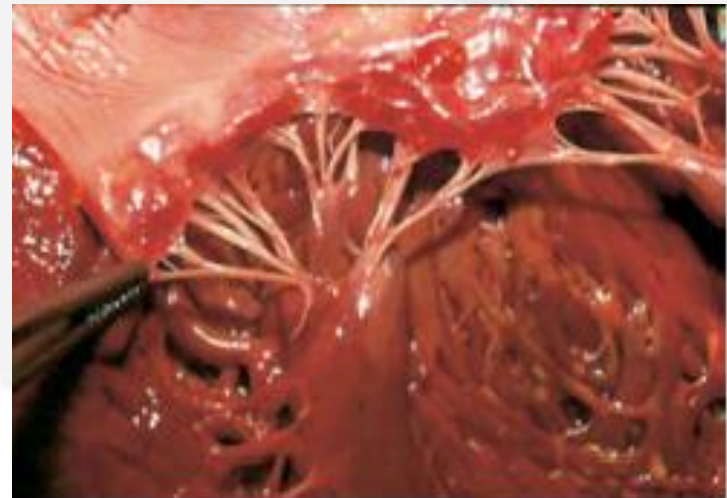
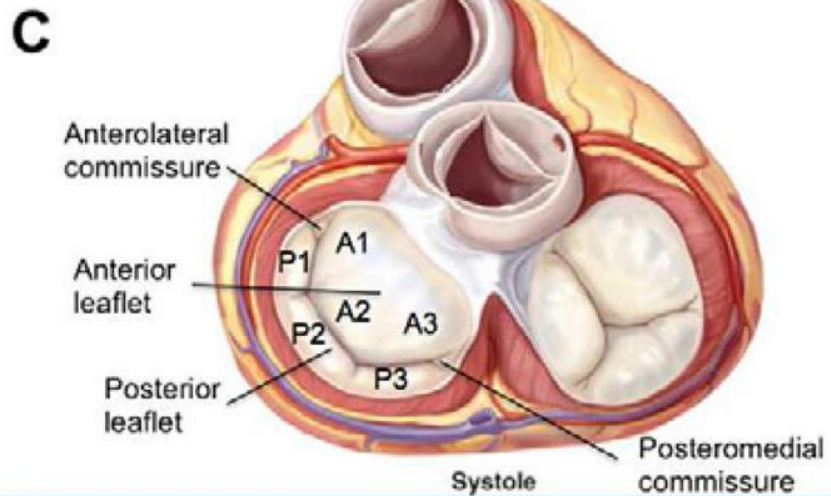
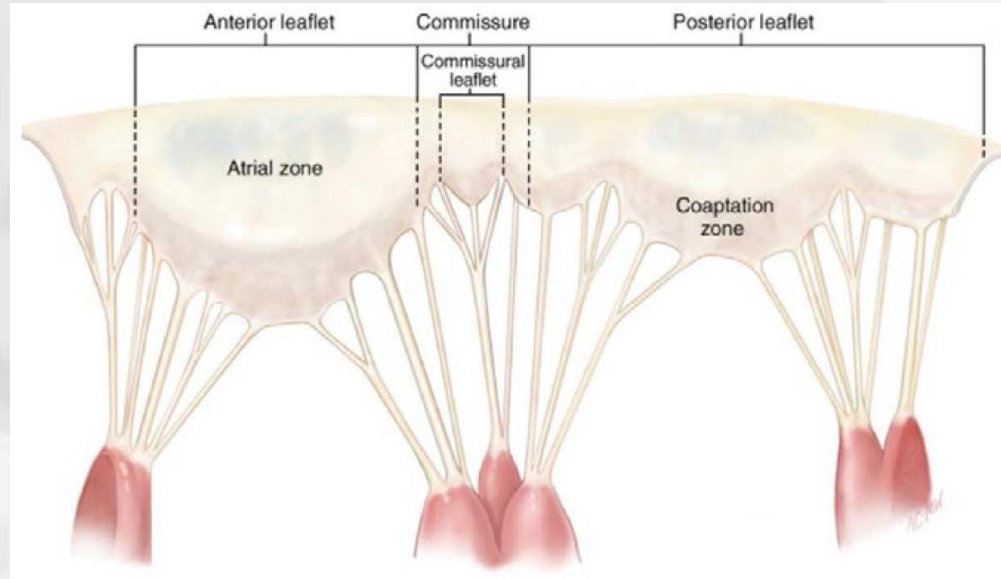
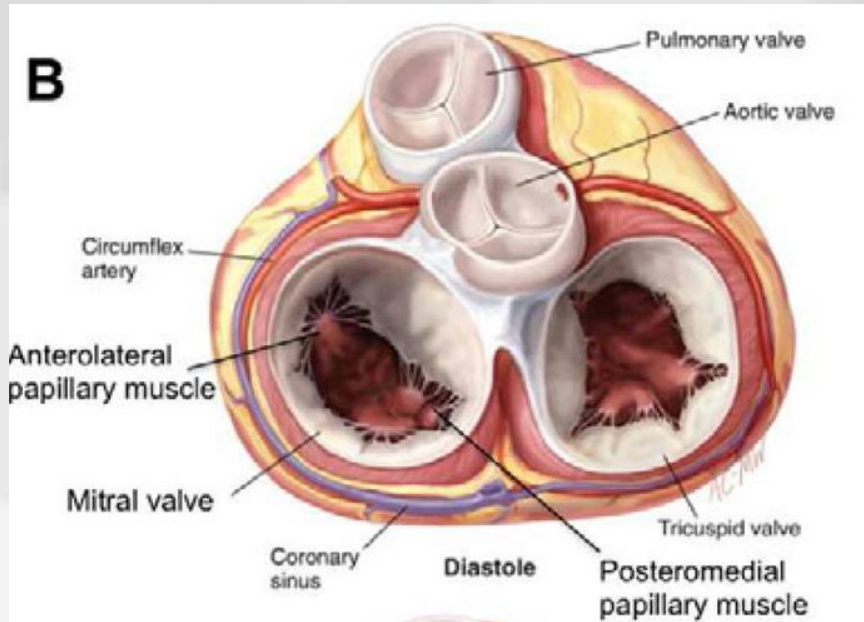
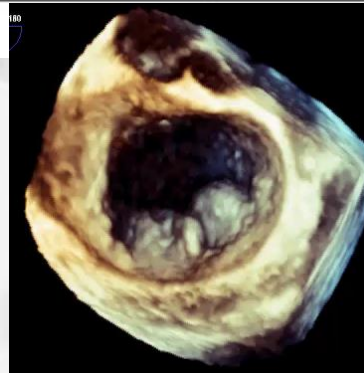
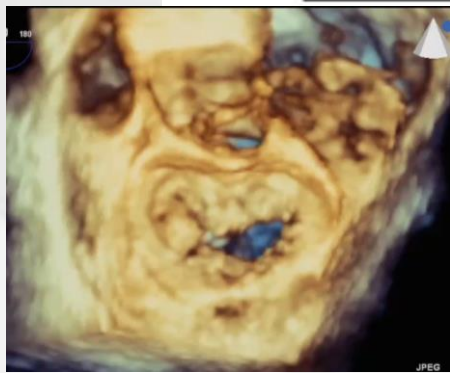
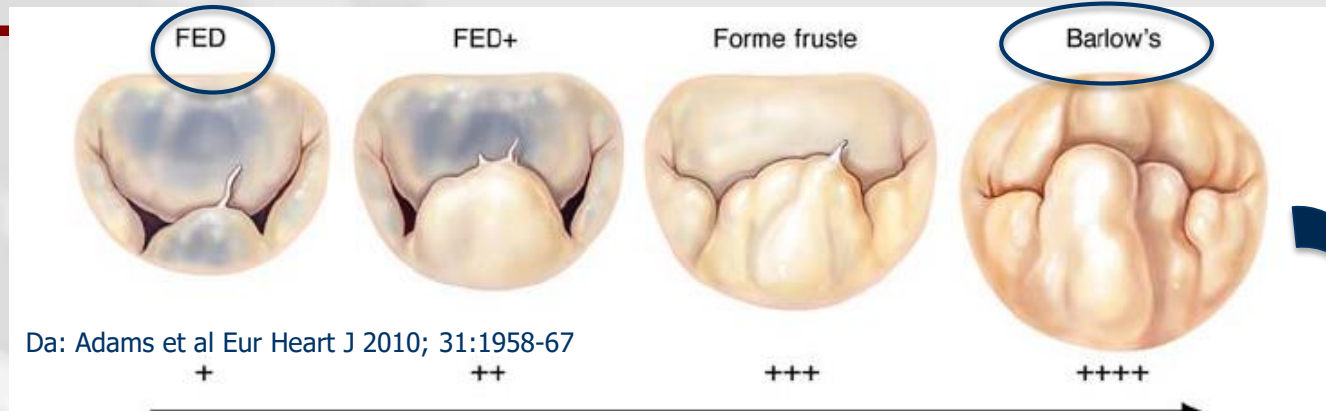


Insufficienza mitralica degenerativa: anatomia



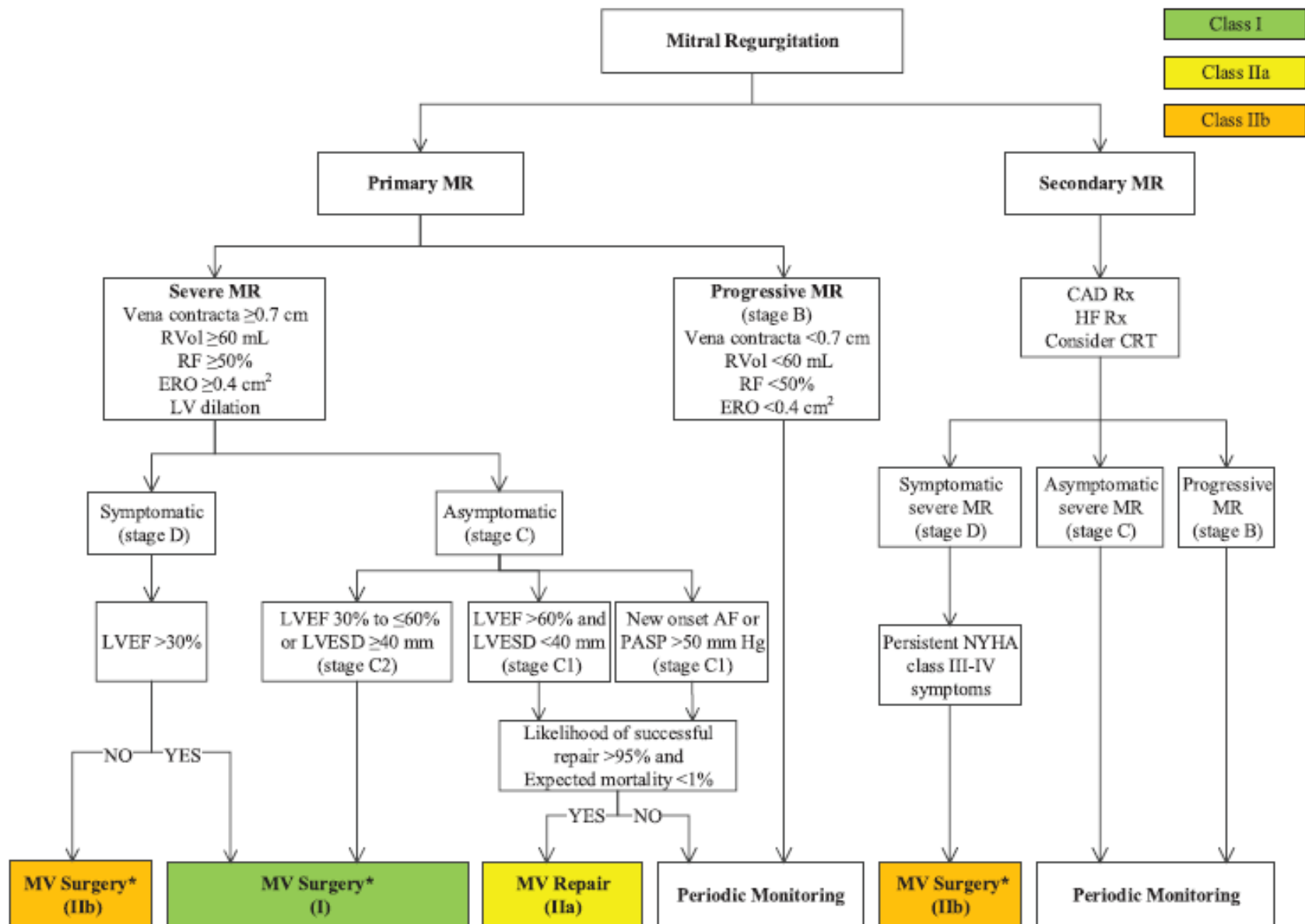
Insufficienza mitralica degenerativa: FED vs BARLOW



Deficienza fibro-elastica: legata a deficit di fibrillina che spesso porta alla rottura cordale.
Coinvolge solo alcuni segmenti dei lembi e presenta dimensioni dell'anulus lievemente incrementate.

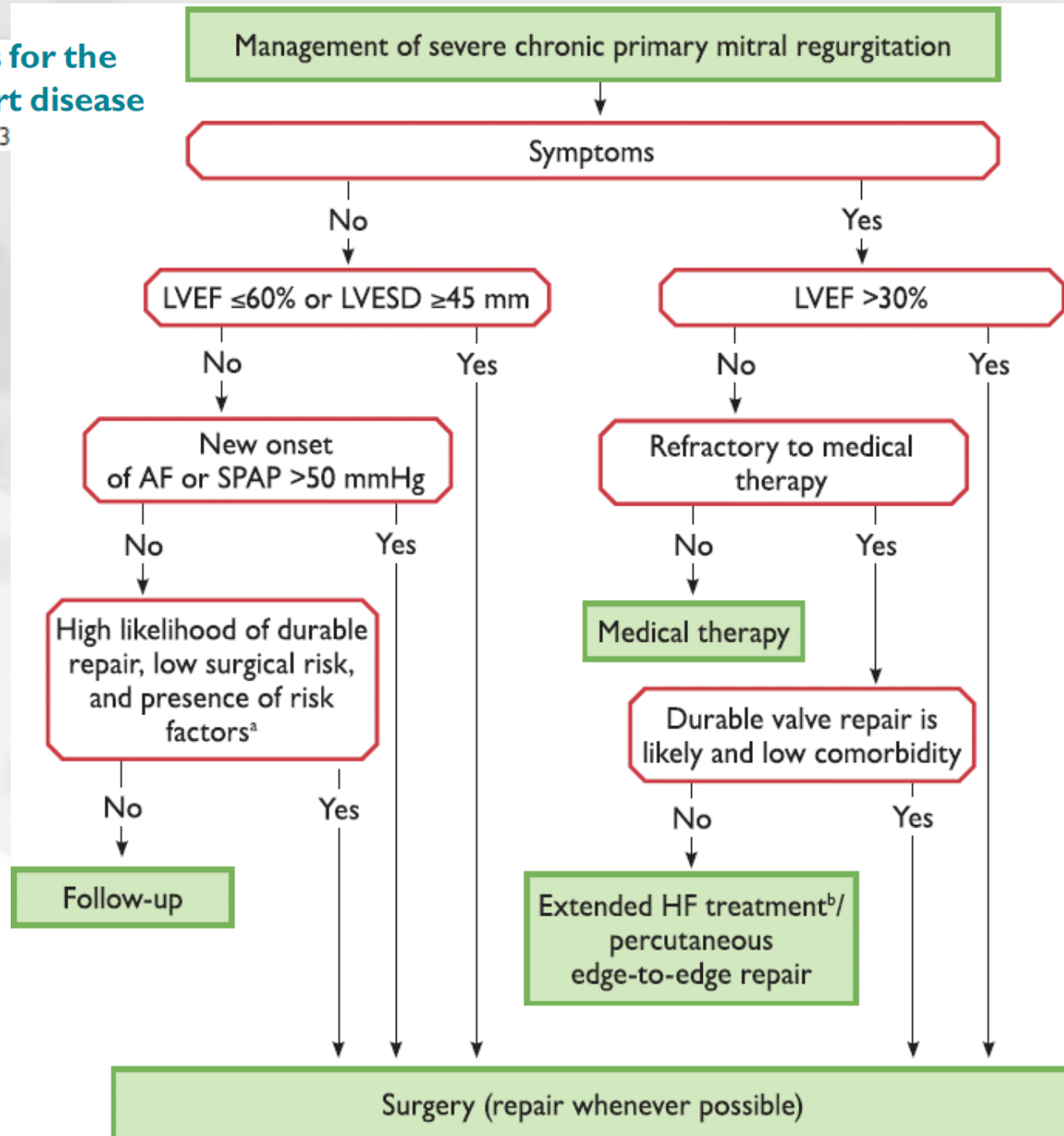
Sindrome di Barlow: caratterizzata dalla degenerazione mixomatosa della valvola.
Coinvolge più lembi e presenta dilatazione marcata dell'anulus.

2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease



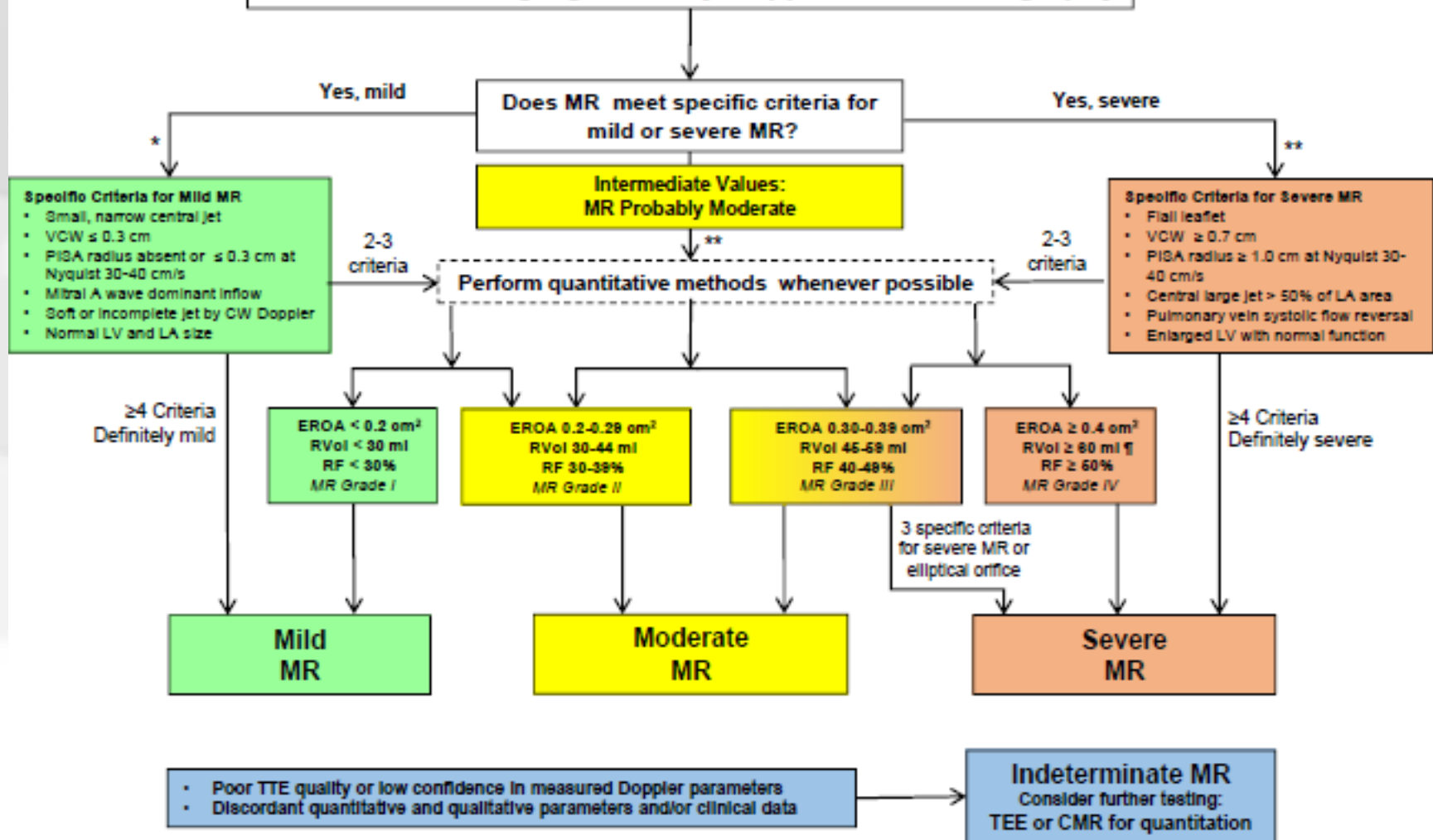
2017 ESC/EACTS Guidelines for the management of valvular heart disease

European Heart Journal (2017) 00, 1–53



Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation

Chronic Mitral Regurgitation by Doppler Echocardiography

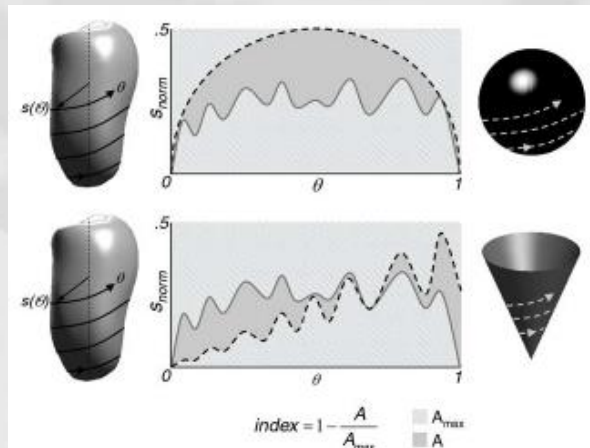


*	Beware of underestimation of MR severity in eccentric, wall impinging jets; quantitation is advised
**	All values for EROA by PISA assume holosystolic MR; single frame EROA by PISA and VCW overestimate non-holosystolic MR
†	Regurgitant volume for severe MR may be lower in low flow conditions.

Serial Changes in Left Ventricular Shape Following Early Mitral Valve Repair

Francesco Maffessanti, MS^{a,b,*}, Enrico G. Caiani, PhD^a, Gloria Tamborini, MD^b,
 Manuela Muratori, MD^b, Lissa Sugeng, MD^c, Lynn Weinert, RDCS^c, Francesco Alamanni, MD^b,
 Marco Zanobini, PhD^b, Victor Mor-Avi, PhD^c, Roberto M. Lang, MD^c, and Mauro Pepi, MD^b

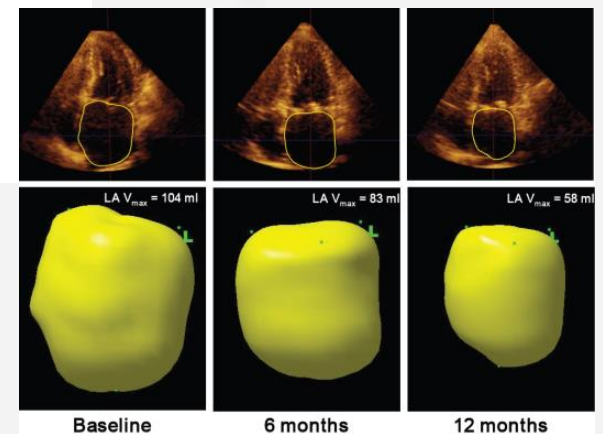
(Am J Cardiol 2010;106:836–842)



Left atrial reverse remodeling and functional improvement after mitral valve repair in degenerative mitral regurgitation: a real-time three-dimensional echocardiography study.

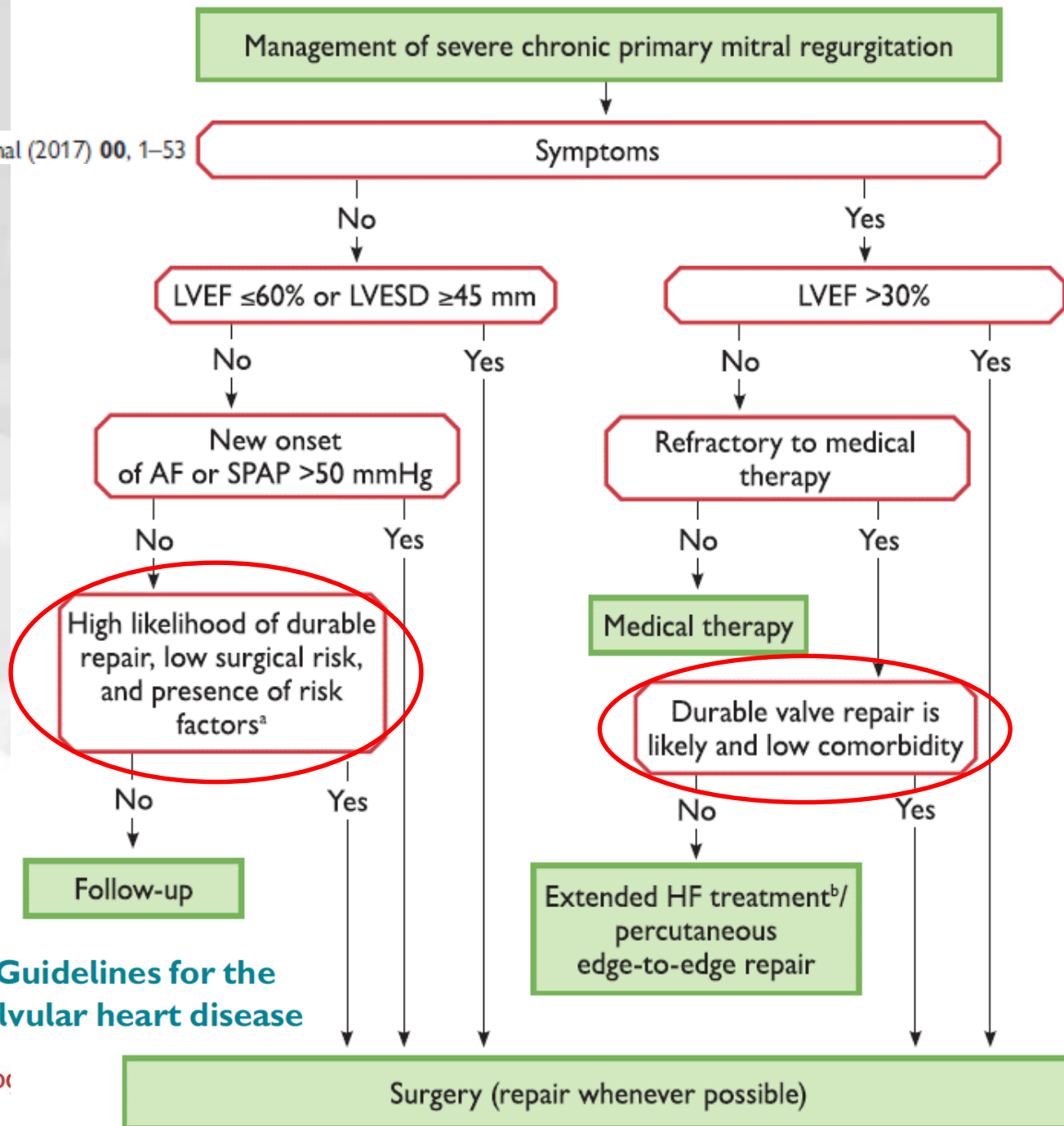
Nina Ajmone Marsan¹, Francesco Maffessanti², Gloria Tamborini¹, Paola Gripari¹, Enrico Caiani², Laura Fusini², Manuela Muratori¹, Marco Zanobini¹,
 Francesco Alamanni¹, Mauro Pepi¹.

Heart 2011



Management of severe chronic primary mitral regurgitation

European Heart Journal (2017) 00, 1–53



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

Insufficienza mitralica degenerativa: criteri di riparabilità e durabilità della riparazione chirurgica

Recurrent mitral regurgitation after repair: Should the mitral valve be re-repaired?

J Thorac Cardiovasc Surg 2006;132:1390-7

TABLE 3. Findings at reoperation

Abnormal findings	Overall	Re-repair	Replacement	P value
Anterior leaflet	65 (45%)	27 (42%)	38 (47%)	.57
Posterior leaflet	61 (42%)	27 (42%)	34 (42%)	.98
Annuloplasty	42 (29%)	30 (47%)	12 (15%)	<.001
Chordal rupture	20 (14%)	7 (11%)	13 (16%)	.38
Mode of failure				
<u>New pathology</u>	80 (55%)	27 (42%)	53 (65%)	.005
Technical	61 (42%)	36 (56%)	25 (31%)	.002
Unclear	4 (3%)	1 (2%)	3 (4%)	.43

Reoperation After Mitral Valve Repair for Degenerative Disease

A. Marc Gillinov,

(Ann Thorac Surg 2007;84:444-50)

Table 2. Mechanisms of Repair Failure

Mechanism ^a	No.	No. of Patients
Procedure related	96	
Suture dehiscence		40
Hemolysis		21
Chordal shortening		20
Systolic anterior motion		20
Incomplete initial repair		11
Valve related	109	
<u>Progressive degeneration</u>		100
Endocarditis		11
Unknown	8	

Mechanisms of Recurrent Regurgitation After Valve Repair for Prolapsed Mitral Valve Disease

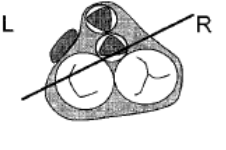

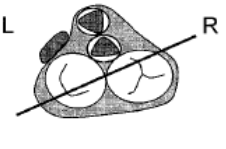
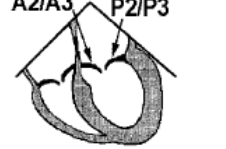
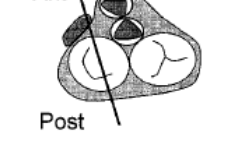
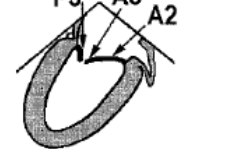
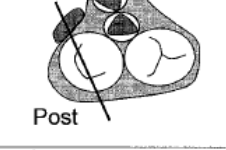
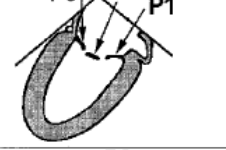
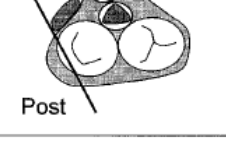
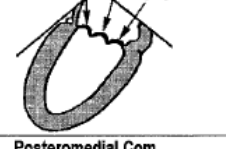


(Ann Thorac Surg 2011;91:1433-9)

Reoperation			
Anterior leaflet prolapse	1.79	1.01-3.18	0.047
No use of ring or band annuloplasty	2.74	1.29-5.83	0.009
Recurrent mitral regurgitation			
<u>Anterior leaflet prolapse</u>	3.21	1.97-5.23	<0.0001
Atrial fibrillation	1.67	1.16-2.40	0.005
No use of ring or band annuloplasty	2.80	1.58-4.96	<0.0001

Insufficienza mitralica degenerativa: *identificare la morfologia della valvola*

Improved Evaluation of the Location and Mechanism of Mitral Valve Regurgitation with a Systematic Transesophageal Echocardiography Examination

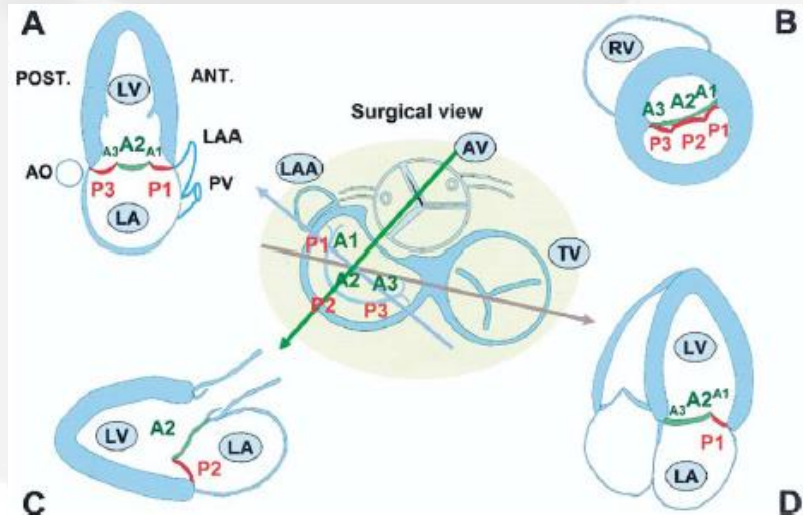
(Anesth Analg 1999;88:1205-12)

5-Chamber Allows localization of pathology to the anterior or posterior leaflet. Specific scallops difficult to identify based only on this view, but generally shows anterior elements of the valve.		
4-Chamber Allows localization of pathology to the anterior or posterior leaflet. Specific scallops difficult to identify based only on this view, but generally shows posterior elements of the valve.		
2-Chamber Anterior Shows a long anterior leaflet (A2/A3) and a short segment of the posterior leaflet (P3). Note that the part of the anterior leaflet that coapts with the P3 segment is the A3 segment.		
2-Chamber Mid Three scallops and two coaptation points are seen: P3, P1, and a variable amount of A2, which disappears during diastole.		
2-Chamber Posterior No coaptation point seen. The plane cuts through the posterior leaflet only. Usually demonstrates mostly P2, with some P1 and P3.		
Short Axis This view is most useful with color Doppler to localize the site of regurgitation. However it rarely demonstrates the nature of the pathology.		Posteromedial Com.  Anterolateral Com.

Functional Assessment of Mitral Regurgitation by Transthoracic Echocardiography Using Standardized Imaging Planes

Diagnostic Accuracy and Outcome Implications

Jean-Luc Monin, MD,* Patrick Dehant, MD,† Cécile Roiron, MD,* Mehran Monchi, MD,‡ Jean-Yves Tabet, MD,* Philippe Clerc, MD,† Guy Fernandez, MD,† Rémi Houel, MD,‡ Jérôme Garot, MD, PHD,* Christophe Chauvel, MD,† Pascal Gueret, MD, FACC*



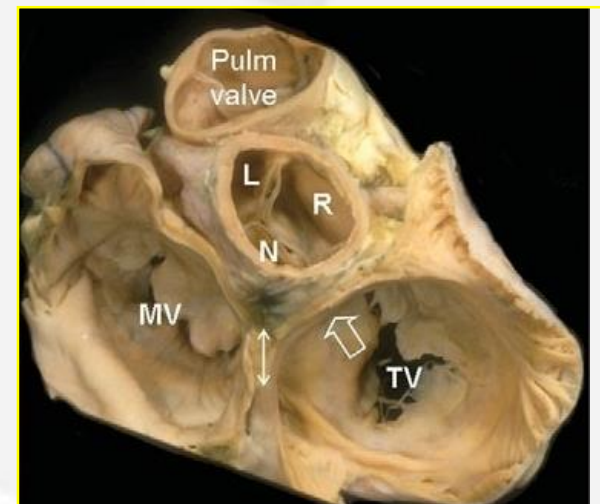
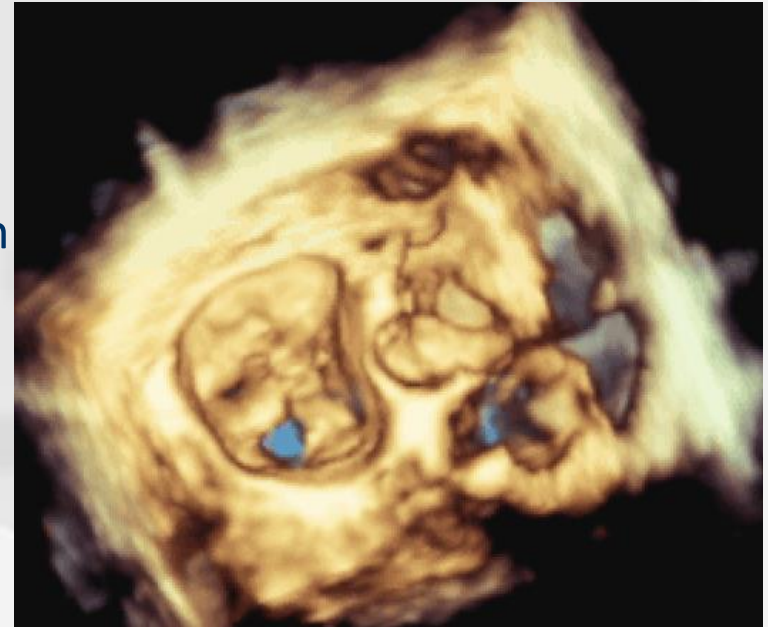
(J Am Coll Cardiol 2005;46:302-9)

Insufficienza mitralica degenerativa: *identificare la morfologia della valvola*

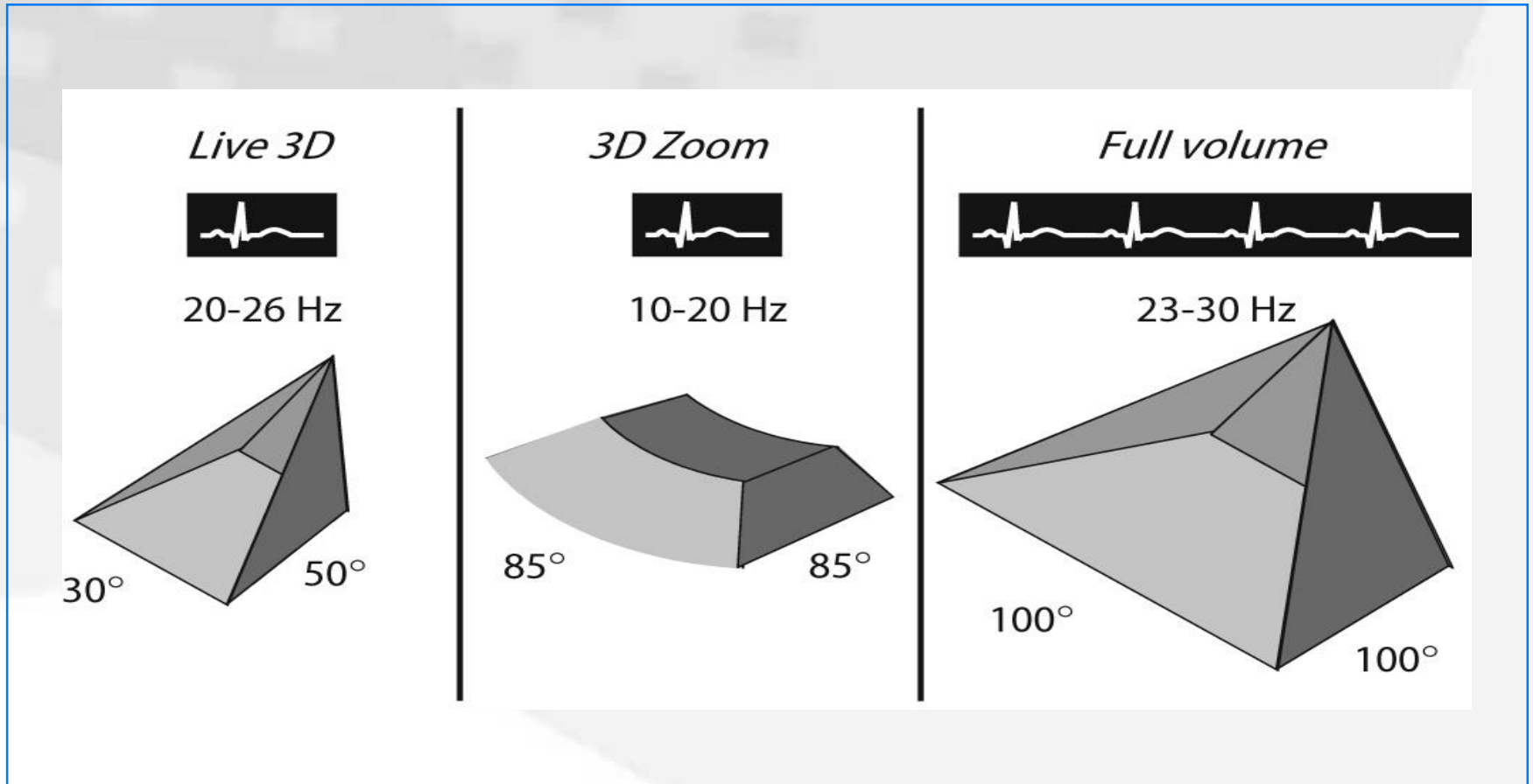
3D TEE REAL TIME O FULL VOLUME

Visualizzare l'apparato valvolare mitralico in una prospettiva analoga alla visione chirurgica, ma con una sostanziale differenza:

- il flail o le regione prolassanti vengono viste in movimento, mentre durante l'intervento chirurgico il cuore e i lembi sono immobili
- È possibile angolare e ruotare piramide di dati e pertanto esaminare plurime prospettive



2002-2007: 3D real time TTE and TEE



Head-to-Head Comparison of Two- and Three-Dimensional Transthoracic and Transesophageal Echocardiography in the Localization of Mitral Valve Prolapse

Mauro Pepi, MD, Gloria Tamborini, MD, Anna Maltagliati, MD, Claudia Agnese Galli, MD, Erminio Sisillo, MD, Luca Salvi, MD, Moreno Naliato, MD, Massimo Porqueddu, MD, Alessandro Parolari, MD, Marco Zanobini, MD, Francesco Alamanni, MD
 Milan, Italy

- 112 pts with severe mitral regurgitation due to MV prolapse
- 2D/3D TTE and 2D/3D TEE data were compared with surgical inspection

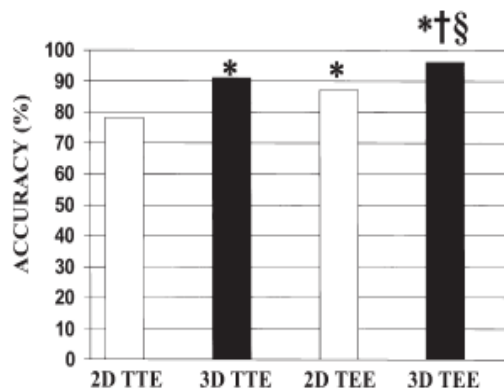


Figure 1. Overall accuracy of the 4 techniques in the identification of mitral valve pathology. *p < 0.001 versus 2D TTE; †p < 0.001 versus 3D TTE; §p < 0.001 versus 2D TEE. 2D = two-dimensional; 3D = three-dimensional; TEE = transesophageal echocardiography; TTE = transthoracic echocardiography.

Table 2. Detection of Pathology With the Four Echocardiographic Techniques

	Sensitivity (%)	Specificity (%)	Accuracy (%)
PML			
2D TTE	74	75	74
3D TTE	87*	91†	89†‡
2D TEE	83†	83*	83†
3D TEE	97†§	92†	96†§
AML			
2D TTE	71	88	84
3D TTE	88†§	95	94†
2D TEE	72	97*	91†
3D TEE	96†§‡	97*	97†§‡
AML + PML			
2D TTE	73	83	78
3D TTE	87†	93†	91†
2D TEE	80†	91†	87†
3D TEE	96†‡	95†‡	96†‡
Chordal rupture			
2D TTE	77.5	80	78
3D TTE	93†	92	92.5†
2D TEE	98†	92*	95.5†
3D TEE	100†	94†	98†
Anterolateral commissure			
2D TTE	40	85	78
3D TTE	55	98†	91†
2D TEE	54	95†	89†
3D TEE	89†‡§	99†	97†‡
Posteromedial commissure			
2D TTE	54	84	75
3D TTE	82†¶	92	89†
2D TEE	66	90*	82†
3D TEE	92†‡	95*	93*‡

CONCLUSIONS Three-dimensional TTE and TEE are feasible and useful methods in identifying the location of MV prolapse. They were superior in the description of pathology in comparison with the corresponding 2D techniques and should be regarded as an important adjunct to standard 2D examinations in decisions regarding MV repair. (J Am Coll Cardiol 2006;48:2524–30)

A Framework for Systematic Characterization of the Mitral Valve by Real-Time Three-Dimensional Transesophageal Echocardiography

Ernesto E. Salcedo, MD, Robert A. Quaife, MD, Tamas Seres, MD, and John D. Carroll, MD, *Denver, Colorado*

(*J Am Soc Echocardiogr* 2009;22:1087-99.)

Table 1 Publications on 3D TEE of the MV

Reference	Population	Echocardiographic modalities	Assessment	Findings
Pepi et al ¹⁶	112 patients with MVP and severe MR	2D and 3D TTE, 2D TEE, 3D TEE (reconstruction)	MV repair surgery	3D TEE superior on description of pathology; 95% accuracy
Valocik et al ¹⁸	45 patients with MS	2D TTE, 2D TEE, 3D TEE (reconstruction)	Quantitative 3D echocardiography of MS	Funnel-like geometry may predict MS severity
Garcia-Orta et al ²⁵	81 patients with severe MR	2D TEE, 3D TEE (reconstruction)	MV repair surgery	3D better in A1 defects and commissures
Sugeng et al ¹⁴	211 patients referred for TEE	2D TEE, 3D MTEE	Image quality of native valves	85%-91% visualization of all MV scallops
Sugeng et al ¹²	40 prosthesis, 47 MV surgery	3D MTEE	Image quality, Surgical findings	Best for MVR; 96% surgical agreement
Grewal et al ²⁷	42 patients with MV repair	2D TEE, 3D TEE	Surgical inspection	3D TEE superior for P1, A2, A3, and bileaflet disease

MR, Mitral regurgitation; *MS*, mitral stenosis; *MTEE*, matrix-array TEE; *MV*, mitral valve; *MVP*, mitral valve prolapse; *MVR*, mitral valve prosthesis.

3DTEE was superior to 2DTEE imaging in the diagnosis of P1, A2, A3 and bileaflet disease. JASE 2009

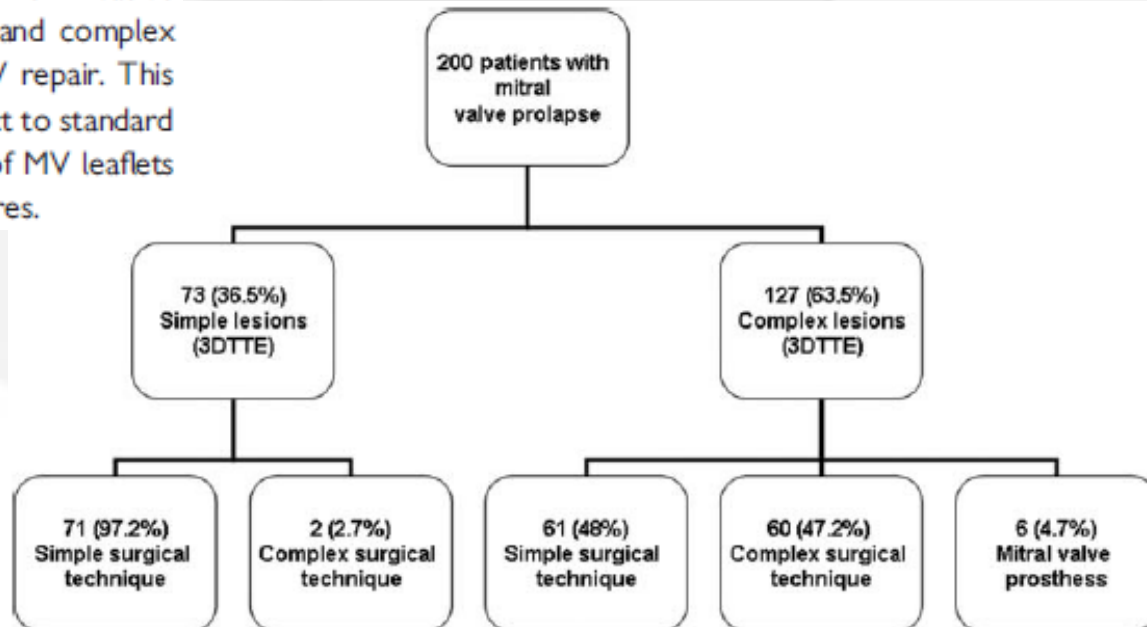


Pre-operative transthoracic real-time three-dimensional echocardiography in patients undergoing mitral valve repair: accuracy in cases with simple vs. complex prolapse lesions

Gloria Tamborini*, Manuela Muratori, Anna Maltagliati, Claudia Agnese Galli, Moreno Naliato, Marco Zanobini, Francesco Alamanni, Luca Salvi, Erminio Sisillo, Cesare Fiorentini, and Mauro Pepi

Conclusions

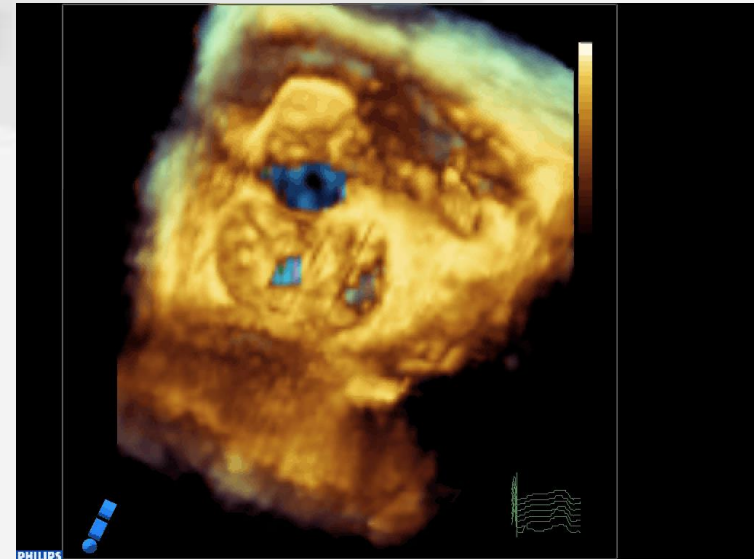
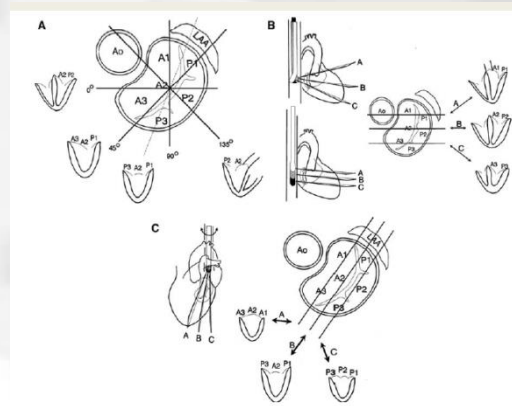
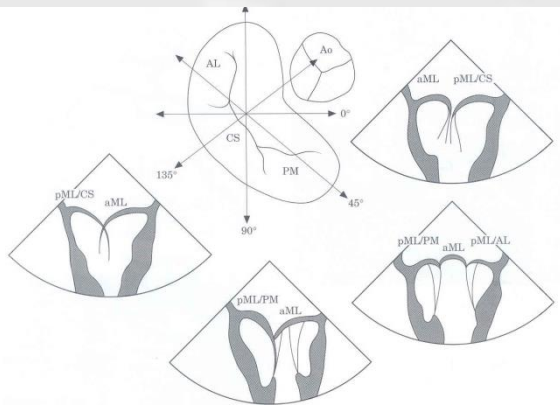
Real-time 3D TTE is a feasible, not time-consuming, non-invasive useful method in identifying the location of simple and complex lesions in patients with MV prolapse undergoing MV repair. This technique should be regarded as an important adjunct to standard 2D examination in recognizing all the components of MV leaflets and may facilitate the prediction of surgical procedures.



Recommendations for transoesophageal echocardiography: update 2010

F.A. Flachskampf^{1*}, L. Badano², W.G. Daniel¹, R.O. Feneck³, K.F. Fox⁴, Alan G. Fraser⁵, Agnes Pasquet⁶, M. Pepi⁷, L. Perez de Isla⁸, and J.L. Zamorano⁸ for the European Association of Echocardiography; endorsed by the Echo Committee of the European Association of Cardiothoracic Anaesthesiologists

Document Reviewers: J.R.T.C. Roelandt^a and L. Piérard^b

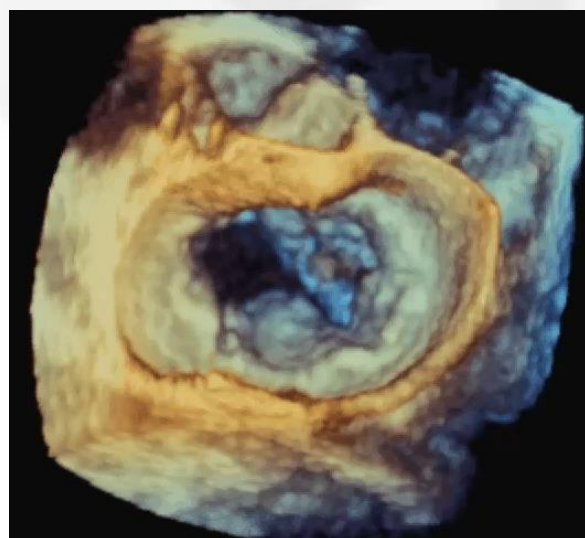


The recent advent of 3D imaging has considerably enhanced TOE by providing relatively high image quality and several unique views, and by its capability to show intuitively understandable 3D images to physicians not specialized in imaging.

Table 2 Techniques for repair of P2 prolapse and flail

Type of prolapse	Morphometric characteristics	Surgical technique
Limited P2 prolapse	Prolapse less than one-third of the total free edge of the posterior leaflet	Triangular resection, leaflet continuity restored either with interrupted stitches or with a continuous, blocked suture; ring annuloplasty
Extensive P2 prolapse	Prolapse more than one-third of the total free edge of the posterior leaflet; height of remaining tissue < 20 mm	Quadrangular resection, plication of the annulus (used to approximate the remaining leaflet tissue); leaflet continuity reestablished either with interrupted stitches or with a continuous, blocked suture; plication of the annulus and ring annuloplasty
Extensive P2 prolapse	Prolapse more than one-third of the total free edge of the posterior leaflet; height of remaining tissue >20 mm	Quadrangular resection, limited resection at the base of the leaflets to restore optimal height (<15 mm); plication of the annulus and ring annuloplasty
Very extensive P2 prolapse	Gap after the resection >20 mm	Sliding leaflet plasty: the segments adjacent to the removed tissue are disconnected from the annulus medially and laterally to the resected area over a distance equal to one-half the length of the gap; each segment is pulled toward the gap and reattached to the annulus by consecutive stitches; plication of the annulus and ring annuloplasty

(J Am Soc Echocardiogr 2015;28:437-48.)



Insufficienza mitralica degenerativa: *identificare la morfologia della valvola*
esteso prolasso di P2 CON PLURIME ROTTURE CORDALI

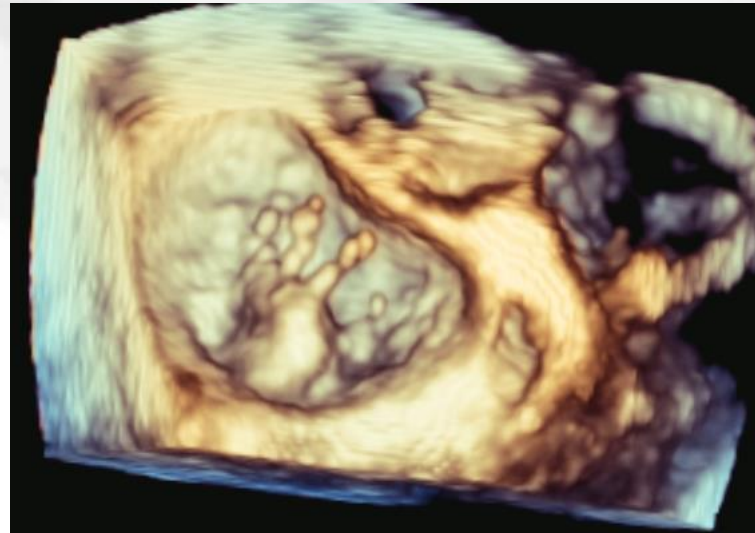
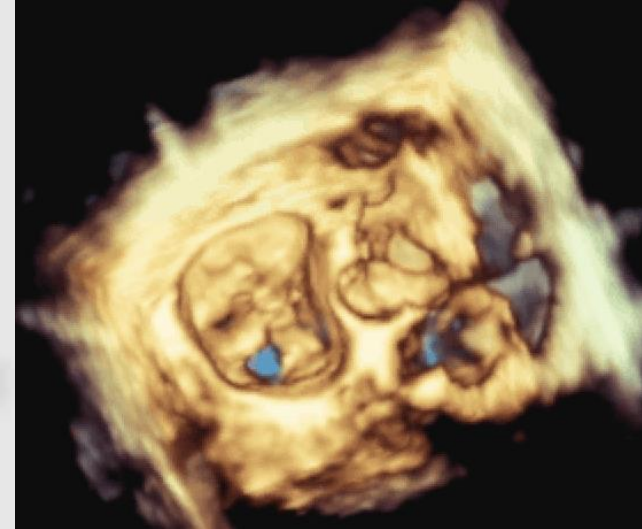
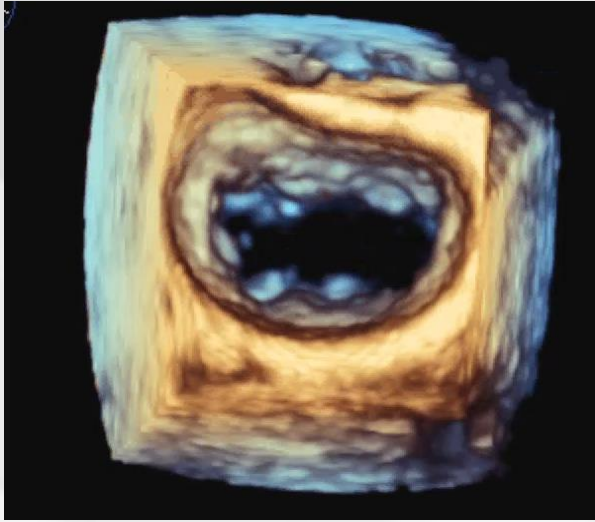


Table 2 Techniques for repair of P2 prolapse and flail

Extensive P2 prolapse

Prolapse more than one-third of the total free edge of the posterior leaflet; height of remaining tissue >20 mm

Quadrangular resection, limited resection at the base of the leaflets to restore optimal height (<15 mm); plication of the annulus and ring annuloplasty

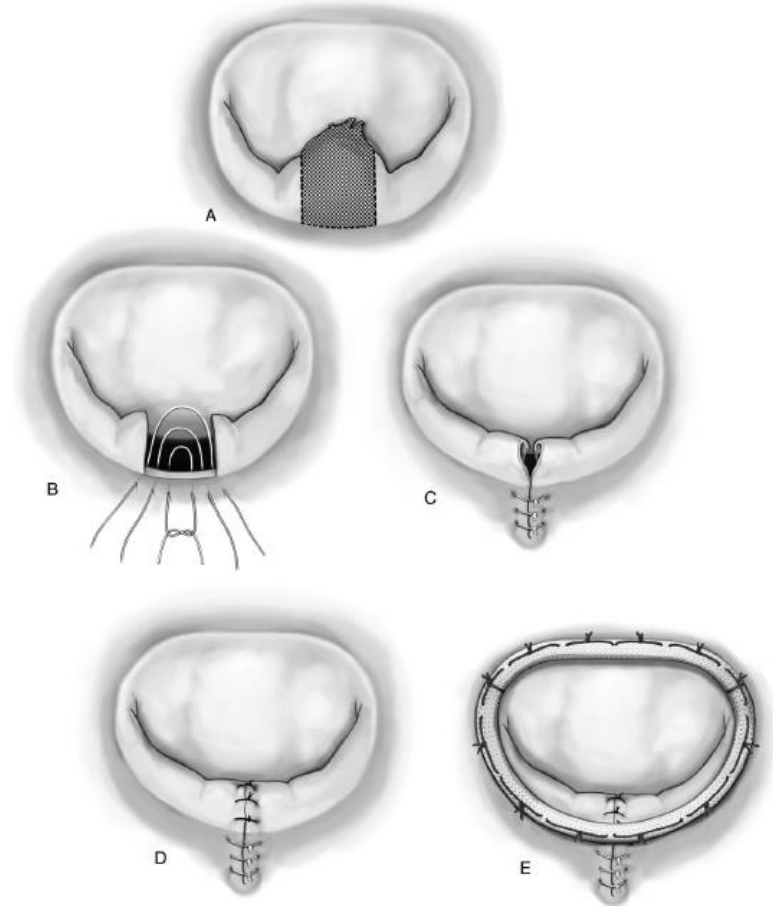


Figure 3 Posterior leaflet quadrangular resection with annular plication.

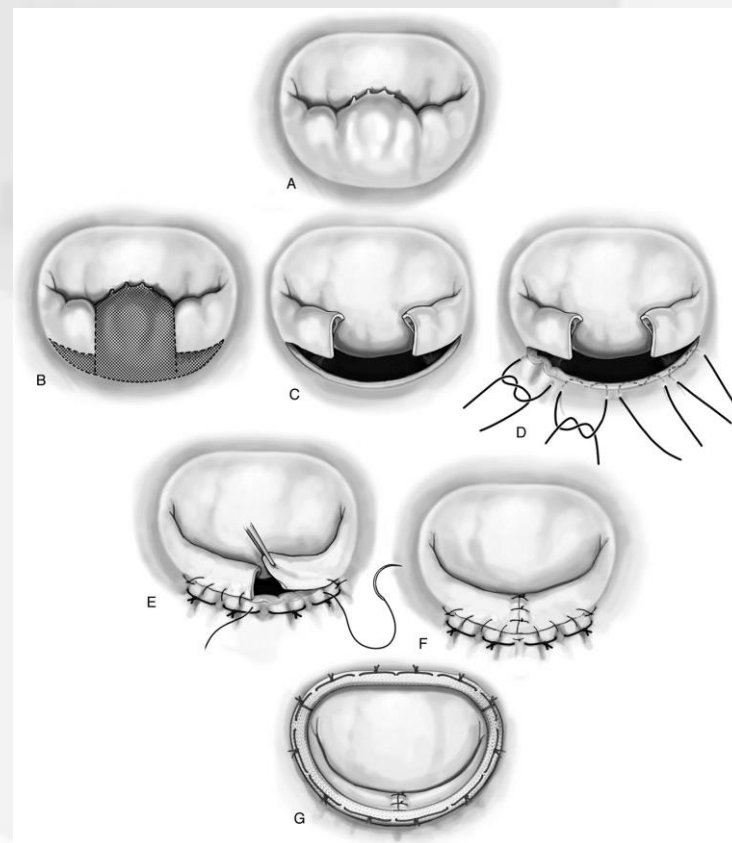
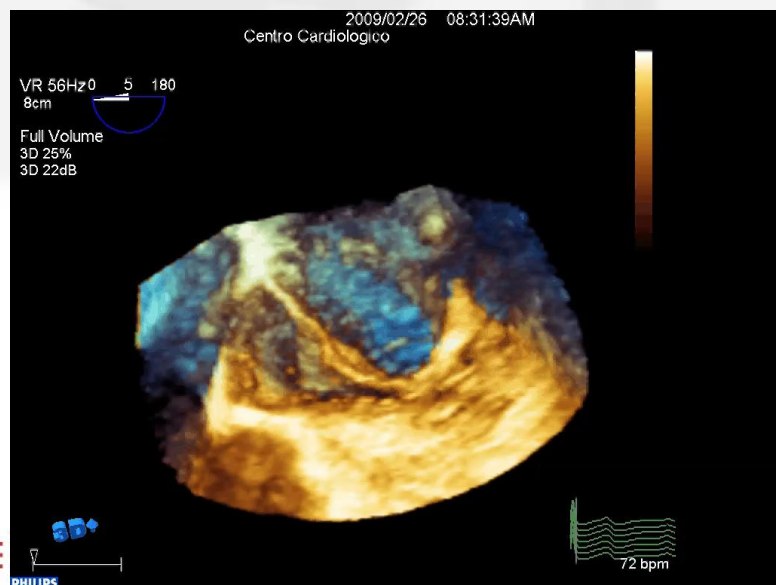
Table 2 Techniques for repair of P2 prolapse and flail

Type of prolapse	Morphometric characteristics	Surgical technique
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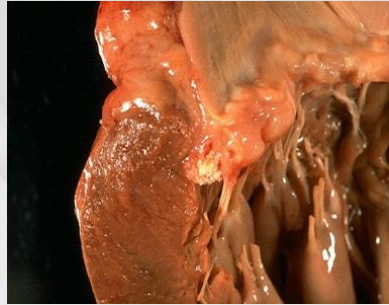
Very extensive P2 prolapse

Gap after the resection >20 mm

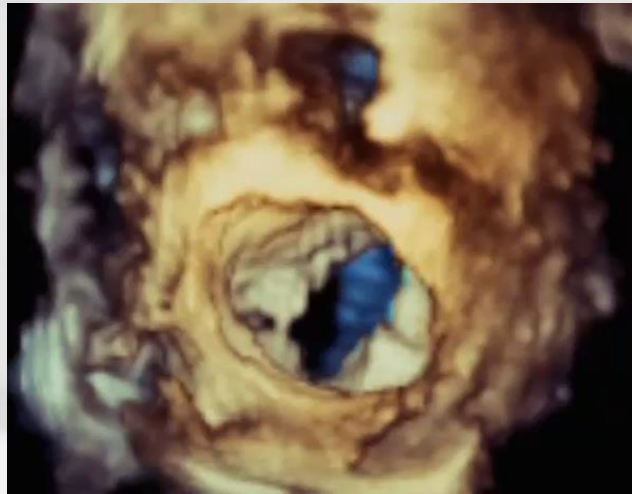
Sliding leaflet plasty: the segments adjacent to the removed tissue are disconnected from the annulus medially and laterally to the resected area over a distance equal to one-half the length of the gap; each segment is pulled toward the gap and reattached to the annulus by consecutive stitches; plication of the annulus and ring annuloplasty



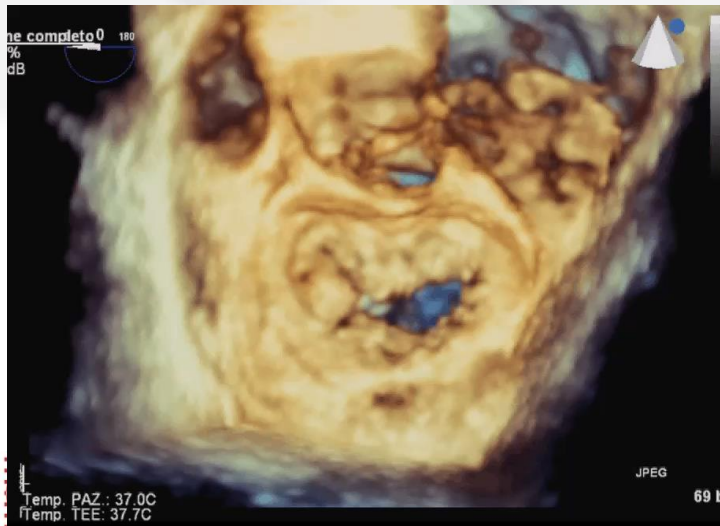
Insufficienza mitralica degenerativa: *identificare la morfologia della valvola* *Prolassi complessi lembo posteriore*



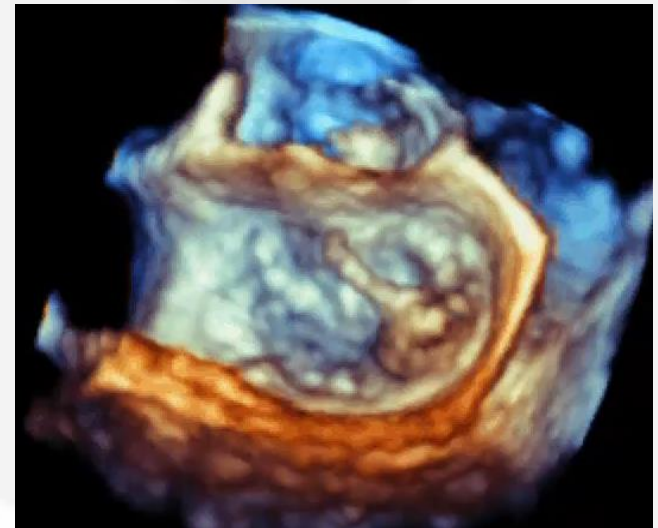
FLAIL di P1



**FLAIL di P2
e
CALCIFICAZIONE ANULARE**

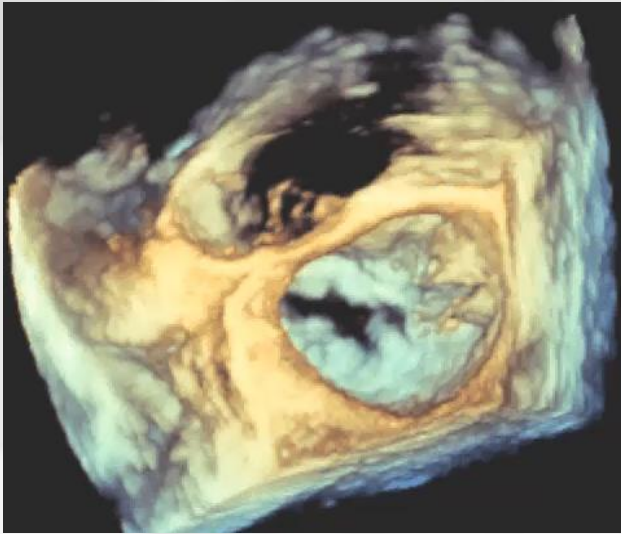


FLAIL di P3

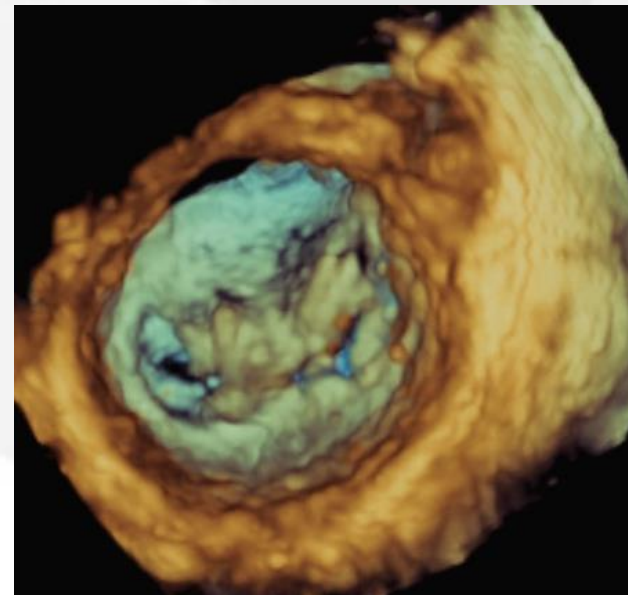
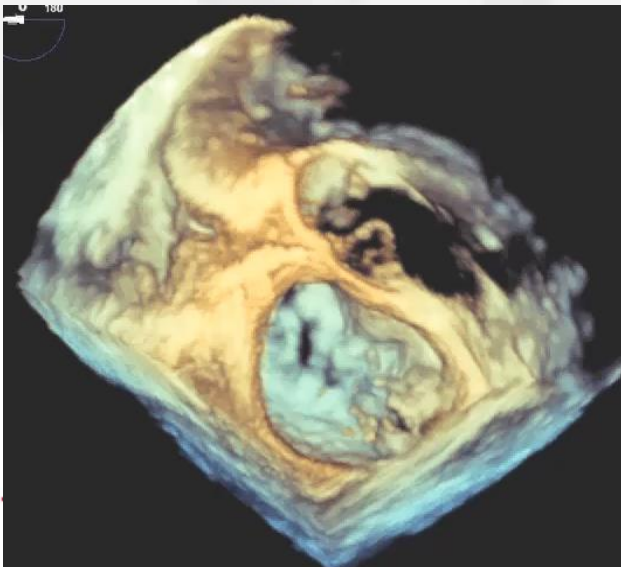


Insufficienza mitralica degenerativa: *identificare la morfologia della valvola* *Prolasso e rottura delle corde della commissura posteromediale*

FLAIL della commissura posteromediale

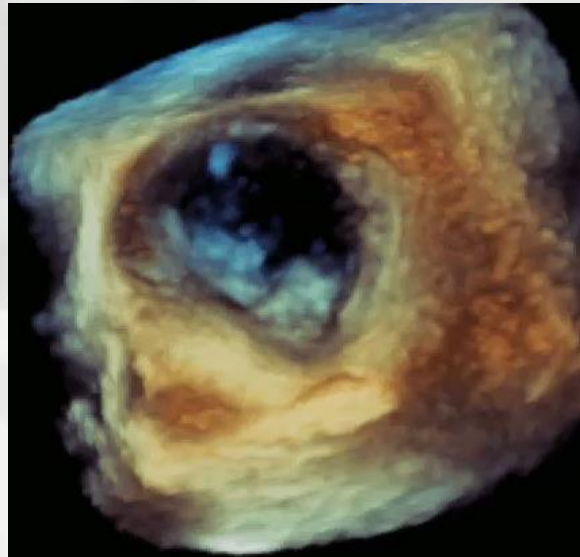
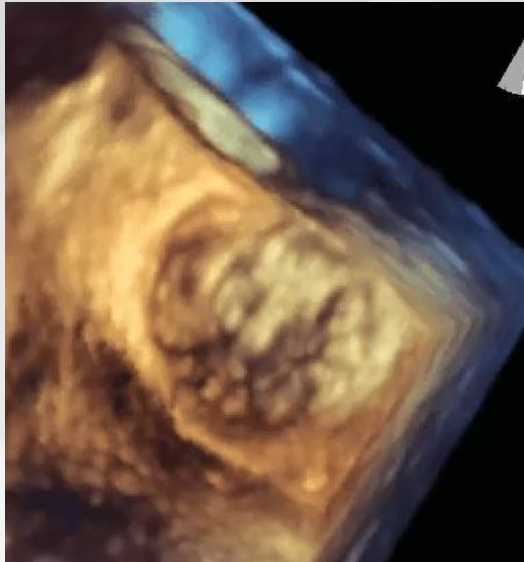


Visione dal ventricolo



Insufficienza mitralica degenerativa: *identificare la morfologia della valvola*

Flail di A1-A2. Visione chirurgica dall'atrio



Visione dal ventricolo

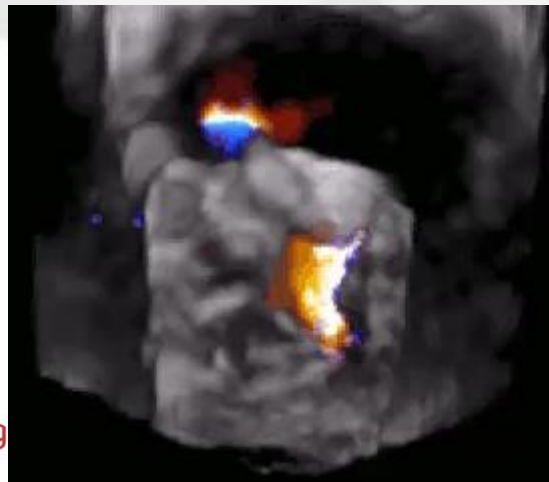
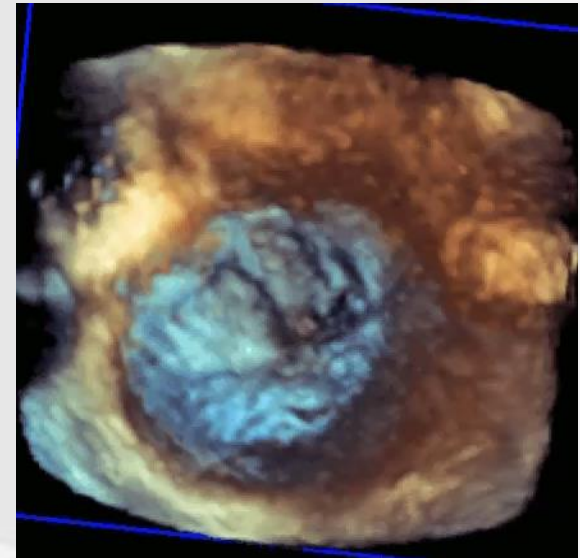


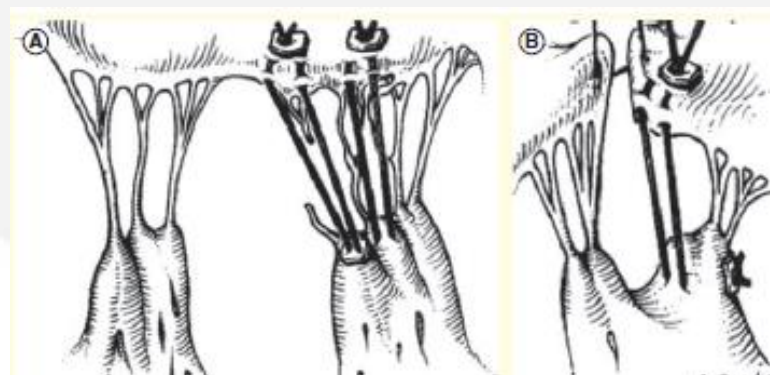
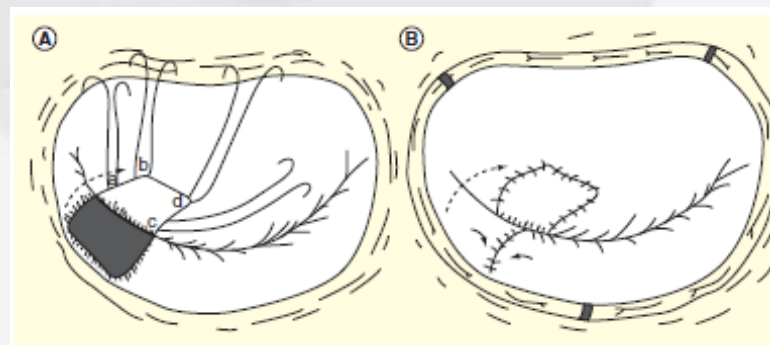
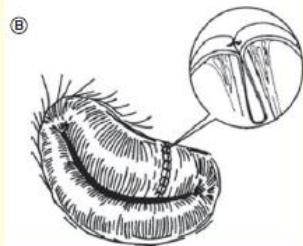
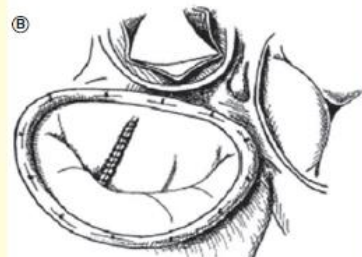
Table 3 Techniques for repair of A2 prolapse and flail

Type of prolapse	Morphometric characteristics	Surgical techniques
Limited A2 prolapse	Prolapse tissue less than one-quarter of the total free edge of the anterior leaflet	Triangular resection with resection limited to the rough zone
Limited A2 prolapse	Distance between the "normal" native chordae inserted on the rough zone of the same leaflet and the free margin of prolapsing tissue >5 mm	Secondary chordae inserted on the rough zone of the same leaflet are detached near their origin on the body of the anterior leaflet and reattached to the free margin of the prolapsing area Alternative technique: implantation of a neochord
Extensive A2	Prolapse tissue more than one-quarter of the total free edge of the anterior leaflet	(1) Implantation of a neochord to the free margin of A2 (2) Alternative technique: transferring a strip of variable height of the posterior leaflet with its chordae to the prolapsing or flail region of the anterior leaflet; the posterior leaflet is reconstructed as in triangular or quadrangular resection (chordal transfer)

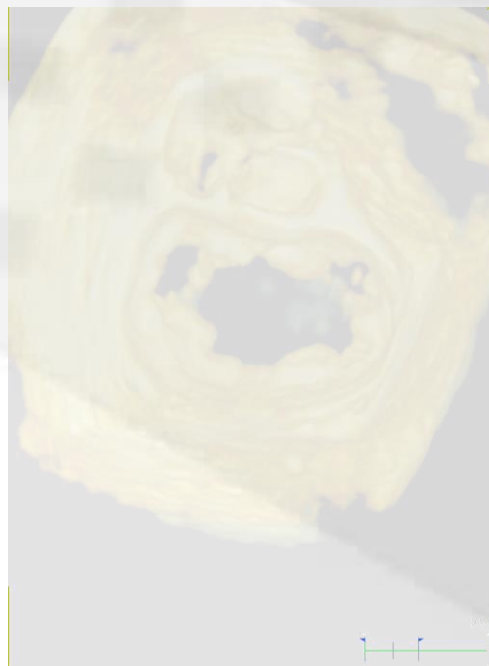
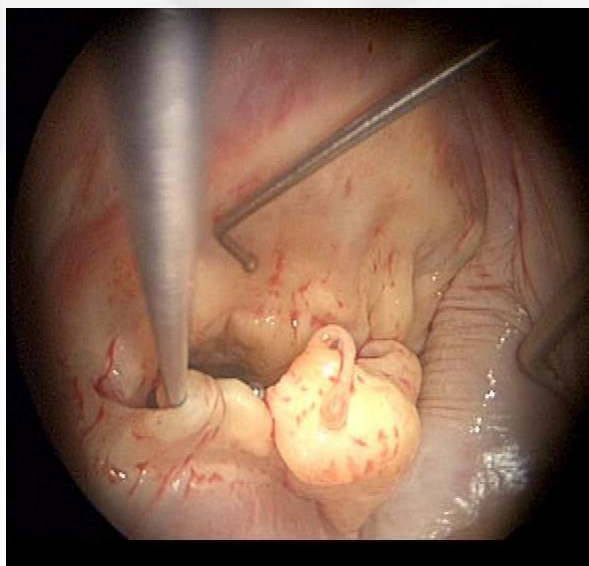
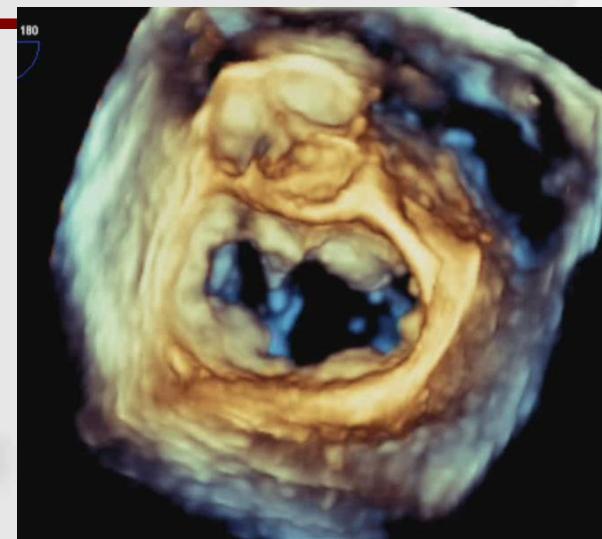
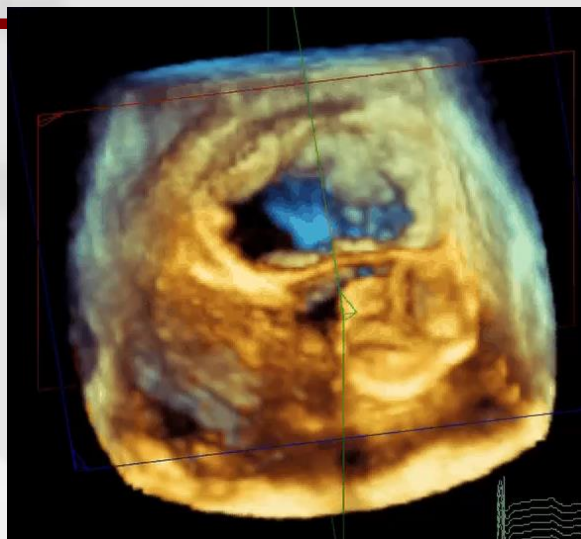
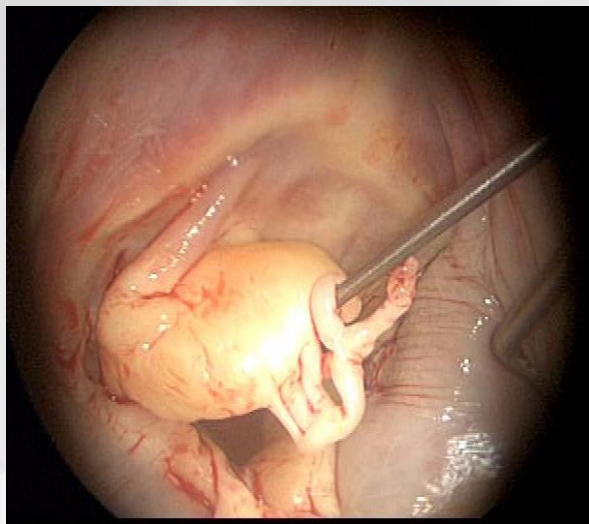
EXPERT
REVIEWS

Repair of the anterior mitral leaflet prolapse

Expert Rev. Med. Devices 11(1), 89-100 (2014)



Insufficienza mitralica degenerativa: *identificare la morfologia della valvola*



Diagnosi:

Prolasso di entrambi i lembi. Rottura di corde del lembo anteriore (A2) e del lembo posteriore (P2)

Protocollo operatorio:

Resezione e sliding del lembo posteriore.
Plicatura di entrambi i muscoli papillari.
Impianto di 3 corde di Gore-Tex sul lembo anteriore
Impianto di anello Edwards-Phisyo II 38 mm



Definizione diagnostica dell'insufficienza mitralica degenerativa con imaging integrato.

Gli elementi che dobbiamo fornire al chirurgo nella preparazione e nella esecuzione dell'intervento cardiocirurgico