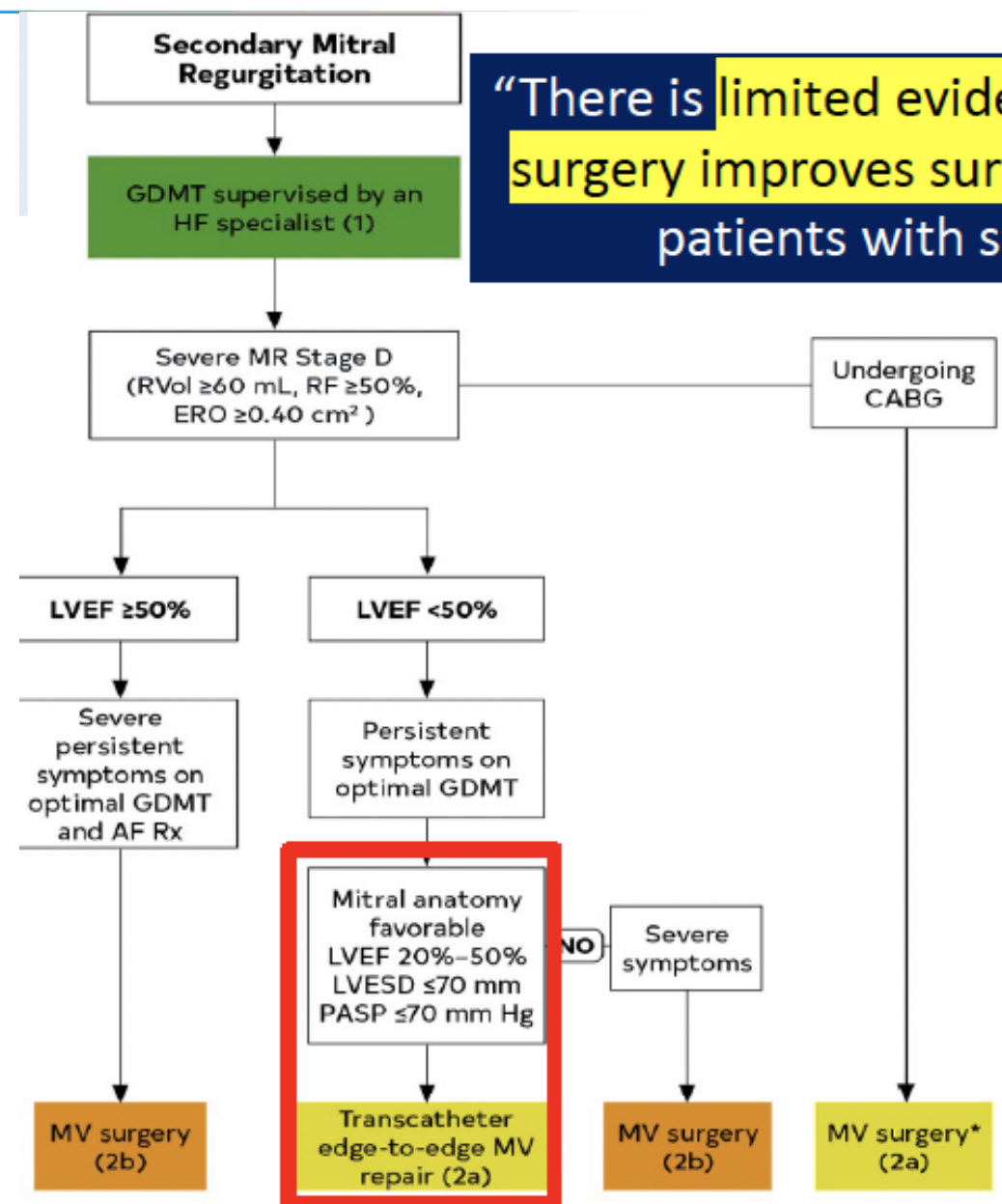
OR

- <75 years, then has:

- (1) Society of Thoracic Surgeons (STS) Predicted Risk of Mortality (PROM) Repair Score $\geq 2\%$, OR
- (2) Presence of other comorbidities which may introduce a potential surgery-specific impediment.

Percutaneous MitraClip Device or Surgical Mitral Valve REpair in PATients With PRImaRY Mitral Regurgitation Who Are Candidates for Surgery (REPAIR MR)

2a



“There is limited evidence that mitral valve surgery improves survival in symptomatic patients with secondary MR”

There is **NOT** a I - A indication

2a

Indications for mitral valve intervention in chronic severe secondary mitral regurgitation

2017 VHD Guidelines	Class	2021 VHD Guidelines	Class
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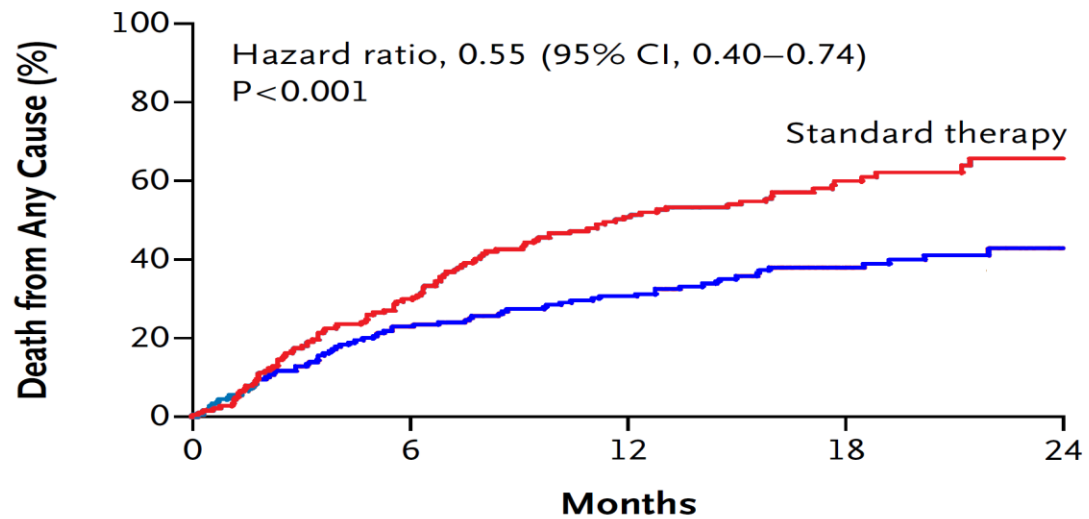
Patients without concomitant coronary artery or other cardiac disease requiring treatment

When revascularization is not indicated and surgical risk is not low, a percutaneous edge-to-edge procedure may be considered in patients with severe secondary mitral regurgitation and LVEF >30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have a suitable valve morphology by echocardiography, avoiding futility.

IIb

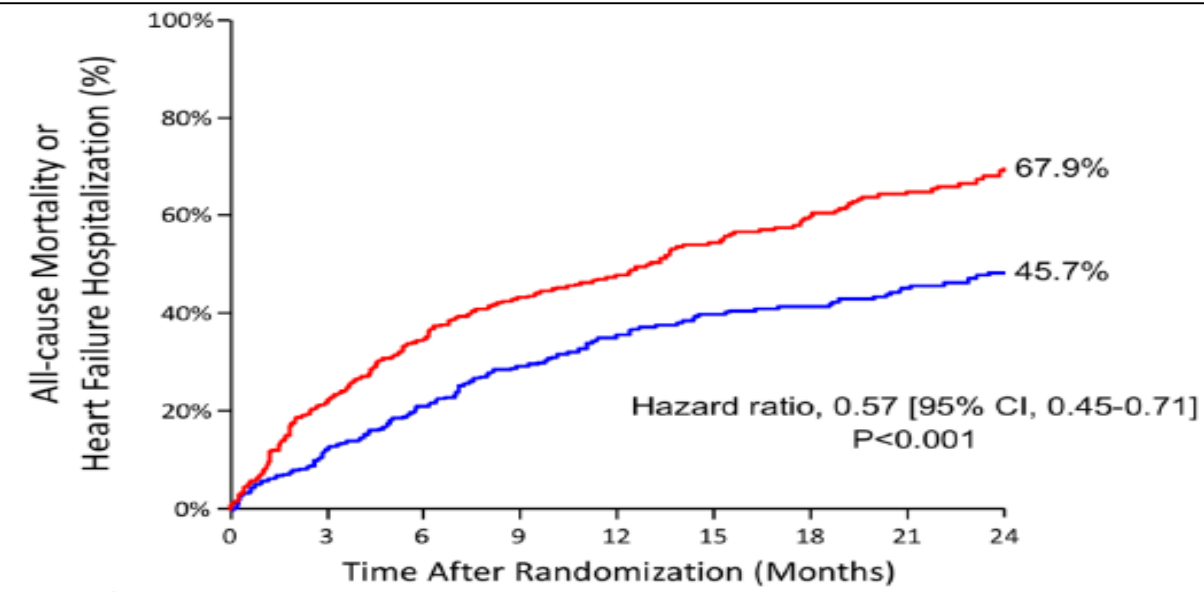
TEER should be considered in selected symptomatic patients, not eligible for surgery and fulfilling criteria suggesting an increased chance of responding to the therapy.

IIa



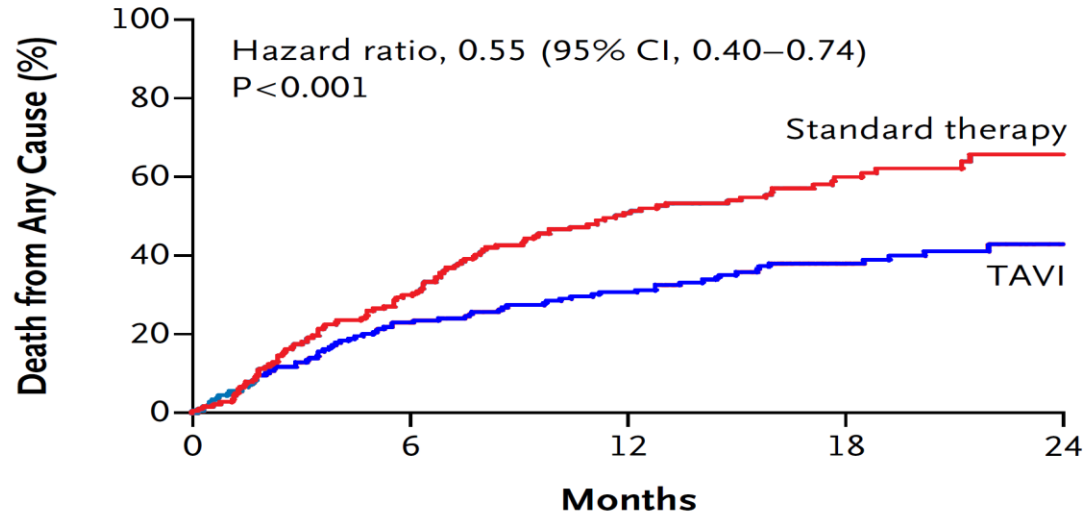
No. at Risk

Months	0	6	12	18	24
Standard therapy	179	138	122	67	26
Experimental group	179	121	83	41	12



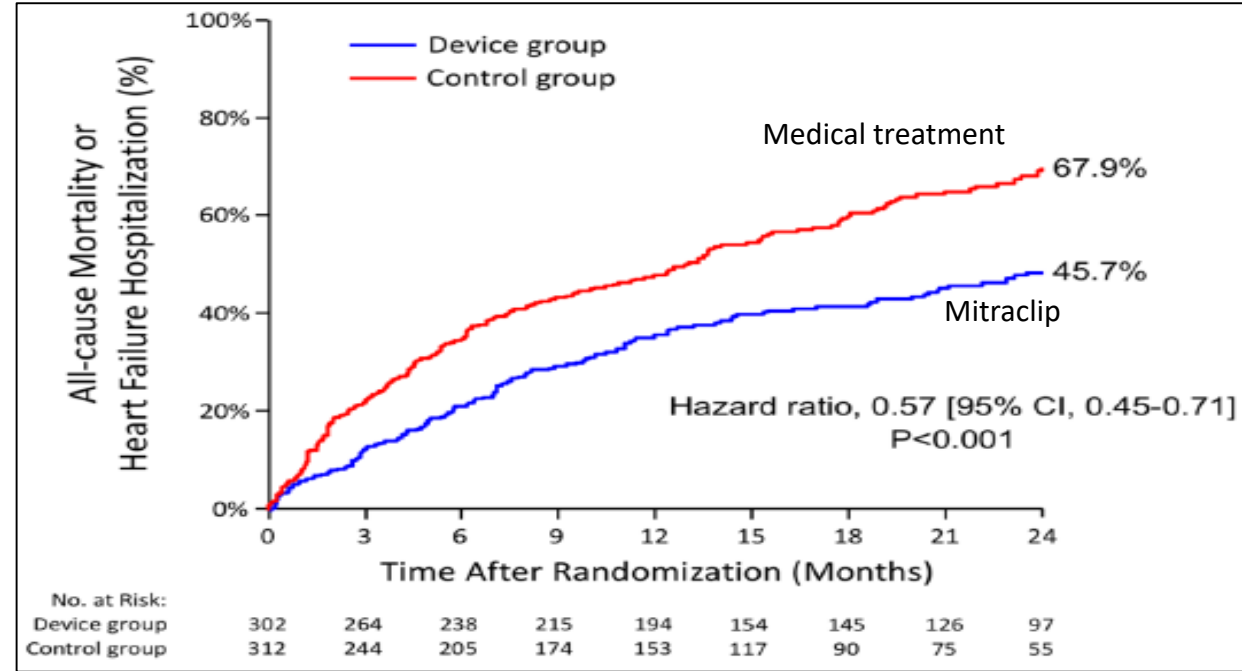
No. at Risk:

Time After Randomization (Months)	0	3	6	9	12	15	18	21	24
Standard therapy	302	264	238	215	194	154	145	126	97
Experimental group	312	244	205	174	153	117	90	75	55



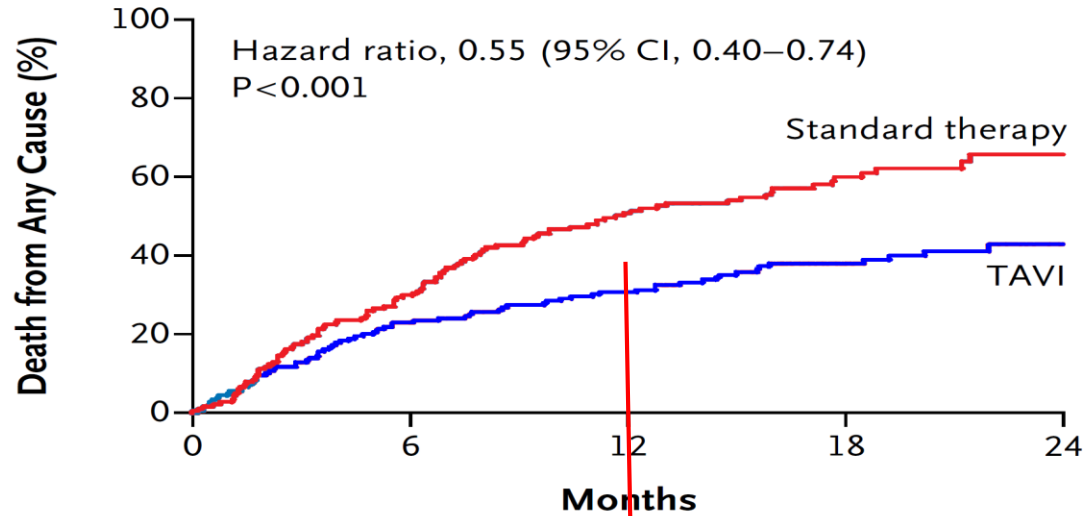
No. at Risk

	0	6	12	18	24
TAVI	179	138	122	67	26
Standard therapy	179	121	83	41	12



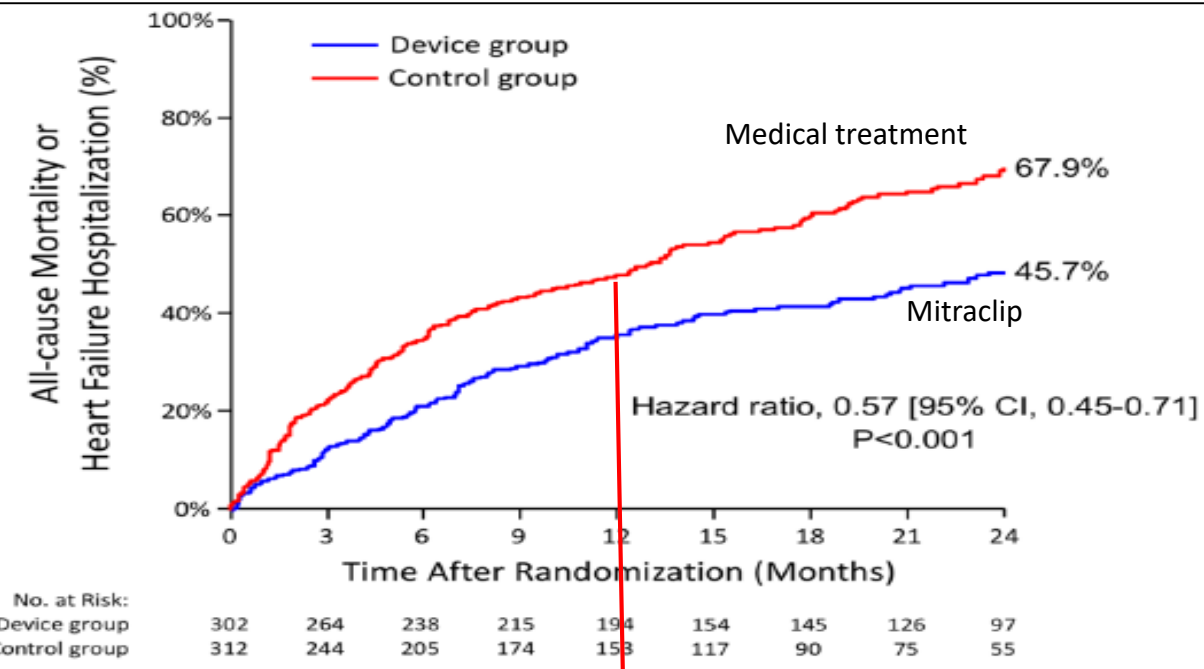
No. at Risk:

	0	3	6	9	12	15	18	21	24
Device group	302	264	238	215	194	154	145	126	97
Control group	312	244	205	174	153	117	90	75	55



No. at Risk	0	6	12	18	24
TAVI	179	138	122	67	26
Standard therapy	179	121	83	41	12

Mortalidad 1y: 30.7%
 Reingreso 1y: 22.3%



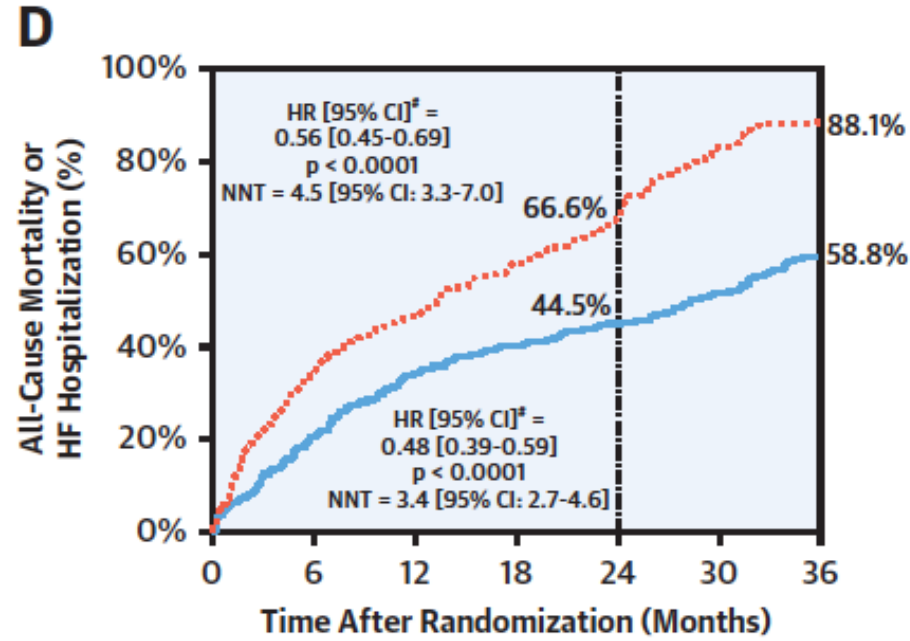
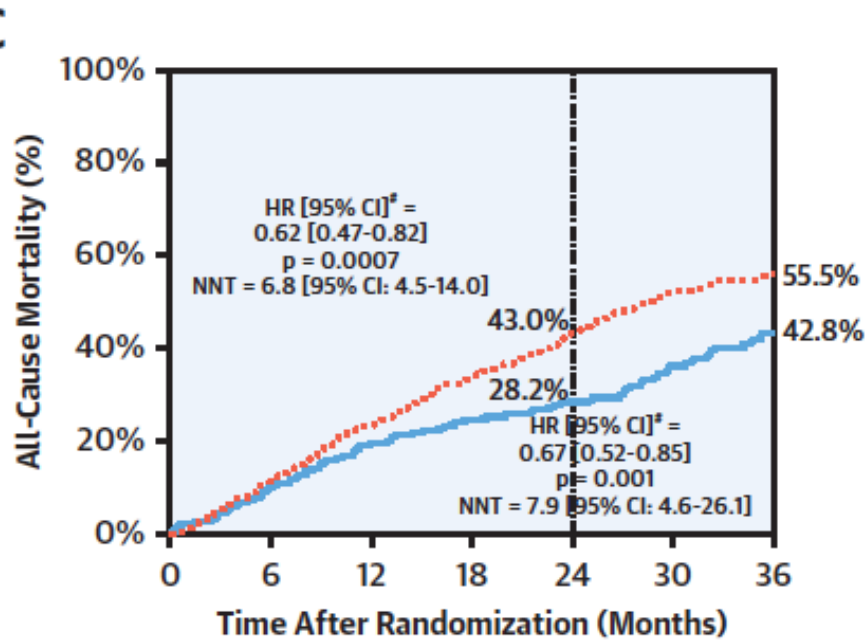
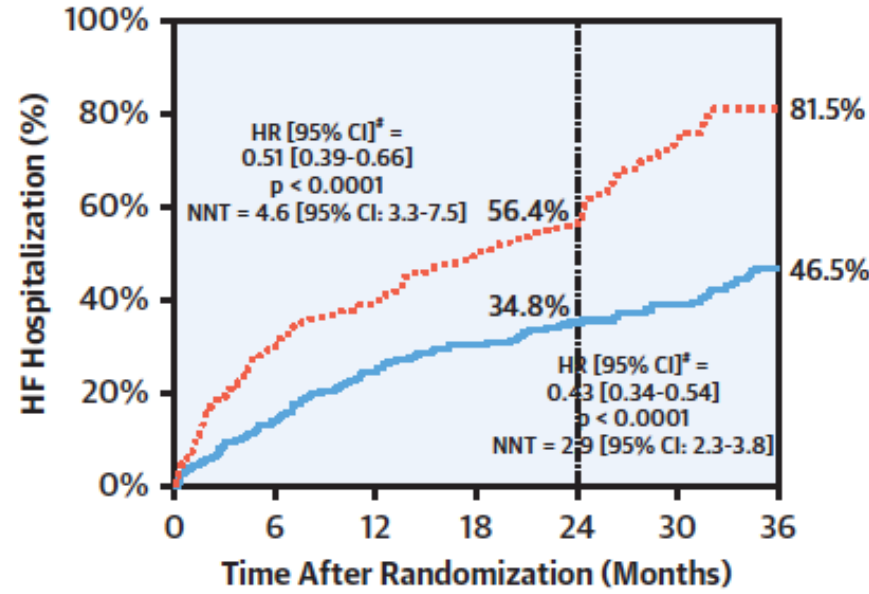
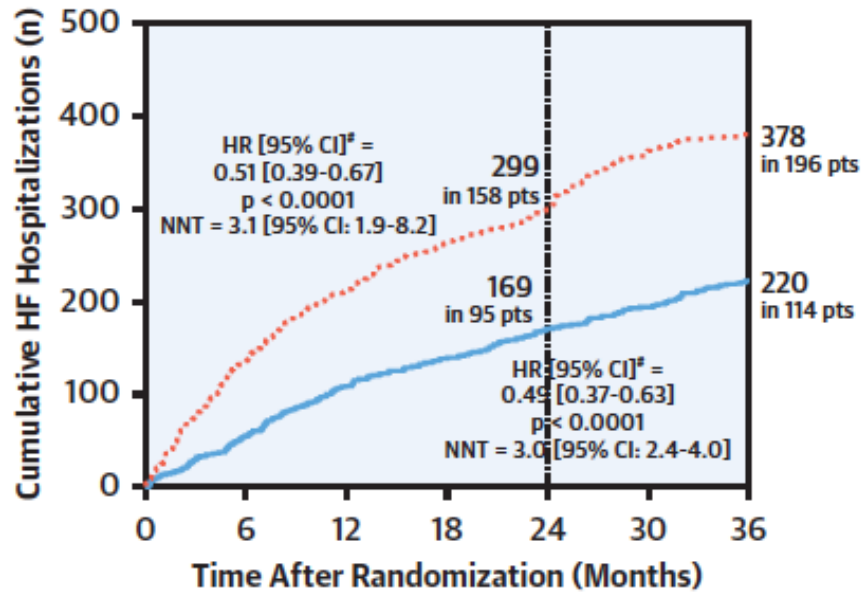
No. at Risk:	0	3	6	9	12	15	18	21	24
Device group	302	264	238	215	194	154	145	126	97
Control group	312	244	205	174	153	117	90	75	55

Mortalidad 1y: 18.8%
 Reingreso 2y: 35.8%

Overview in transcatheter edge-to-edge Mitral valve repair

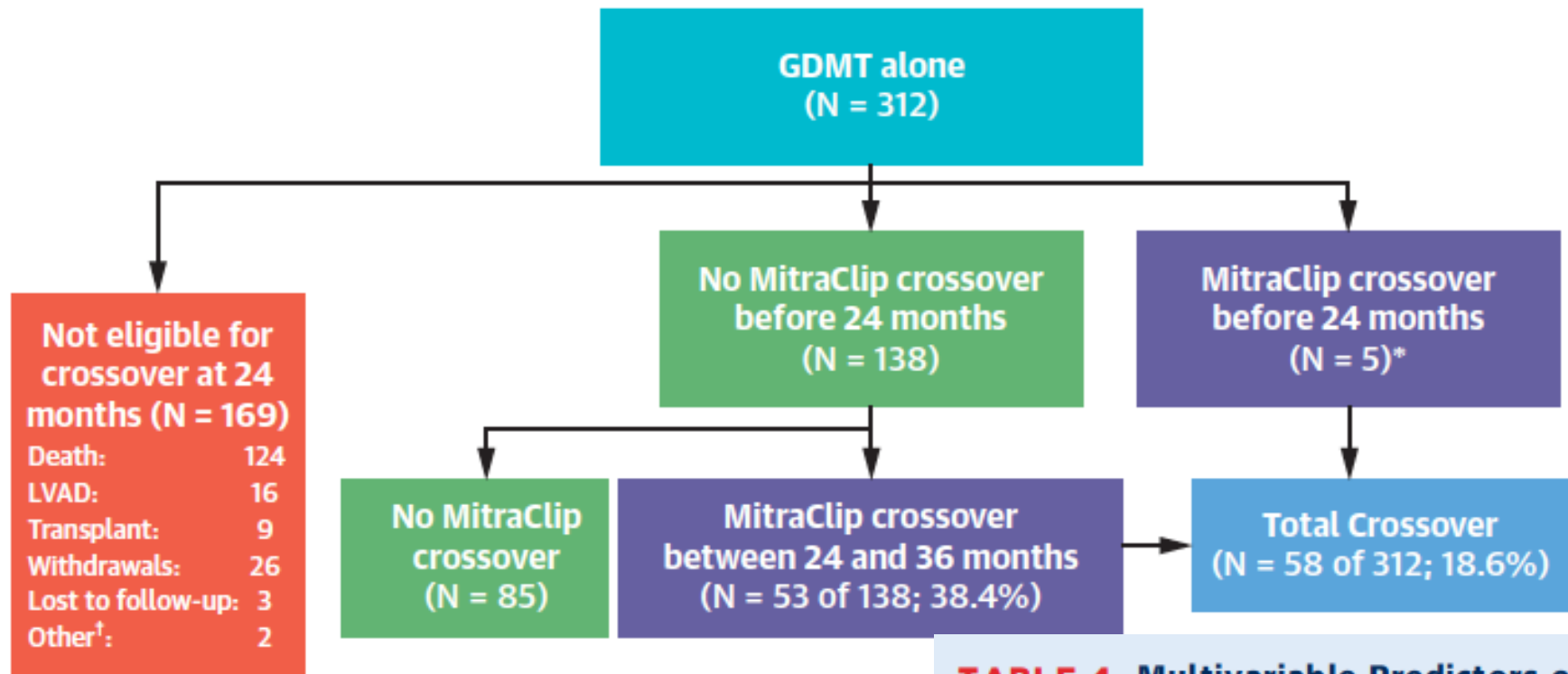
- Current indications
- **New evidence in TEER**
- Patient selection
- Expanding the indications
- Mitraclip (gold standard) vs other devices

COAPT TRIAL 3-YEARS



— MitraClip + GDMT (n = 302) GDMT Only (n = 312)

HR [95% CI] = 0.48 [0.39, 0.59]
P=0.0000000000001
NNT = 3.4 [95% CI 2.7, 4.6]



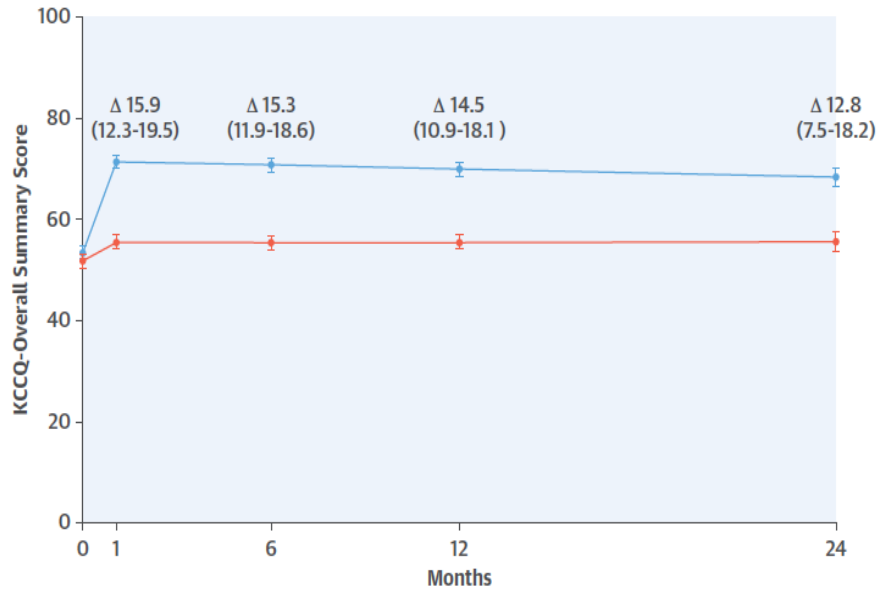
Not eligible for crossover at 24 months (N = 169)

- Death: 124
- LVAD: 16
- Transplant: 9
- Withdrawals: 26
- Lost to follow-up: 3
- Other[†]: 2

TABLE 4 Multivariable Predictors of Death or Heart Failure Hospitalization in the GDMT Alone Group

	Hazard Ratio (95% CI)	p Value
Treatment with MitraClip	0.43 (0.24–0.78)	0.006
BNP (per 250 pg/ml)	1.06 (1.03–1.09)	<0.0001
Vasodilator use (hydralazine or nitrates)	1.91 (1.37–2.66)	0.0001
Systolic blood pressure (per 10 mm Hg)	0.87 (0.80–0.96)	0.004
STS replacement score (per 1 U)	1.04 (1.01–1.07)	0.005
Beta-blocker use	0.57 (0.37–0.88)	0.01
LVEDV (per 50 ml)	1.13 (1.02–1.25)	0.02

Kansas City Cardiomyopathy Questionnaire (KCCQ)-Overall Summary Score

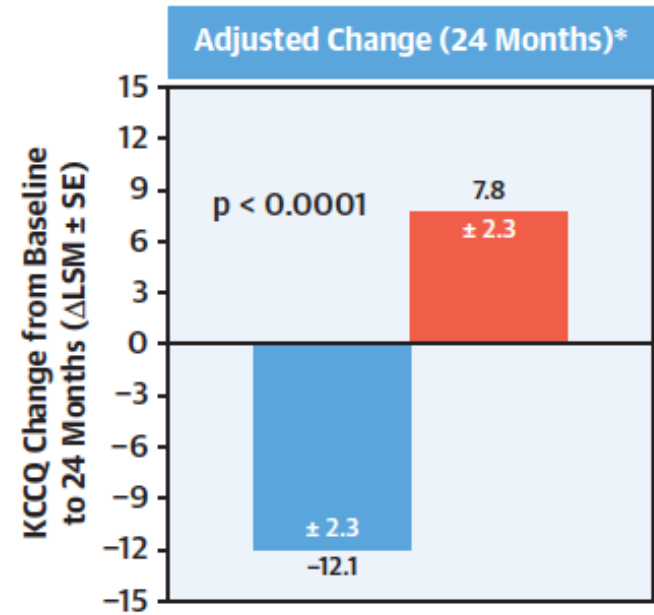
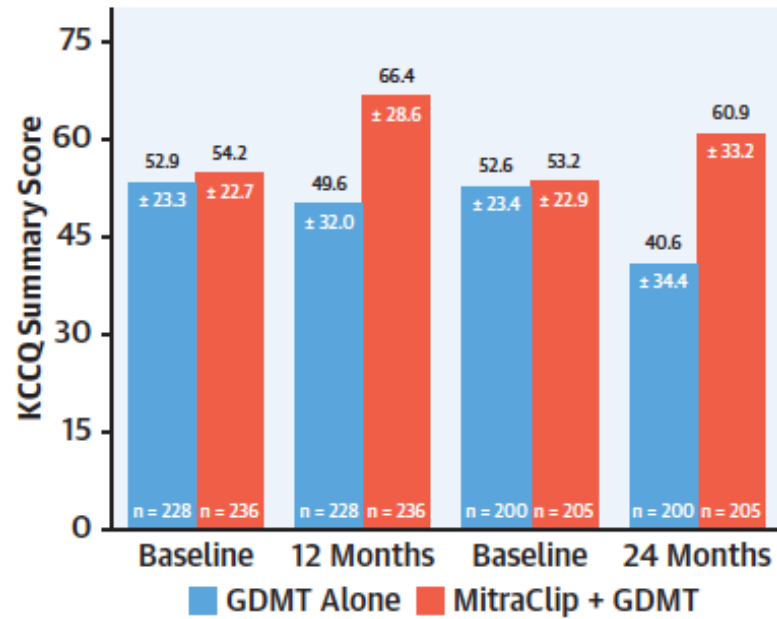


N	TMVr	Std Care
0	302	309
1	279	275
6	252	237
12	219	189
24	128	90

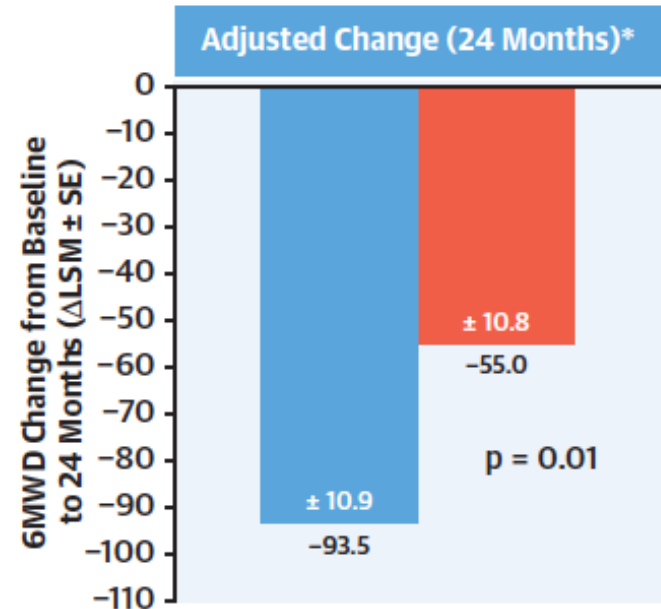
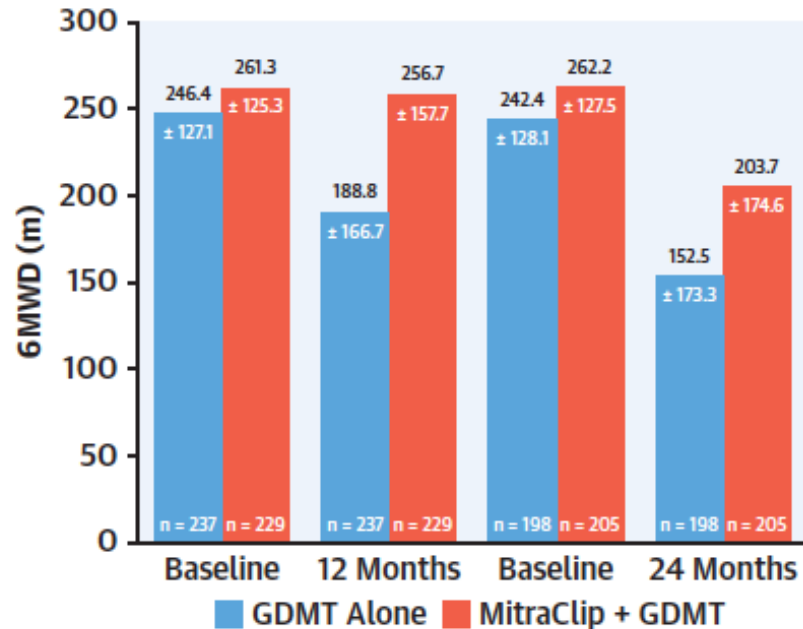
— Transcatheter Mitral Valve Repair (TMVr) — Standard Care (Std Care)

Arnold, et al JACC 2019

A



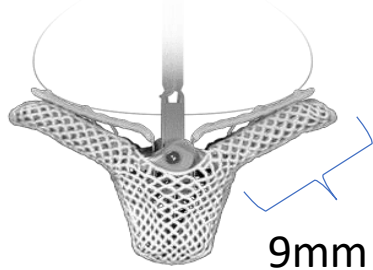
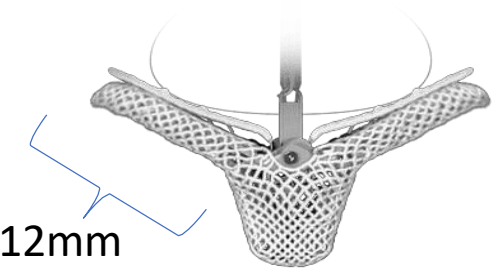
B



Mack, et al JACC 2021

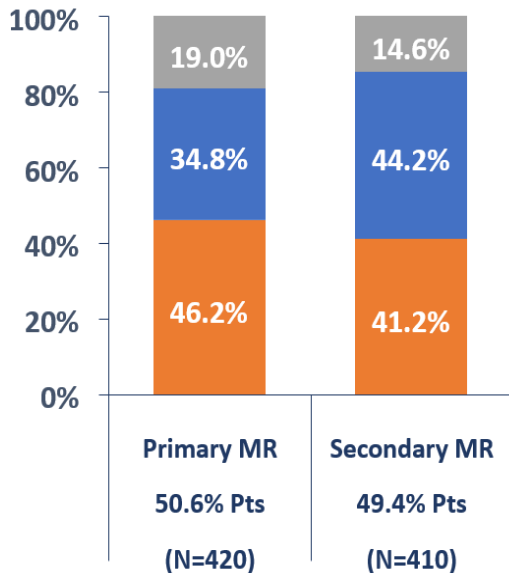
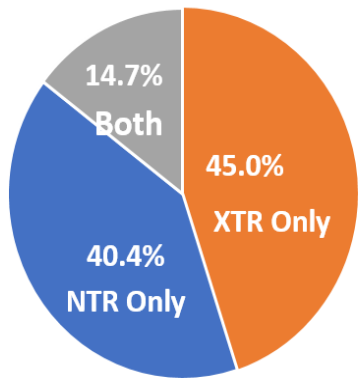
EXPAND STUDY

- 99%
- 96%
- 46%
- 80%



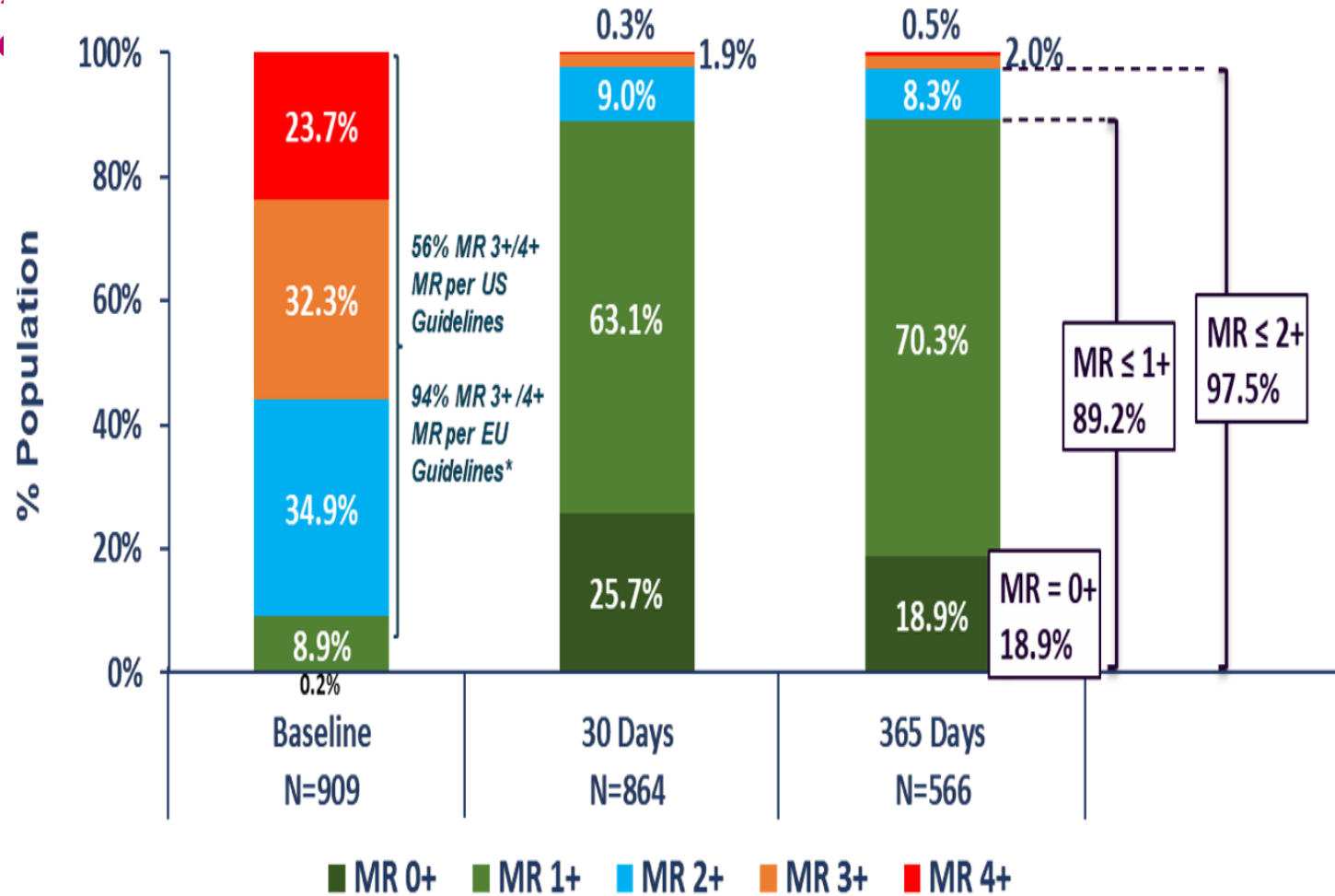
Clip Mix (n= 1030)¹

Clip Size Use by MR Etiology¹



■ XTR Only ■ NTR Only ■ Both NTR & XTR

ECL Adjudicated MR Severity

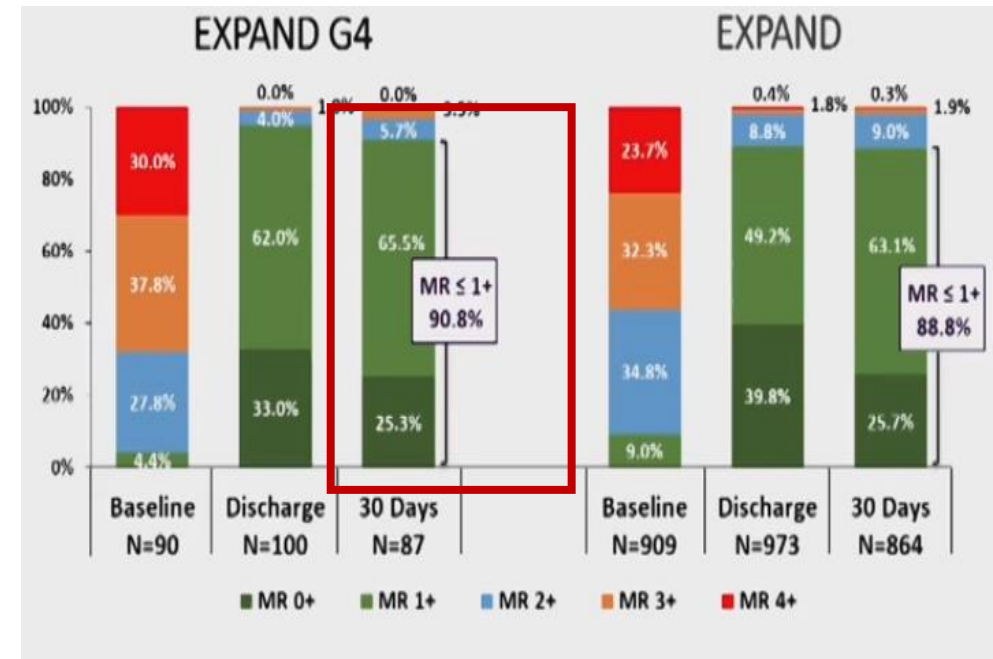


Kar, et al. TCT 2020

EXPAND G4 Study

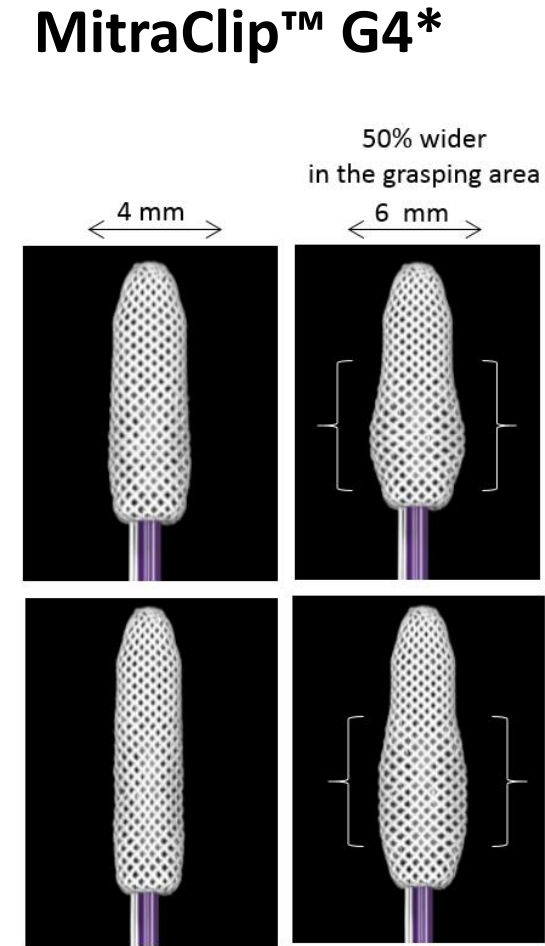
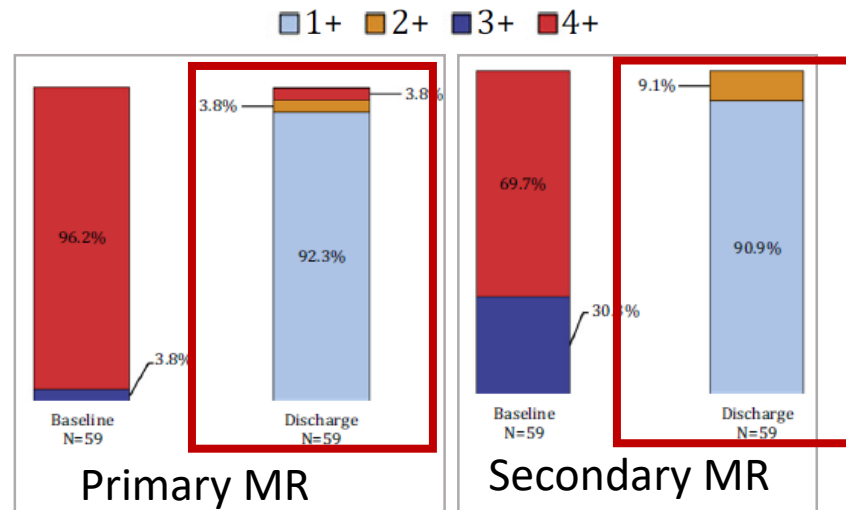
n=101

More subjects treated with a single clip (61%) compared to EXPAND (55%)*
Wider clips used in large proportion of single clip cases (82%)
NT used often as the second clip of choice (66%)



Transcatheter Edge-to-Edge Mitral Valve Repair With the MitraClip G4 System

- n=59 patients
- 60% wider clip
- Independent grasping: 49.2%
- Fluoroscopy time: 14 min (1 clip)
- Median procedure time: 22 min (1 clip)





Central spacer

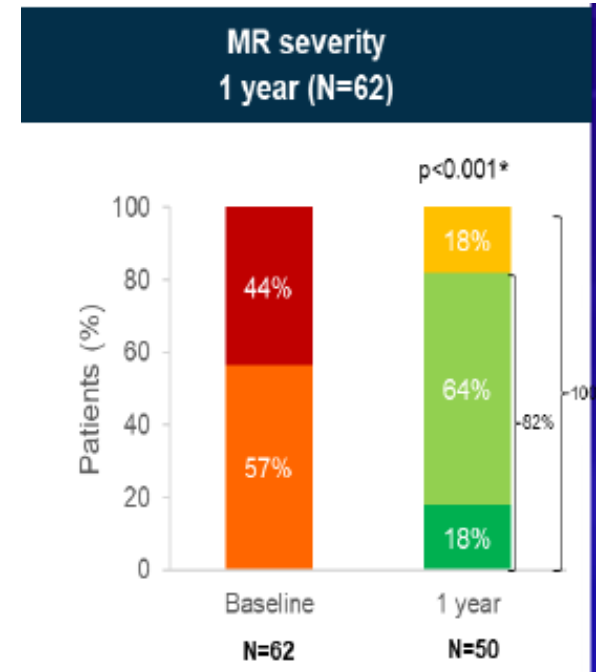
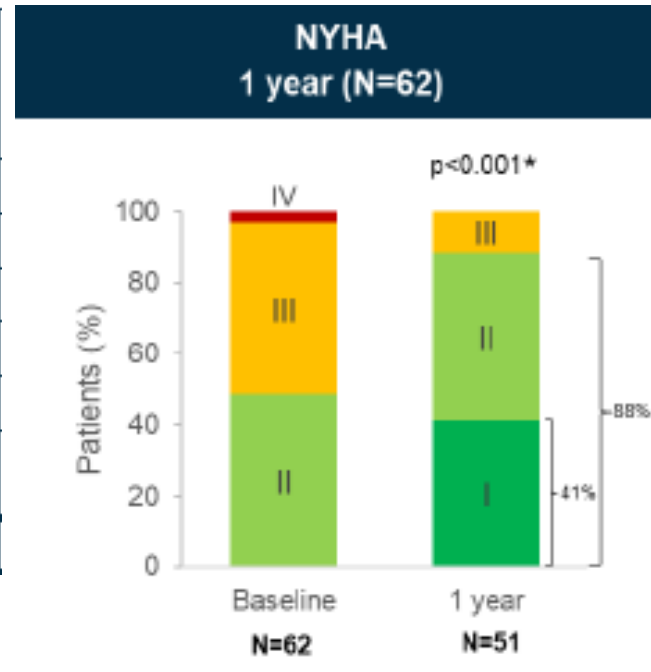
Independent leaflet grasping

Device elongation

Six-month and one-year outcomes for transcatheter repair in patients with mitral regurgitation from the CLASP study

Single arm, multicentre, prospective study to evaluate the safety, performance, and clinical outcomes of the **PASCAL Transcatheter Valve Repair System** for clinically significant mitral regurgitation

CEC adjudicated events	30 days N=109 % (n)	1 year N=62 % (n)
Cardiovascular mortality	0.9% (1)	6.5% (4)
Stroke	0.9% (1)	0.0% (0)
Myocardial infarction	0.0% (0)	1.6% (1)
New need for renal replacement therapy	0.0% (0)	0.0% (0)
Severe bleeding*	7.3% (8)	9.7% (6)
Re-Intervention for study device-related complications†	0.9% (1)	1.6% (1)
Composite MAE rate	8.3% (9)	14.5% (9)

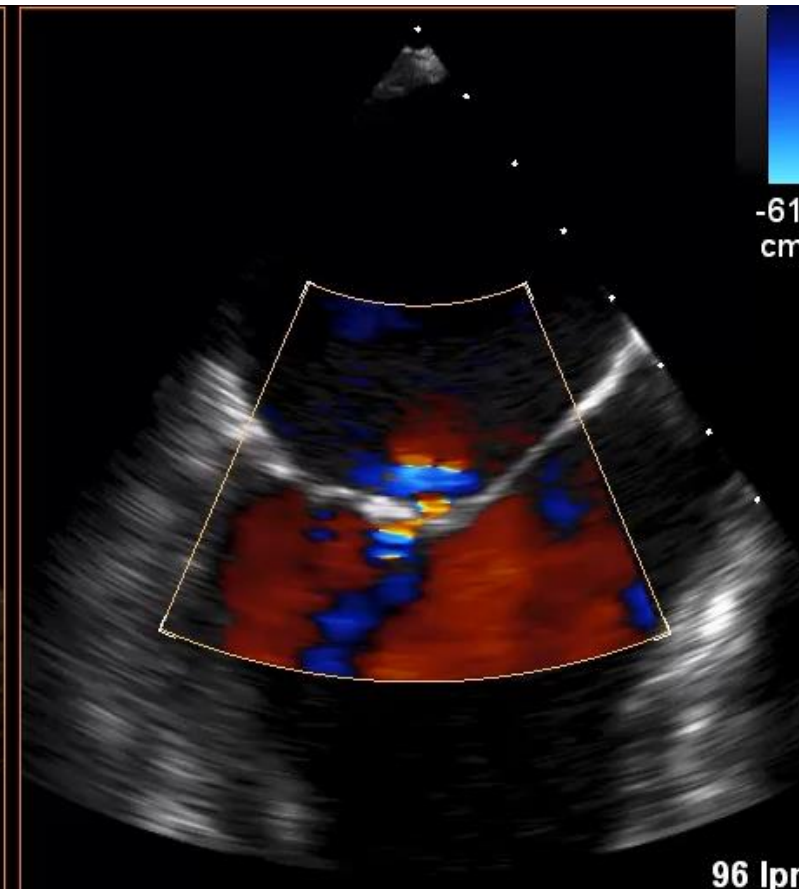
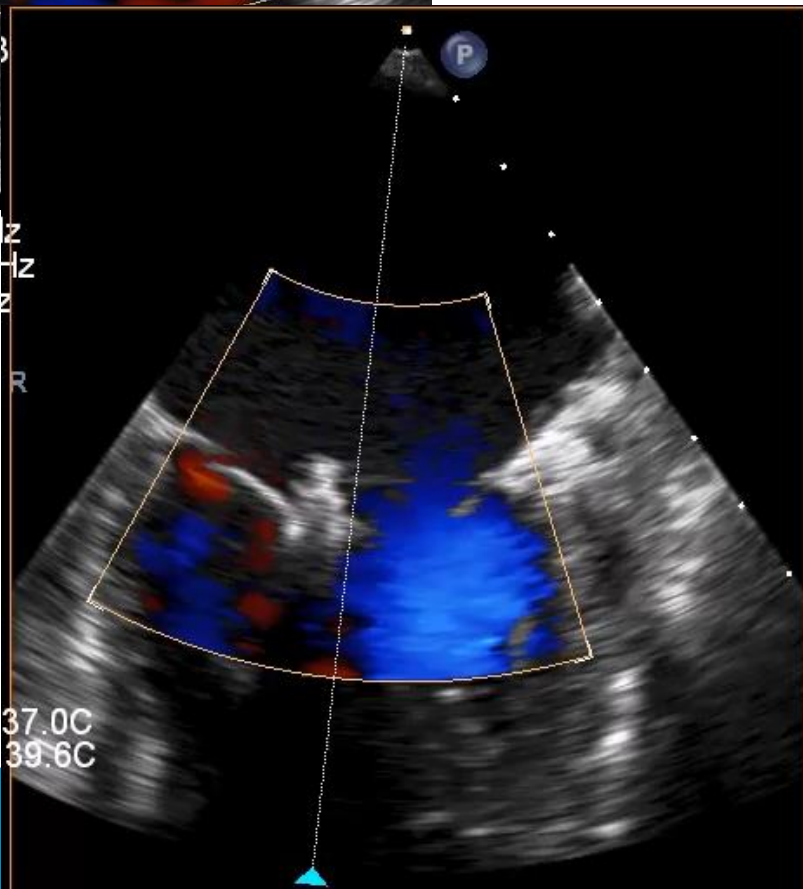
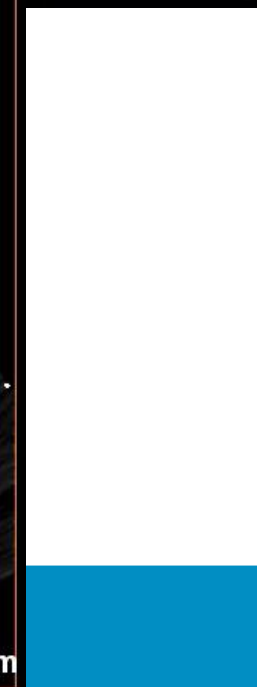
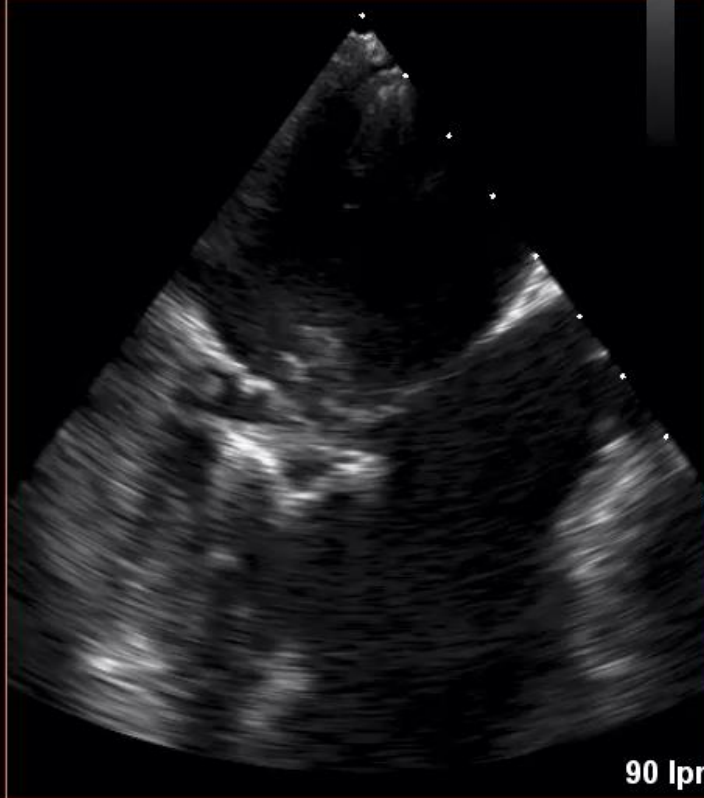
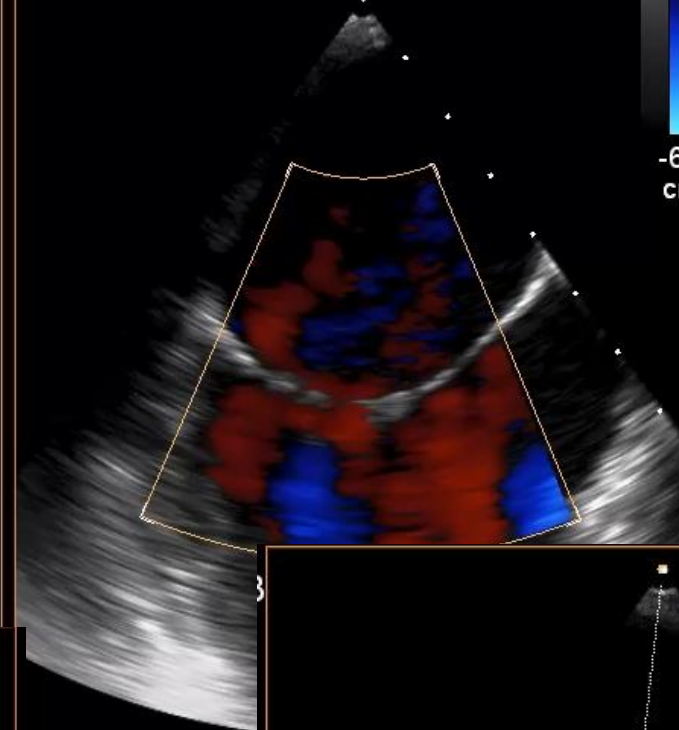
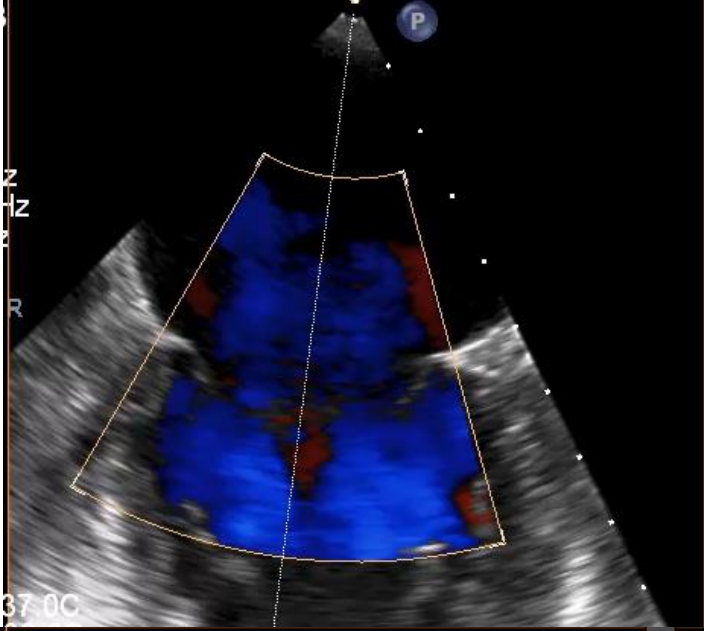


88% NYHA I-II

100% MR $\leq 2+$

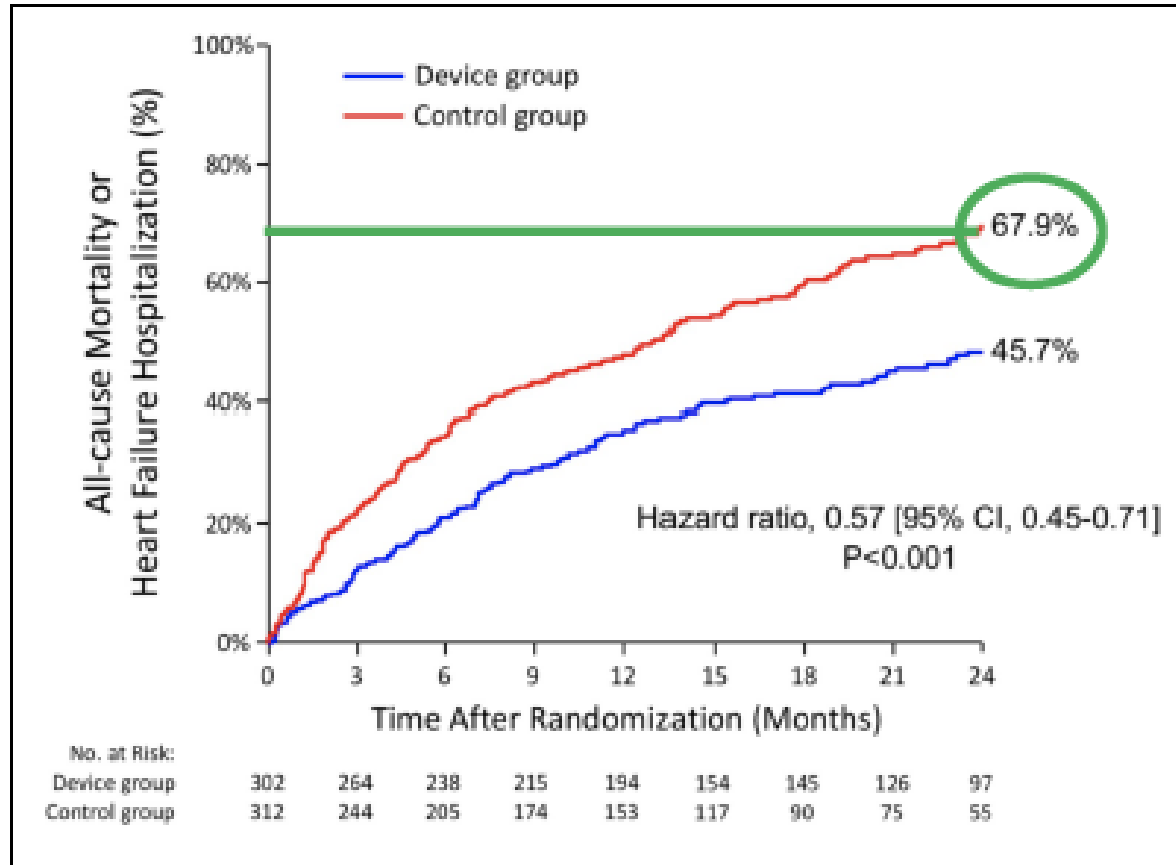
New Evidence in TEER

PASCAL ACE EXAMPLE

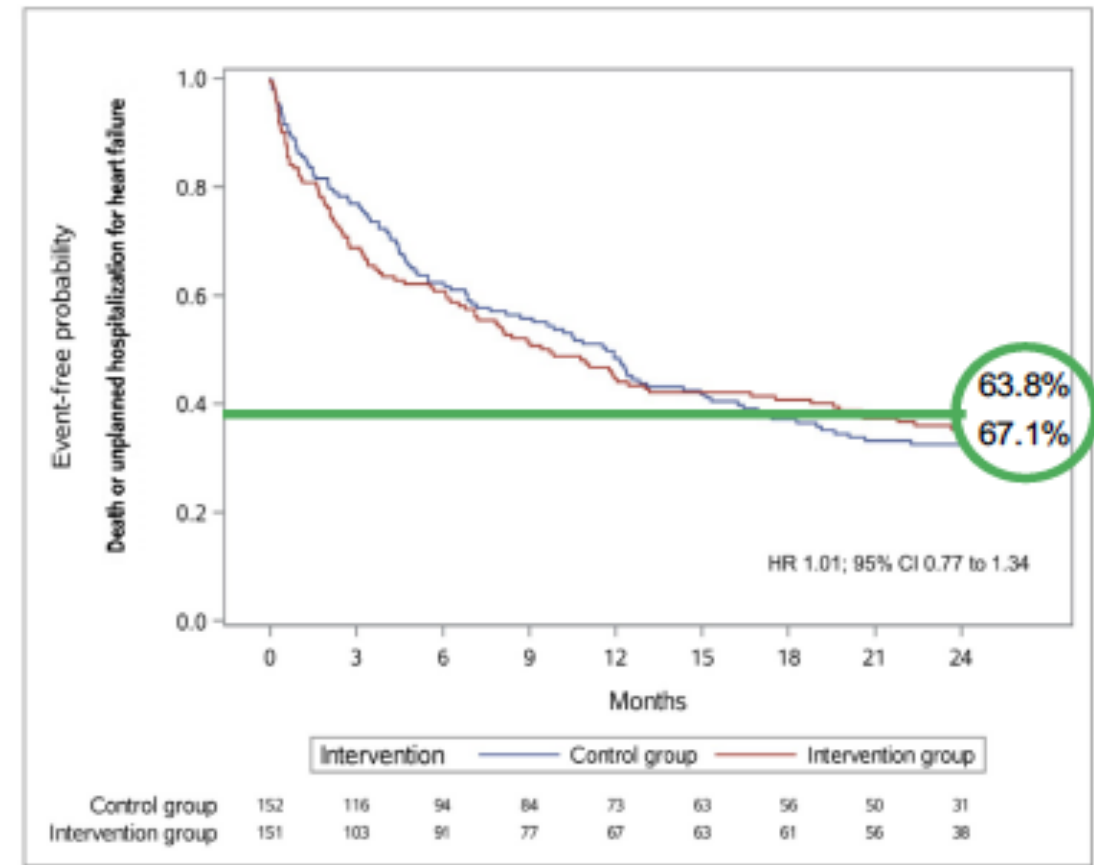


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- Current indications
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Stone G. NEJM 2018



Obadia JF. Eur J HF 2019

Super-Responders and Nonresponders in the COAPT Trial

Not as Simple as Clip or No Clip*

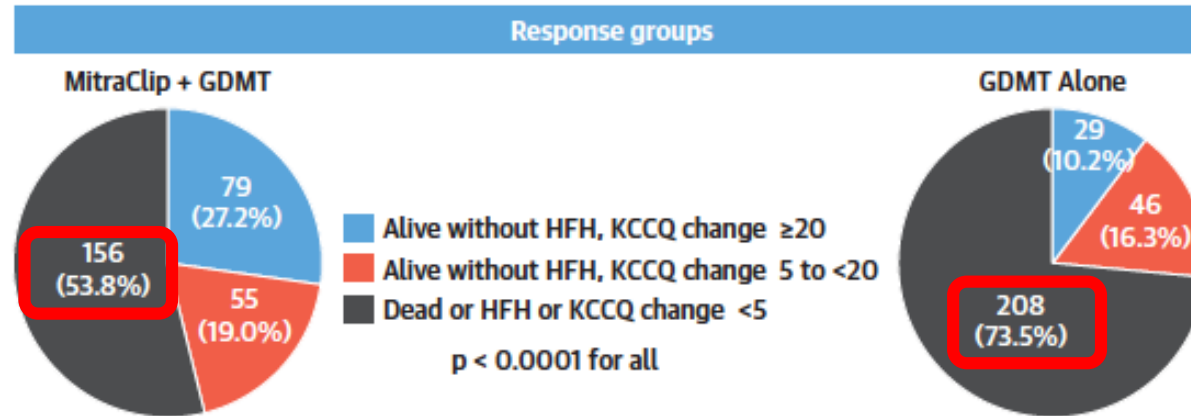
Predictors of improvement:

- Low Baseline creatinine:
- Low baseline KCCQ-OS:
- Mitraclip group

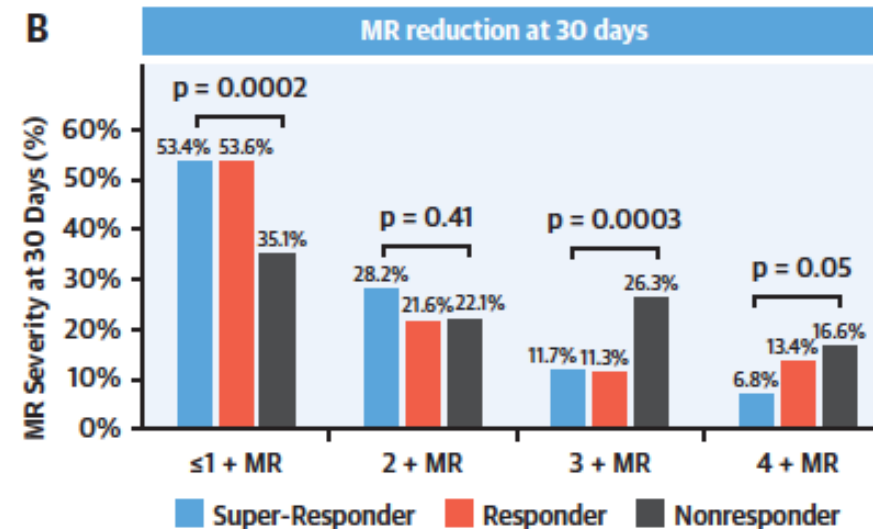
Non-responders:

- High systolic pulmonary pressure
- High transmitral gradient
- Large LVEDV and LVESD
- Inferior basal aneurism

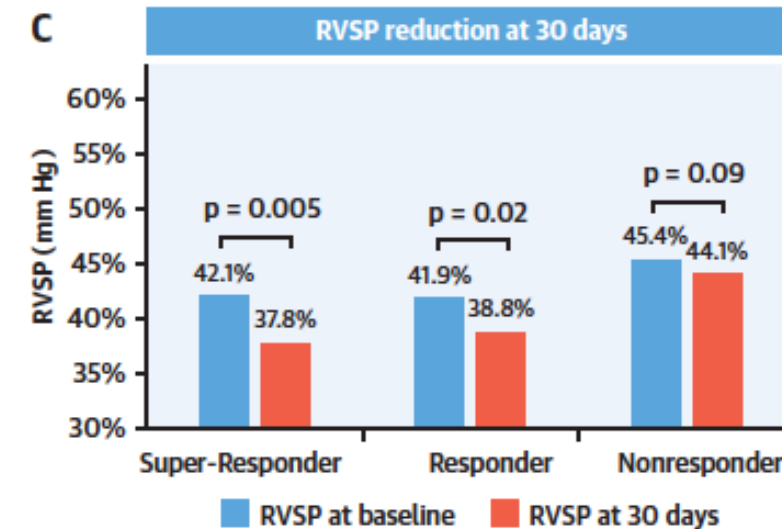
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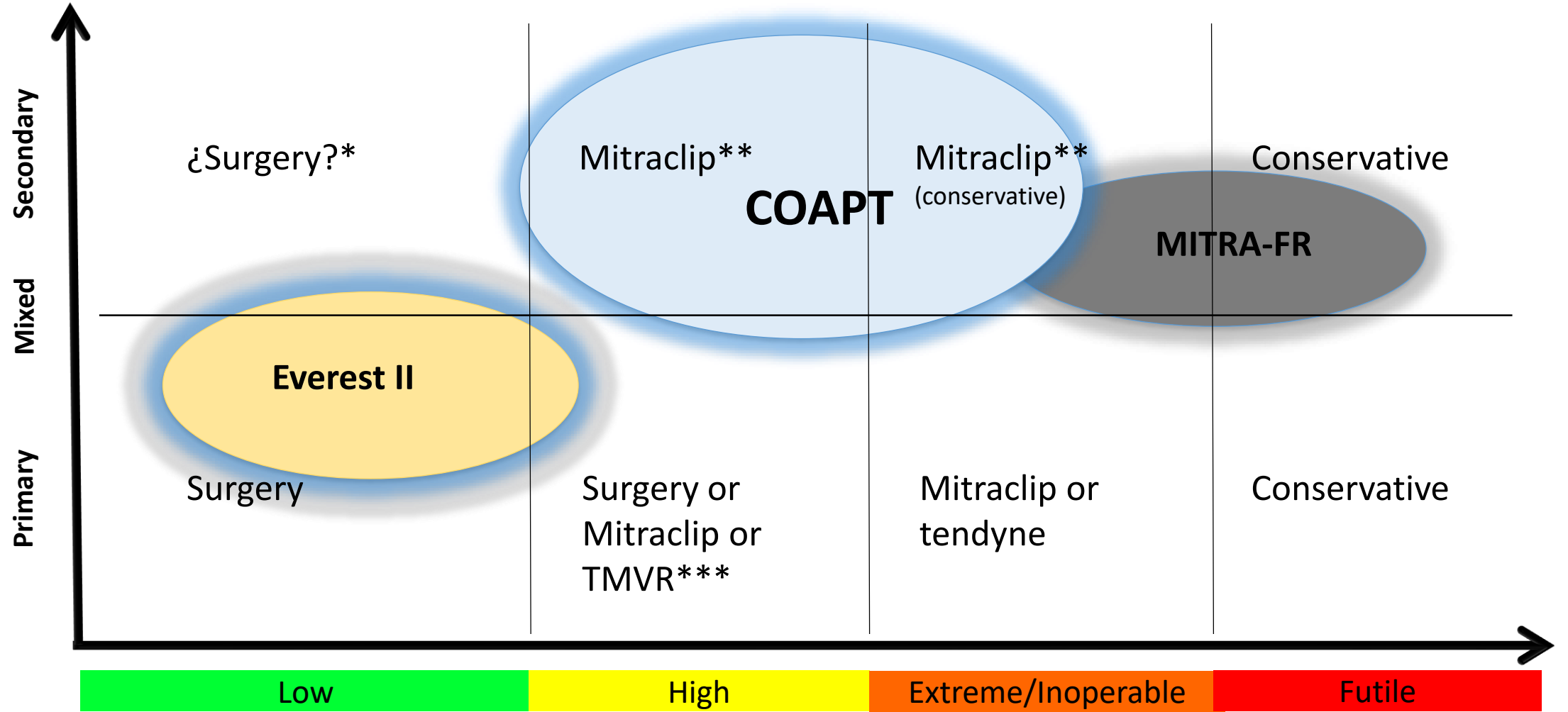
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C



MR Etiology



Surgical Risk

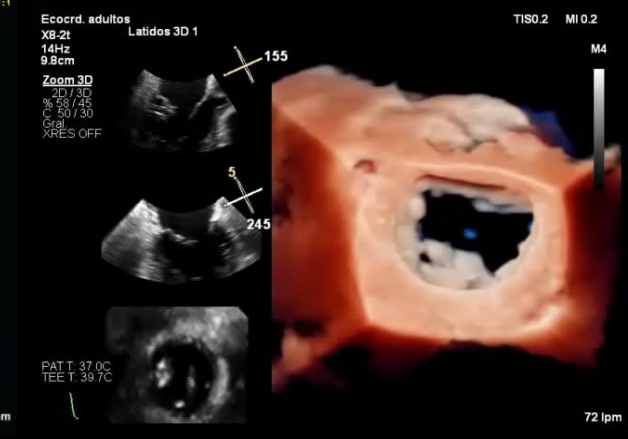
* Undergoing CABG or other cardiac surgery

**Who remained symptomatic with OMT (including CRT if indicated) ;

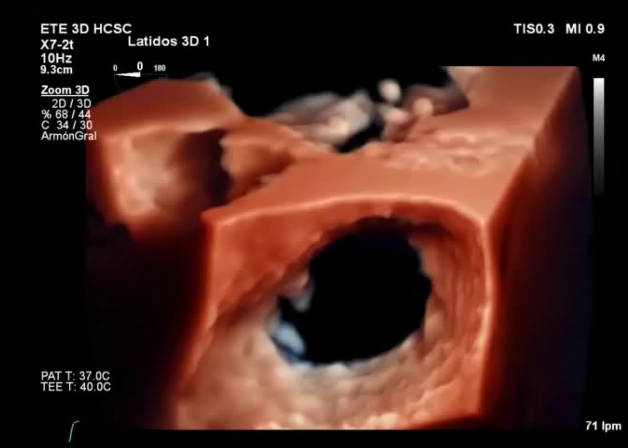
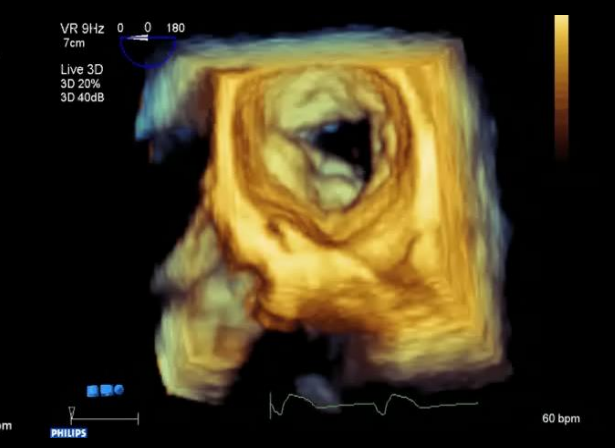
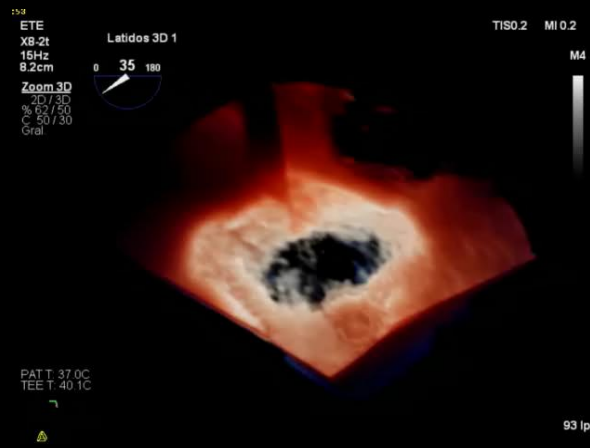
*** As assessed by the Heart Team

Overview in transcatheter edge-to-edge Mitral valve repair

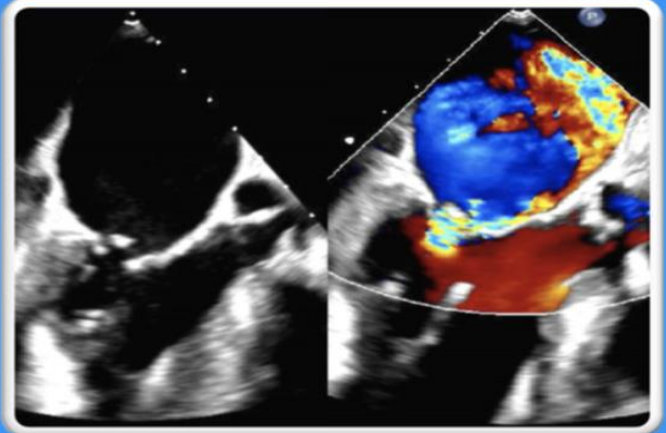
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DIFFERENT ETIOLOGY
AND
DIFFERENT PATIENTS

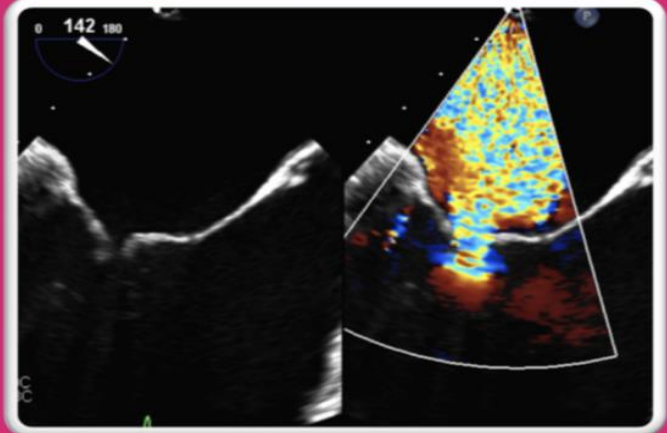


Borderline MVA (3.5 – 4 cm²)



Commissural pathology
Short or restricted PML (6-9 mm)
Mitral annular calcification
Coaptation/flail gap <10 mm

Preferred for secondary MR



NT

NTW

Narrow / circular jet
Flail width < 15 mm

NARROWER (4 MM)

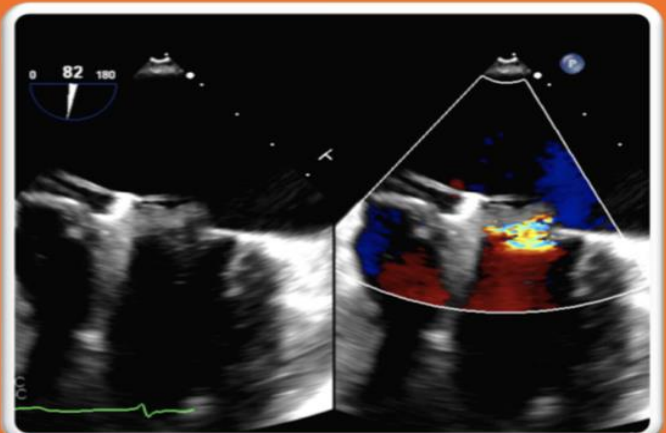
ARM DIMENSIONS

WIDER (6 MM)

Wide / elongated jet
Flail width > 15 mm

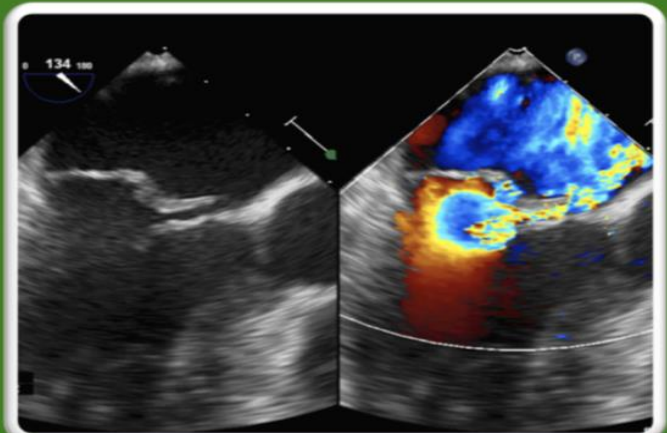
XT

XTW



Adjunct to XTW for additional MR reduction if concerned about MVA

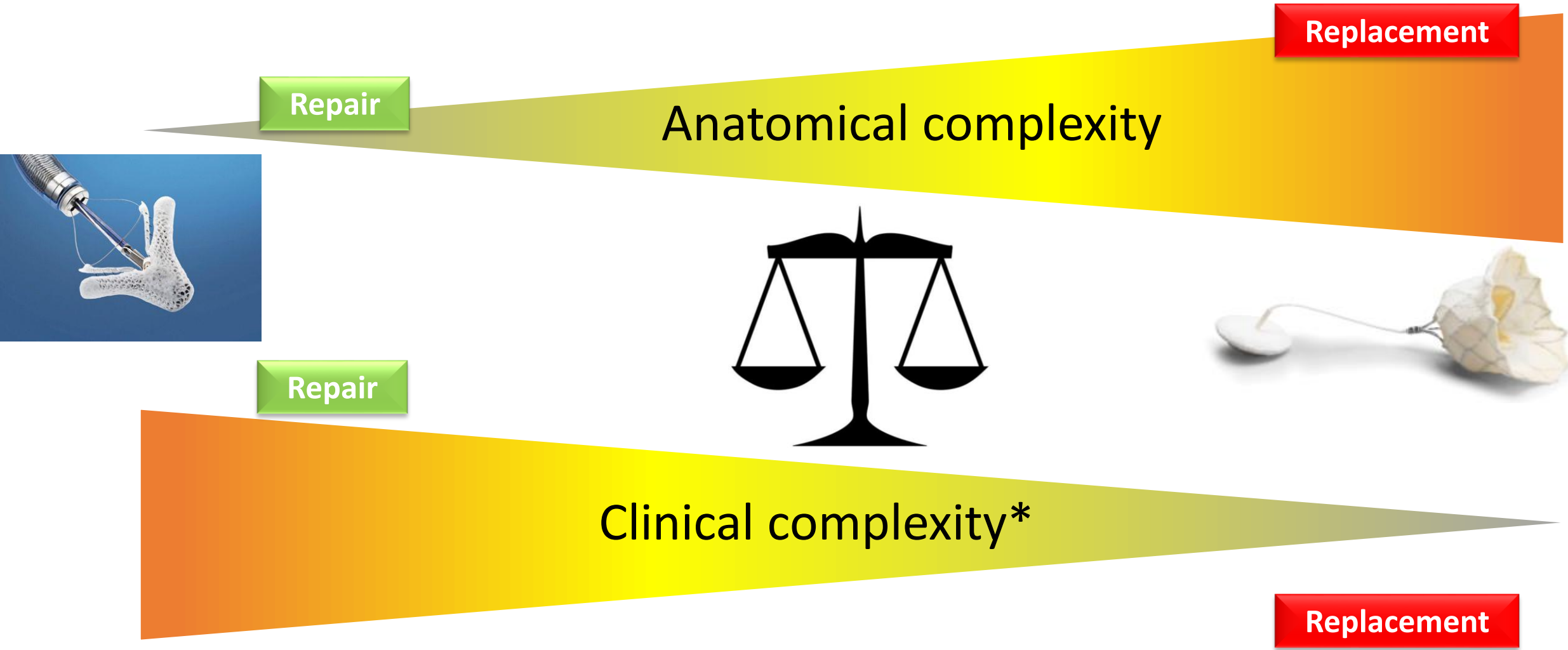
Central (A2-P2) pathology
Long or redundant PML >9 mm
No mitral annular calcification
Large coaptation gap or height



Preferred for primary MR with large flail or bileaflet prolapse

LONGER (12 MM)

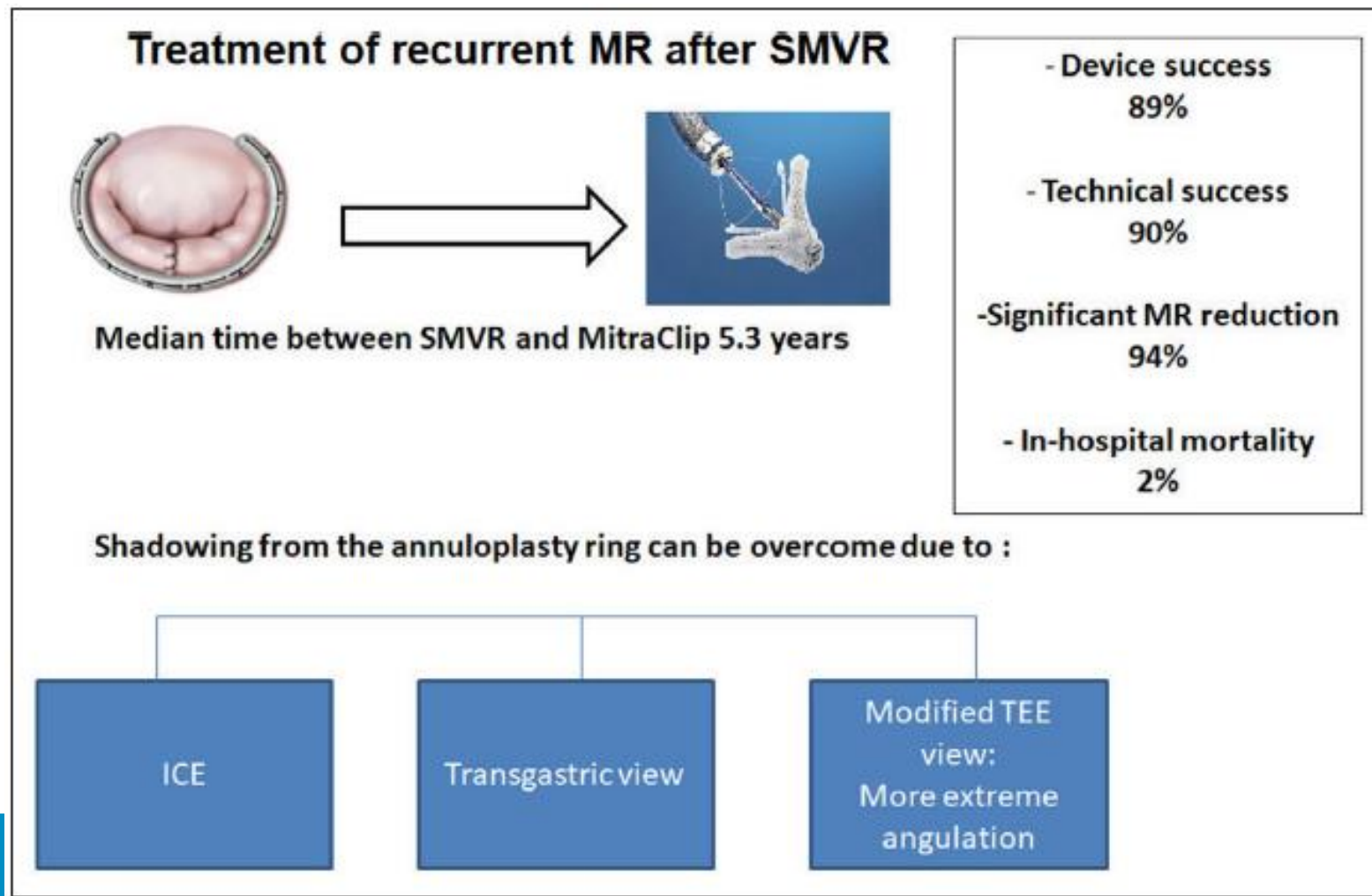
Patient selection for a TEER procedure




*Surgical risk, frailty, unstable situation, age...

MitraClip After Failed Surgical Mitral Valve Repair—An International Multicenter Study

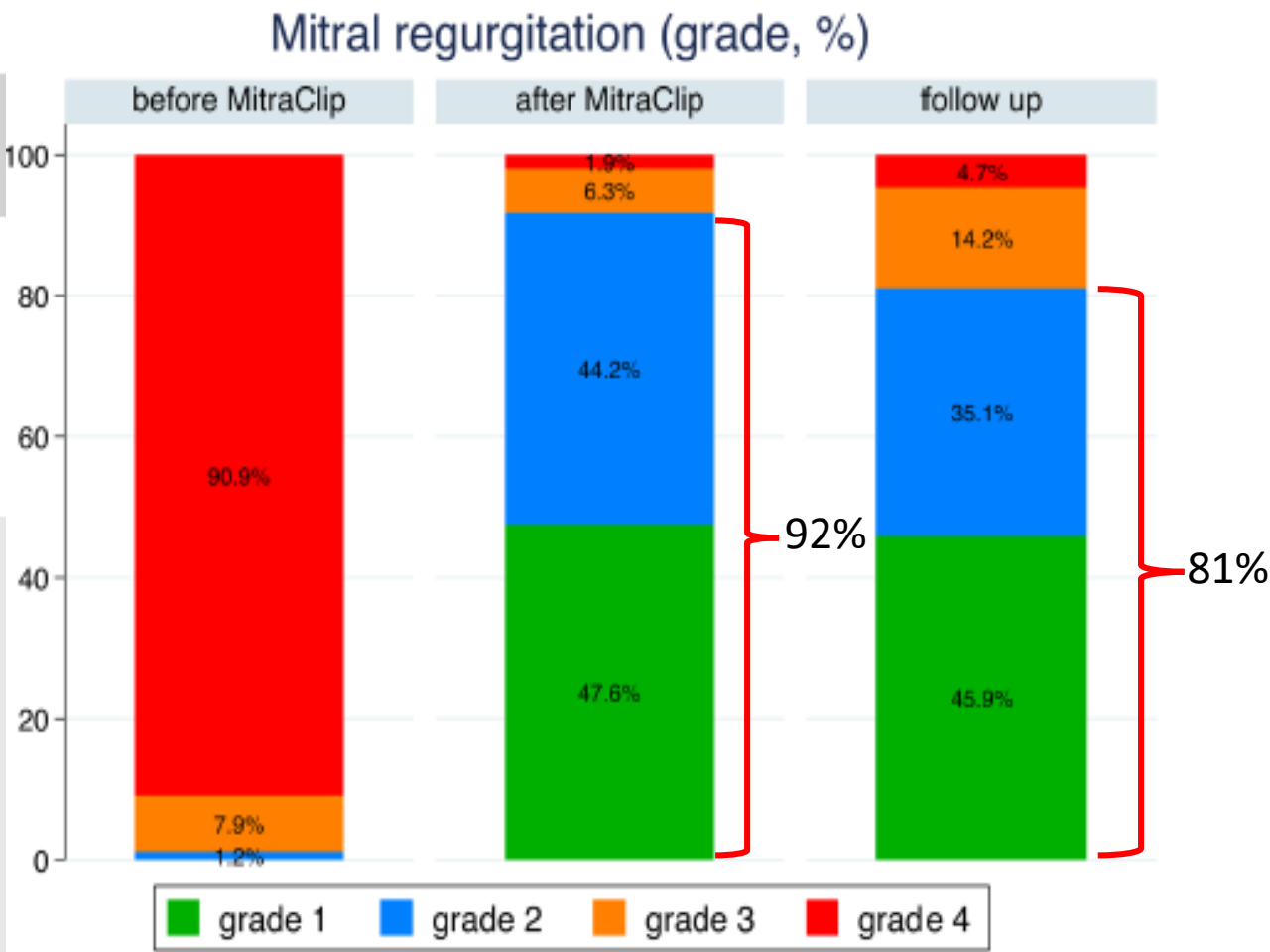
Rahbad... Van Mieghem, JAHA 2020



Percutaneous mitral valve repair with MitraClip device in hemodynamically unstable patients: A systematic review

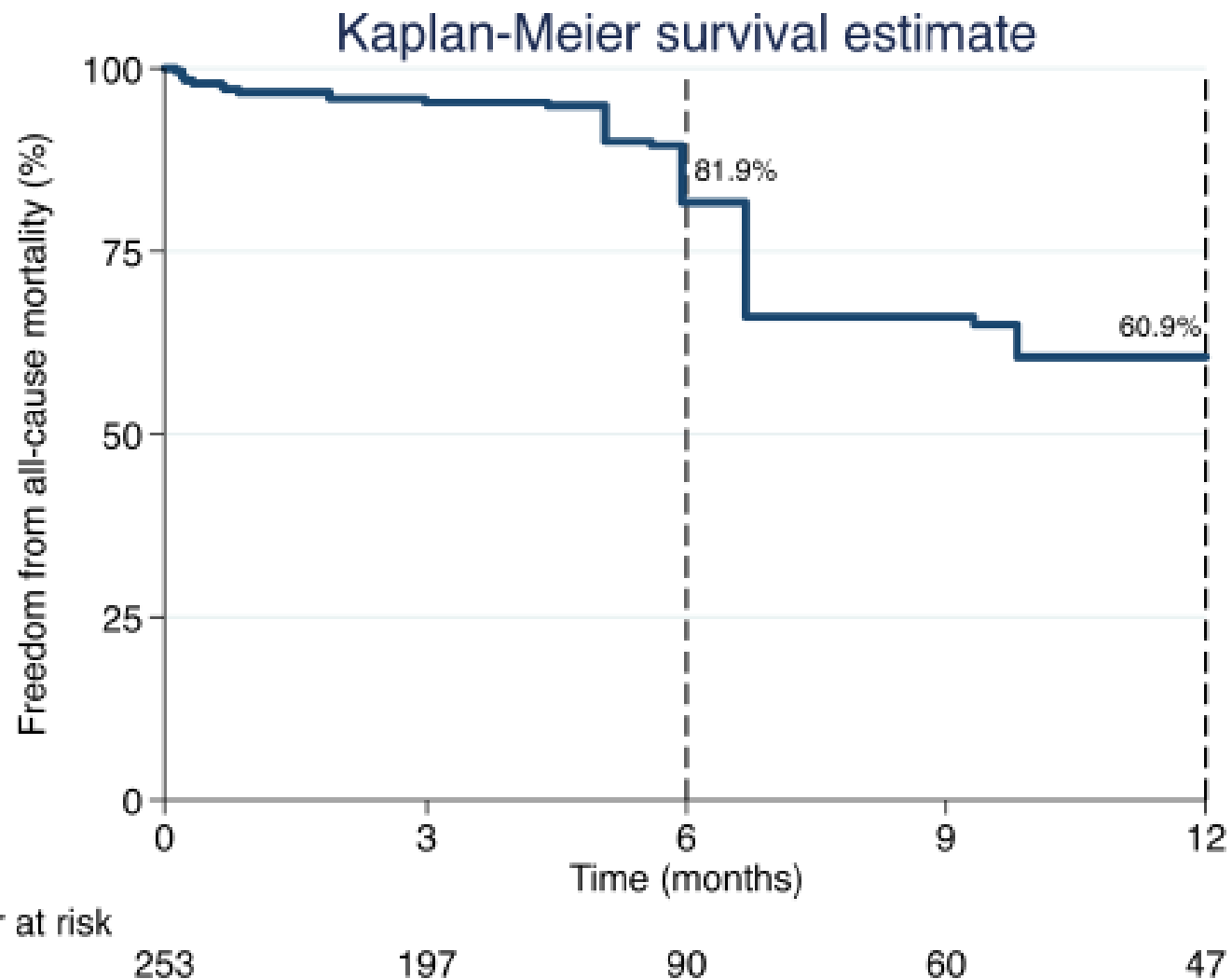
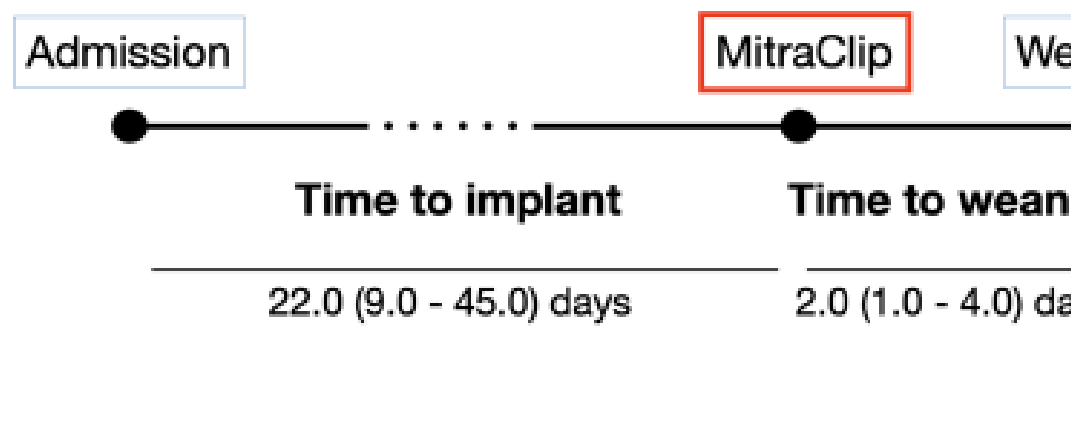
Carlos Macaya MD, PhD¹ | Luis Nombela-Franco MD, PhD¹ 

Procedural and post-procedural characteristics	Total patients (n = 254)
Procedural technical aspects	
Device success (%)	93.7%
Number of MitraClip used	1.8 ± 0.7
Procedure duration (min)	127 ± 49
Post procedure echocardiographic data	
Mitral regurgitation (grade, %)	Grade 1 (47.6%) Grade 2 (44.2%) Grade 3 (6.3%) Grade 4 (1.9%)
Mitral valve area (cm ²)	2.9 ± 0.9
Mitral valve gradient (mmHg)	3.4 ± 1.5



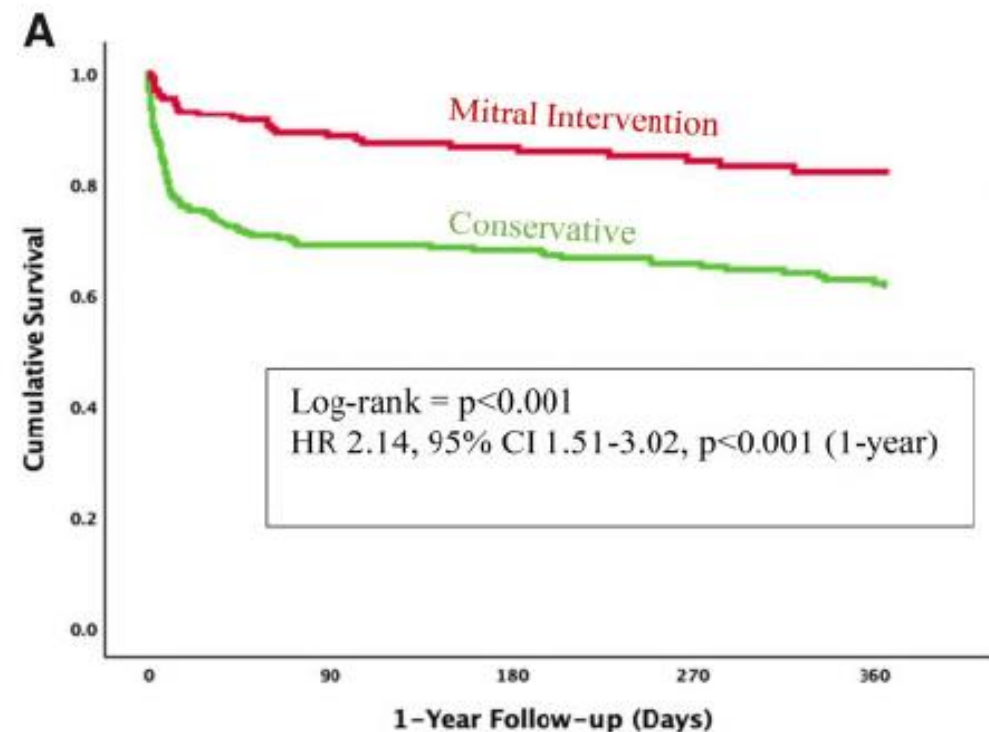
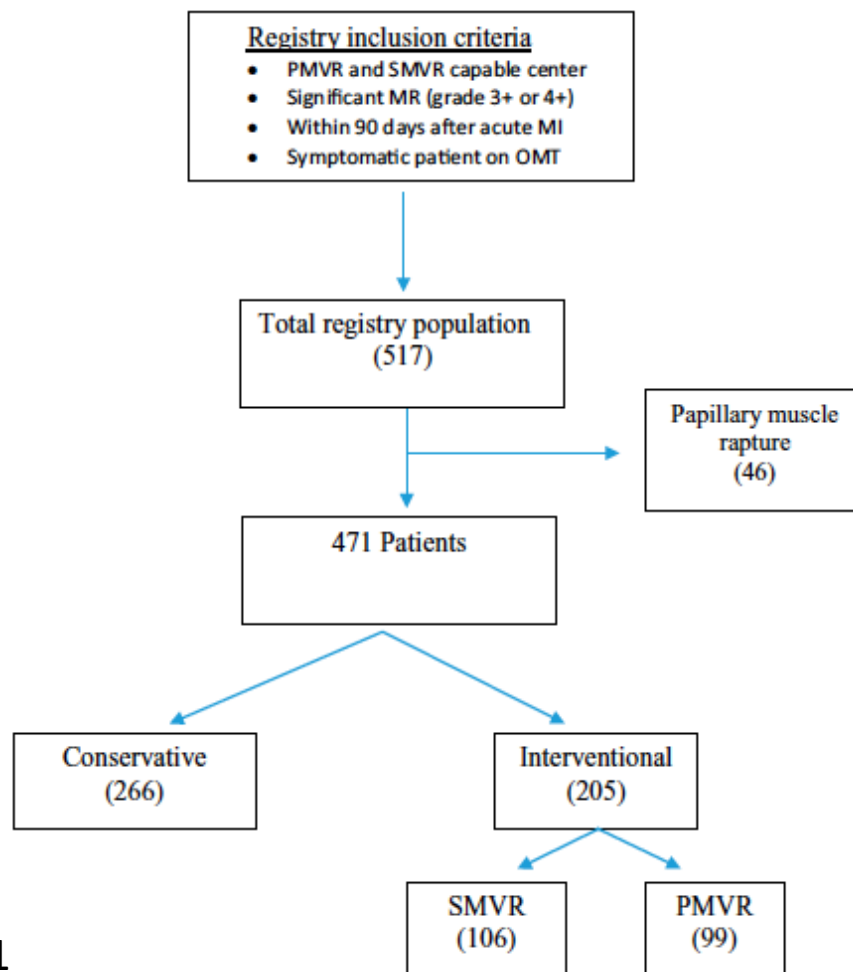
Expanding the indications for mitral TEER

Percutaneous mitral valve repair with MitraClip device in hemodynamically unstable patients: A systematic review



Expanding the indications for mitral TEER

Conservative, surgical, and percutaneous treatment for mitral regurgitation shortly after acute myocardial infarction

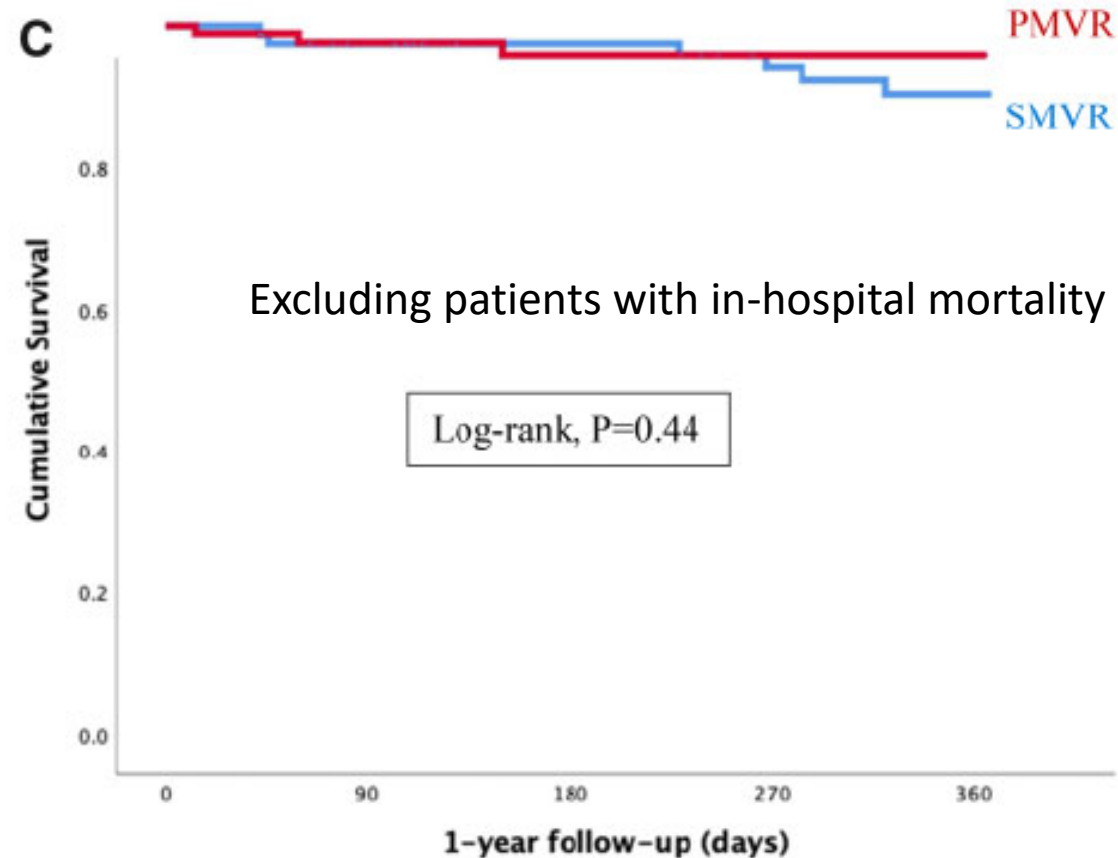


Number at Risk	0	3-Month	6-Month	9-Month	1-Year
Conservative	256	161	147	126	90
Intervention	201	184	139	115	64

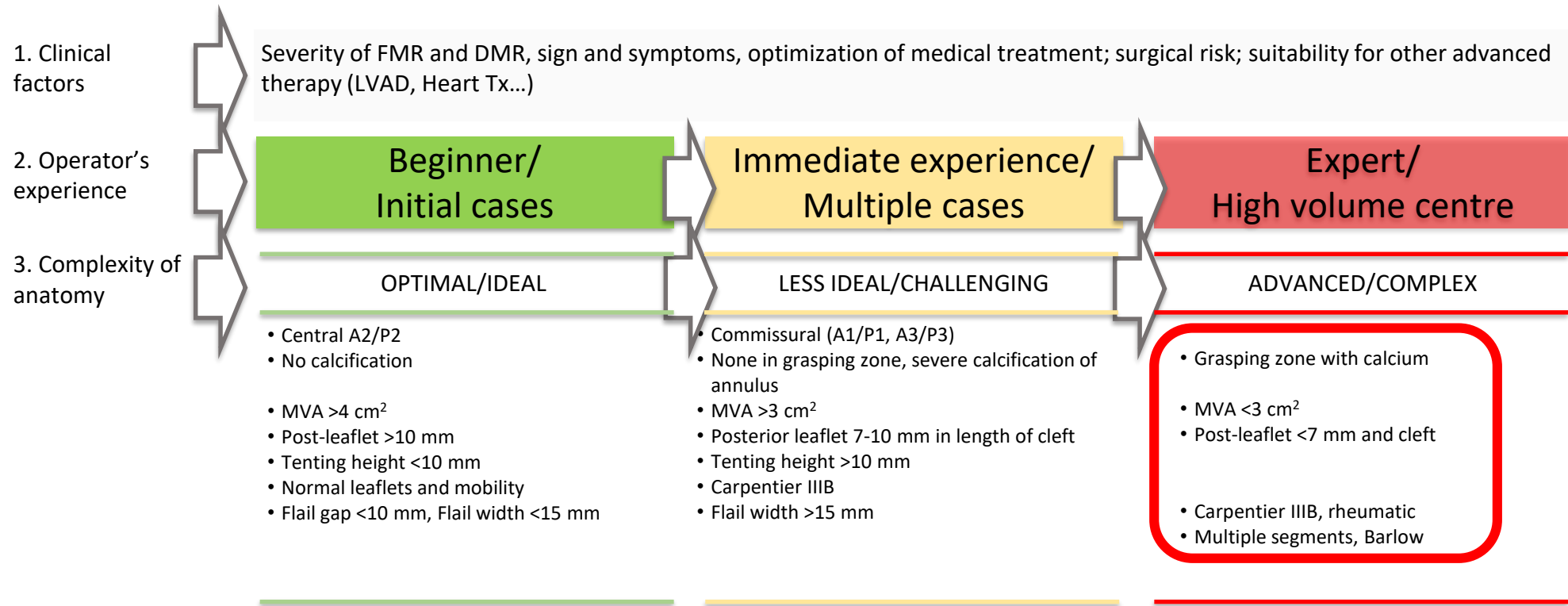
Expanding the indications for mitral TEER

Table 2 Procedural details and patient outcomes of surgical mitral valve repair or replacement and percutaneous mitral valve repair

Variable	SMVR (n = 106)	PMVR (n = 99)	P-value
Procedure			
Procedure time, min	150 [118–240]	90 [60–136]	<0.01
MI to Procedure, days	12 [5–19]	19 [10–40]	<0.01
MR >2 at discharge	9 (8)	8 (8)	0.80
Major complications	36 (34)	6 (6)	<0.01
Outcomes			
Procedure success	98 (92)	92 (93)	0.53
In-hospital mortality	17 (16)	6 (6)	0.03
Mortality at 3 months	21 (20)	10 (10)	0.13
Rehospitalization at 3 months	6 (6)	13 (13)	0.14
1-year mortality	32 (31)	16 (17)	0.04



Number at Risk	0	3-Month	6-Month	9-Month	1-Year
SMVR	86	73	66	54	40
PMVR	92	62	48	38	28

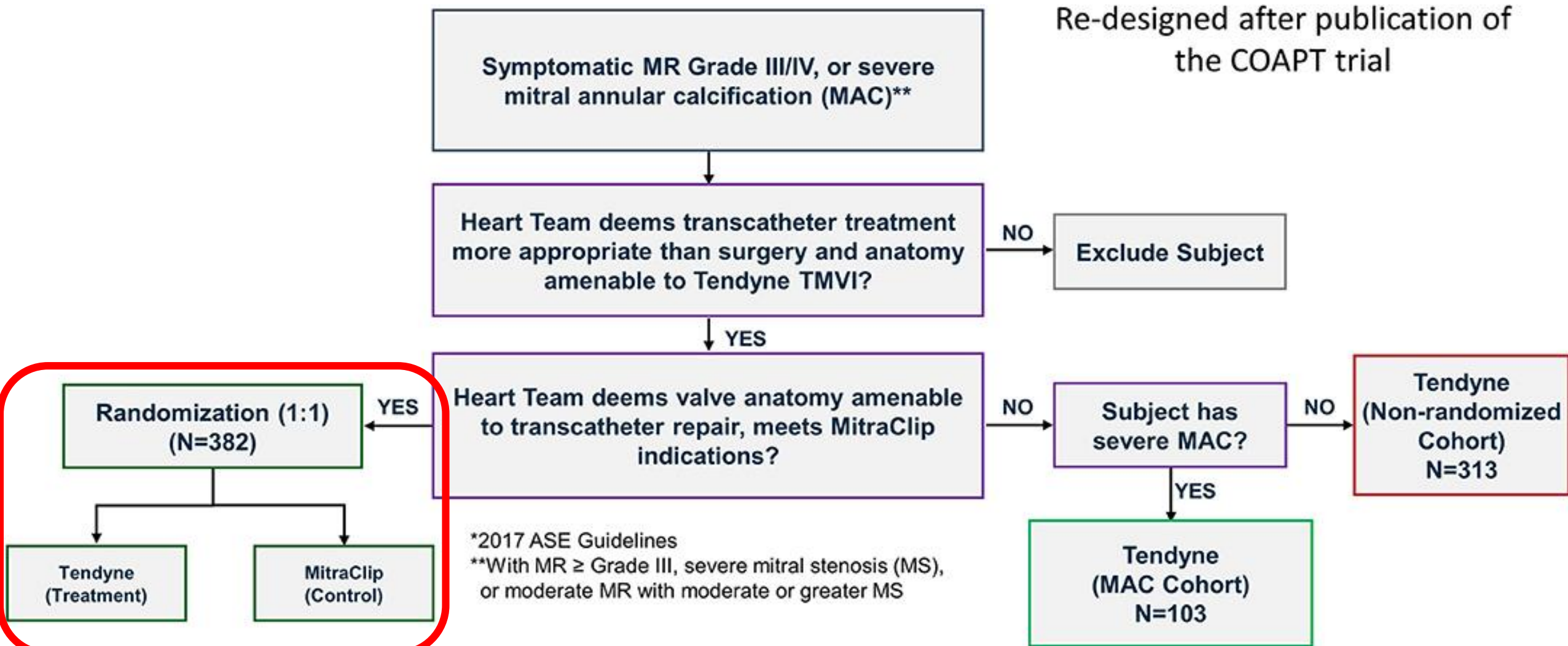


Reproduced from Gavazzoni et al., Eur Heart J Cardiovasc Imaging (2020). DOI: 10.1093/ehjci/jeaa062.

Overview in transcatheter edge-to-edge Mitral valve repair

- Current indications
- New evidence in TEER
- Patient selection
- Expanding the indications
- **Mitraclip (gold standard) vs other devices**

Clinical Trial to Evaluate the Safety and Effectiveness of Using the Tendyne Mitral Valve System for the Treatment of Symptomatic Mitral Regurgitation (SUMMIT)



- TEER therapy is the only therapy approved for functional MR in patients after optimization of medical treatment and no indication for CABG (IIa indication)
- TEER has demonstrated a reduction in mortality, and HF hospitalization with an improvement in QOL (in patients with FMR and OMT).
- TEER may be considered in primary MR and high risk or inoperable patients
- TEER is evolving and expanding its indications (technologic advances coupled with operators experiences)
- TEER should be the gold-standard to compare other mitral interventions in patients with functional MR.

Thank you

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