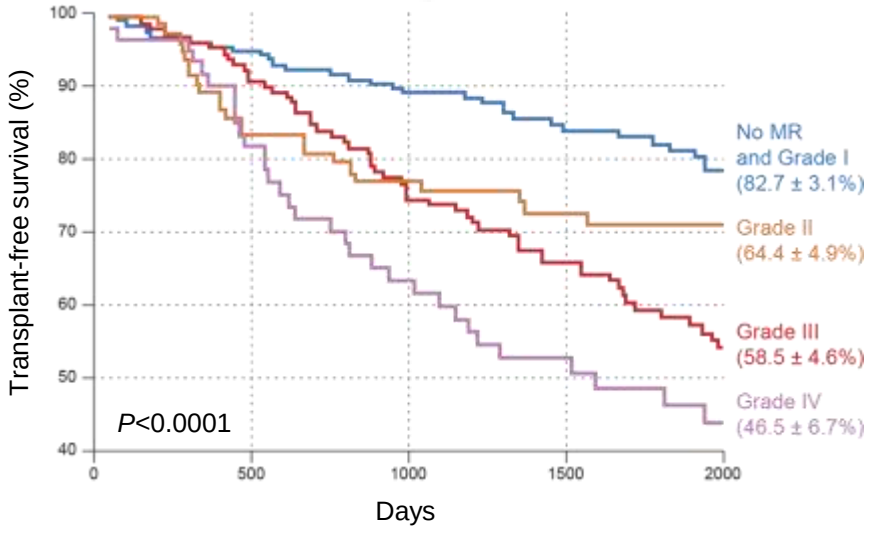
Mitraclip Procedure: A-to-Z Lifehack

09-August 2018

Anna Sonia Petronio
Chief of S.D. Laboratorio di Emodinamica
Cardiothoracic and Vascular Department
University of Pisa

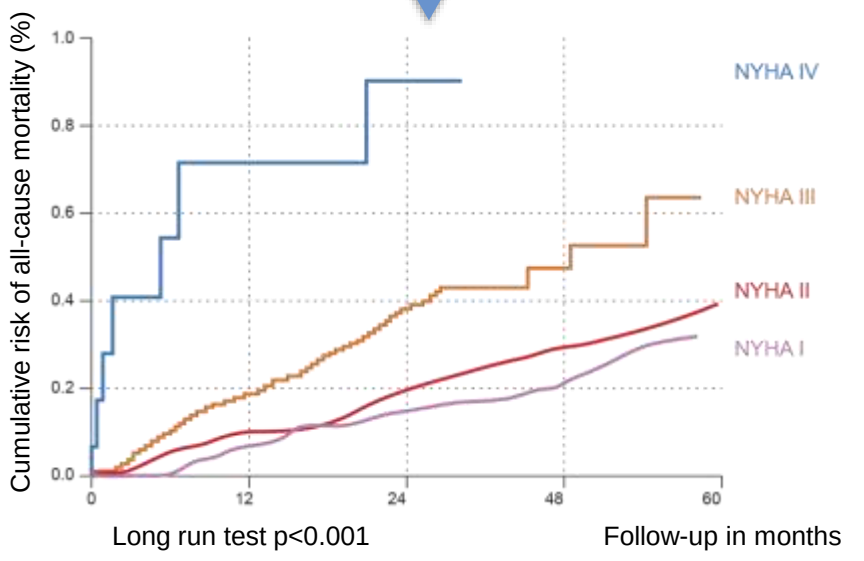
As mitral regurgitation becomes more severe morbidity and mortality risk increases

Event – free survival decreases with increasing MR severity



Bursi F, Barbieri A, Grigioni F, et al. Prognostic implications of functional mitral regurgitation according to the severity of the underlying chronic heart failure: a long-term outcome study. Eur J Heart Fail. 2010;12(4):382-388.

Risk of mortality increases with increasing NYHA class



Kaplan-Meier plots for cumulative probability of all-cause mortality

Ahmed A et al. - Higher NYHA Classes and increased mortality and hospitalisation in HF patients with preserved LV function - Am Heart J. 2006 151: 444–50

Surgery in MR

- In expert centres, in patients with primary MR, the repair rate is >90% and 90% of patients are alive and free of reoperation after 10-15 years.
- Surgery for secondary MR remains a challenge. Operative mortality after mitral valve surgery for FMR is not negligible ranging from 8.8 to 21%.
- FMR is the consequence and not the cause of an LV dysfunction.

Di Salvo T, et al. Mitral valve Surgery in advanced heart failure, JAAC 2010

2017 ESC/EACTS Guidelines for the management of valvular heart disease

Primary mitral regurgitation

Indications for intervention in severe primary mitral regurgitation

Recommendations	Class[a]	Level[b]
Mitral valve repair should be the preferred technique when the results are expected to be durable.	I	C
Surgery is indicated in symptomatic patients with LVEF >30%.[121,131,132]	I	B
Surgery is indicated in asymptomatic patients with LV dysfunction (LVESD ≥45 mm[c] and/or LVEF ≤60%).[122,131]	I	B
Mitral valve repair should be considered in symptomatic patients with severe LV dysfunction (LVEF <30% and/or LVESD >55 mm) refractory to medical therapy when the likelihood of successful repair is high and comorbidity low.	IIa	C
Mitral valve replacement may be considered in symptomatic patients with severe LV dysfunction (LVEF <30% and/or LVESD >55 mm) refractory to medical therapy when the likelihood of successful repair is low and comorbidity low.	IIb	C
Percutaneous edge-to-edge procedure may be considered in patients with symptomatic severe primary mitral regurgitation who fulfil the echocardiographic criteria of eligibility and are judged inoperable or at high surgical risk by the Heart Team, avoiding futility.	IIb	C

inoperable patients →

2017 ESC/EACTS Guidelines for the management of valvular heart disease

Secondary mitral regurgitation

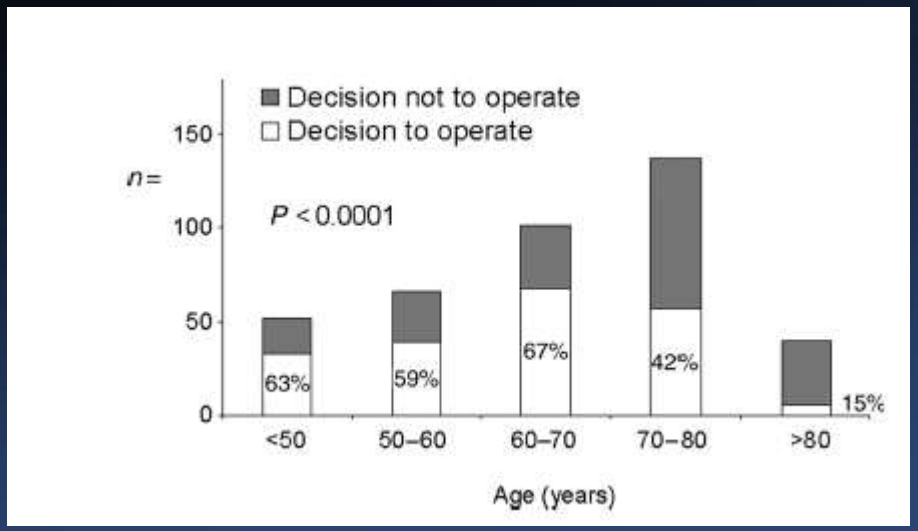
Surgical risk > low →

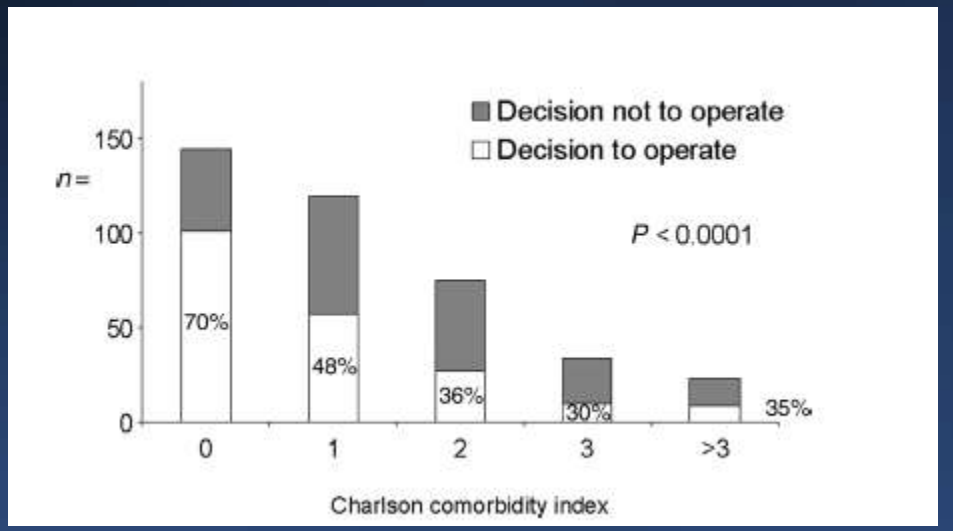
EF<30% →

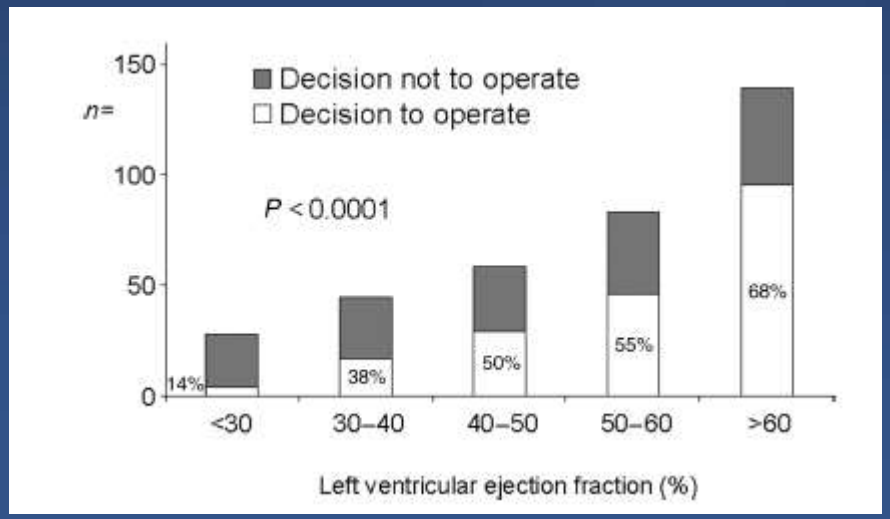
Indications for mitral valve intervention in chronic secondary mitral regurgitation[a]

Recommendations	Class[b]	Level[c]
Surgery is indicated in patients with severe secondary mitral regurgitation undergoing CABG and LVEF >30%.	I	C
Surgery should be considered in symptomatic patients with severe secondary mitral regurgitation, LVEF <30% but with an option for revascularization and evidence of myocardial viability.	IIa	C
When revascularization is not indicated, surgery 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 have a low surgical risk.	IIb	C
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	C
In patients with severe secondary mitral regurgitation and LVEF <30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have no option for revascularization, the Heart Team may consider a percutaneous edge-to-edge procedure or valve surgery after careful evaluation for a ventricular assist device or heart transplant according to individual patient characteristics.	IIb	C

What are the characteristics of patients with severe, symptomatic, mitral regurgitation who are denied surgery?

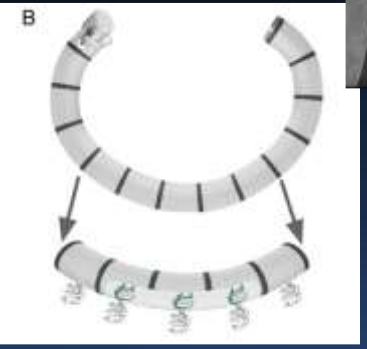




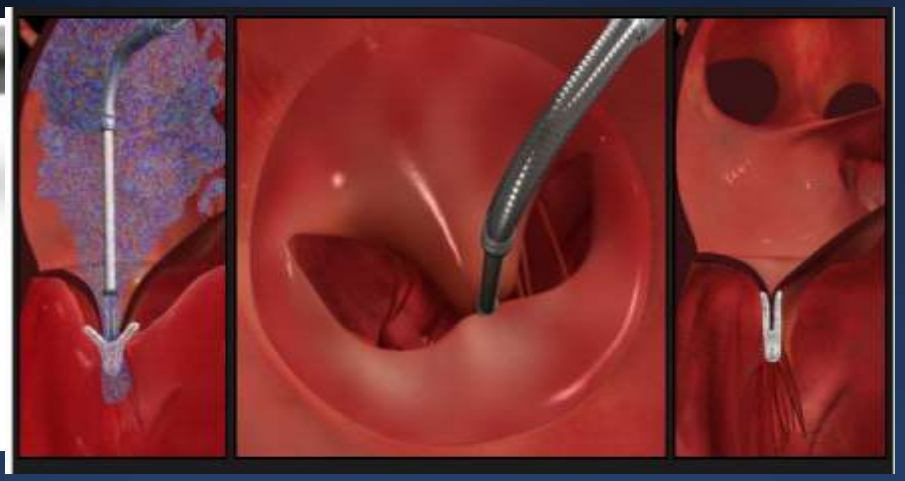


Mirabel M, et al., European Heart J 2007

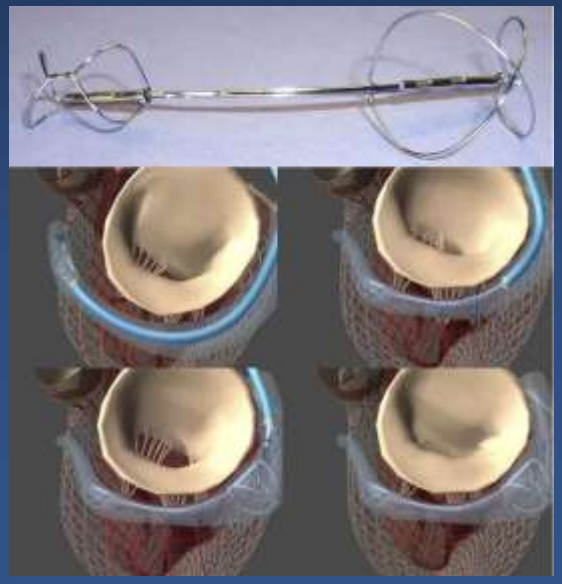
Percutaneous mitral valve repair devices



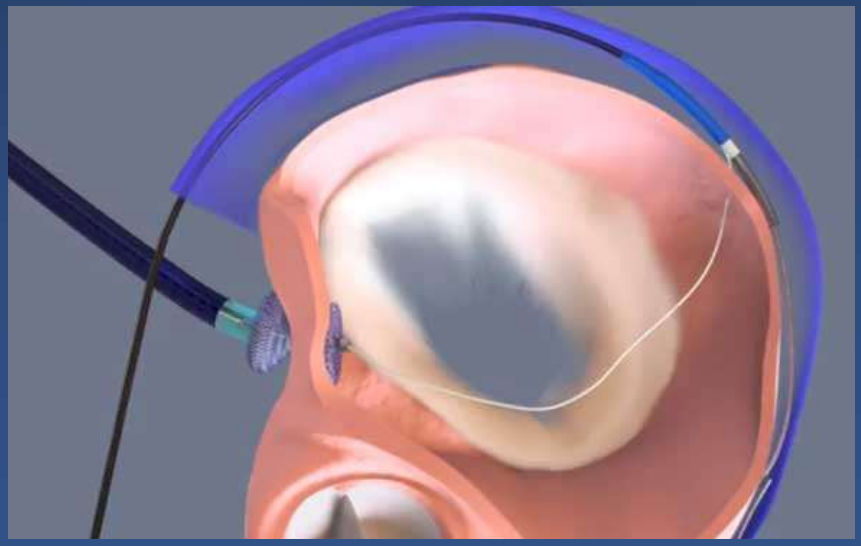
Cardioband



MitraClip



Carillon



Arto System

Mitral valve repair in advanced heart failure: Transcatheter repair

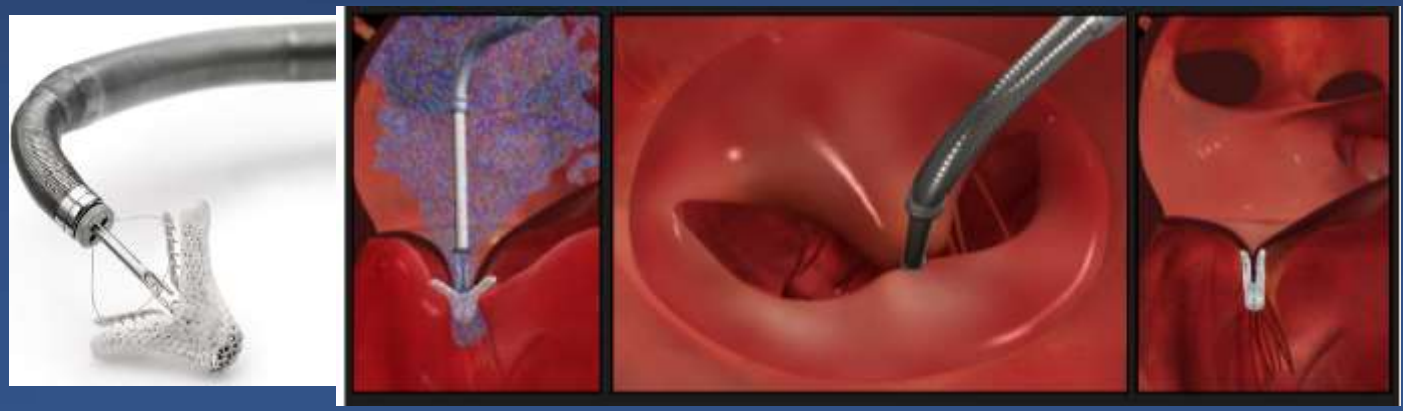
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 APRIL 14, 2011 VOL. 364 NO. 15

Percutaneous Repair or Surgery for Mitral Regurgitation

Ted Feldman, M.D., Elyse Foster, M.D., Donald D. Glower, M.D., Saibal Kar, M.D., Michael J. Rinaldi, M.D., Peter S. Fail, M.D., Richard W. Smalling, M.D., Ph.D., Robert Siegel, M.D., Geoffrey A. Rose, M.D., Eric Engeron, M.D., Catalin Loghin, M.D., Alfredo Trento, M.D., Eric R. Skipper, M.D., Tommy Fudge, M.D., George V. Letsou, M.D., Joseph M. Massaro, Ph.D., and Laura Mauri, M.D., for the EVEREST II Investigators*

In patients who remain symptomatic despite GDMT and CRT, transcatheter mitral valve repair has been shown to improve symptoms

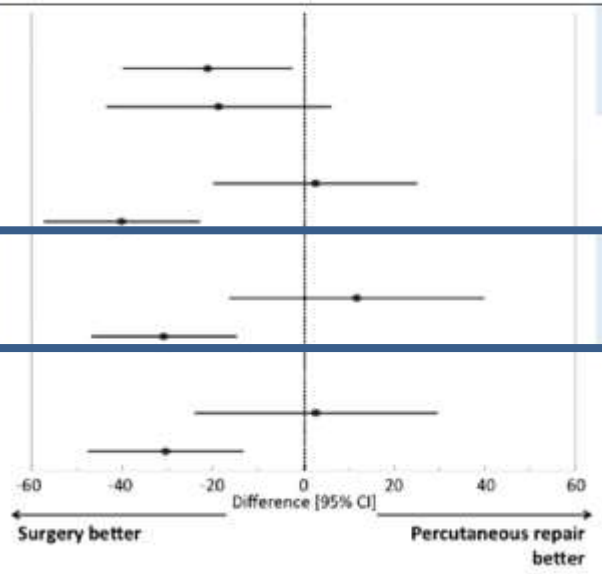


Randomized Comparison of Percutaneous Repair and Surgery for Mitral Regurgitation

5-Year Results of EVEREST II

TABLE 4 Subgroup Analyses for Freedom From Death, MV Surgery or Reoperation, and 3+ or 4+ MR at 5 Years

Subgroup	Percutaneous Repair	Surgery	Difference (95% CI)	p value	Interaction p value
Sex					0.89
Male	42.9 (42/98)	63.9 (23/36)	-21.0% (-39.5% to -2.5%)	0.03	
Female	46.4 (26/56)	65.0 (13/20)	-18.6% (-43.2% to 6.1%)	0.15	
Age					0.005
Age ≥70 yrs	45.1 (32/71)	42.3 (11/26)	2.8% (-19.5% to 25.0%)	0.81	
Age <70 yrs	43.4 (36/83)	83.3 (25/30)	-40.0% (-57.0% to -22.9%)	<0.001	
Type of MR					0.02
Functional MR	40.5 (17/42)	28.6 (4/14)	11.9% (-16.0% to 39.8%)	0.43	
Degenerative MR	45.5 (51/112)	76.2 (32/42)	-30.7% (-46.5% to -14.8%)	<0.001	
LVEF					0.04
LVEF <60%	44.1 (26/59)	41.2 (7/17)	2.9% (-23.7% to 29.5%)	0.83	
LVEF ≥60%	44.1 (41/93)	74.4 (29/39)	-30.3% (-47.3% to -13.3%)	0.001	



Feldman et al, JACC, 2015

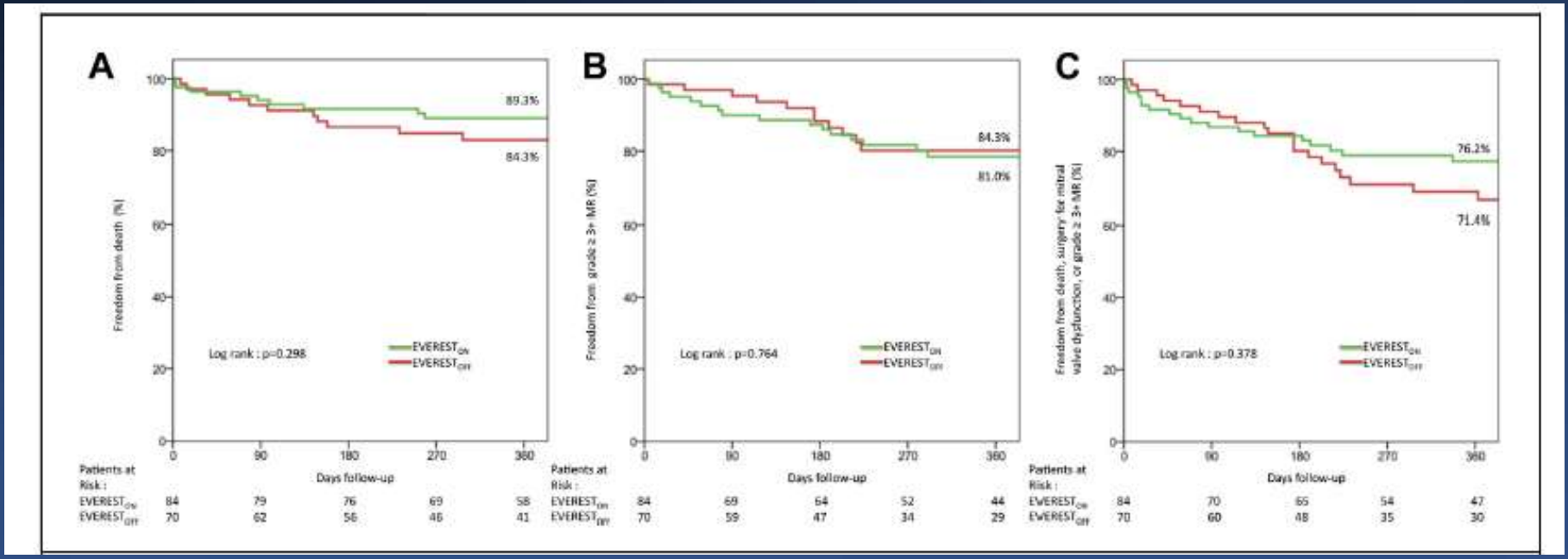
Anatomical EVEREST criteria

Inclusion criteria	The primary regurgitant jet originates from mal-coaptation of the A2 and P2 scallops of the MV. In case of a secondary jet, it must be considered clinically insignificant.
Exclusion criteria	MV orifice area $< 4\ cm^2$
	Leaflet flail: Width of flail segment ≥ 15 mm Flail gap ≥ 10 mm
	Leaflet tethering: Coaptation depth >11 mm Vertical coaptation length ≤ 2 mm
	Severe calcification: Annular calcification Calcification of the grasping area of A2 or P2 scallop
	Presence of a significant cleft of A2 or P2 scallops
	Bileaflet flail or severe prolapse
	Lack of both primary and secondary chordal support
	Presence of atrial septal defect or patent PFO with clinical symptoms

To date, the EVEREST criteria have been acknowledged as the baseline of an anatomical selection process. However, it is important to clarify that those criteria were arbitrarily assigned

the limited anatomical EVEREST criteria have constantly been expanded.....

Extended Use of Percutaneous Edge-to-Edge Mitral Valve Repair Beyond EVEREST (Endovascular Valve Edge-to-Edge Repair) Criteria



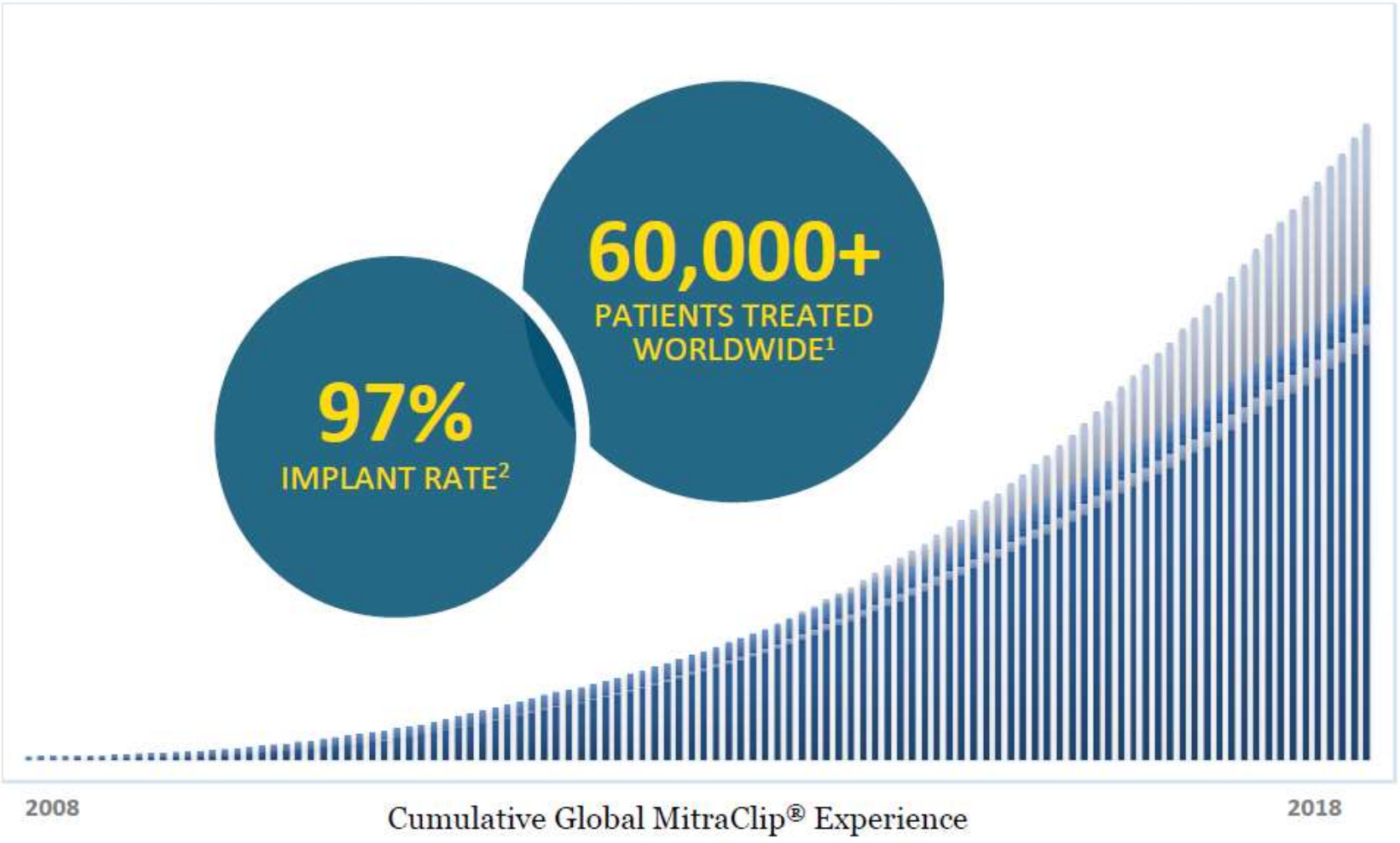
JAAC Cardiov. Intervention, Attizzani, 2014

The German Consensus by the Working Group of Interventional Cardiology

Morphology for a Mitraclip therapy

Optimal valve morphology	Conditionally suitable valve morphology	Unsuitable valve morphology
Central pathology in Segment 2	Pathology in Segment 1 oder 3	Perforated mitral valve leaflet or cleft
No leaflet calcification	Mild calcification outside of the grip-zone of the clip system; ring calcification, post annuloplasty	Severe calcification in the grip-zone
Mitral valve opening area >4 cm^2	Mitral valve opening area >3 cm^2 with good residual mobility	Haemodynamically significant mitral stenosis (valve opening area <3 cm^2, MPG ≥ 5 mmHg)
Mobile length of the posterior leaflet ≥10 mm	Mobile length of the posterior leaflet 7–<10 mm	Mobile length of the posterior leaflet <7 mm
Coaption depth <11 mm	Coaption depth ≥11 mm	
Normal leaflet strength and mobility	Leaflet restriction in systole (Carpentier IIIB)	Rheumatic leaflet thickening and restriction in systole and diastole(Carpentier IIIA)
Flail-width <15 mmFlail-Gap <10 mm	Flail-width >15 mm only with a large ring width and the option for multiple clips	Barlow's syndrome with multisegment flail leaflets

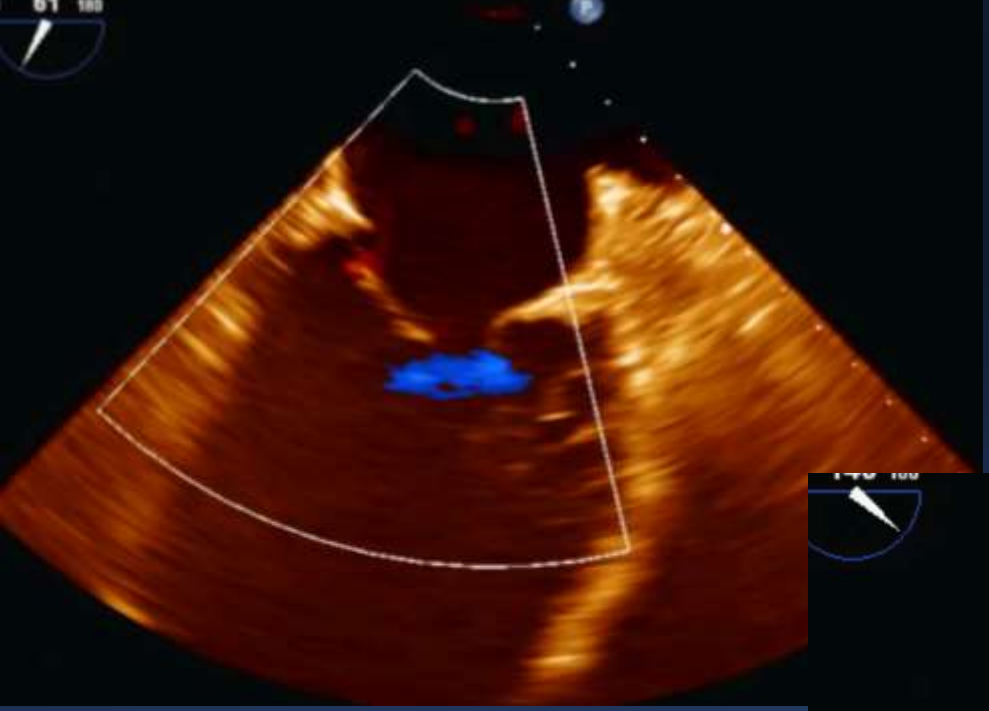
AN ESTABLISHED THERAPY WITH GLOBAL COMMERCIAL EXPERIENCE

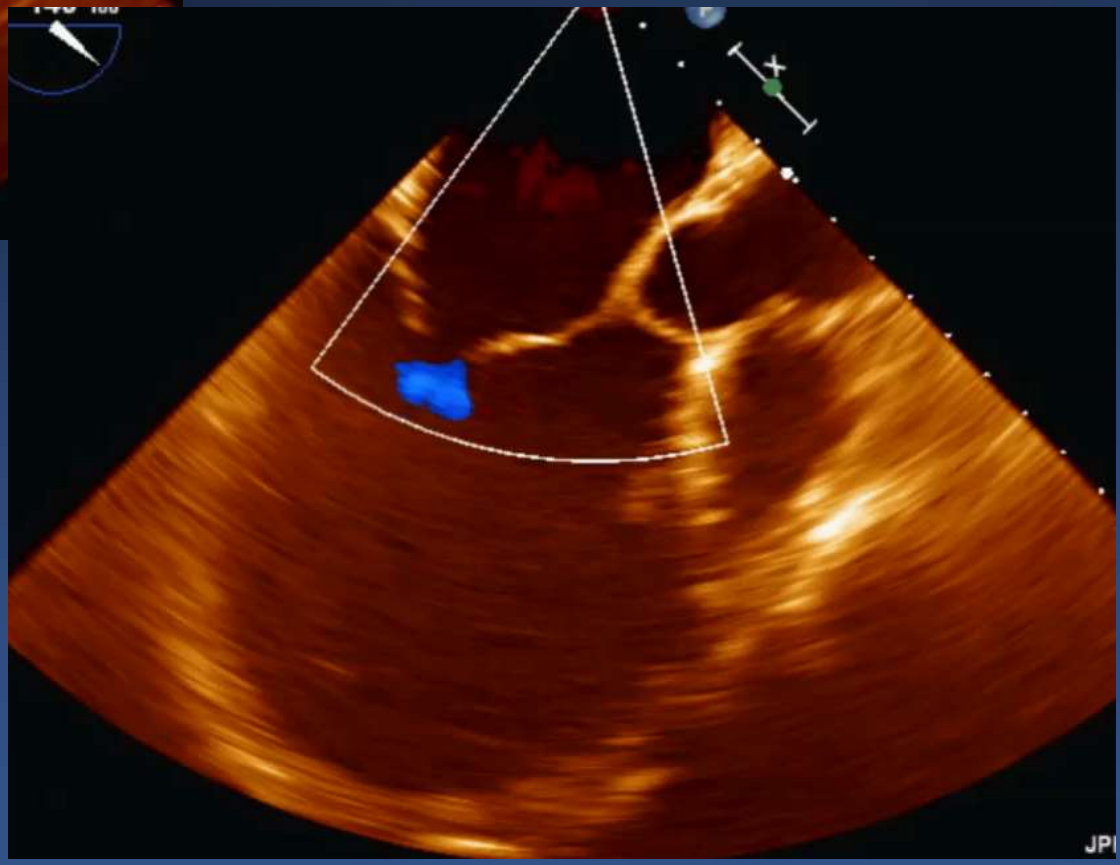


Cumulative Global MitraClip® Experience

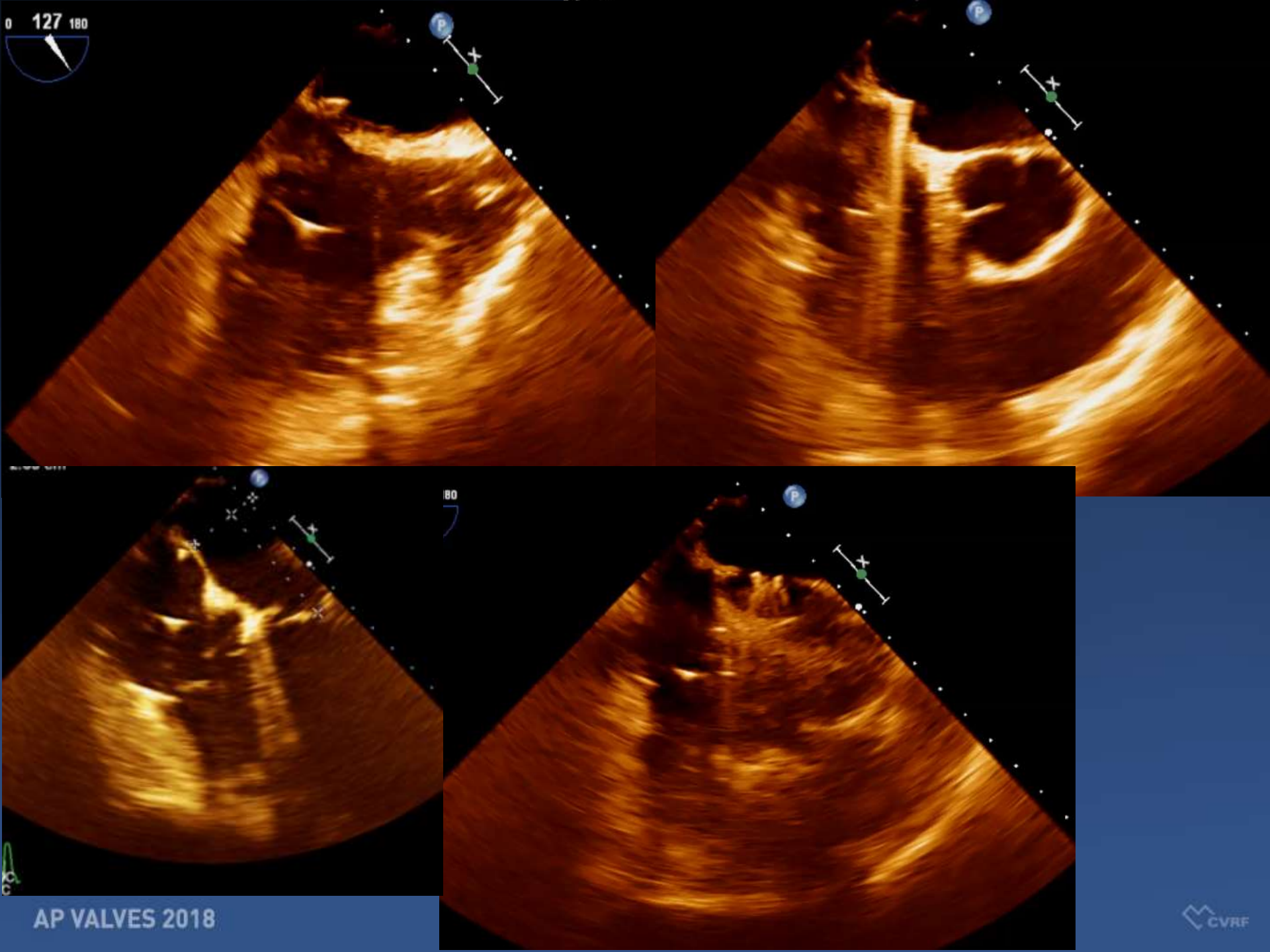
1. Data on file at Abbott, February 28, 2018.
2. First-time procedures only. Includes commercial and clinical patients.

FMR in pz with DCM





Colour Doppler shows Central and Lateral Commissural jet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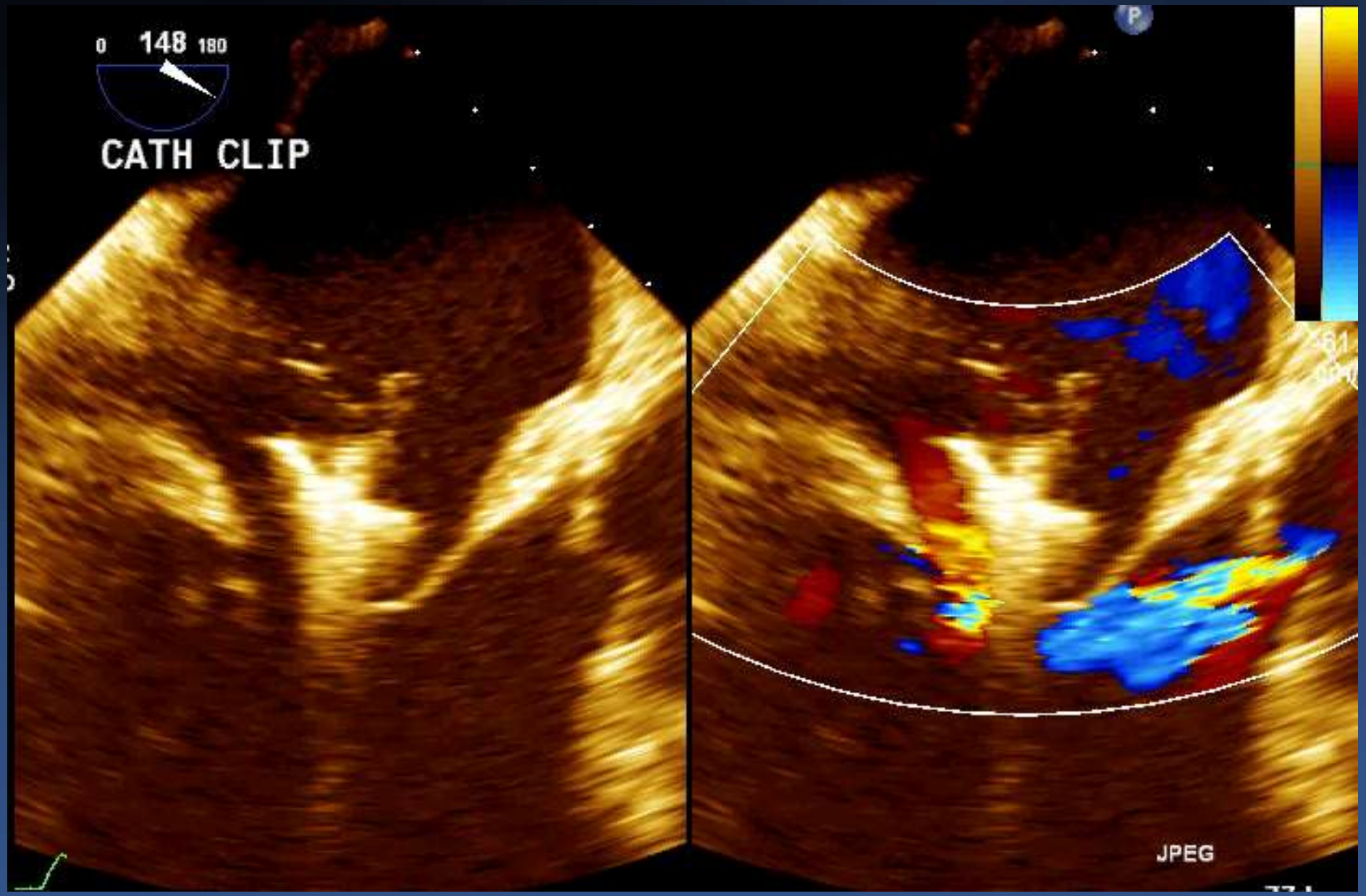
AP VALVES 2018
CVRF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CATH CLIP
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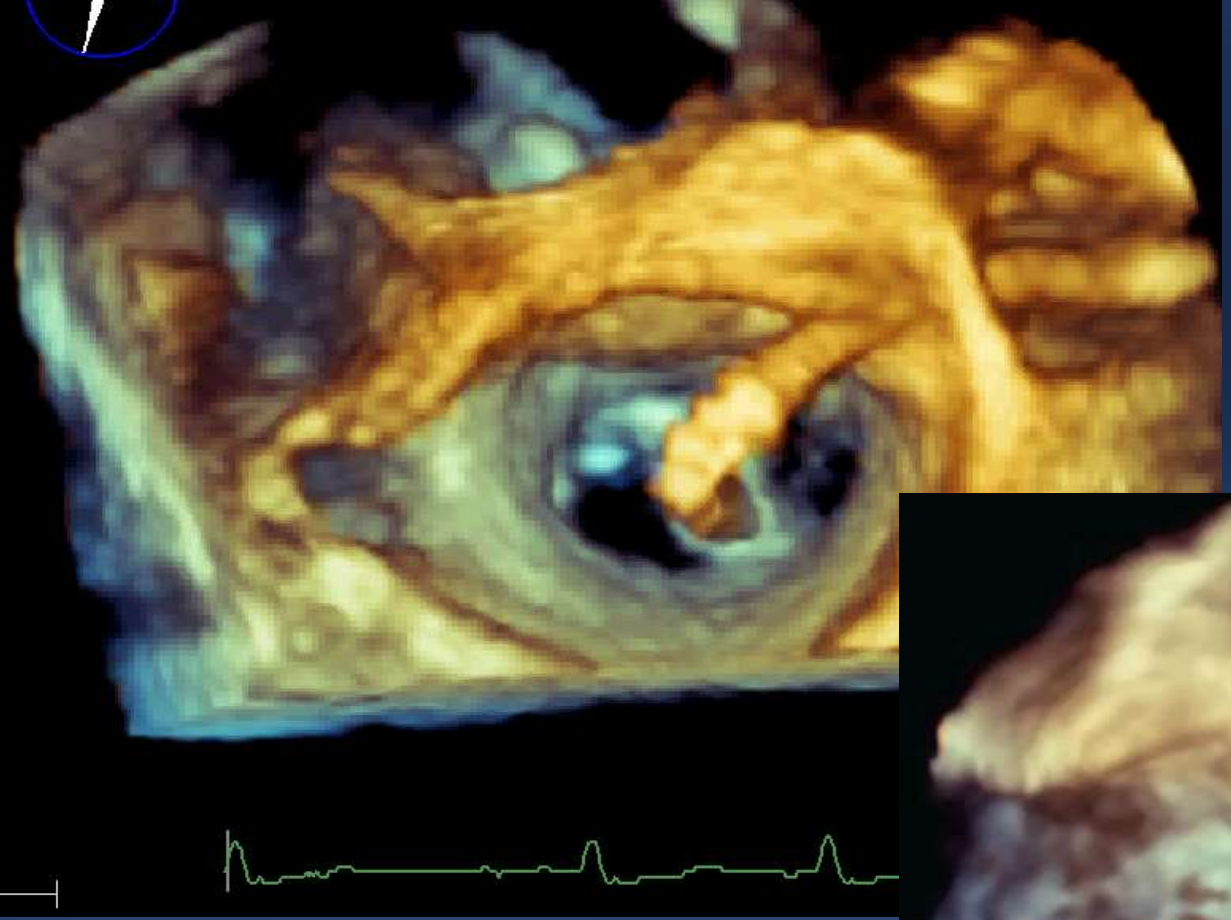
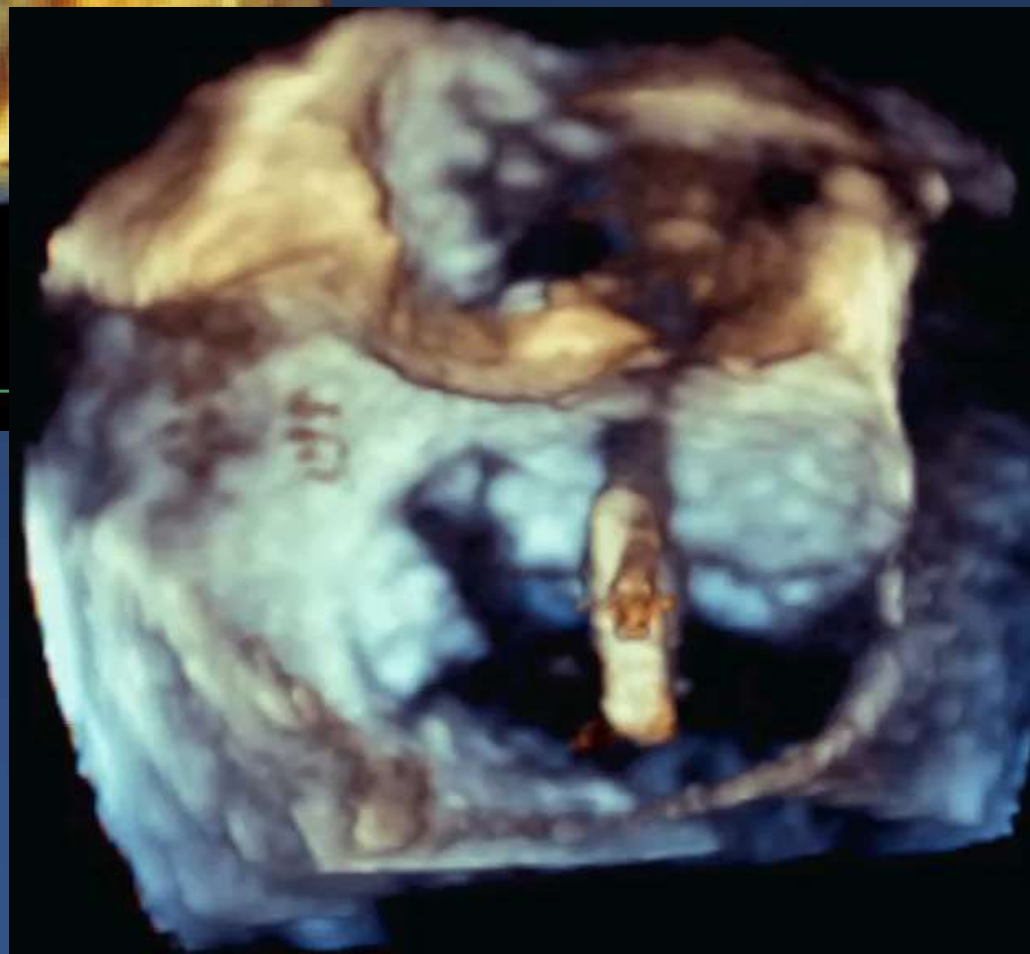
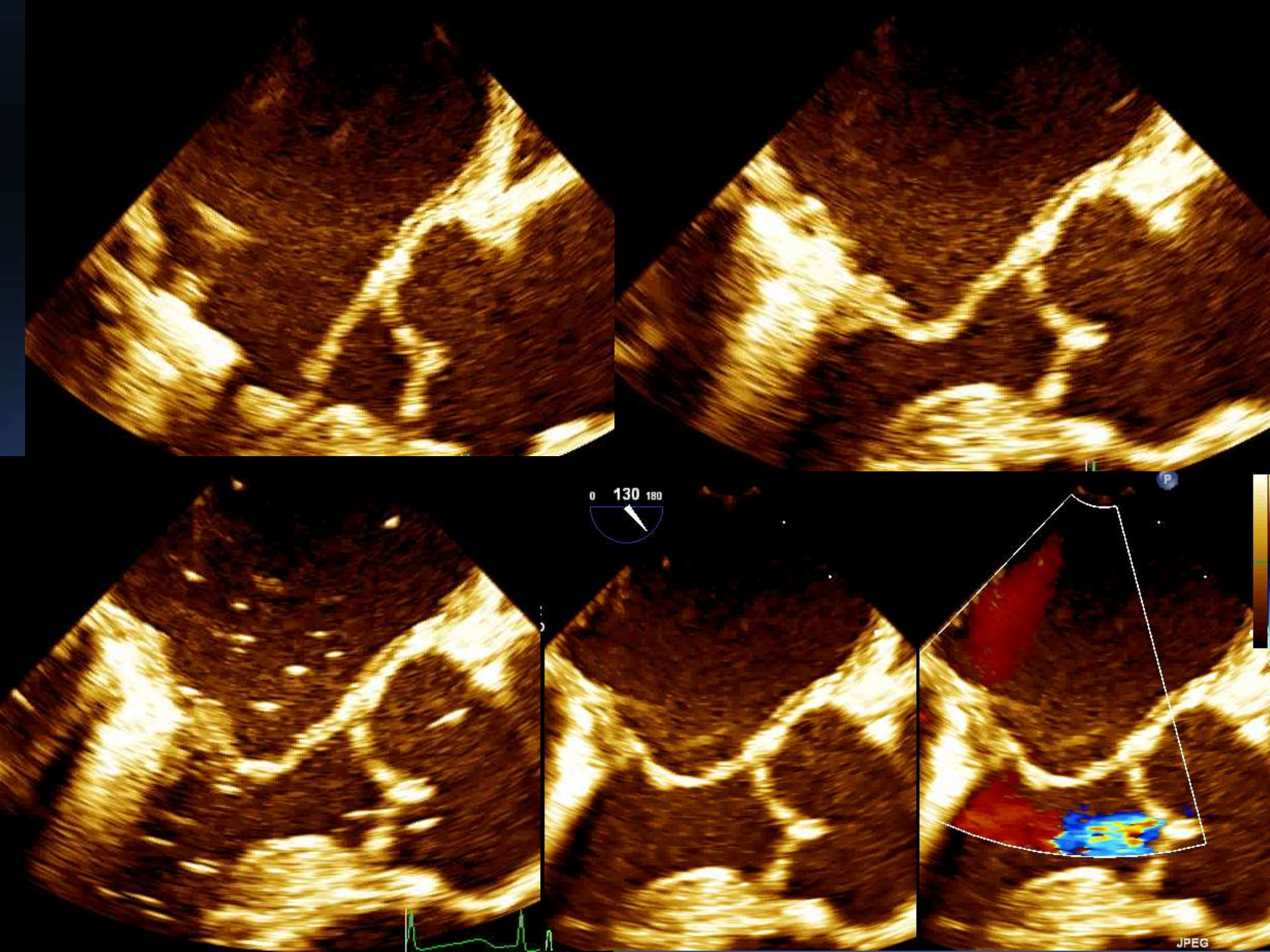




3D Orientation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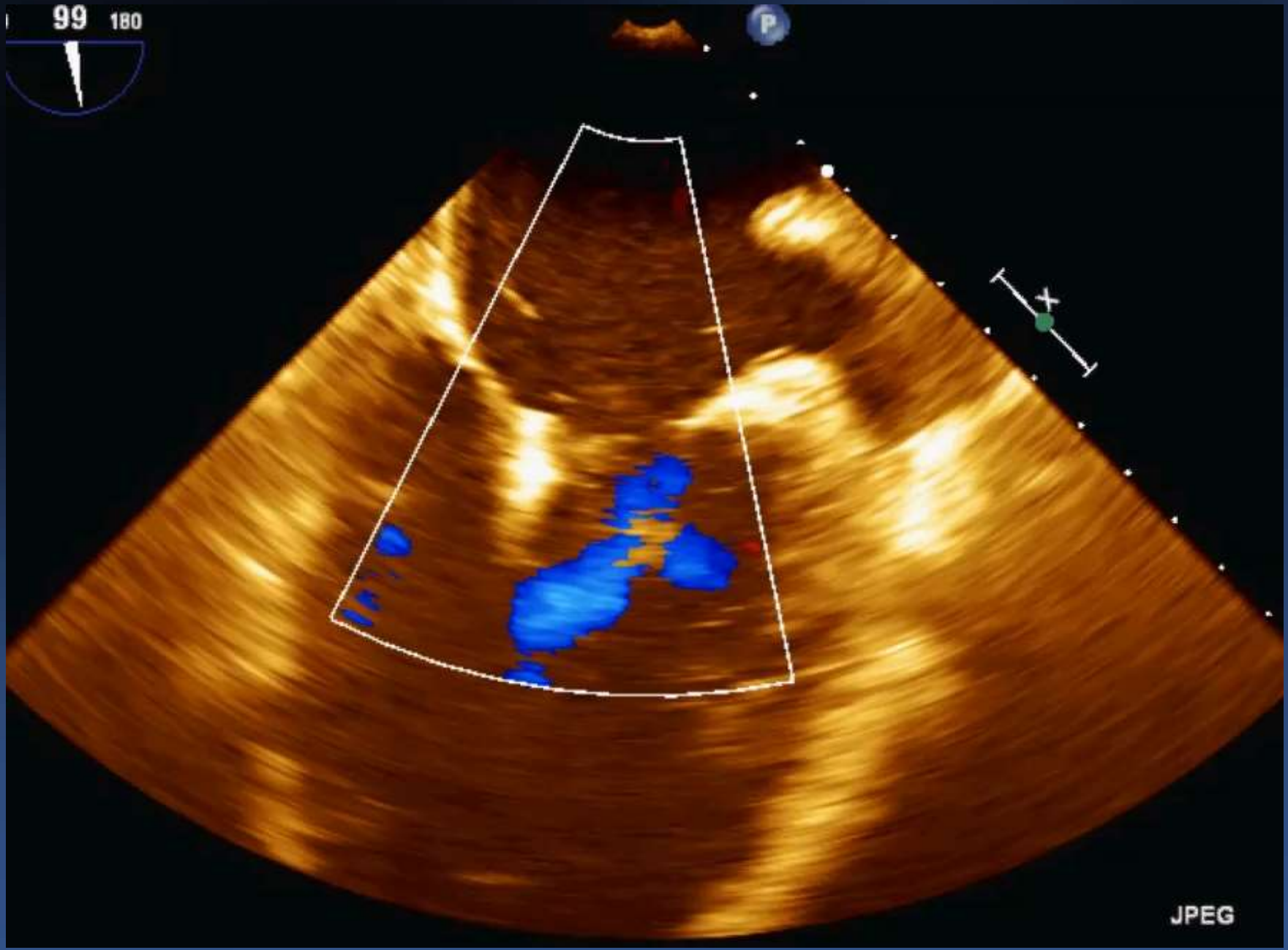
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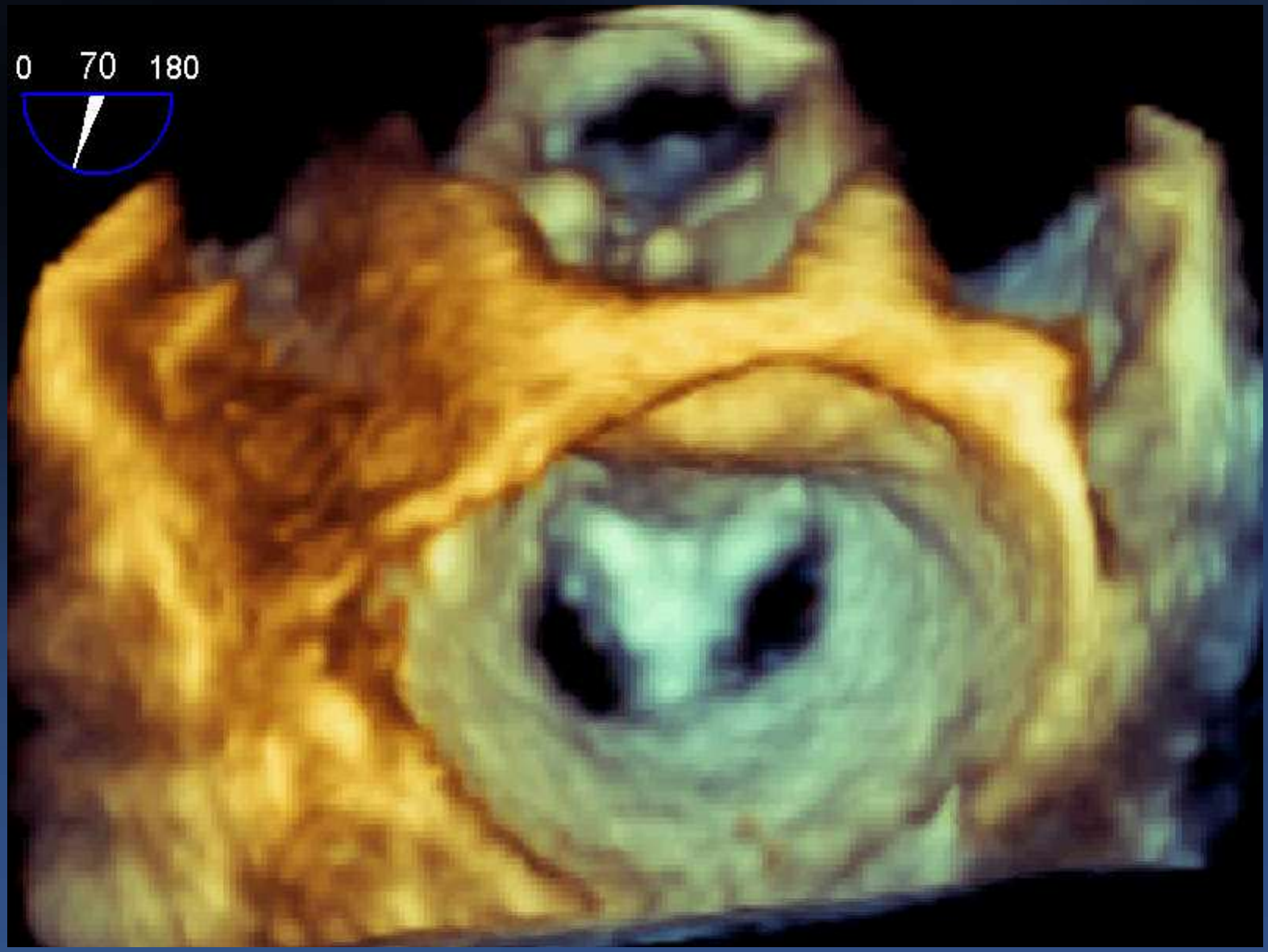
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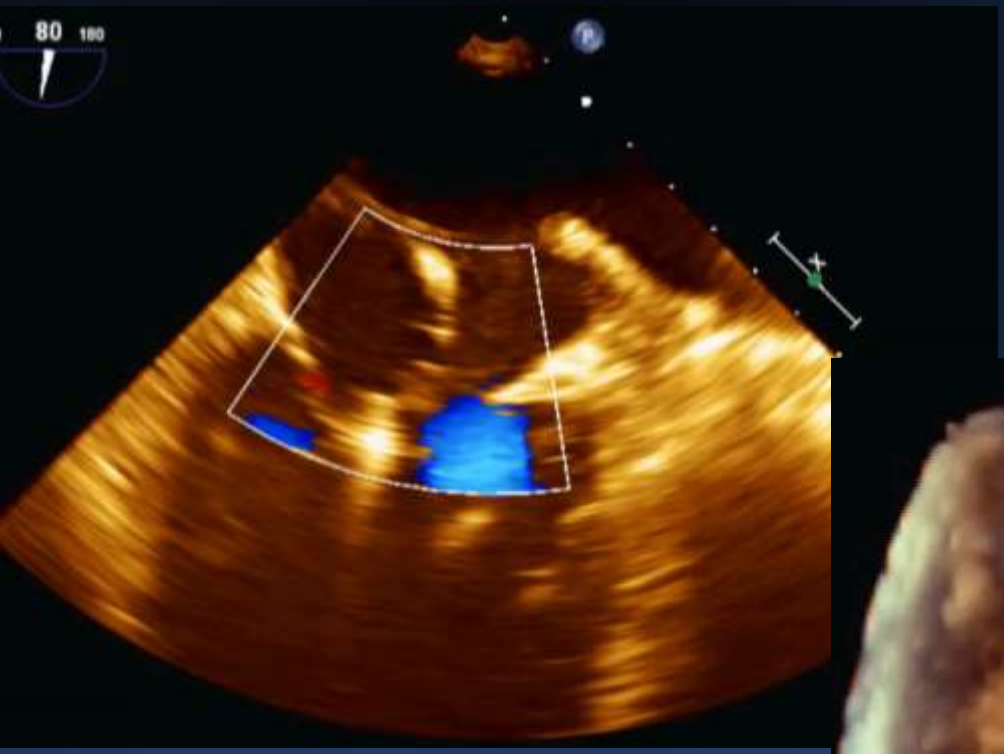
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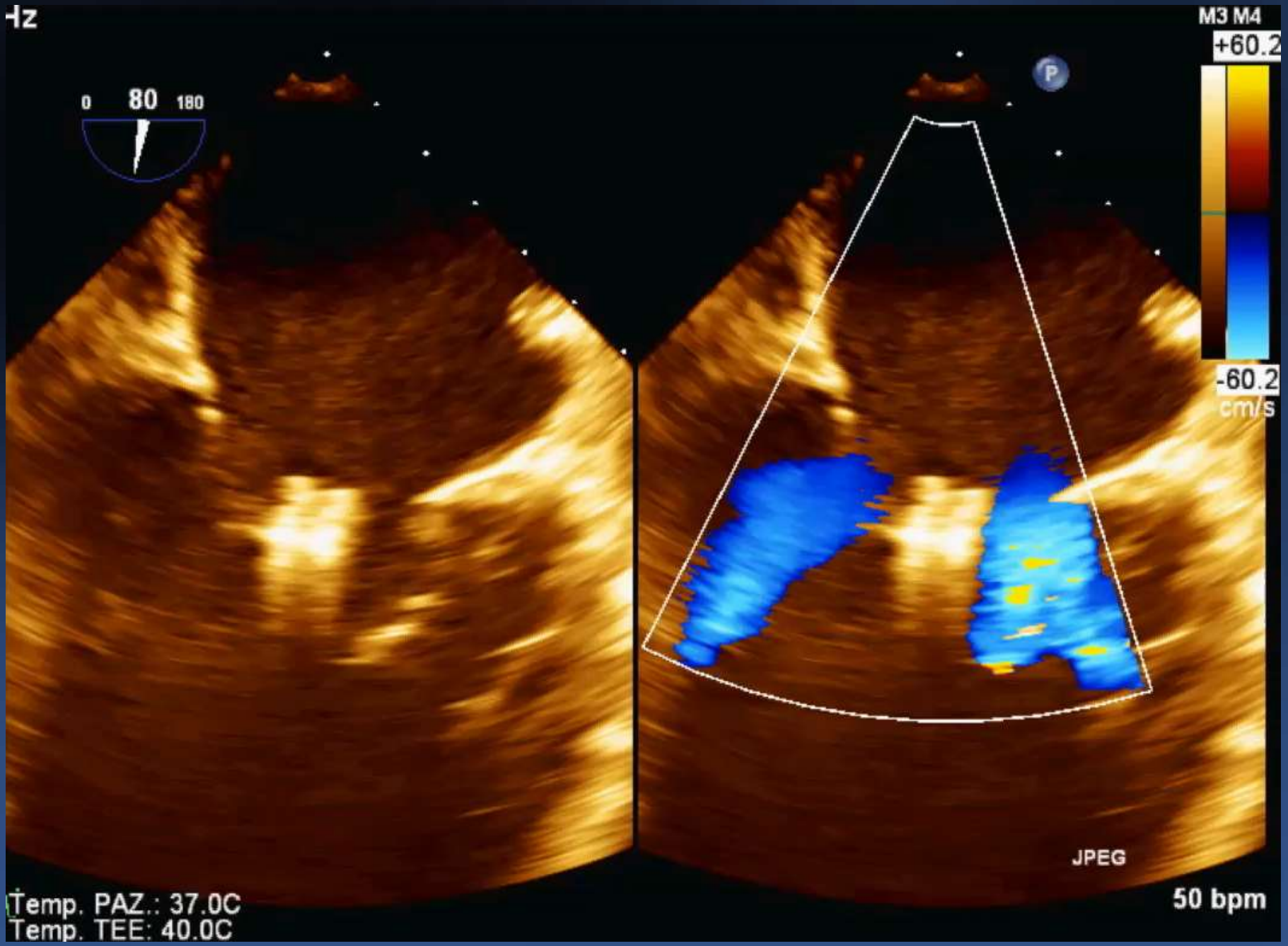
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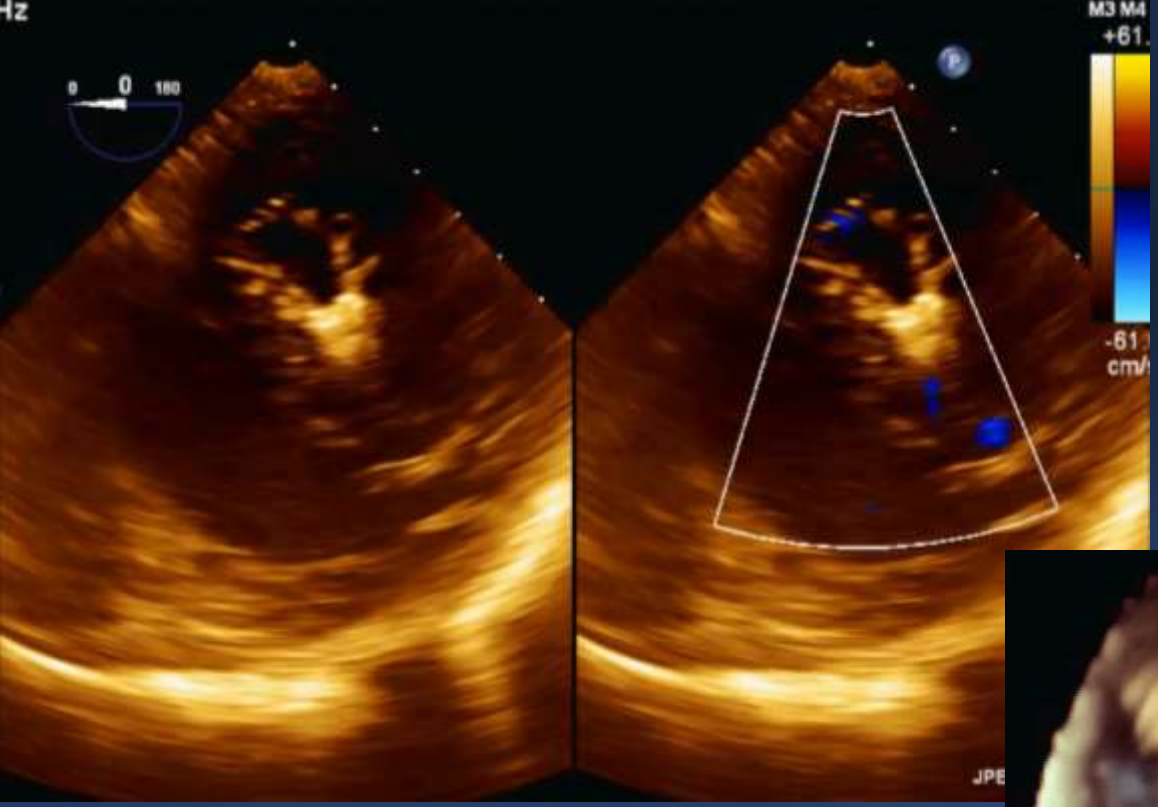
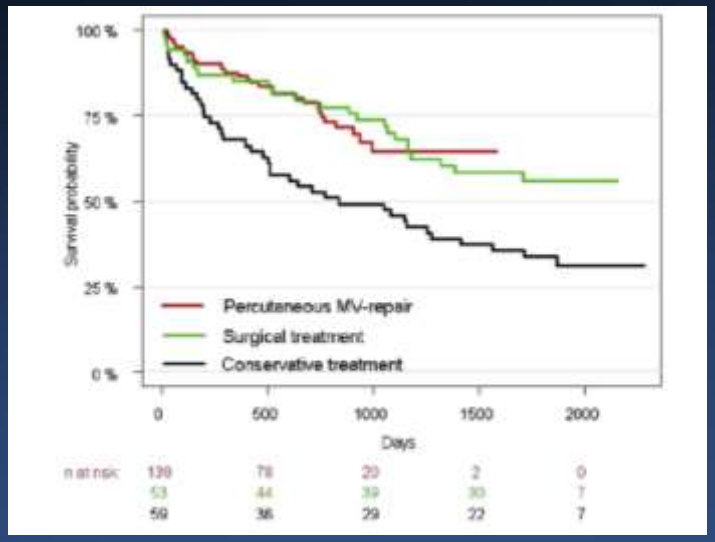


Transgastric view after capture

And 3D surgical view

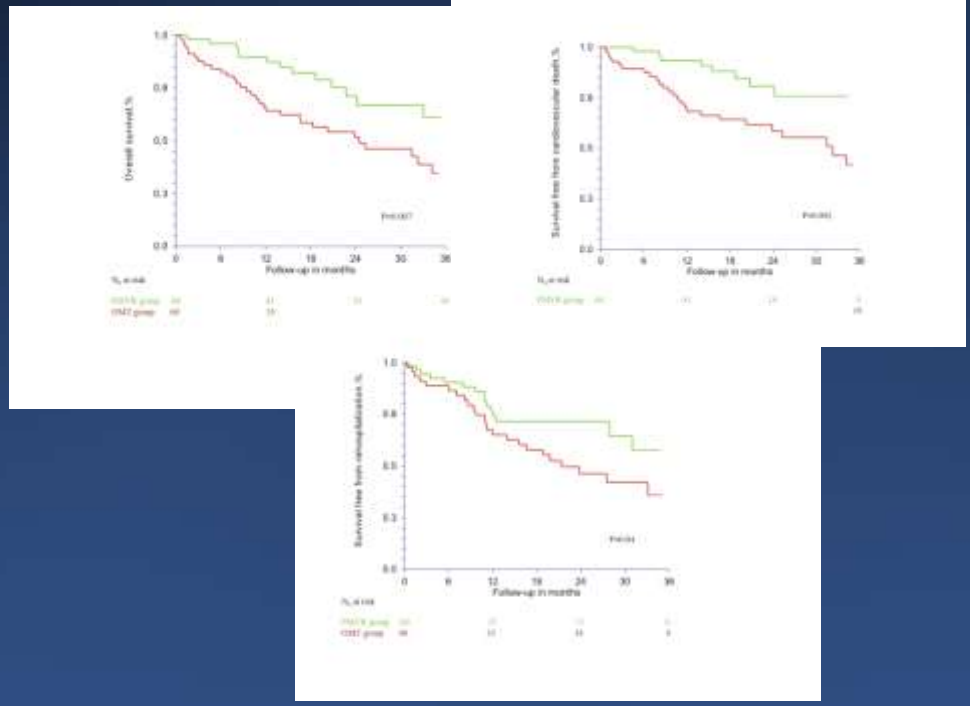
Percutaneous repair vs. medical therapy in FMR

Survival of Transcatheter Mitral Valve Repair Compared With Surgical and Conservative Treatment in High-Surgical-Risk Patients



Swaans et al; JACC CI 2014

Comparison of Percutaneous Mitral Valve Repair Versus Conservative Treatment in Severe Functional Mitral Regurgitation

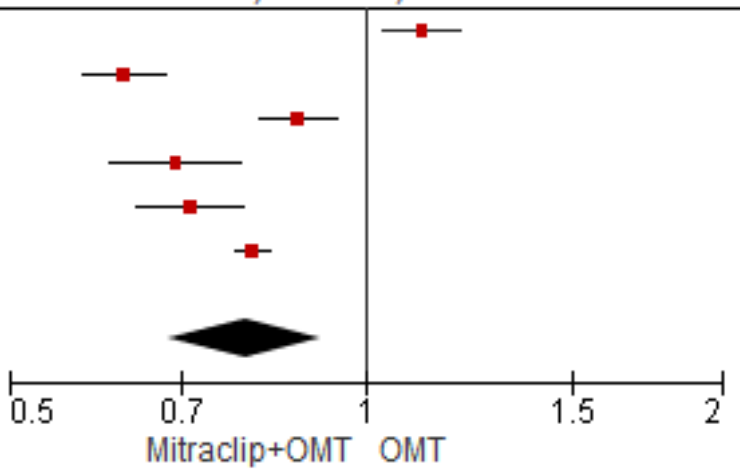


Giannini et al; Am Journal of Cardiology 2016

A meta-analysis of MitraClip combined with medical therapy versus medical therapy alone for treatment of mitral regurgitation in heart failure patients

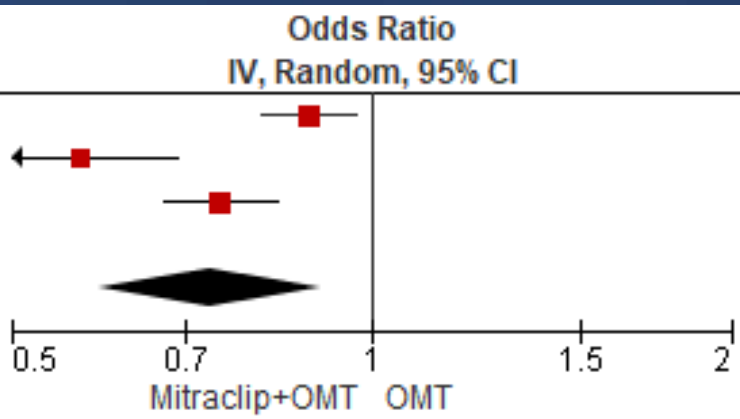
Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Adamo, 17	0.11	0.039	16.9%	1.12 [1.03, 1.20]
Armeni, 16	-0.47	0.042	16.8%	0.63 [0.58, 0.68]
Asgar, 17	-0.13	0.039	16.9%	0.88 [0.81, 0.95]
Giannini, 16	-0.37	0.065	15.6%	0.69 [0.61, 0.78]
Swaans, 14	-0.34	0.053	16.3%	0.71 [0.64, 0.79]
Velazquez, 15	-0.22	0.017	17.5%	0.80 [0.78, 0.83]
Total (95% CI)			**100.0%**	**0.79 [0.68, 0.92]**

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 122.27$, $df = 5$ ($P < 0.00001$); $I^2 = 96\%$
Test for overall effect: $Z = 3.12$ ($P = 0.002$)



Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Adamo, 17	-0.12	0.046	35.7%	0.89 [0.81, 0.97]
Asgar, 17	-0.56	0.096	29.5%	0.57 [0.47, 0.69]
Giannini, 16	-0.29	0.055	34.8%	0.75 [0.67, 0.83]
Total (95% CI)			**100.0%**	**0.73 [0.59, 0.91]**

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 18.71$, $df = 2$ ($P < 0.0001$); $I^2 = 89\%$
Test for overall effect: $Z = 2.83$ ($P = 0.005$)



Only FMR patients

Giannini et al; ESC HF, 2018

Comparison of Randomized Trials of the MitraClip in patients With Heart Failure and Secondary Mitral Regurgitation

	COAPT	RESHAPE-HF	MITRA-FR
Number of patients and sites	610 patients at 75 U.S. and Canadian sites Data presented at TCT'17	288 patients at 50 E.U. sites	420 patients at 18 French sites Data presented at ESC '18
Secondary MR grade (core laboratory verified)	≥3+ (EROA ≥ 30 mm^2 and/or Rvol > 45 ml)	≥3+ (EROA ≥ 30 mm^2 and/or Rvol > 45 ml)	Severe (EROA ≥ 20 mm^2 + Rvol > 30 ml)
NYHA functional class	II, III, or ambulatory IV	II, III, or ambulatory IV	II-IV
LVEF	≥ 20% to ≤ 50%	≥ 15% to ≤ 40%	≥ 15% to ≤ 40%
Surgical criteria	Not appropriate for mitra valve surgery (heart team)	None	None
Primary efficacy endpoint (superiority)	Heart failure rehospedalizations at 1yr	Death or heart failure	Death or recurrent heart failure hospedalization at 1 yr
Primary safety endpoint (non inferiority)	The composite of SLDA; device embolization; endocarditis requiring surgery; echocardiography core laboratory-confirmed mitral stenosis requiring surgery; LVAD implant; heart transplant; or any deice-related complications requiring nonelective cardiovascular at 12 months	None	None
Follow-up, yrs	5	2	2

Conclusion

The limitations given by leaflet morphology can constantly be surpassed by rising experience, placement of multiple clips across multiple segments, or asymmetric convergent clipping.

As long as no left ventricular inlet restriction occurs after clipping, a reduction of the MR bears the potential for clinical improvement.

Considering the clinical profile of the patient, the limits of treatment may be adjusted and residual MR accepted according to the individual therapeutic goal.