ECO 3D: bello, utile e.. Anche facile

3DTEE : Cosa aggiunge nella valutazione della mitrale

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ITALY

Centro Cardiologico Monzino

Napoli 2015

ECO 3D TEE Mitrale

- ***Storia – Attuale accuratezza***
- Valutazione morfo-funzionale
- Utilità chirurgica
- Utilità monitoraggi

Utilità – Semplicità vs Complessità

Rapido miglioramento delle tecniche con semplicità d'uso e fattibilità sia trantoracica che transesofagea

Dagli anni 90 – agli anni 2000

Real Time

In ECO si impone ciò che è semplice ed utile.

Eco 2D seconda armonica

TEE

Eco Stress

Doppler

DTI

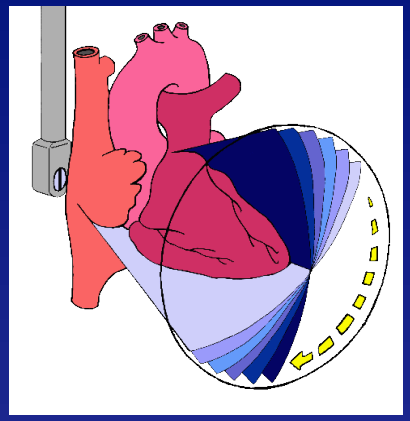
3D

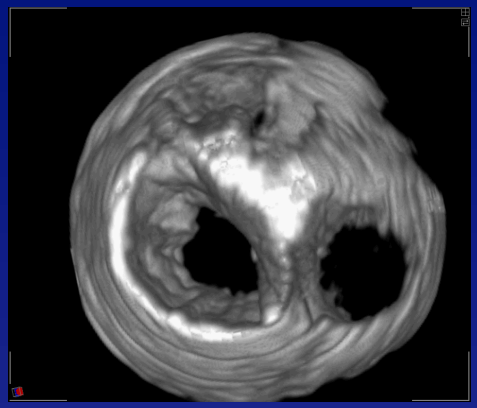
Accuratezza

Valore Clinico addizionale

Historical Background

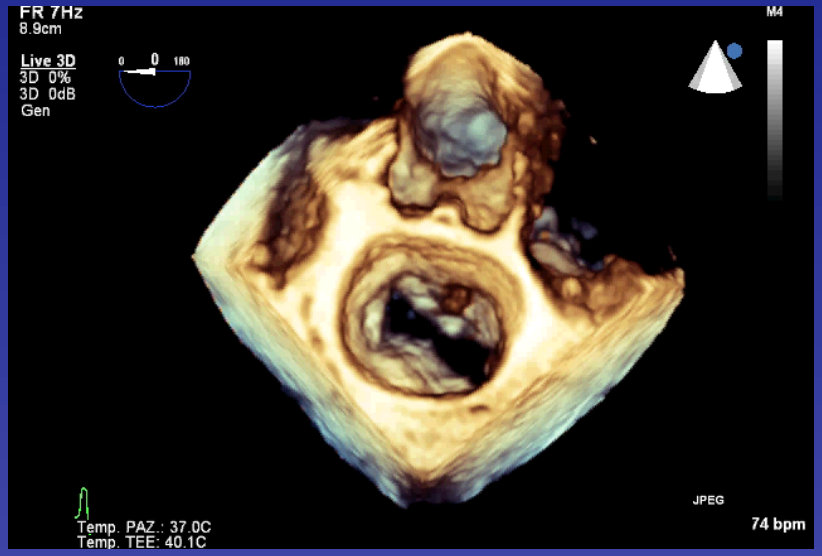
- Research
- activities……
- Nineties…..





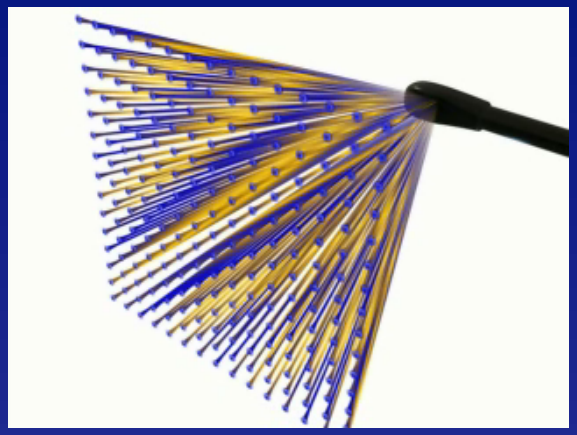
Rotational TEE acquisition

- 2002
- Transthoracic
- Real Time 3D



- 2007 real time
- 3DTEE

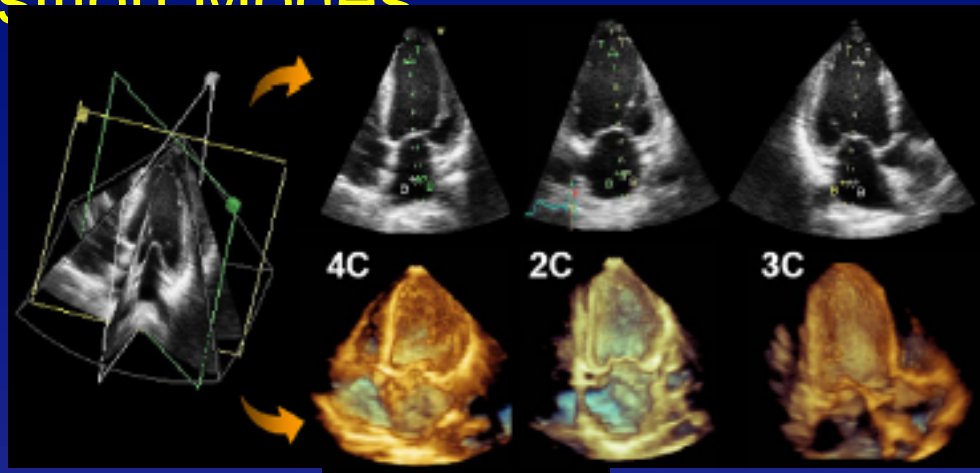
A view over the future…… 2007



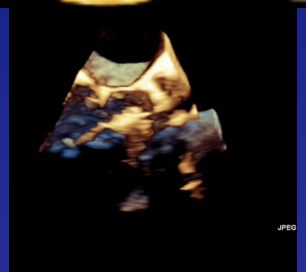
Just one touch
on the
keyboard
And
REAL TIME
3D TEE
may be
obtaiined

Data Acquisition Modes

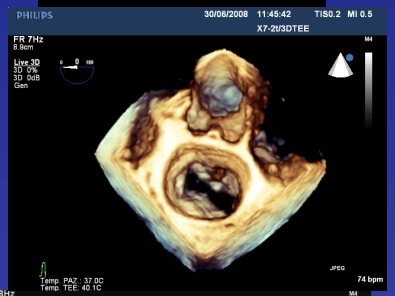
- Simultaneous Multiplane
- Mode.



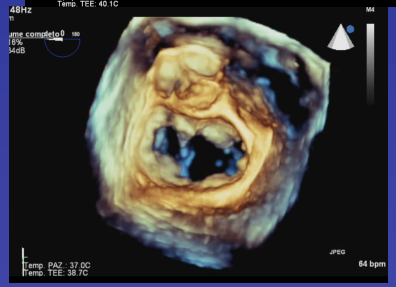
- Real-Time 3D Mode—Narrow Sector



- Focused Wide Sector—“ZOOM”.

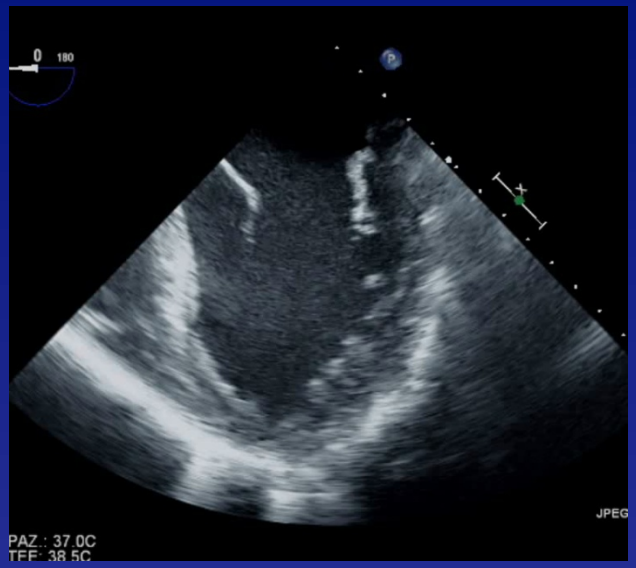


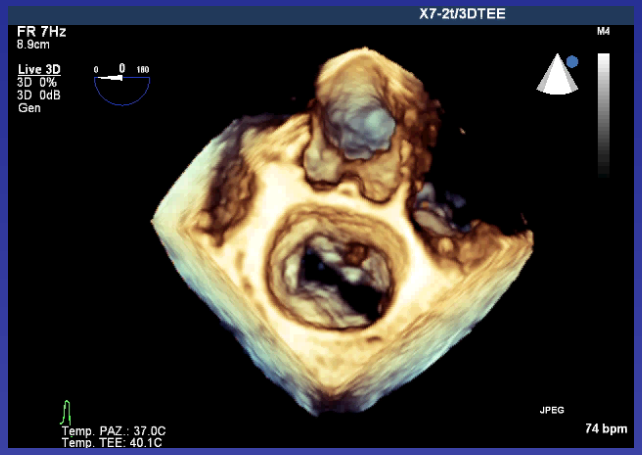
- Full Volume—Gated Acquisition.



Mitral Valve Prolapse

TEE





7 Frame/sec

M-mode

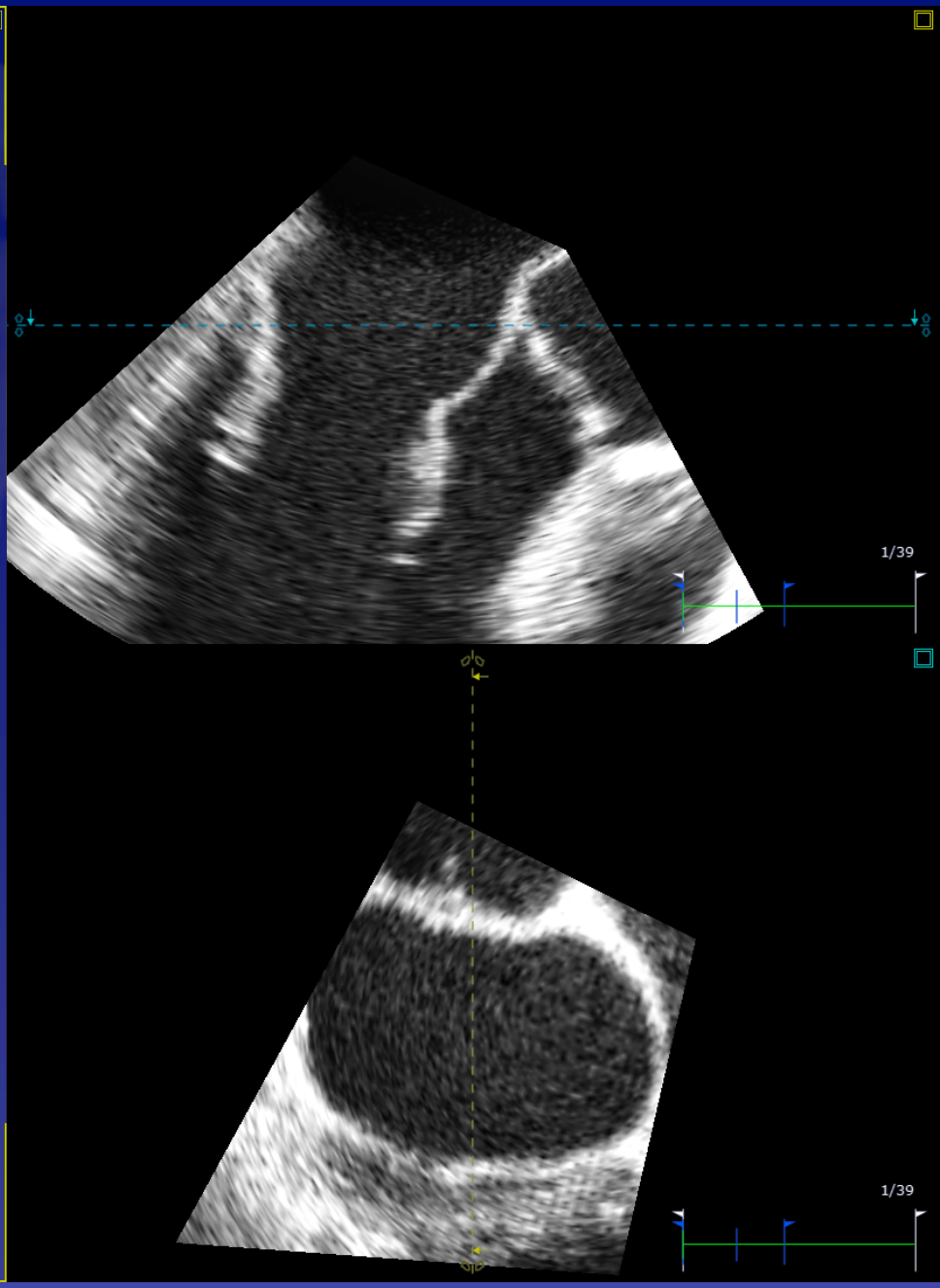
2D TT o TEE
Anni 80/90

3D anni 90

3D real time 2002/2007

2009


1/39


1/39
1/39

3D ECHOCARDIOGRAPHY
CLINICAL ADVANTAGES vs 2D

- **Better evaluation of morphologic abnormalities and understanding of complex spatial orientation**

- Better quantitative evaluation (area and volume) (obviates any geometrical assumptions)
- Facilitates Training and Communication between experts and non-experts (and different specialists)
- Facilitates monitoring of interventional procedures

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*

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.

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ISSN 0735-1097/06/$32.00
doi:10.1016/j.jacc.2006.02.079

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

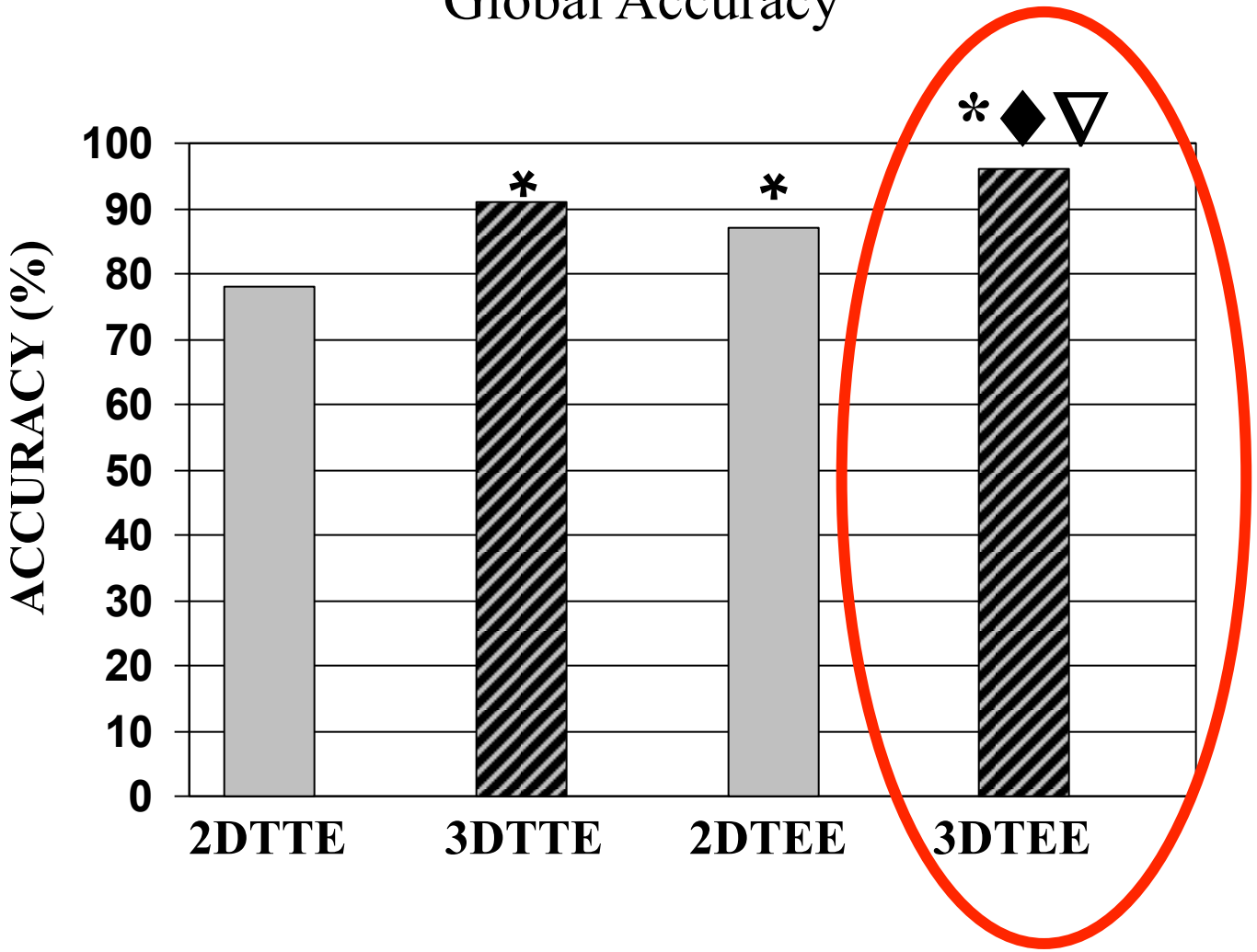
Milan, Italy

Routine application of
2D tranthoracic and 3D transthoracic ECHO
intraoperative 2D and 3D transesophageal ECHO:

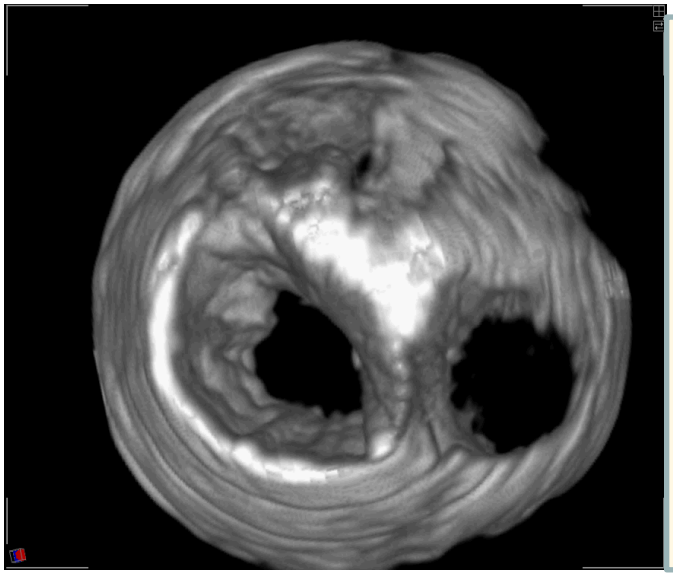
RESULTS ON 110 CASES vs SURGICAL INSPECTION

HEAD TO HEAD COMPARISON OF 2D/3DTT , 2D/3DTEE

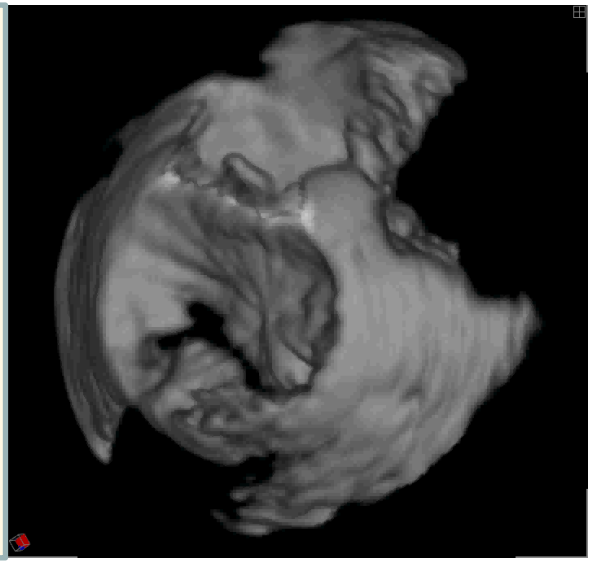
Global Accuracy



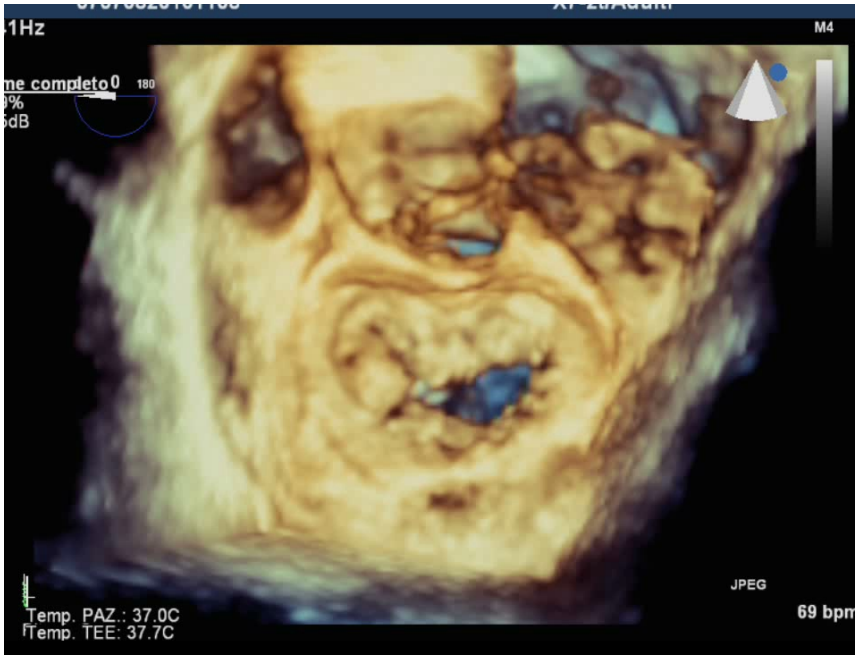
Pepi JACC 2006



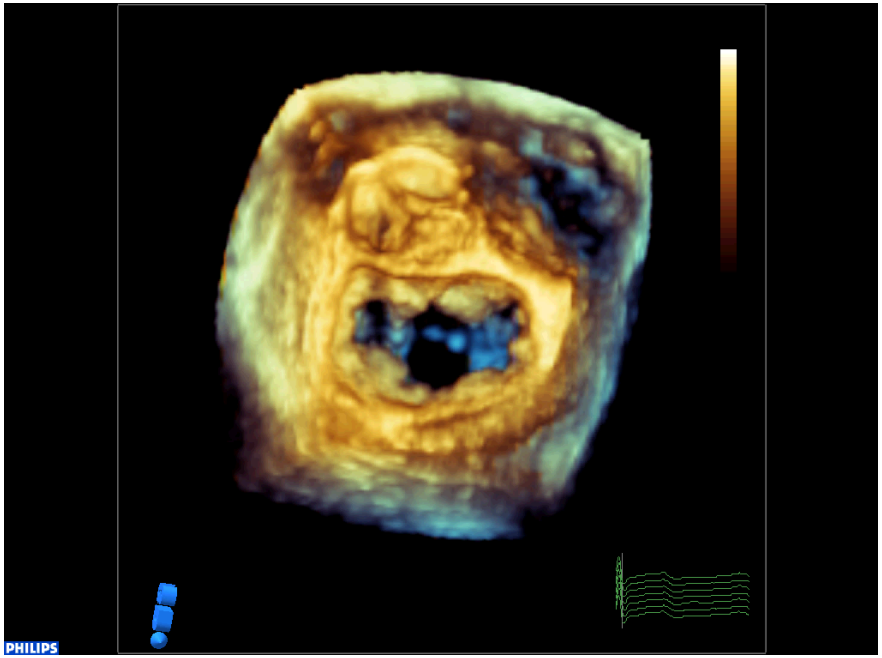
Rotational acquisition 2002



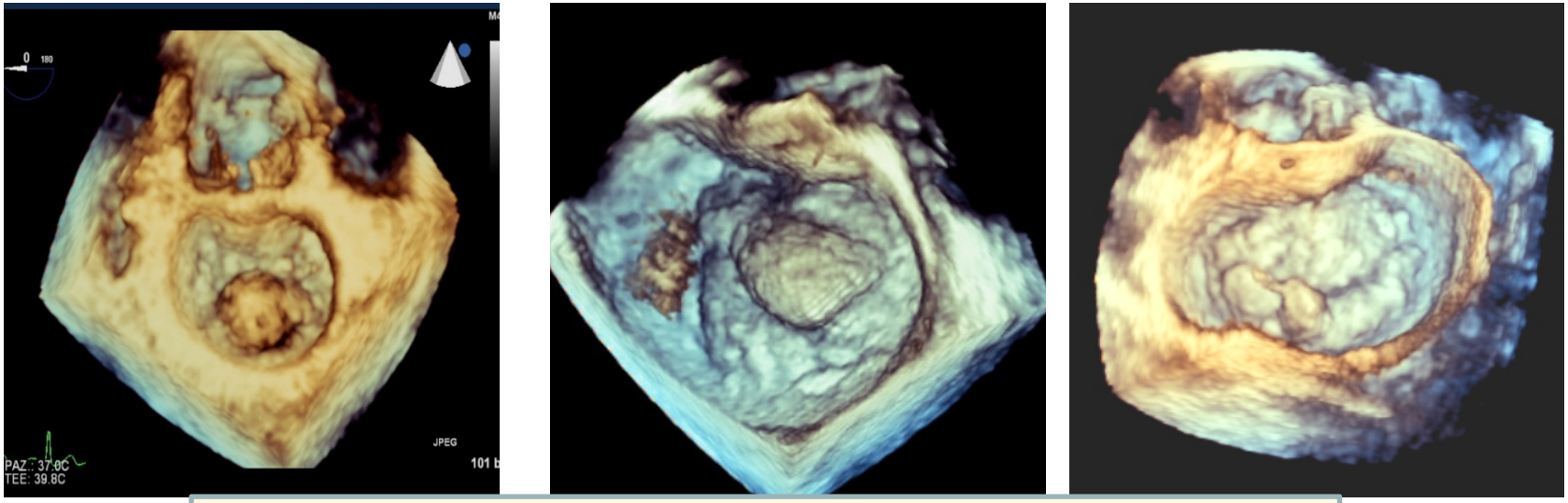
Fibro-elastic-deficiency



Barlow'sDisease



Transthoracic 3D

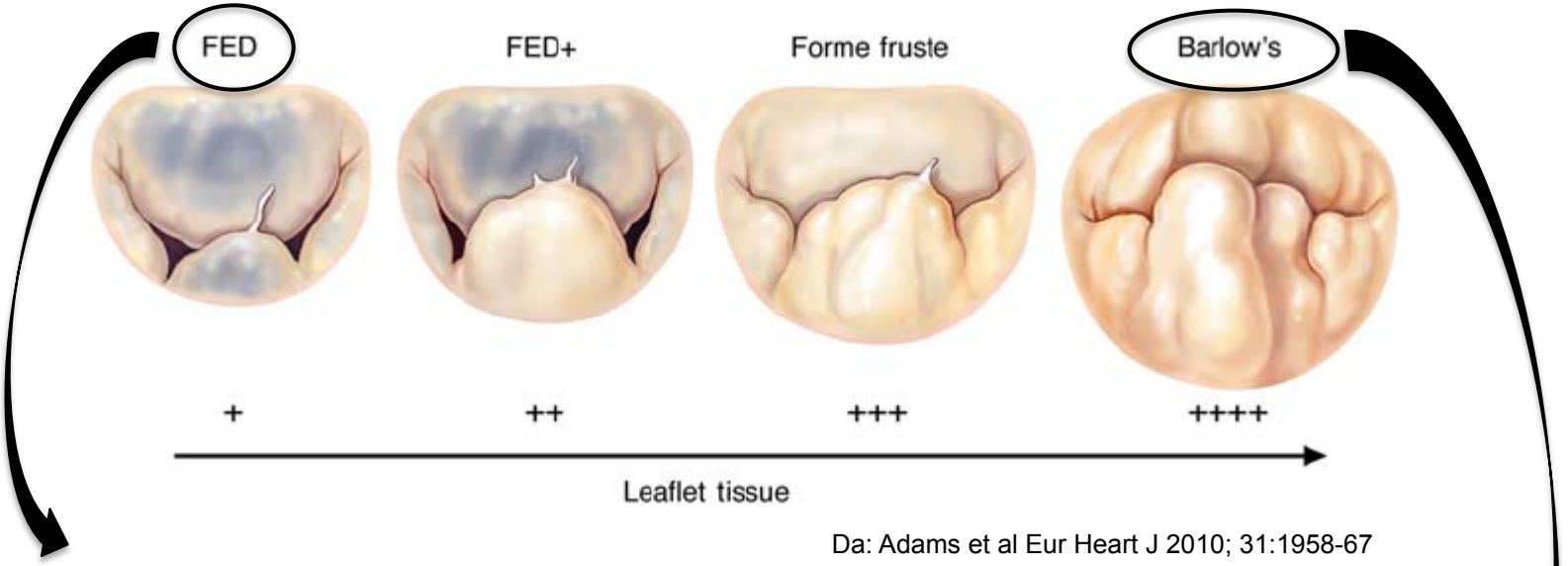


Transesophageal 3D

ECO 3D TEE Mitrale

- *Storia – Attuale accuratezza*
- **Valutazione morfo-funzionale**
- Utilità chirurgica
- Utilità monitoraggi

Insufficienza mitralica degenerativa



Da: Adams et al Eur Heart J 2010; 31:1958-67

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.

MVP

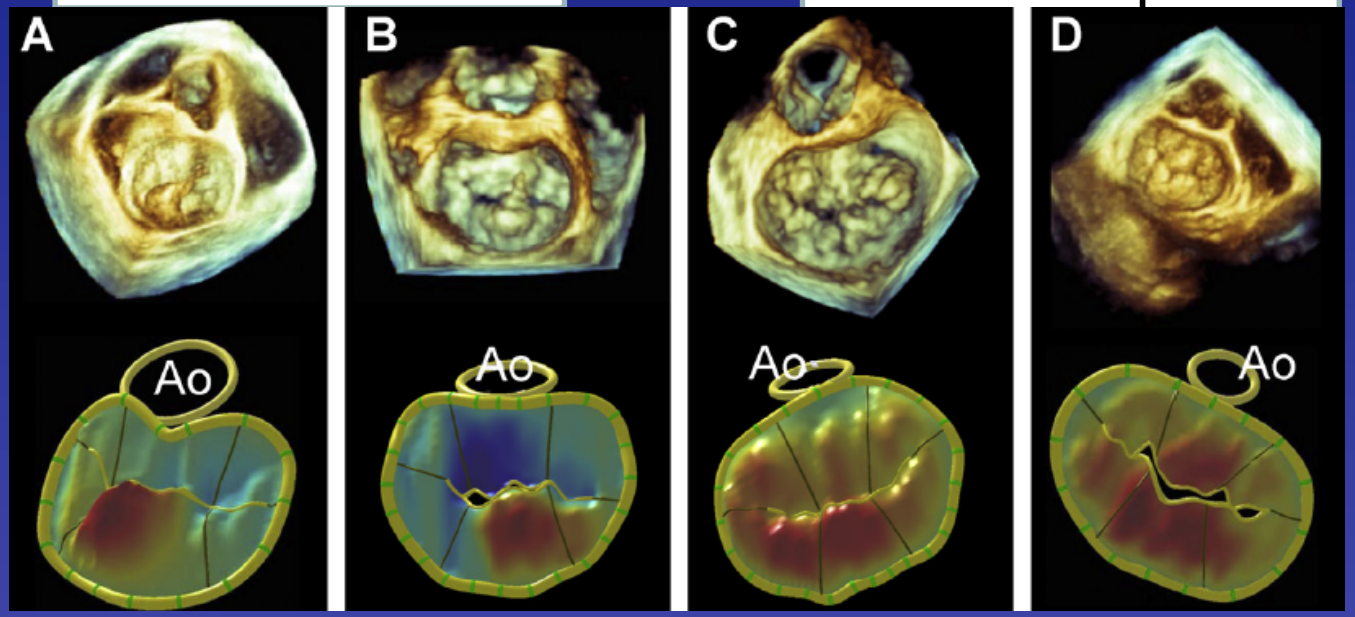
FED

Flattening Anello

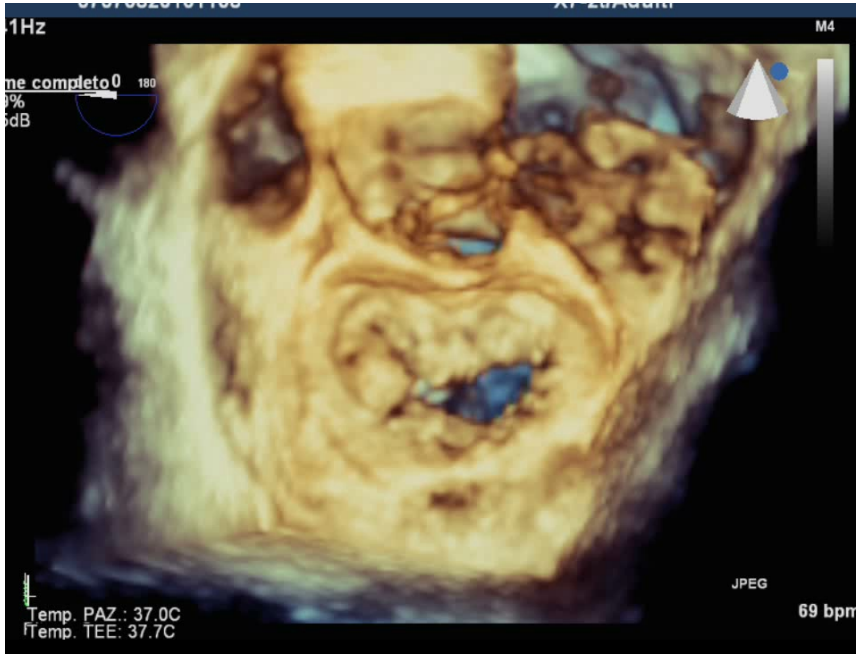
Stress locale lembi

Barlow

Flattening e dilatazione marcata anello e stress su più scallop

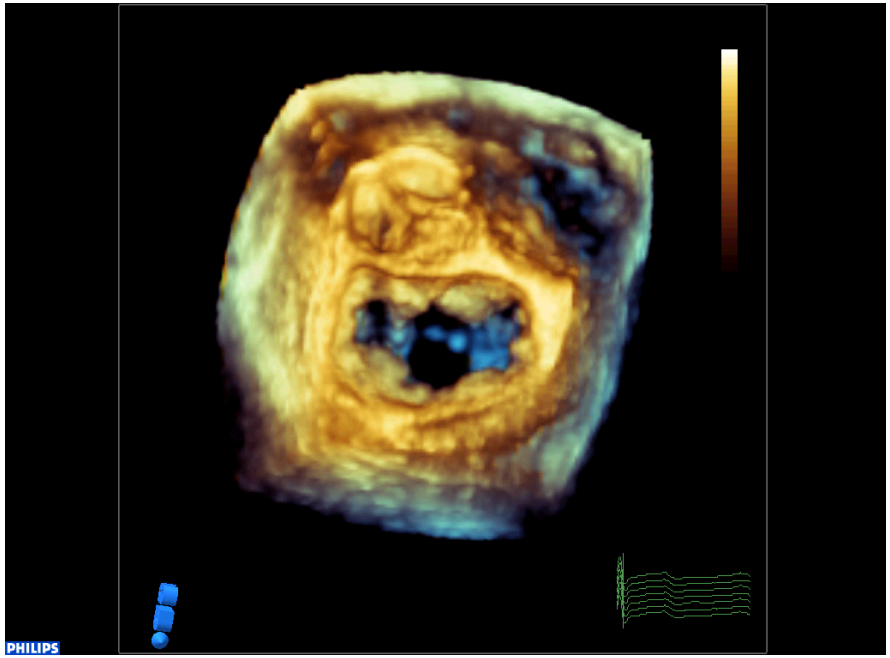


Fibro-elastic-deficiency



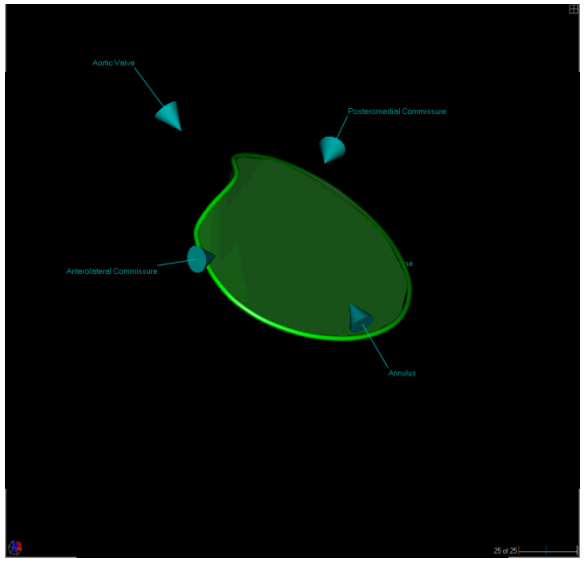
Coinvolge solo alcuni segmenti dei lembi e presenta dimensioni dell'anulus lievemente incrementate.

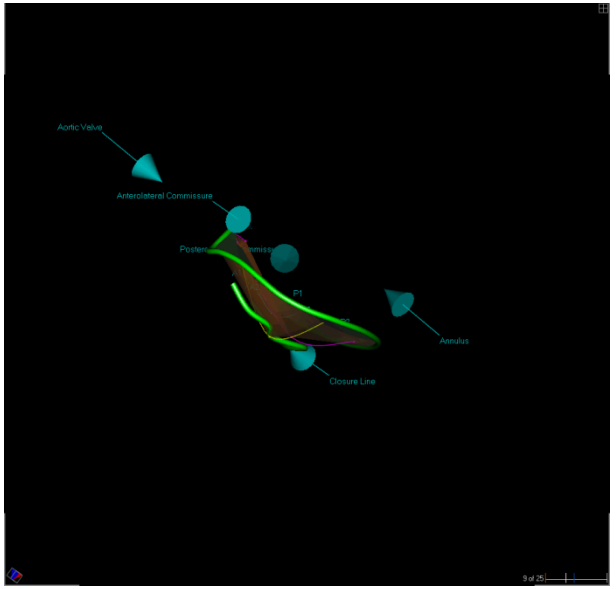
Barlow'sDisease



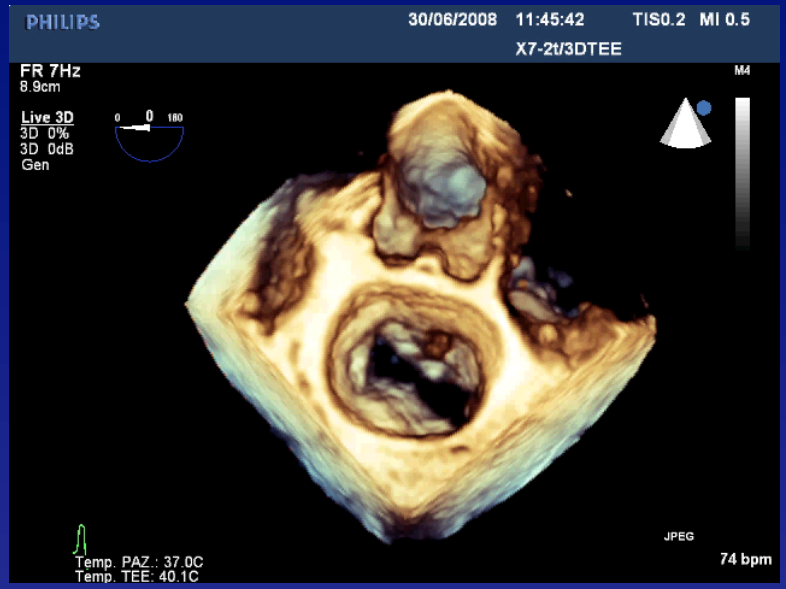
Coinvolge più lembi e presenta dilatazione marcata dell'anulus.

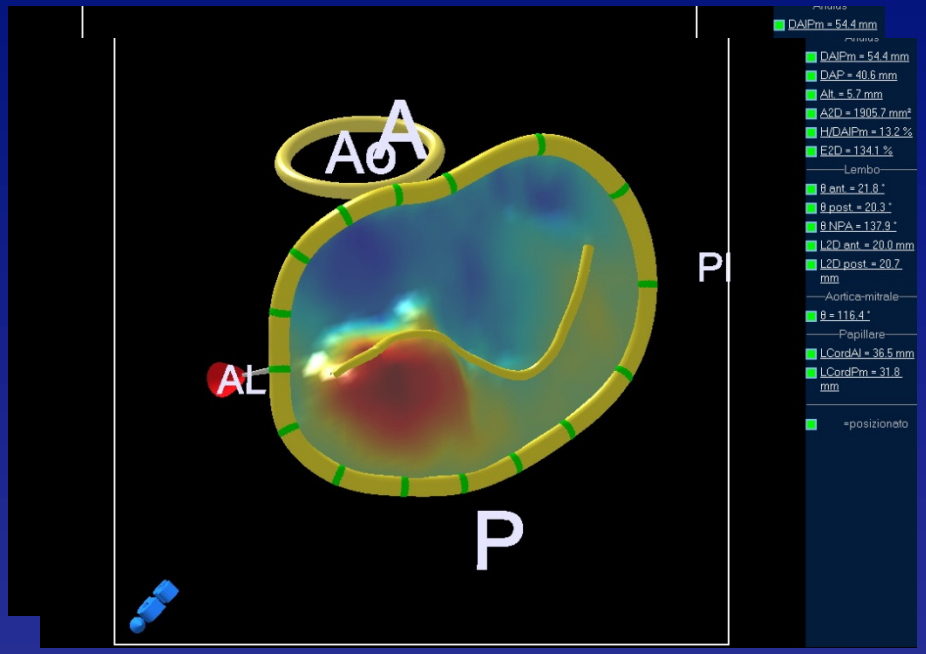
Automatic 3D annulus analysis

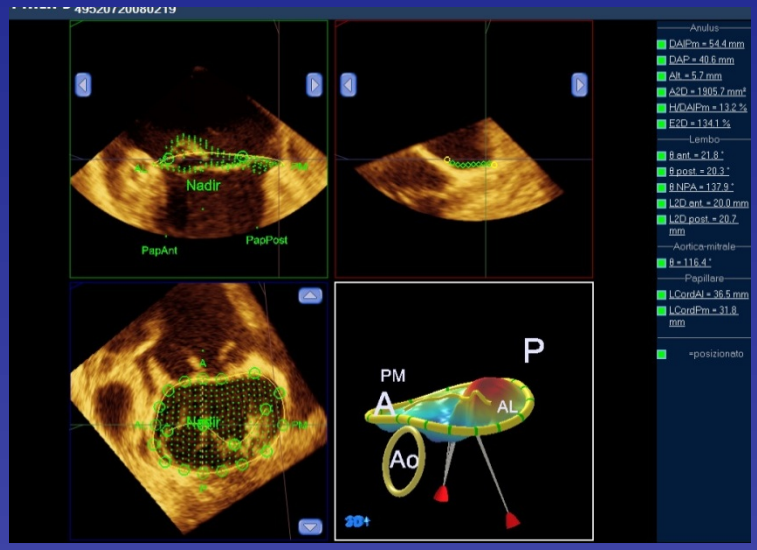


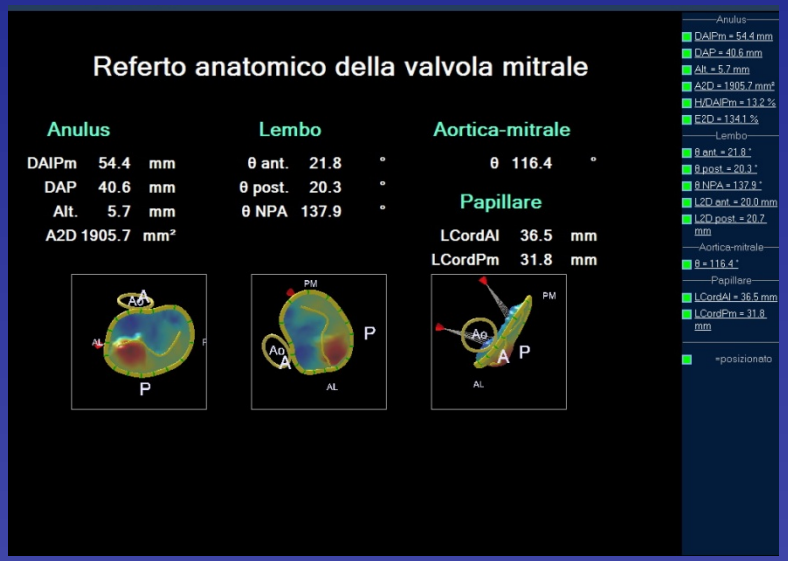


Nuove conoscenze Sull'anello mitralico


PHILIPS
30/06/2008 11:45:42 TIS0.2 MI 0.5
X7-2t/3DTEE
FR 7Hz
8.9cm
Live 3D
3D 0%
3D 0dB
Gen
M4
JPEG
74 bpm
Temp. PAZ.: 37.0C
Temp. TEE: 40.1C


A
Ao
AL
P
DAIPm = 54.4 mm
DAP = 40.6 mm
Alt. = 5.7 mm
A2D = 1905.7 mm²
H/DAIPm = 13.2 %
E2D = 134.1 %
Lembo
θ ant. = 21.8 °
θ post. = 20.3 °
θ NPA = 137.9 °
L2D ant. = 20.0 mm
L2D post. = 20.7 mm
Aortica-mitrale
θ = 116.4 °
Papillare
LCordAl = 36.5 mm
LCordPm = 31.8 mm
=posizionato


Nadir
PapAnt
PapPost
PM
A
AL
Ao
P
Anulus
DAIPm = 54.4 mm
DAP = 40.6 mm
Alt. = 5.7 mm
A2D = 1905.7 mm²
H/DAIPm = 13.2 %
E2D = 134.1 %
Lembo
θ ant. = 21.8 °
θ post. = 20.3 °
θ NPA = 137.9 °
L2D ant. = 20.0 mm
L2D post. = 20.7 mm
Aortica-mitrale
θ = 116.4 °
Papillare
LCordAl = 36.5 mm
LCordPm = 31.8 mm
=posizionato


Referto anatomico della valvola mitrale
Anulus
DAIPm 54.4 mm
DAP 40.6 mm
Alt. 5.7 mm
A2D 1905.7 mm²
Lembo
θ ant. 21.8 °
θ post. 20.3 °
θ NPA 137.9 °
Aortica-mitrale
θ 116.4 °
Papillare
LCordAl 36.5 mm
LCordPm 31.8 mm
Anulus
DAIPm = 54.4 mm
DAP = 40.6 mm
Alt. = 5.7 mm
A2D = 1905.7 mm²
H/DAIPm = 13.2 %
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θ ant. = 21.8 °
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L2D post. = 20.7 mm
Aortica-mitrale
θ = 116.4 °
Papillare
LCordAl = 36.5 mm
LCordPm = 31.8 mm
=posizionato

Quantitative Analysis of Mitral Valve Apparatus in Mitral Valve Prolapse Before and after Annuloplasty: A Three-Dimensional Intraoperative Transesophageal Study

Francesco Maffessanti, MS, Nina A. Marsan, MD, Gloria Tamborini, MD, Lissa Sugeng, MD, Enrico G. Caiani, PhD, Paola Gripari, MD, Francesco Alamanni, MD, Valluvan Jeevanandam, MD, Roberto M. Lang, MD, and Mauro Pepi, MD, *Milan, Italy; Chicago, Illinois*

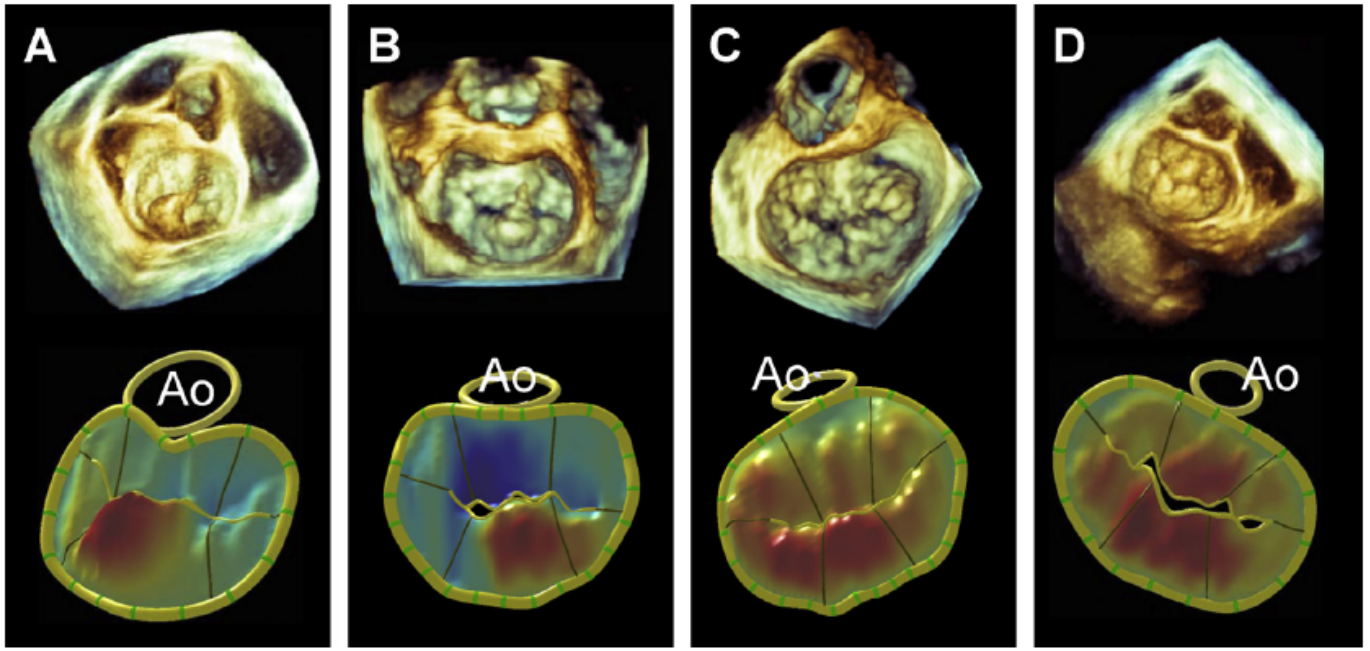


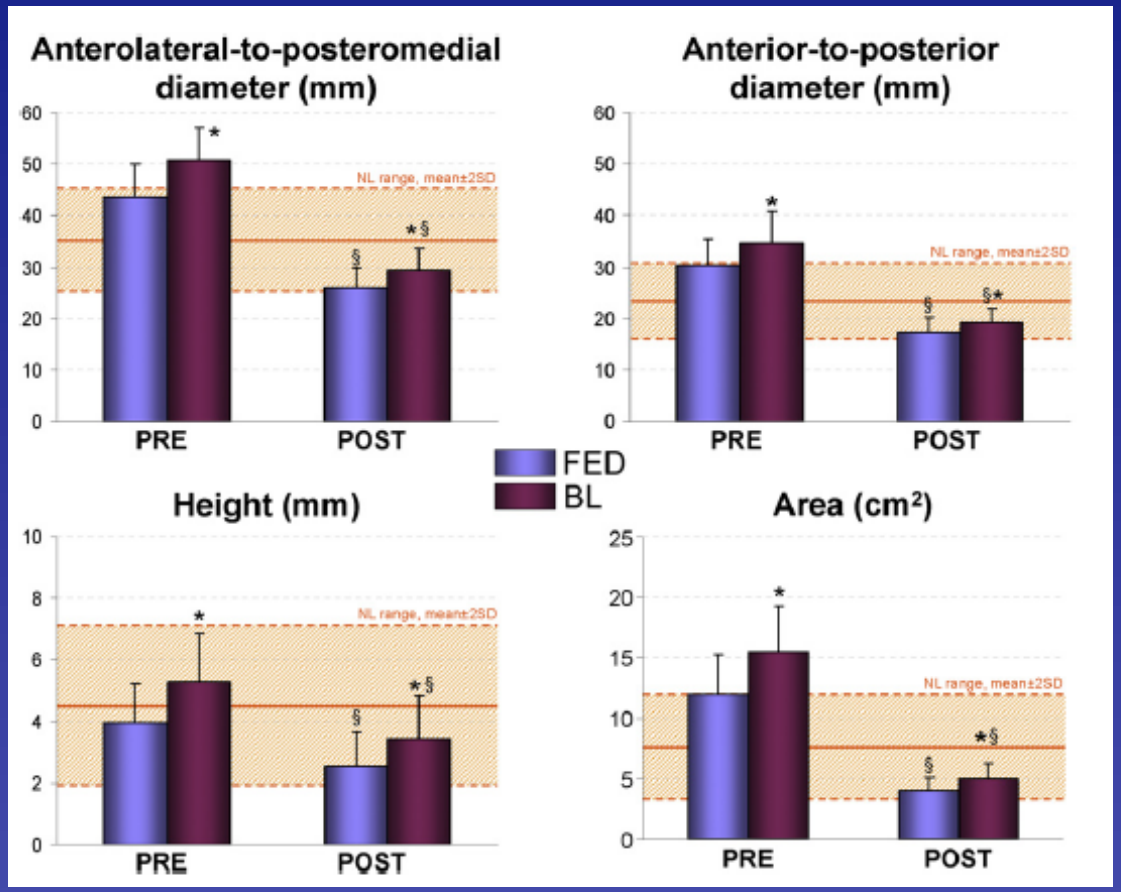
Figure 3 Example of volume-rendered MV (top) as seen from the left atrium in patients with MV prolapse associated with FED **(A,B)** or BD **(C,D)**. The 3D representations (bottom) clearly show the morphology of the MV and the region of prolapse in red scale: isolated P2 scallop associated with FED and diffuse prolapse with redundant tissue in BD. The dynamic RT3D transesophageal echocardiographic data sets relevant to the same patients, are illustrated in Videos 1 to 4. *Ao*, Aorta.

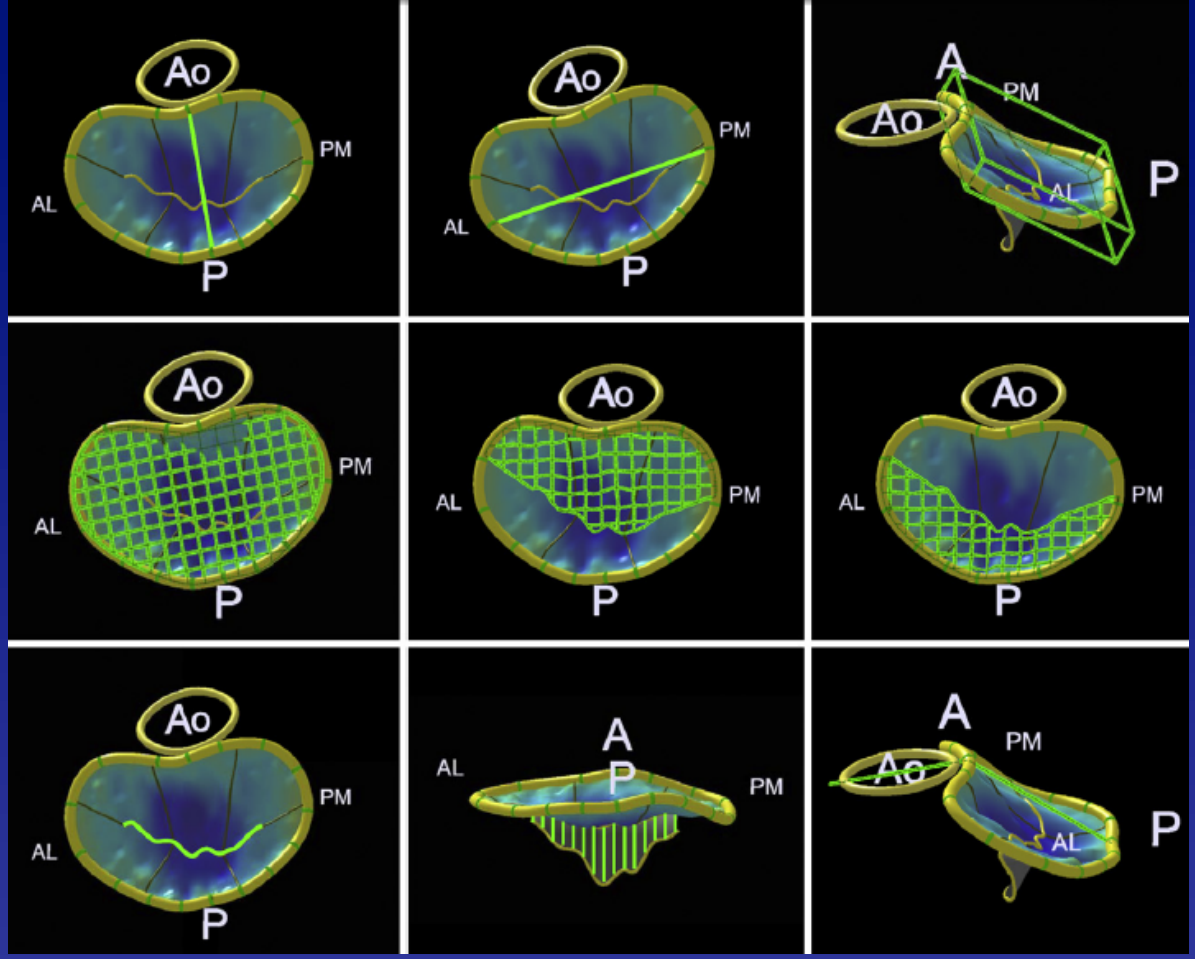
JASE 2011

Differences in MVA according to FED and BW

- MV prolapse and regurgitation were associated with a markedly enlarged annulus and leaflets compared with controls .
- Controls : 7. 5 cmq ;
- FED : 12 cmq
- BW : 15.4 cmw

Maffessanti JASE 2011

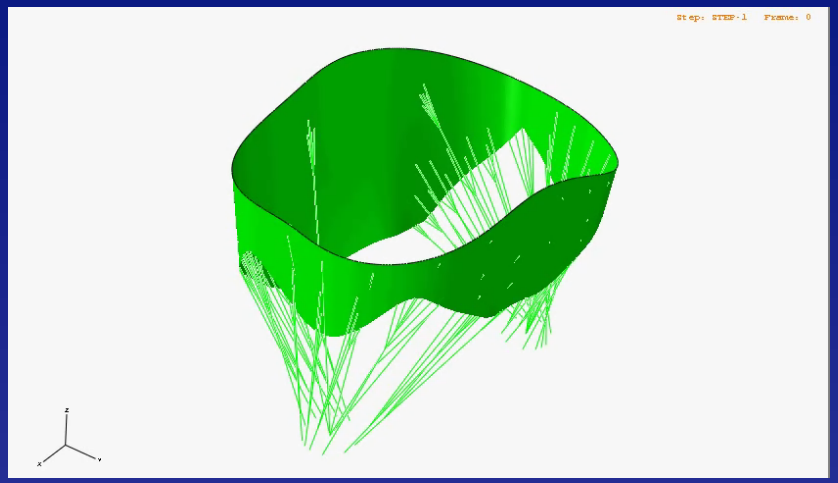




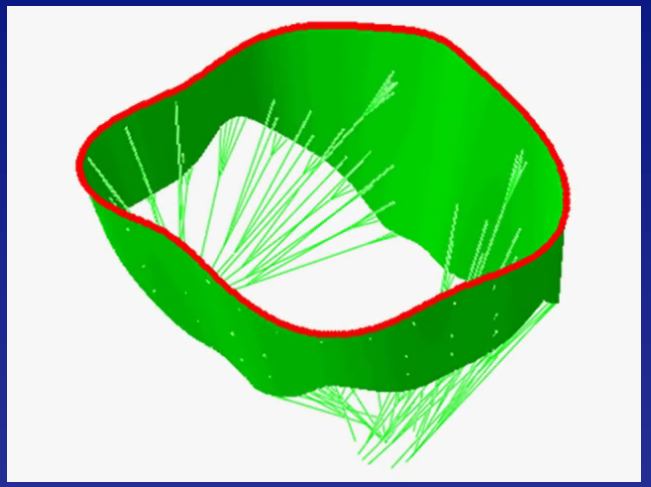
- **Conclusions:** Intraoperative 3D TEE allows quantitative evaluation of the MV apparatus in the presence of FED or BD and could be useful for immediate assessment of the surgical procedure.
- *Maffessanti JASE 2011;24:405-13*

MV Patient specific finite elements model

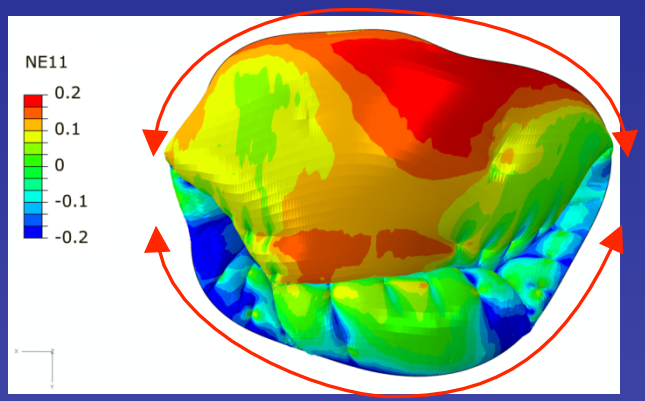
MVP PRE-OP.



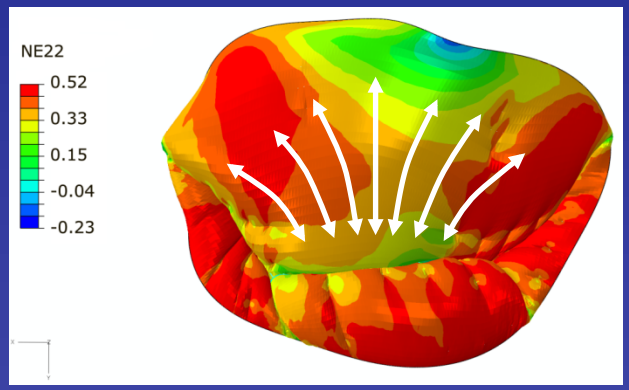
MV REPAIR



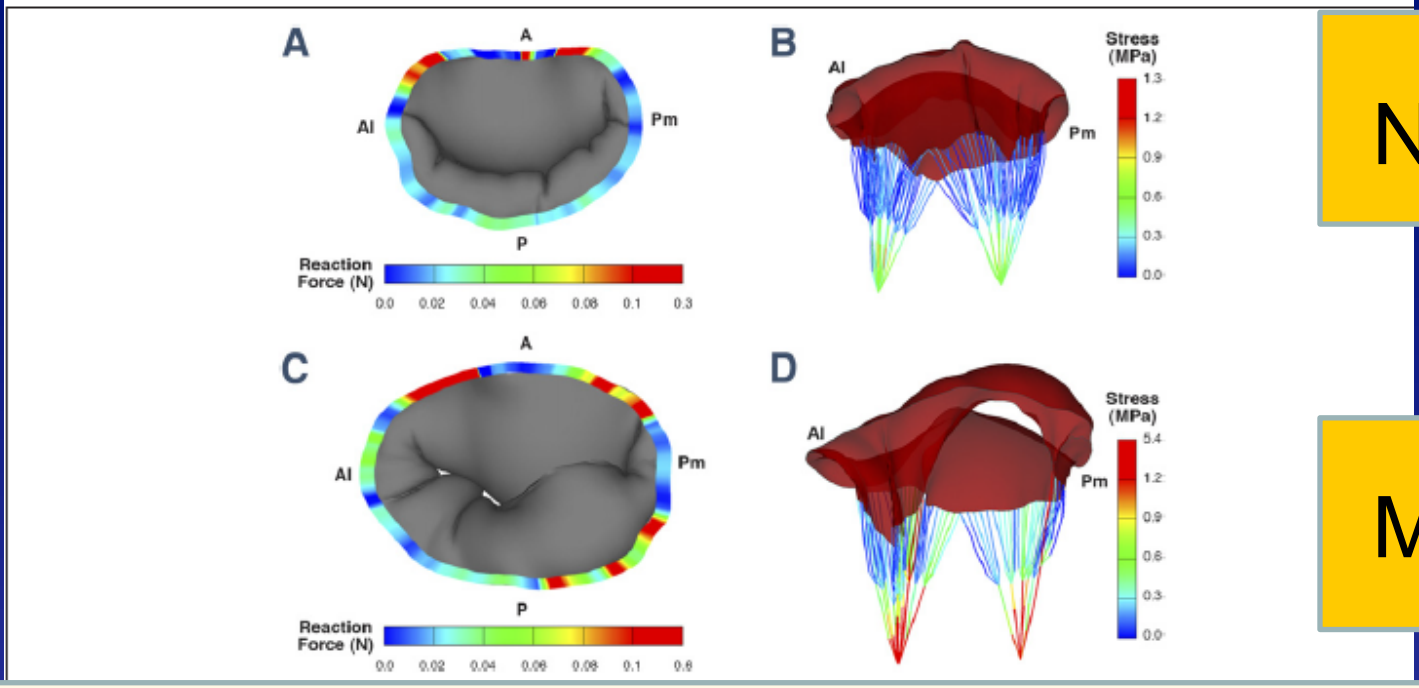
Circumferential strains



Radial strains



Stevanella et al, Cardiovascular Eng Tech 2011



NORMAL

MV flail

- Computational simulations clearly demonstrated deformation and stress distribution of the MV structure across the cardiac cycle.

-Extremely asymmetric and large stress distribution over the leaflets and lack of leaflet coaptation in the regurgitant region.

Rim JACC Imag 2013

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

Quantitative Analysis of Mitral Valve Morphology in Mitral Valve Prolapse Using Real-Time Three-Dimensional Echocardiography: Importance of Annular Saddle-Shape in Pathogenesis of Mitral Regurgitation

Alex Pui-Wai Lee, Ming C. Hsiung, Ivan S. Salgo, Fang Fang, Jun-Min Xie, Yan-Chao Zhang, Qing-Shan Lin, Jen-Li Looi, Song Wan, Randolph H.L. Wong, Malcolm J. Underwood, Jing-Ping Sun, Wei-Hsian Yin, Jeng Wei, Shen-Kou Tsai and Cheuk-Man Yu

Circulation. published online December 24, 2012;
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0009-7322. Online ISSN: 1524-4539

Flattening of the annular saddle-shape is associated with progressive leaflet billowing and increased frequencies of chordal rupture, and the present study have lent strong support to our hypothesis that annular flattening observed in MVP was not an epiphenomenon of MR but a determinant factor.

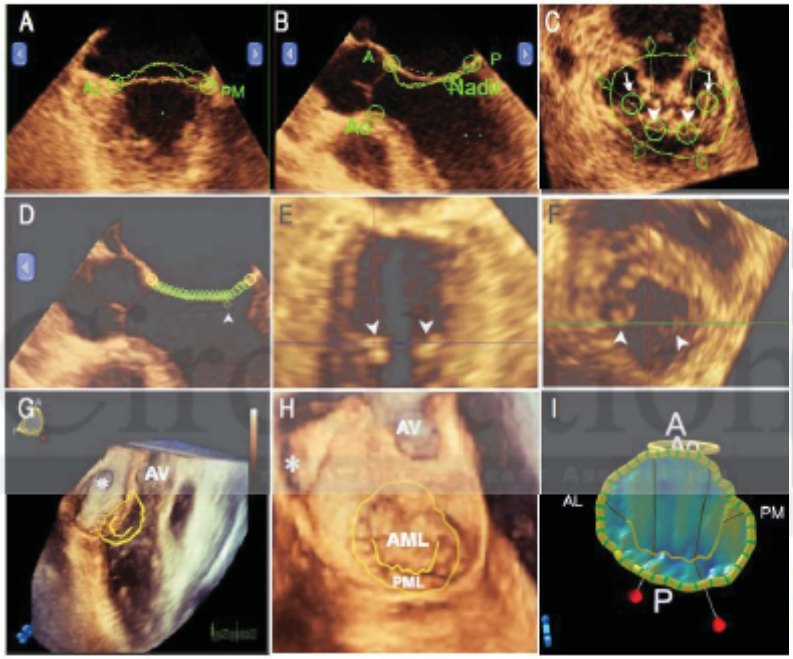
Moreover, **a decrease in annular nonplanarity, whatever its cause, will exert increased tension on the leaflets and chords**,

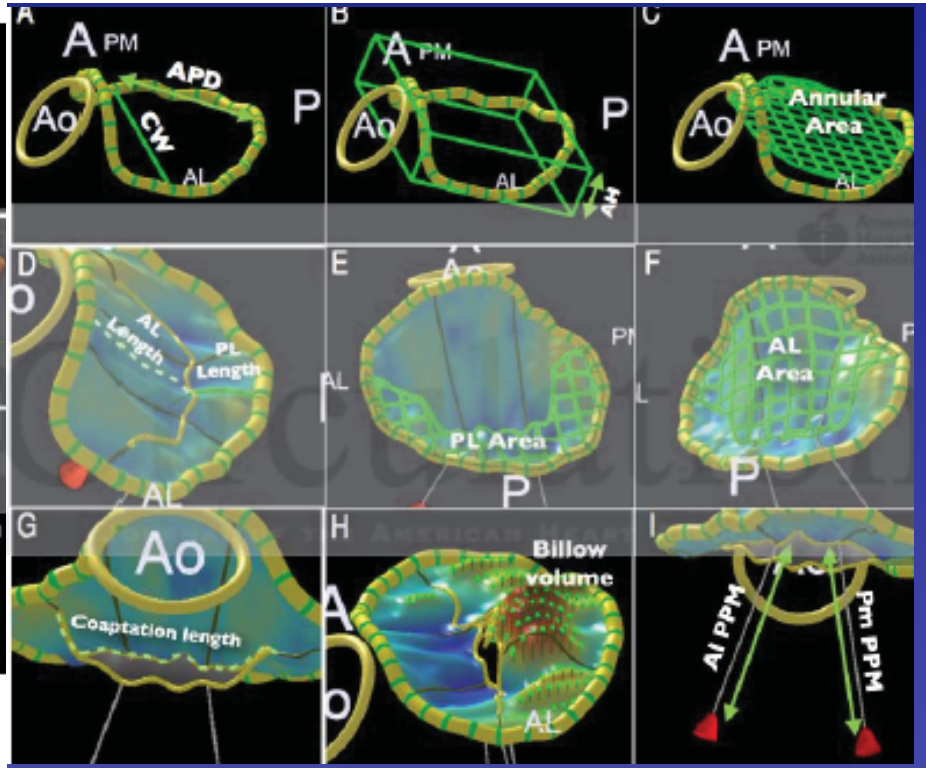
DOI: 10.1161/CIRCULATIONAHA.11

Table 4. Predictors for Clinically Significant MR in MVP.

Variables	Odds ratio (95% CI)	p value
Annular flattening (AHCWR<15%)	7.1 (2.4-21.2)	0.0004
Chordal rupture	10.7 (2.2-51.9)	0.0032
Leaflet billow volume	2.2 (1.4-4.0)	0.0006
Annular area	1.003 (1.001-1.006)	0.003

CI indicates confidence interval.





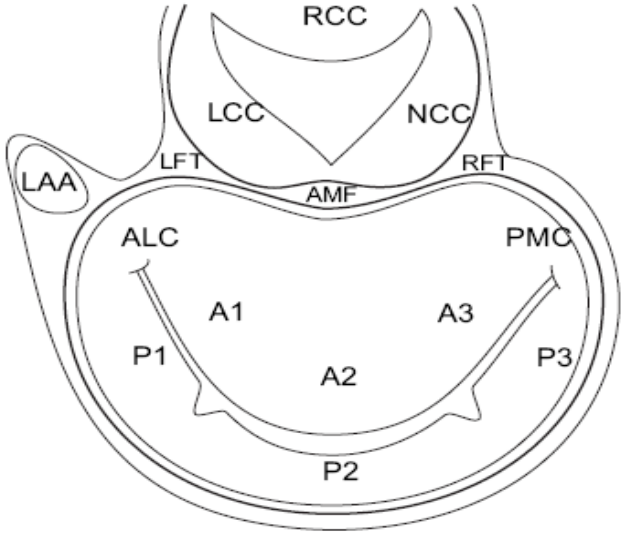


Figure 5 Diagram of the mitral valve as seen from the left atrium. The anterior leaflet and its 3 segments (A1, A2, and A3) are posterior (P) to the left coronary cusp (LCC) and noncoronary cusp (NCC) of the aortic valve and adjacent to the aortomitral fibrosa (AMF) and the left fibrous trigone (LFT) and right fibrous trigone (RFT). The anterolateral commissure (ALC) is next to the left atrial appendage (LAA) and the A1 P1 scallops. The posteromedial commissure (PMC) is next to the A3 and P3 scallops. *RCC*, Right coronary cusp.

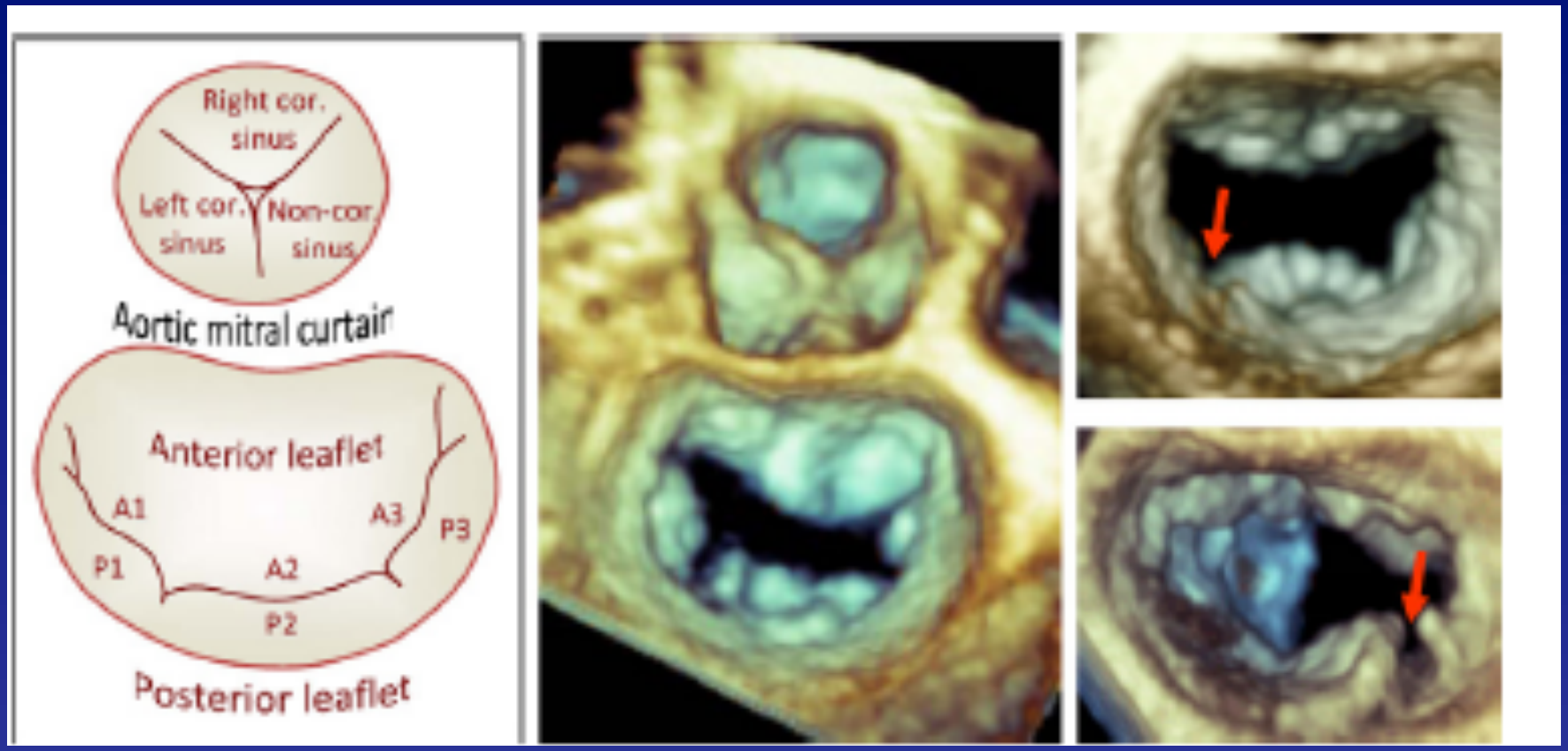
Journal of the American Society of Echocardiography
October 2009

IMPORTANZA DIAGNOSI MORFOLOGICA 3D

Better evaluation of **morphologic abnormalities** and understanding of complex spatial orientation

Better **quantitative evaluation** (area and volume) (obviates any geometrical assumptions)

Facilitates **Training and Communication** between experts, non-experts and different specialists.



Leaflet morphology and quantitative 3D:

Cleft : the lenght of cleft define « true» vs minor «normal» clefts

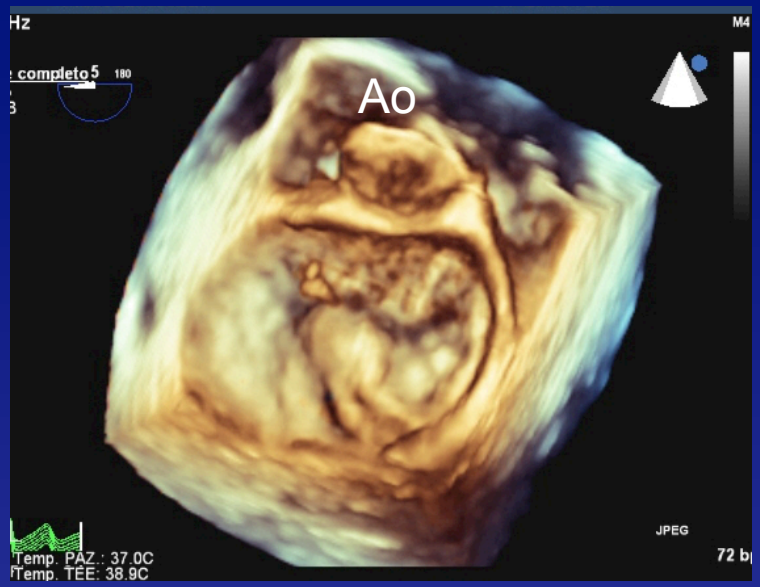
Eur J Echocardiography (2004) 5, 422—429

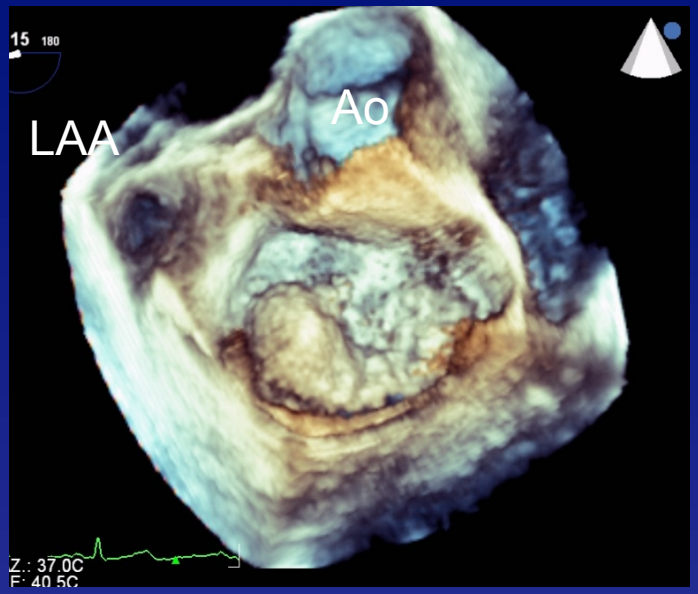
Localization and quantification of mitral valve prolapse using three-dimensional echocardiography

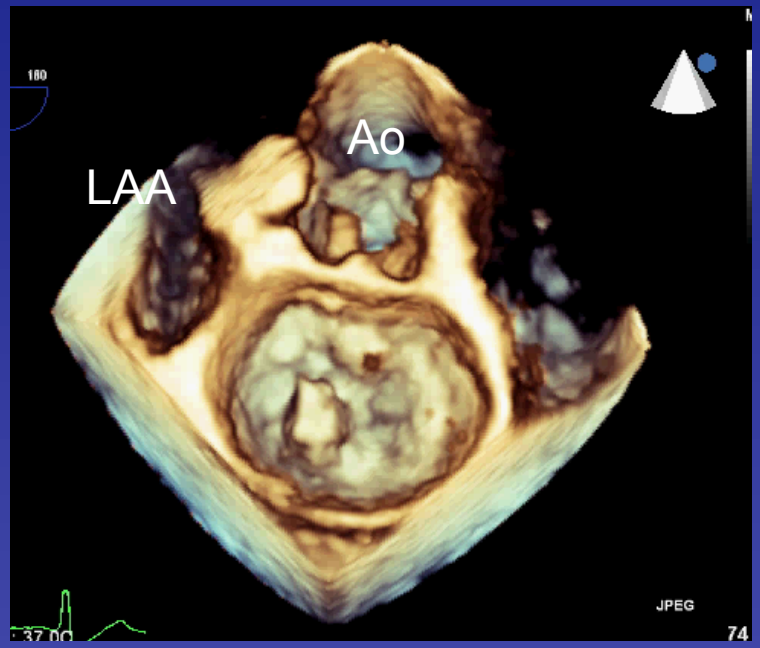
A. Delabays*, X. Jeanrenaud, P.-G. Chassot, L.K. Von Segesser, L. Kappenberger

Division of Cardiology, the Department of Cardiothoracic Surgery and the Department of Anesthesiology, University Hospital Lausanne, BH 16, 1011 Lausanne-CHUV, Switzerland

Excellent correspondence between the volume of prolapsing and surgically resected tissue


Ao
JPEG


LAA
Ao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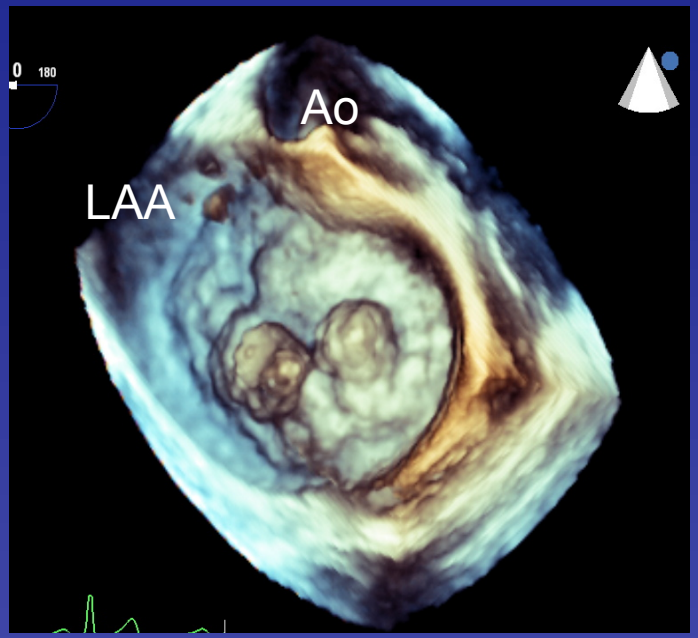
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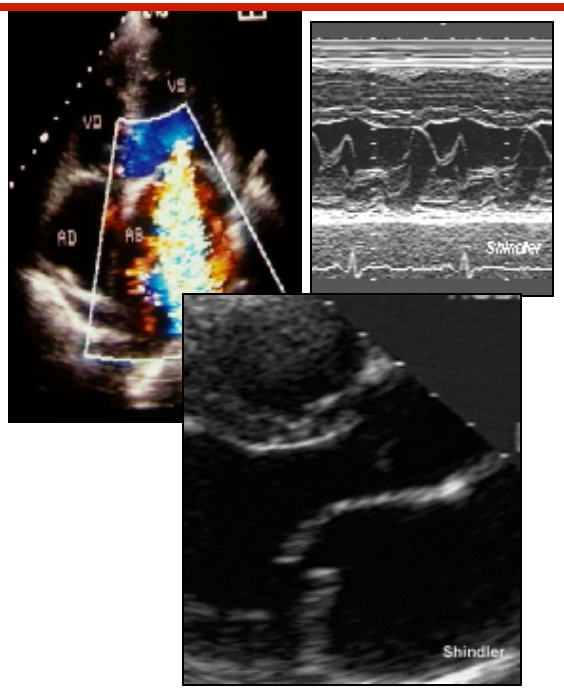
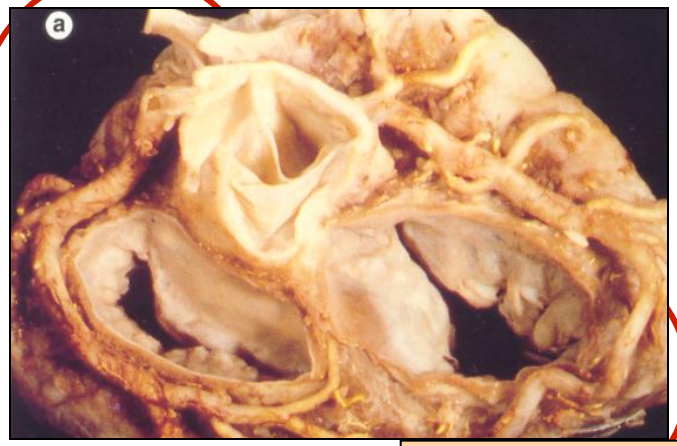




COMMUNICATION

Cardiologists

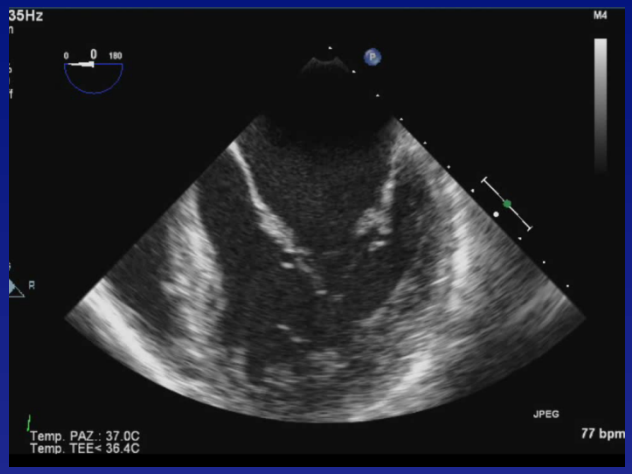
Anesthesiologists

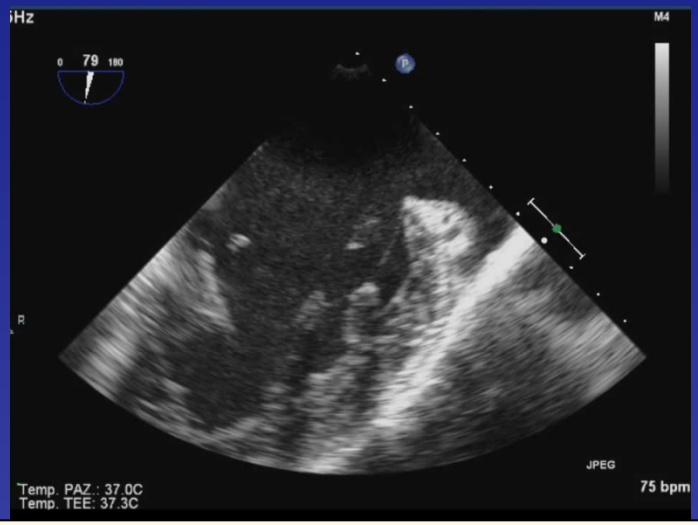
Surgeons

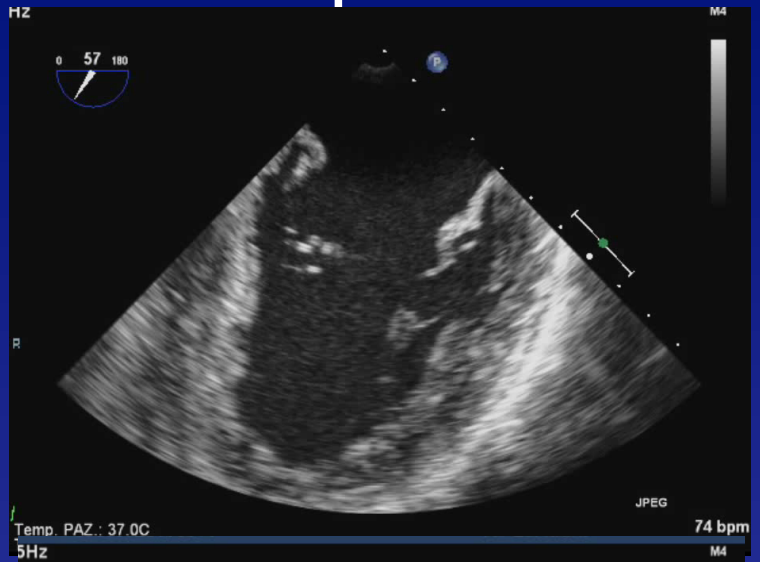
Morphology

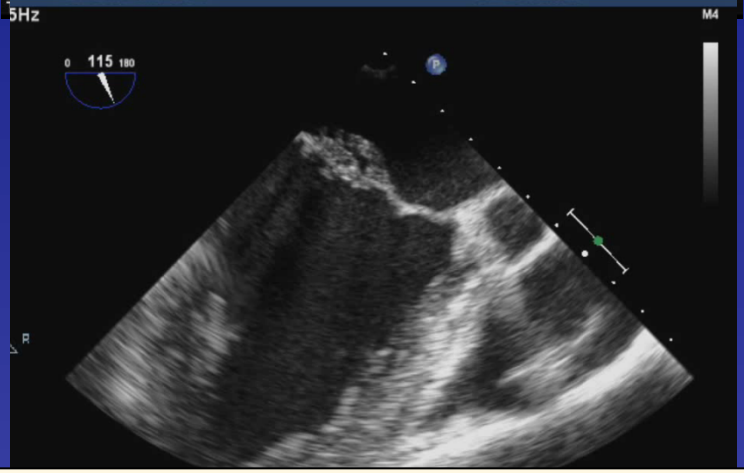
Quantitative analysis

A “complex” MV Prolapse







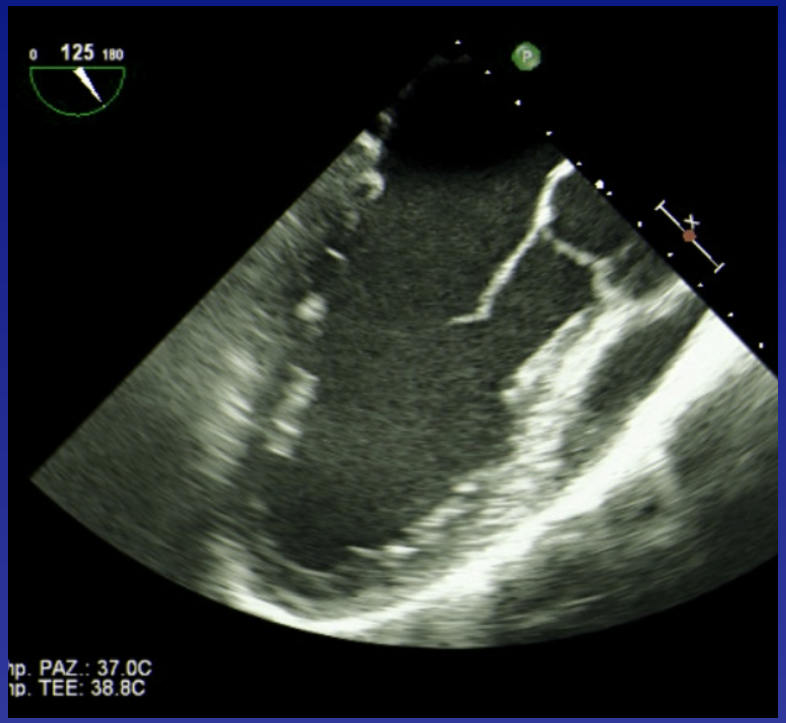


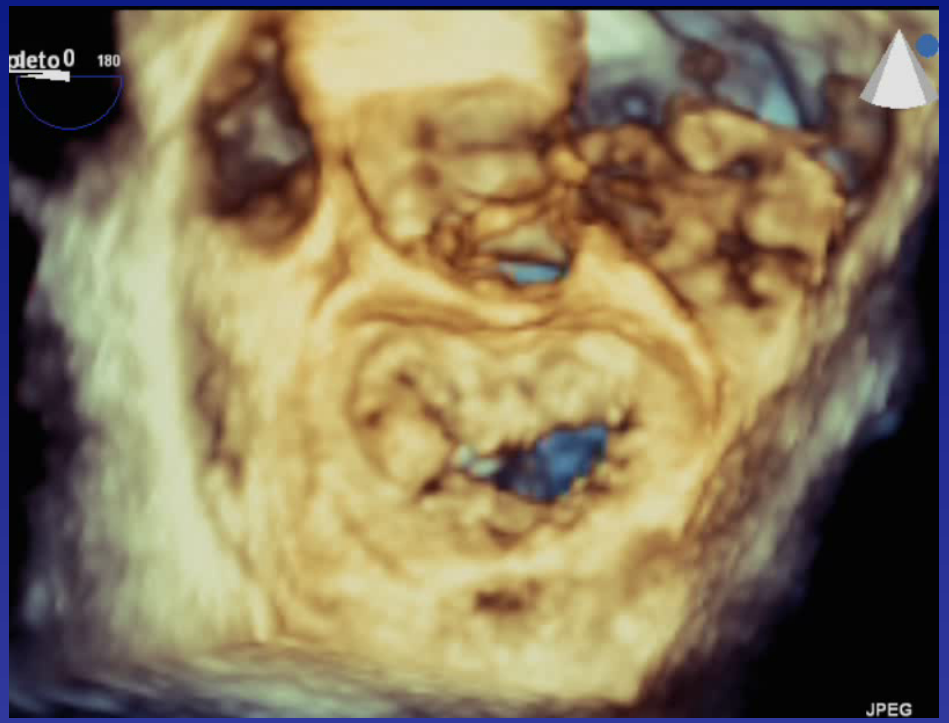
2D Imaging Implies a
“Mental” 3D reconstruction

3D Imaging avoids “Mental” 3D reconstruction
Allows
Easy and real time imaging of all scallops

Prolasso mitralico

3D migliora accuratezza diagnostica

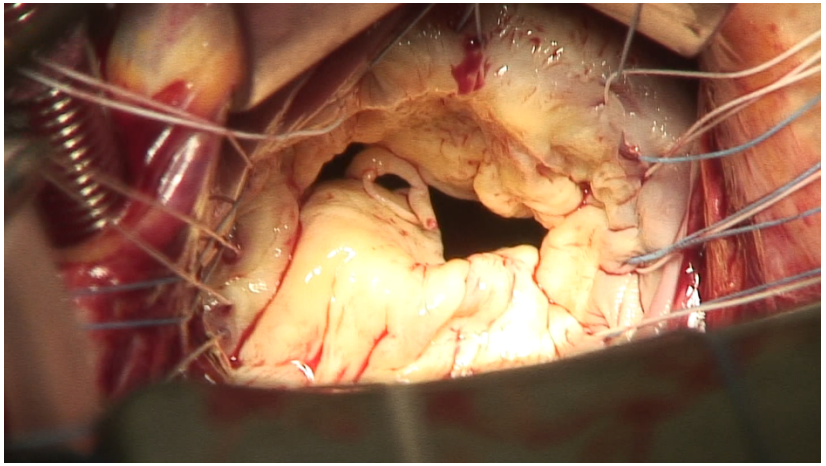




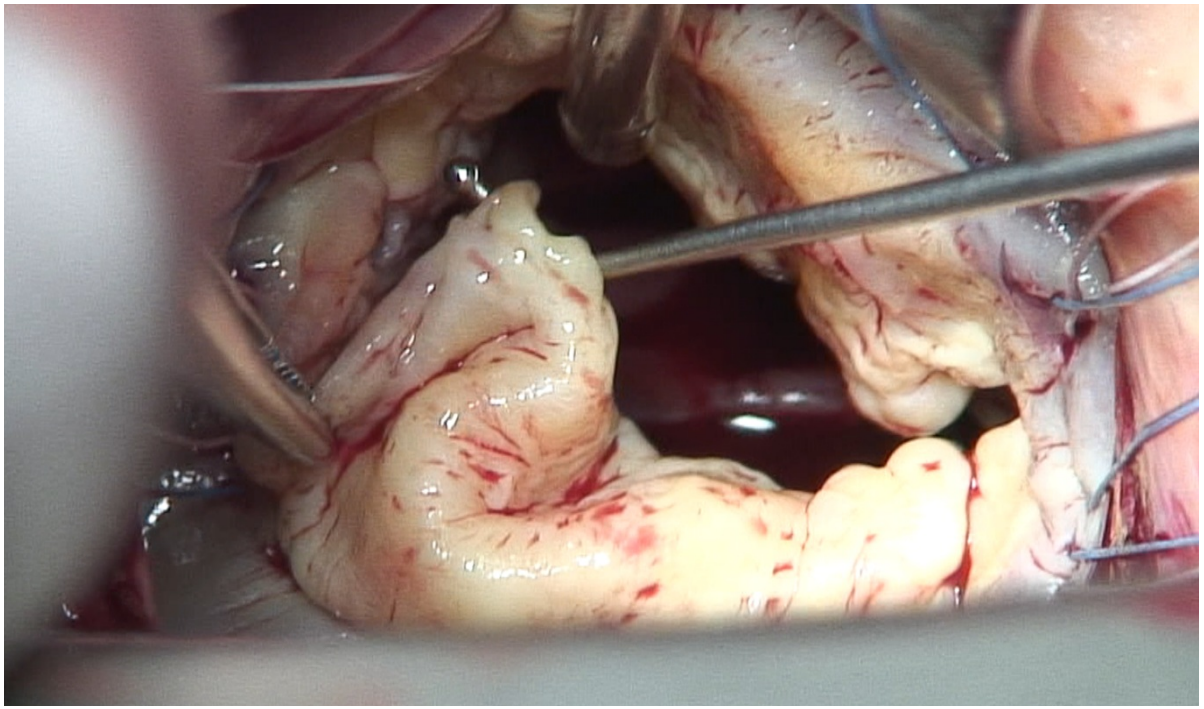
2DTEE

3DTEE

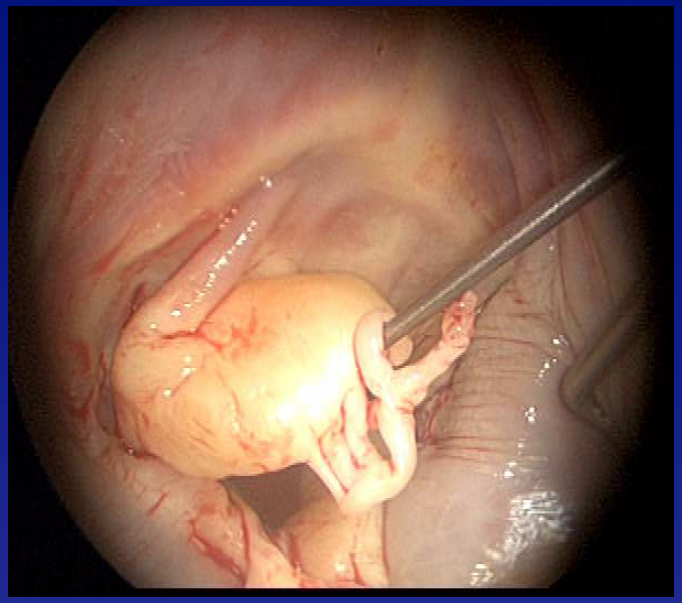
Surgical Inspection



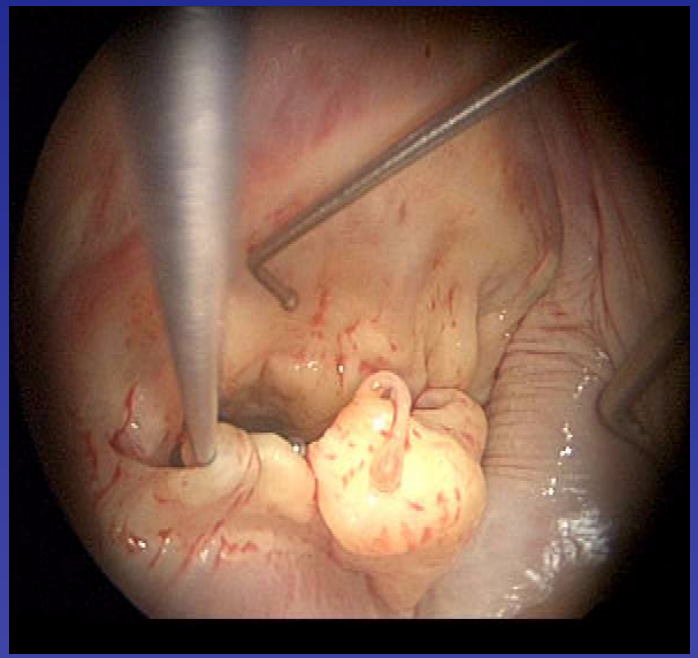
Huge P2 prolapse extenting towards a small P1; chordal rupture.

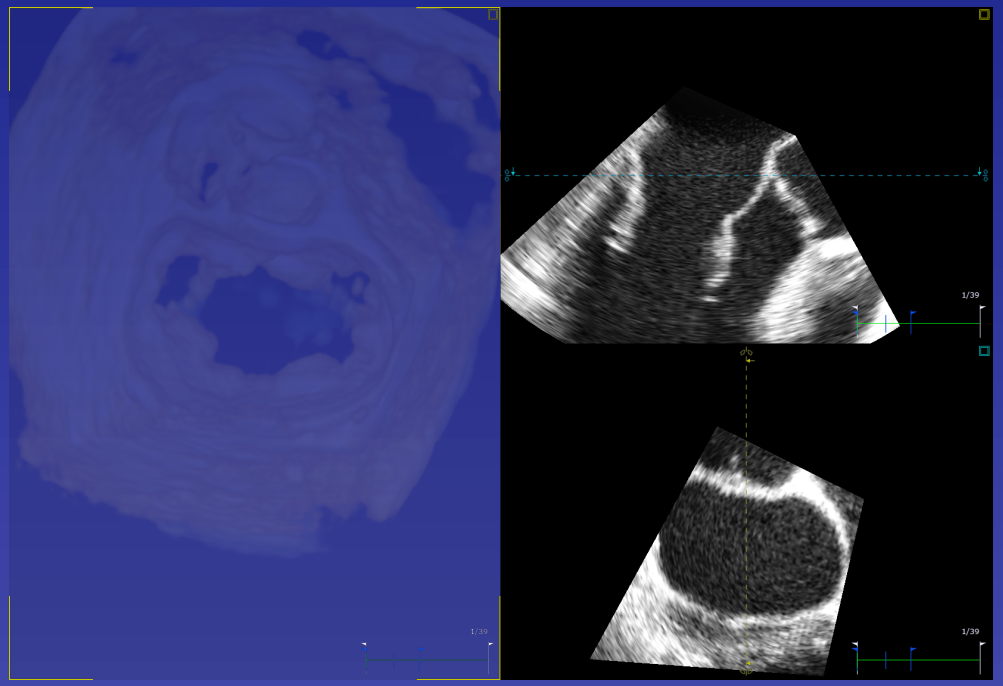


Quadrangular Resection of P2, annuloplasty




48Hz
ume completo 0 180
16%
34dB
M4
JPEG
64 bpm
Temp. PAZ.: 37.0C
Temp. TEE: 38.7C




1/39
1/39
1/39

Real-Time Three-Dimensional Transesophageal Echocardiography for Assessment of Mitral Valve Functional Anatomy in Patients With Prolapse-Related Regurgitation

Giovanni La Canna, MD[a,*], Iryna Arendar, MD[a], Francesco Maisano, MD[b], Fabrizio Monaco, MD[a], Egidio Collu, MD[a], Stefano Benussi, MD[b], Michele De Bonis, MD[b], Alessandro Castiglioni, MD[b], and Ottavio Alfieri, MD[b]

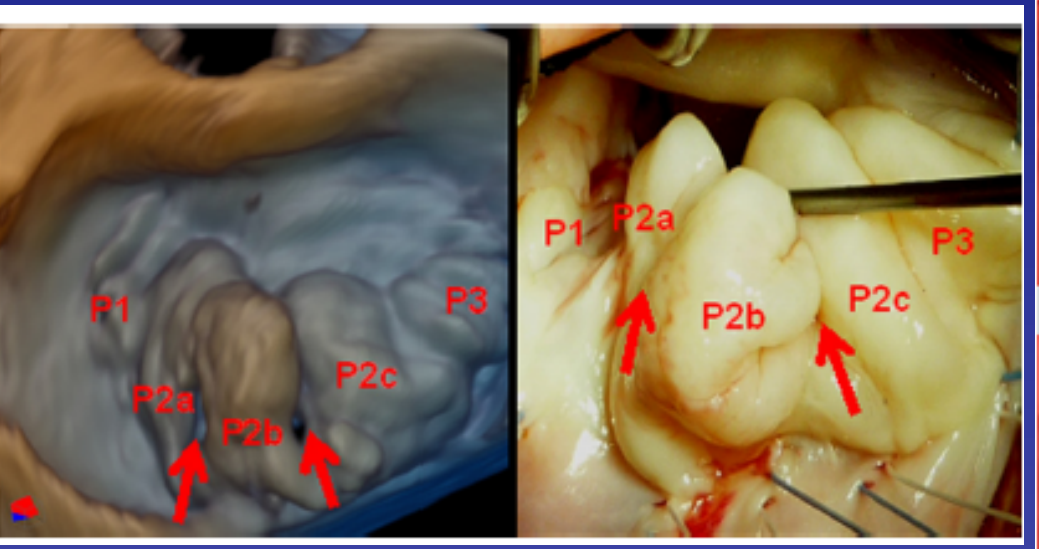
0.0001). Multiplanar reconstruction enabled RT3D-TEE to differentiate dominant (≥5-mm displacement) and secondary (2 to <5-mm displacement) prolapsed segments in agreement with surgically recognized dominant lesions (100%), but with a low predictive value (34%) for secondary lesions. In addition, owing to the identification of clefts and subclefts (indentations of MV tissue that extended ≥50% or <50% of the total leaflet height, respectively), RT3D-TEE accurately characterized the MV anatomy, including that which deviated from the standard nomenclature. In conclusion, RT3D-TEE provided more accurate mapping of MV prolapse than 2D imaging and RT3D-TTE, adding quantitative recognition of dominant and secondary lesions and MV anatomy details. (Am J Cardiol 2011;xx:xxx)

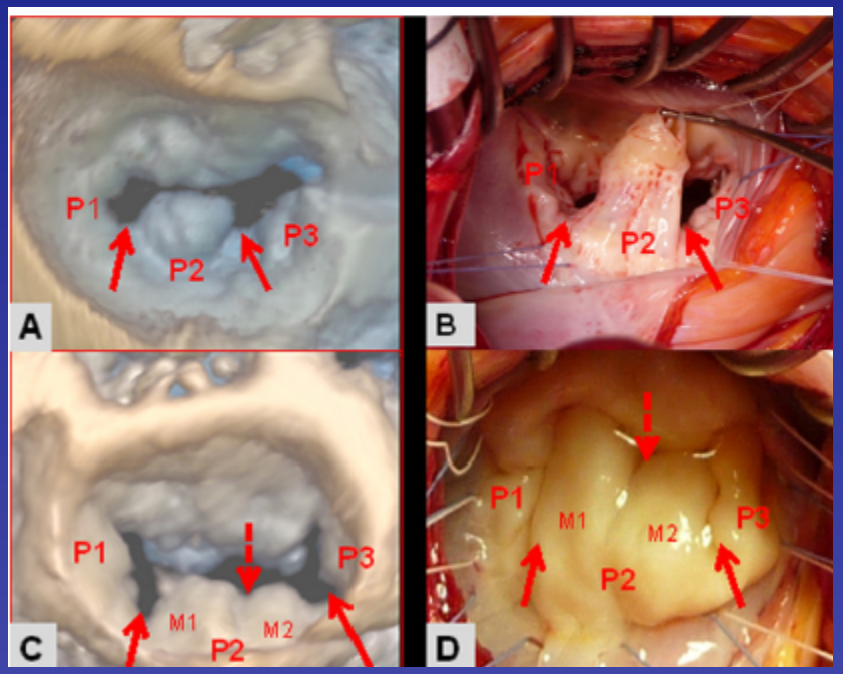
222 Pts (Dominant vs secondary lesions)

Dominant > 5 mm; Secondary 2-5 mm

Real-Time Three-Dimensional Transesophageal Echocardiography for Assessment of Mitral Valve Functional Anatomy in Patients With Prolapse-Related Regurgitation

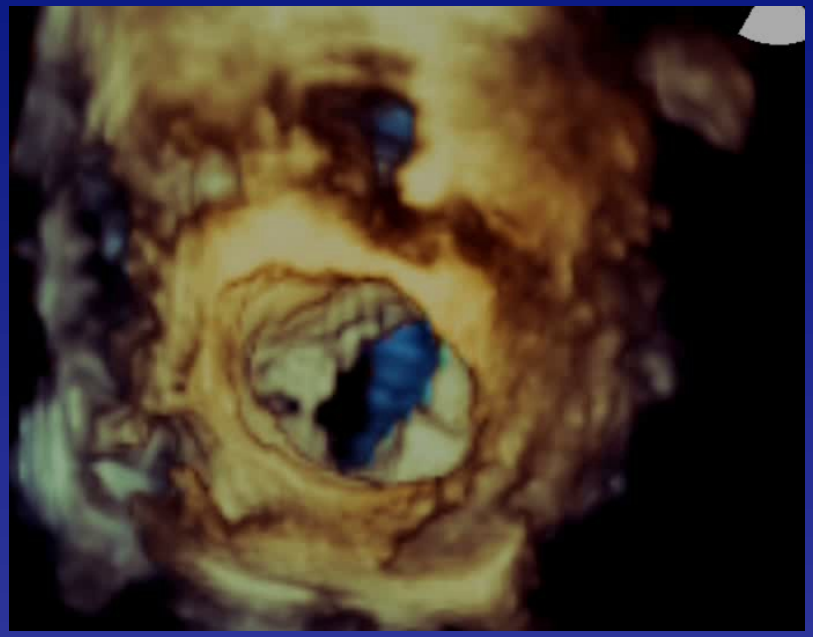
Giovanni La Canna, MD[a,*], Iryna Arendar, MD[a], Francesco Maisano, MD[b], Fabrizio Monaco, MD[a], Egidio Collu, MD[a], Stefano Benussi, MD[b], Michele De Bonis, MD[b], Alessandro Castiglioni, MD[b], and Ottavio Alfieri, MD[b]





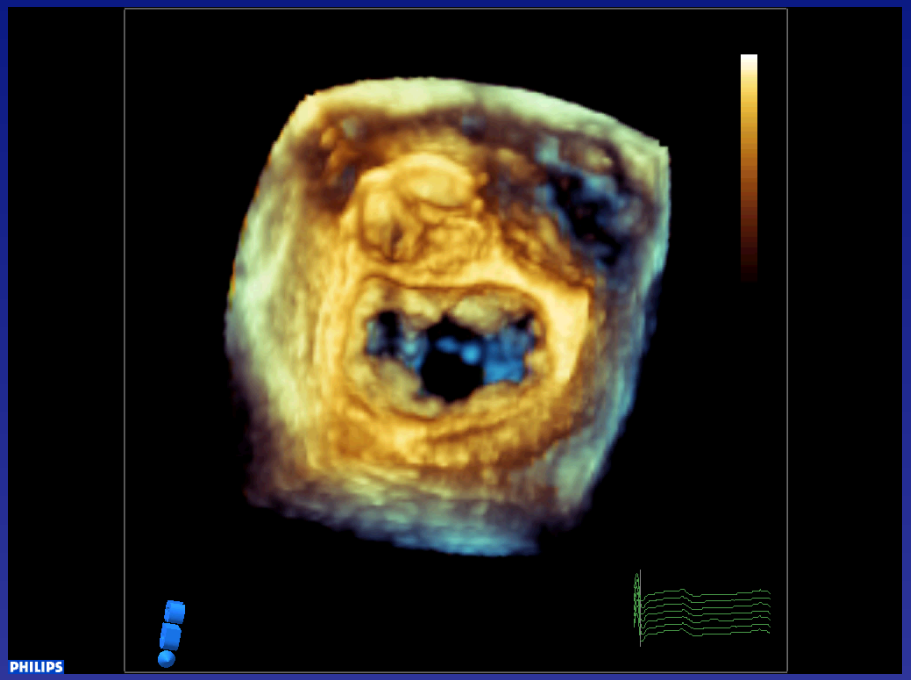
Am J Cardiol 2011

Complex and/or atypical MV prolapses



P2 prolapse with eversion

towards P1 ; anulus calcification –P3



Prolapse of the anterior and medial commissure

GUIDELINES AND STANDARDS

EAE/ASE Recommendations for Image Acquisition and Display Using Three-Dimensional Echocardiography

Roberto M. Lang, MD, FASE,*‡ Luigi P. Badano, MD, FESC,†‡ Wendy Tsang, MD,* David H. Adams, MD,* Eustachio Agricola, MD,† Thomas Buck, MD, FESC,† Francesco F. Faletra, MD,† Andreas Franke, MD, FESC,† Judy Hung, MD, FASE,* Leopoldo Pérez de Isla, MD, PhD, FESC,† Otto Kamp, MD, PhD, FESC,† Jaroslaw D. Kasprzak, MD, FESC,† Patrizio Lancellotti, MD, PhD, FESC,† Thomas H. Marwick, MBBS, PhD,* Marti L. McCulloch, RDCS, FASE,* Mark J. Monaghan, PhD, FESC,† Petros Nihoyannopoulos, MD, FESC,† Natesa G. Pandian, MD,* Patricia A. Pellikka, MD, FASE,* Mauro Pepi, MD, FESC,† David A. Roberson, MD, FASE,* Stanton K. Shernan, MD, FASE,* Girish S. Shirali, MBBS, FASE,* Lissa Sugeng, MD,* Folkert J. Ten Cate, MD,† Mani A. Vannan, MBBS, FASE,* Jose Luis Zamorano, MD, FESC, FASE,† and William A. Zoghbi, MD, FASE*, *Chicago and Oak Lawn, Illinois; Padua and Milan, Italy; New York, New York; Essen and Hannover, Germany; Lugano, Switzerland; Boston, Massachusetts; Madrid, Spain; Amsterdam and Rotterdam, The Netherlands; Lodz, Poland; Liege, Belgium; Cleveland, Ohio; Houston, Texas; London, United Kingdom; Rochester, Minnesota; Charleston, South Carolina; New Haven, Connecticut; Morrisville, North Carolina*

(J Am Soc Echocardiogr 2012;25:3-46.)

3D echocardiography may be **superior to 2DE techniques and even direct inspection** during surgery for diagnosing the location and extent of complex mitral valve disease, especially when commissural pathology or clefts are present.

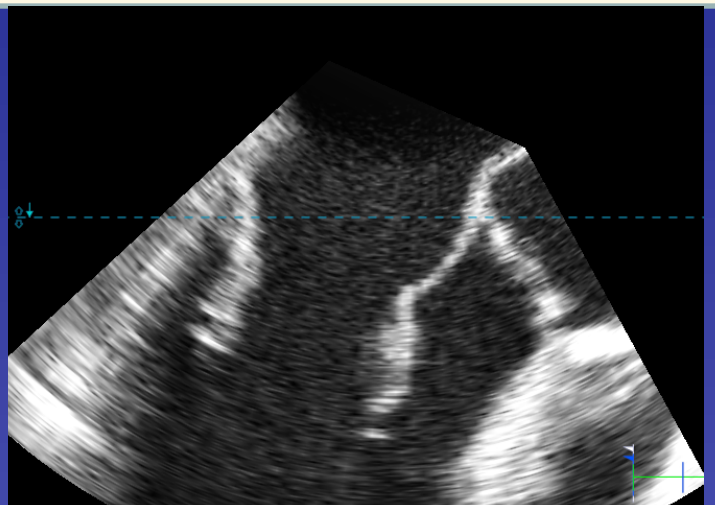
E’ Tutto chiarito nella valutazione del flail mitralico ?

William C. Roberts

William C. Roberts, M.D.

Born	September 11, 1932 Atlanta, Georgia
Nationality	United States
Fields	Cardiology, Pathology
Institutions	National Institutes of Health, Baylor University Medical Center

BACK to the future:
Rivediamo l’anatomopatologia e quindi l’Imaging della rottura cordale



Gross and Histologic Features of Excised Portions of Posterior Mitral Leaflet in Patients Having Operative Repair of Mitral Valve Prolapse and Comments on the Concept of Missing (=Ruptured) Chordae Tendineae

2014
JACC

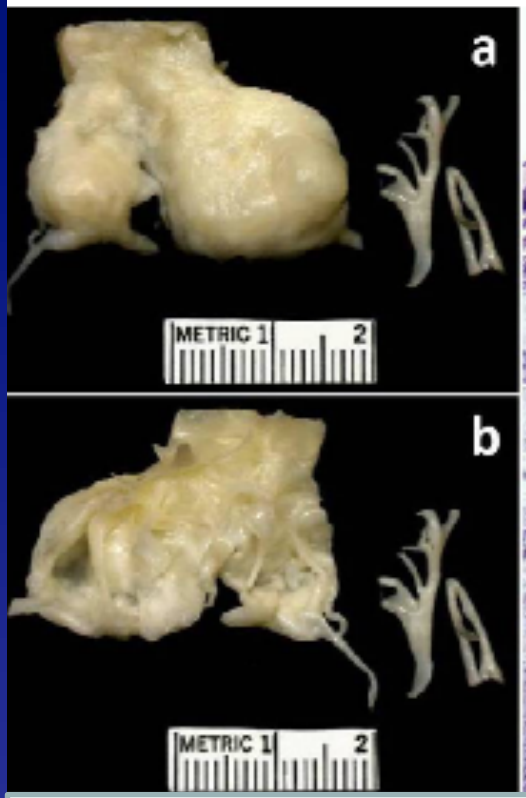
William C. Roberts, MD, MACC[*,†,‡]
Travis J. Vowels, BBA[*,‖]
Jong M. Ko, BA[*]
Robert F. Hebeler, Jr, MD[§]

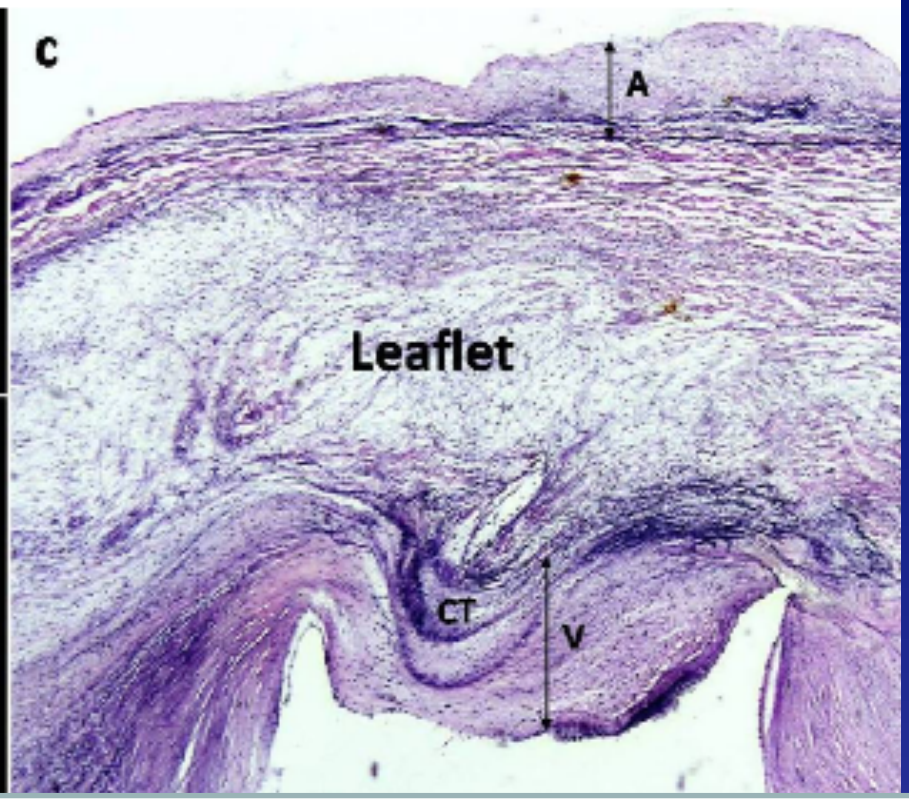
From the [*]Baylor Heart and Vascular Institute and the Departments of [†]Internal Medicine (Division of Cardiology), [‡]Pathology, and [§]Cardiothoracic Surgery, Baylor University Medical Center, Dallas, Texas 75246.

Examination of the posterior mitral leaflet in the 37 patients disclosed several consistent features:

All 37 excised portion of the posterior MV leaflet had «missing» (i.e. ruptured) chordae tendinee on gross examination.

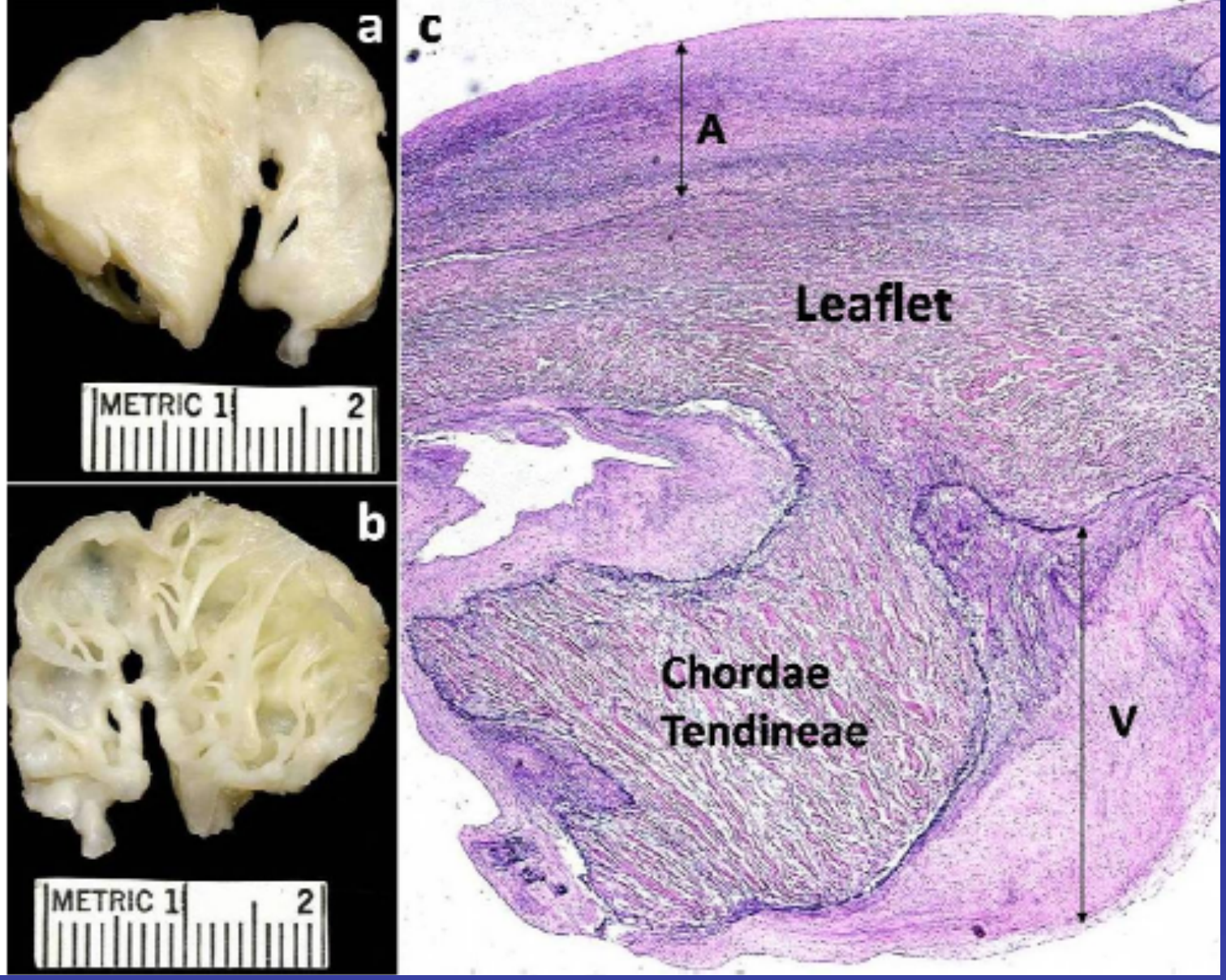
Both atrial and ventricular aspects of the leaflet in all 37 patients contained **superimposed fibrous tissue, thicker on the atrial side** than on the ventricular side





This article of course follows numerous ones discussing gross and histologic features of prolapsed mitral valves examined at either necropsy or after operative excision . Few, however, mentioned the **superimposed fibrous tissue on the leaflet and chordae**, probably because elastic-tissue stains were not used, a requirement to see the outline of the underlying leaflet and chordae. Additionally, **none mentioned hidden – previously ruptured – chordae by the overlying fibrous tissue**.
Thus **chordal rupture in MVP is far more common than previously appreciated.**

PREVIOUS ECHO Article; **Pepi Chordal rupture : 55%**
La Canna 51%
Altri 40-60%

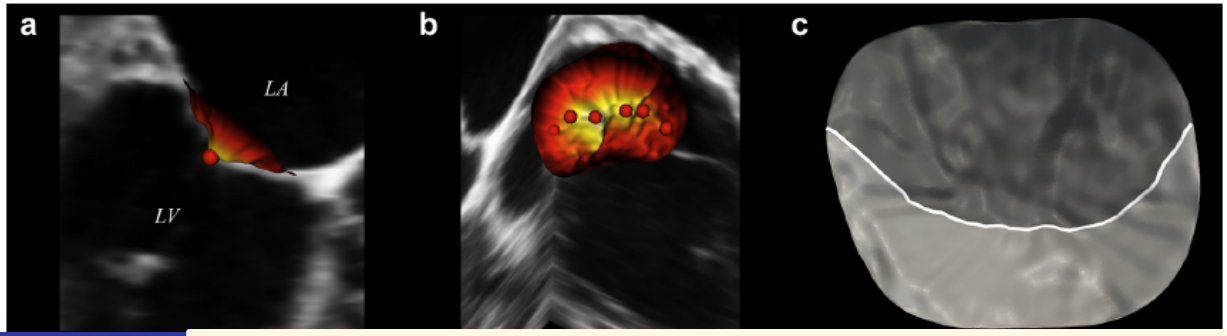

a
METRIC 1
2
b
METRIC 1
2
c
A
Leaflet
Chordae
Tendineae
V

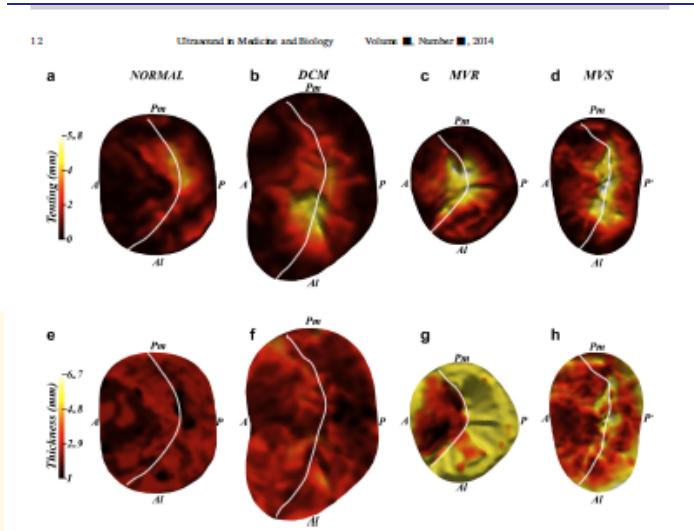
SEMI-AUTOMATED SEGMENTATION AND QUANTIFICATION OF MITRAL ANNULUS AND LEAFLETS FROM TRANSESOPHAGEAL 3-D ECHOCARDIOGRAPHIC IMAGES

MIGUEL SOTAQUIRA,* MAURO PEPI,† LAURA FUSINI,† FRANCESCO MAFFESSANTI,†‡ ROBERTO M. LANG,‡ and ENRICO G. CAIANI*

* Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Milan, Italy; †Centro Cardiologico Monzino IRCCS, Milan, Italy; and ‡Noninvasive Cardiac Imaging Laboratory, University of Chicago, Chicago, IL, USA

(*Received* 23 *December* 2013; *revised* 18 *August* 2014; *in final form* 2 *September* 2014)



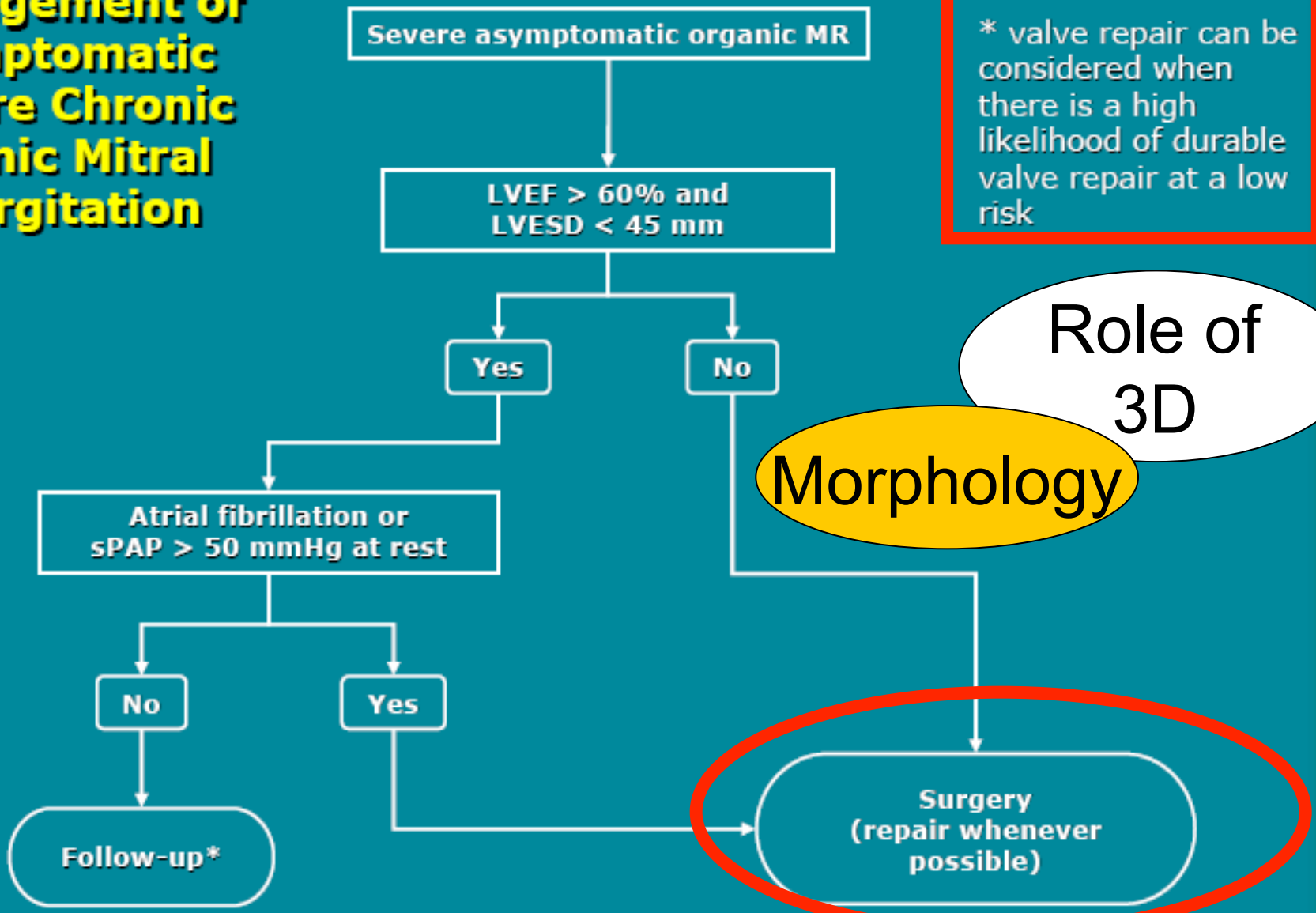


VALUTAZIONE SEMPRE PIU' AUTOMATICA E QUANTITATIVA LEAFLETS

ECO 3D TEE Mitrale

- *Storia – Attuale accuratezza*
- Valutazione morfo-funzionale
- **Utilità chirurgica**
- **Utilità monitoraggi**

Management of Asymptomatic Severe Chronic Organic Mitral Regurgitation

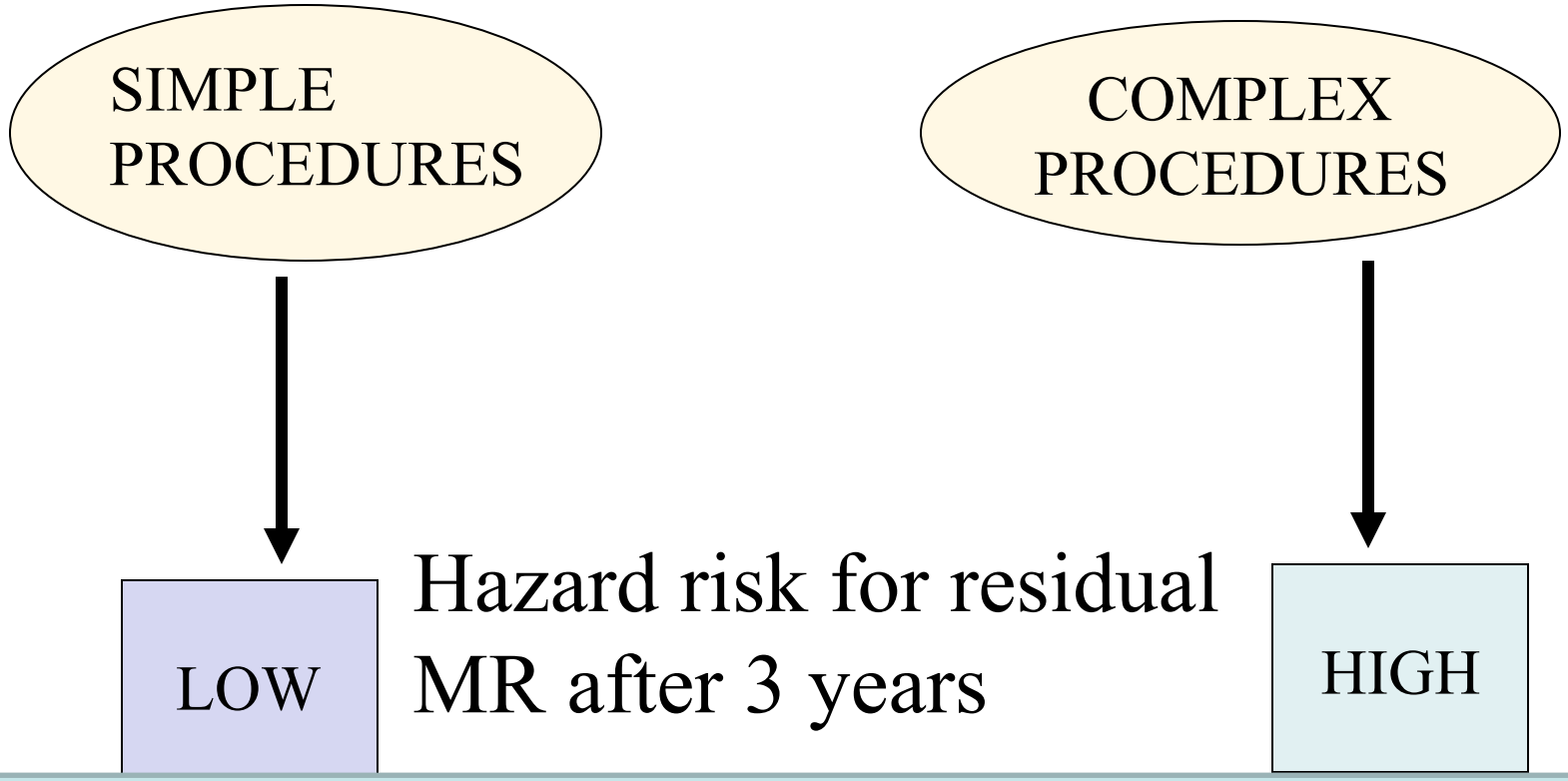


* valve repair can be considered when there is a high likelihood of durable valve repair at a low risk

Role of 3D

Morphology

LONG–TERM RESULTS OF VALVE REPAIR WITH SIMPLE OR COMPLEX TECHNIQUES IN NONRHEUMATIC MV REGURGITATION



2008-2010: Nostra impostazione scientifica: è possibile predire tipo intervento con ECO 3D ?

European Journal of Echocardiography Advance Access published May 20, 2010

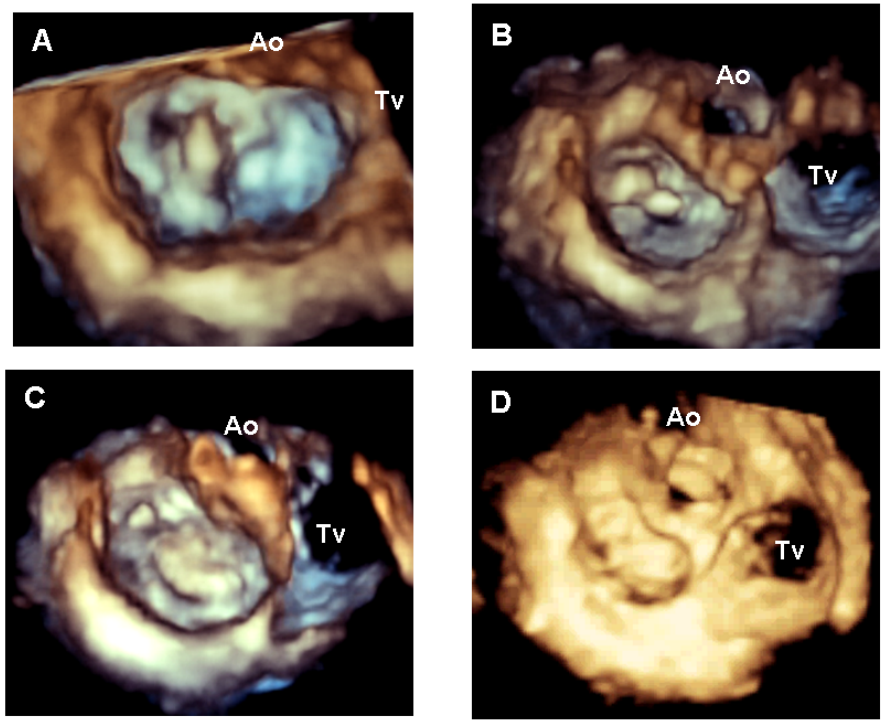
European Journal of Echocardiography
doi:10.1093/ejechocard/jeq066

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

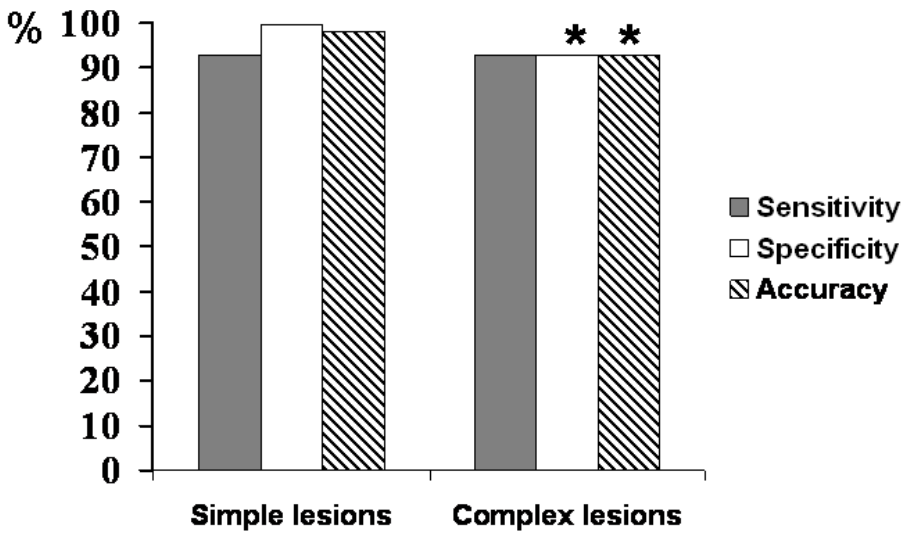
Gloria Tamborini*, Manuela Muratori, Anna Maltagliati, Claudia Agnese Galli, Moreno Naliato, Marco Zanobini, Francesco Alamanni, Luca Salvi, Erminio Sisillo, Cesare Fiorentini, and Mauro Pepi

Centro Cardiologico Monzino, IRCCS, Department of Cardiovascular Sciences, University of Milan, Via Parea 4, 20138 Milan, Italy

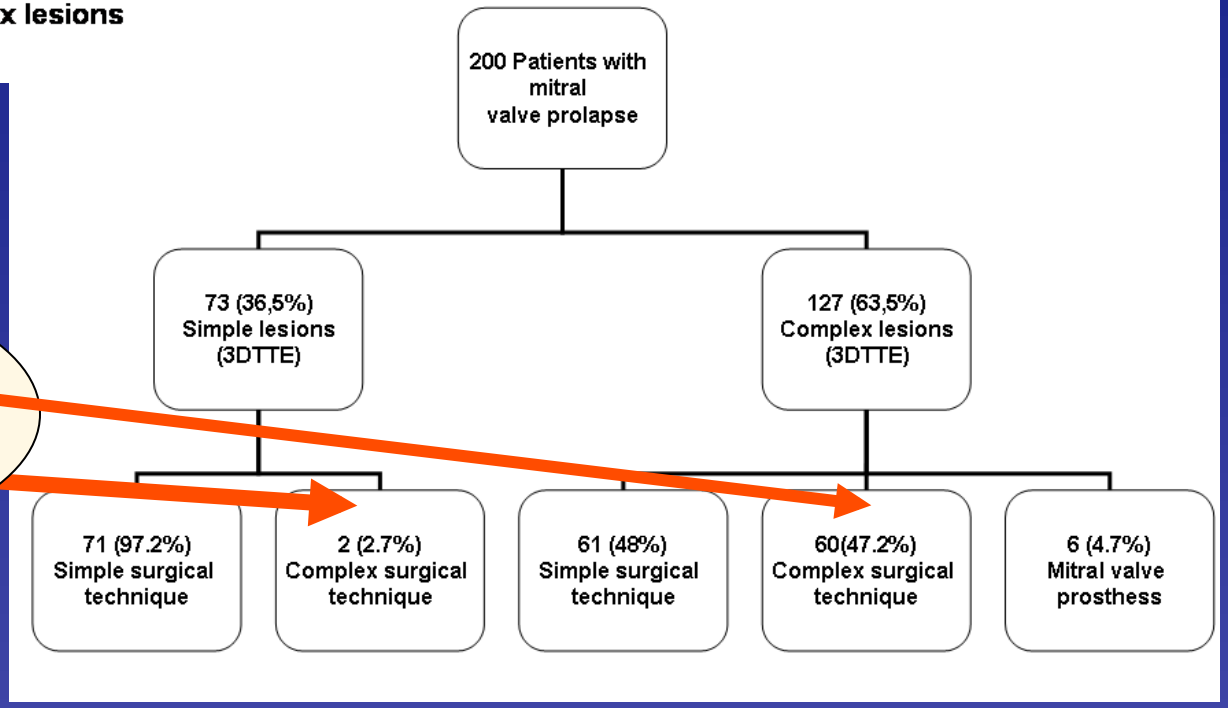
Received 5 February 2010; accepted after revision 25 April 2010



200 patients
3DTTE preop
2DTEE intraop
vs
Surgical
Inspection



Prediction



Tamborini et al. Eur J Echocard 2010 in press

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Real-time transthoracic 3D : Rapid Diagnosis of simple and complex lesions .

↓

May facilitate the prediction of the complexity of surgical procedures.

↓

May further facilitate the clinical decision and
the correct timing (early surgery vs delayed procedures) .

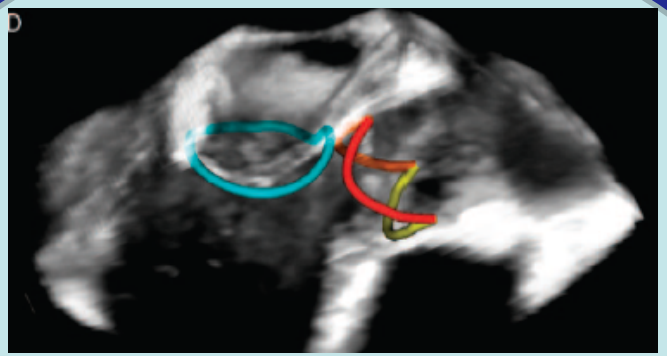
3DTEE postoperative

P2 resection and annuloplasty

VALVULAR HEART DISEASE

Effect of Mitral Valve Repair on Mitral-Aortic Coupling: A Real-Time Three-Dimensional Transesophageal Echocardiography Study

Federico Veronesi, PhD, Enrico G. Caiani, PhD, Lissa Sugeng, MD, Laura Fusini, MS, Gloria Tamborini, MD, Francesco Alamanni, MD, Mauro Pepi, MD, and Roberto M. Lang, MD, *Milan, Italy; New Haven, Connecticut; Chicago, Illinois*

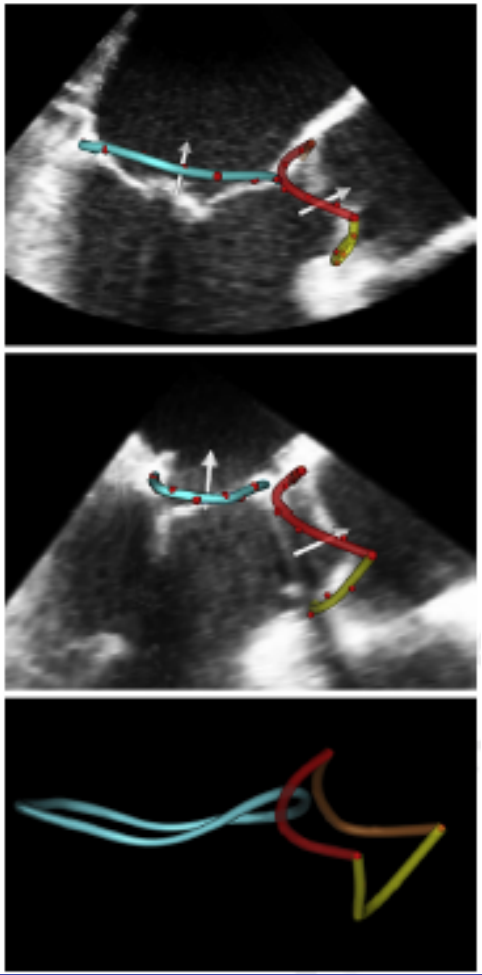


Unexpected changes in aortic annulus function secondary to MV repair

BASIC → CLINICAL RESEARCH

Effect of Mitral Valve Repair on Mitral-Aortic Coupling: A Real-Time Three-Dimensional Transesophageal Echocardiography Study

Federico Veronesi, PhD, Enrico G. Caiani, PhD, Lissa Sugeng, MD, Laura Fusini, MS, Gloria Tamborini, MD, Francesco Alamanni, MD, Mauro Pepi, MD, and Roberto M. Lang, MD, *Milan, Italy; New Haven, Connecticut; Chicago, Illinois*



This study shows unwanted and unexpected changes in aortic annular function secondary to MV repair with an annuloplasty ring due to altered AMC mechanisms. These changes may alter the dynamic mechanism of the aortic root that facilitates blood ejection, so AMC should be considered and evaluated from diagnosis to treatment in MV disease.

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Quantification of mitral annulus dynamic morphology in patients with mitral valve prolapse undergoing repair and annuloplasty during a 6-month follow-up

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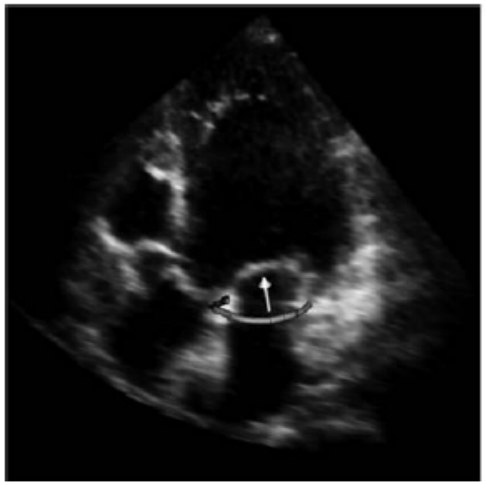
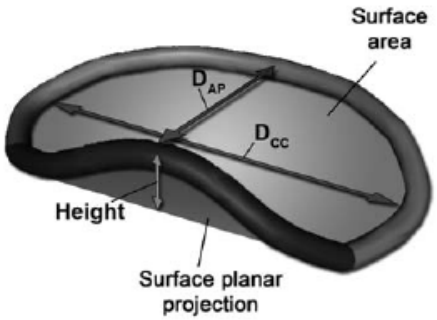
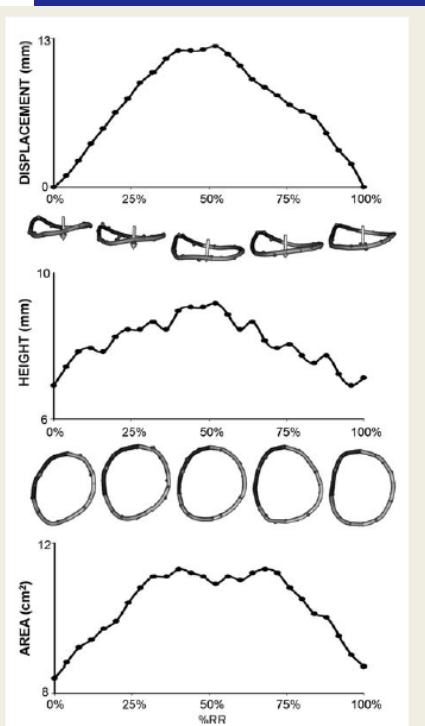
3D TTE





44 pts
Pre-post
MV repair

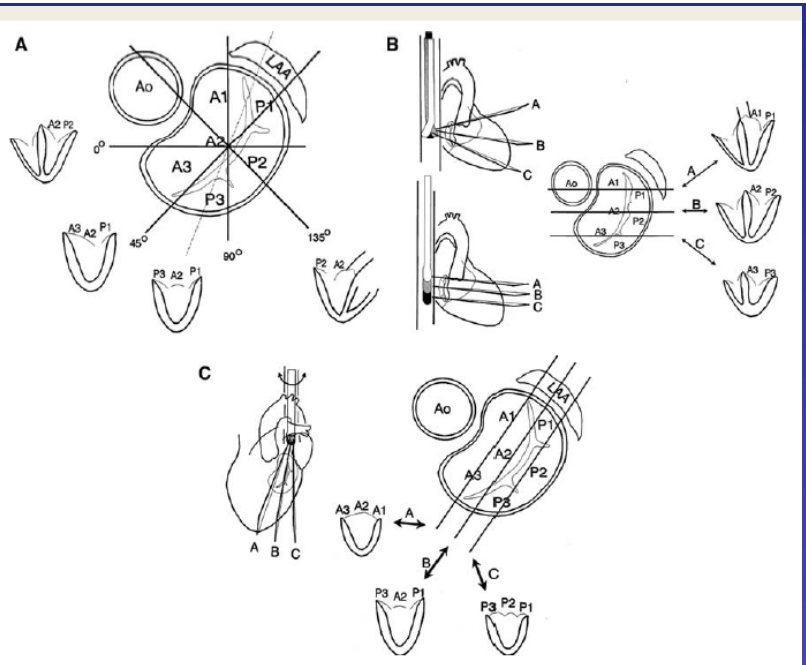


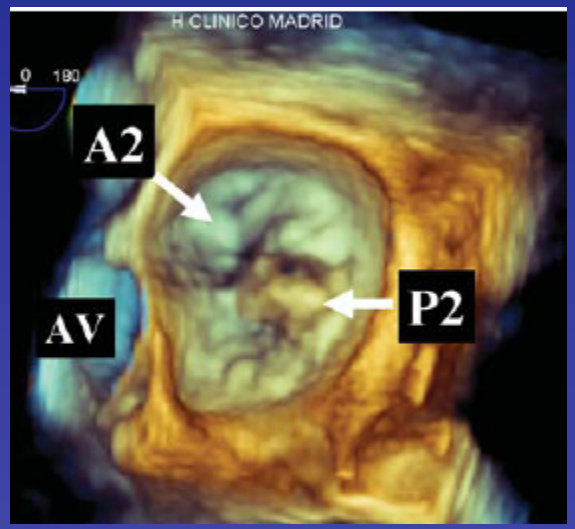
European Journal of Echocardiography (2010) **11**, 557–576
doi:10.1093/ejechocard/jeq057

Recommendations for transoesophageal echocardiography: update 2010

F.A. Flachskampf[1]*, L. Badano[2], W.G. Daniel[1], R.O. Feneck[3], K.F. Fox[4], Alan G. Fraser[5], Agnes Pasquet[6], M. Pepi[7], L. Perez de Isla[8], and J.L. Zamorano[8] 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]





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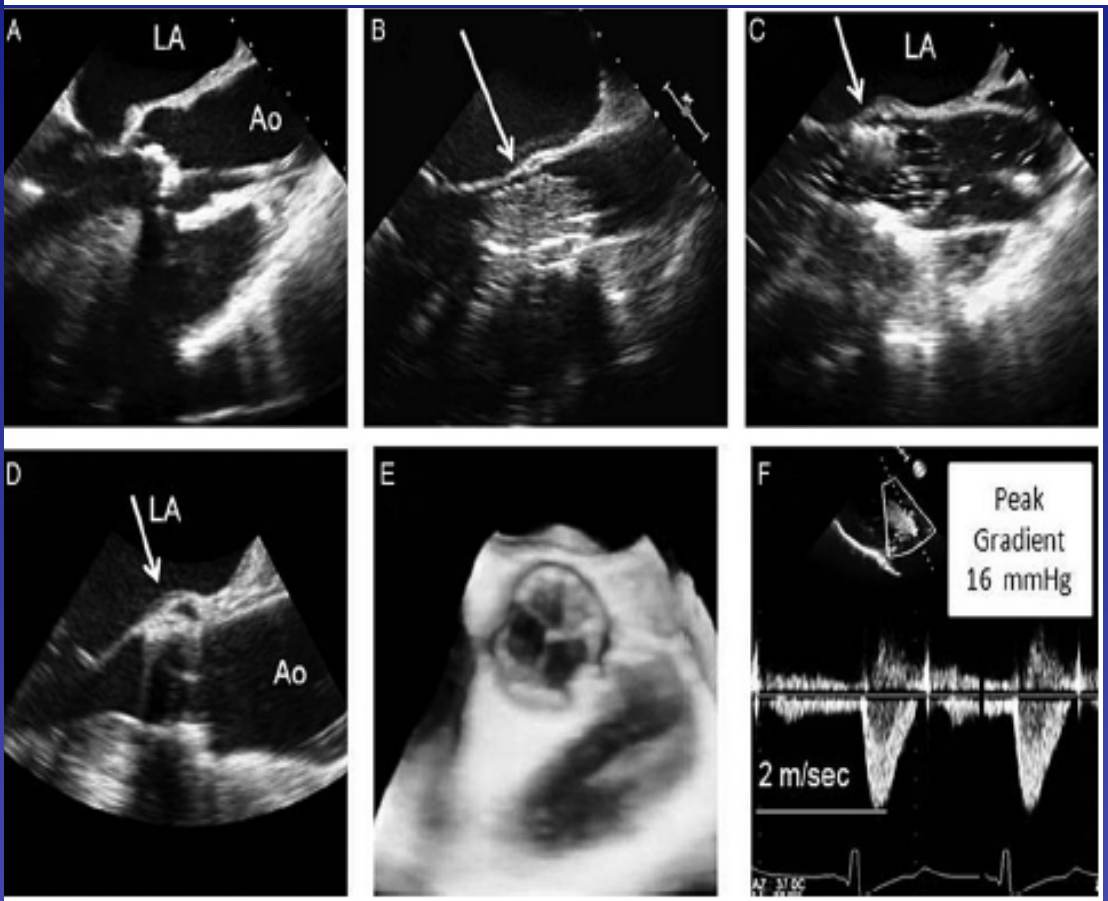
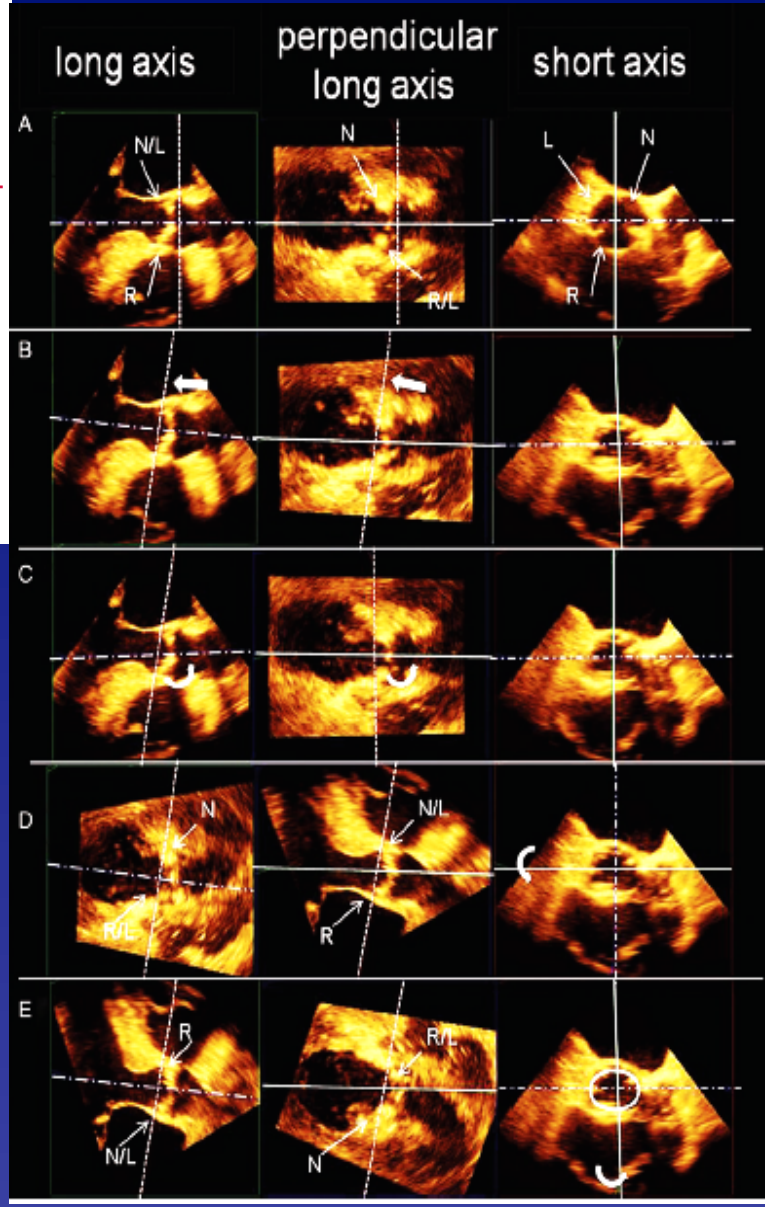
European Heart Journal – Cardiovascular Imaging
doi:10.1093/ehjci/jeu015

Recommendations for transoesophageal echocardiography: EACVI update 2014

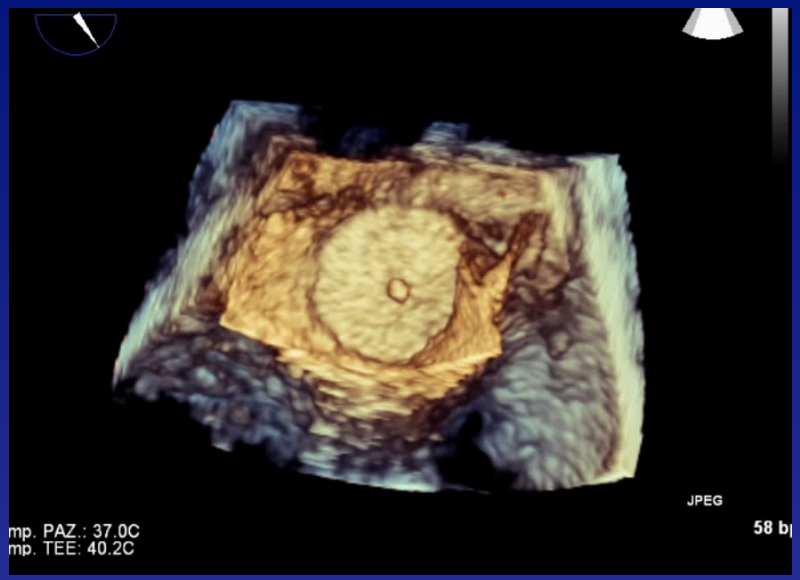
Frank A. Flachskampf[1]*, Patrick F. Wouters[2], Thor Edvardsen[3], Artur Evangelista[4], Gilbert Habib[5], Piotr Hoffman[6], Rainer Hoffmann[7], Patrizio Lancellotti[8], and Mauro Pepi[9], for the European Association of Cardiovascular Imaging



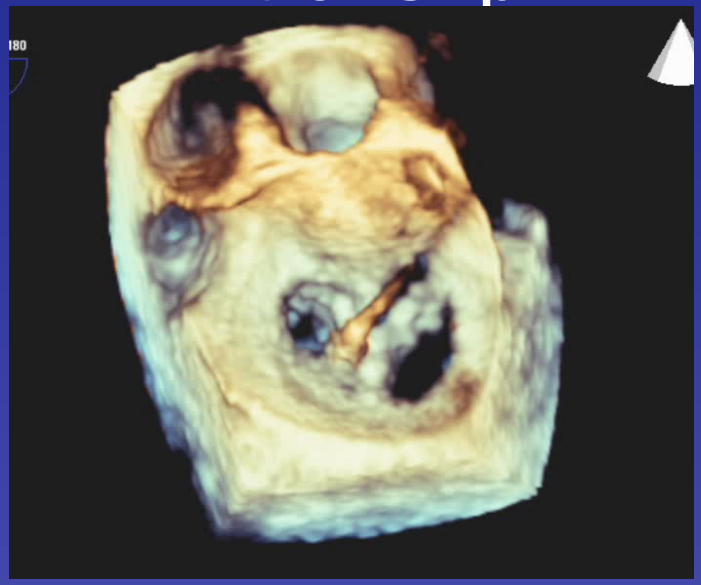


TAVI

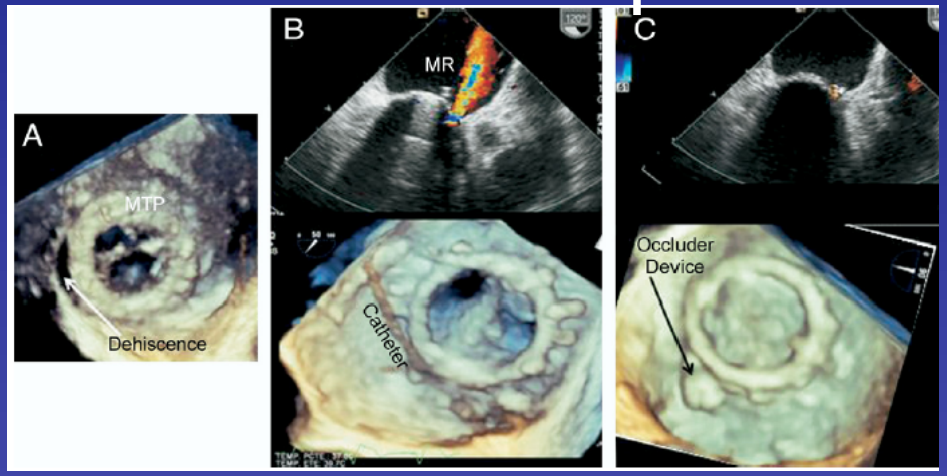
CHIUSURA Auricola



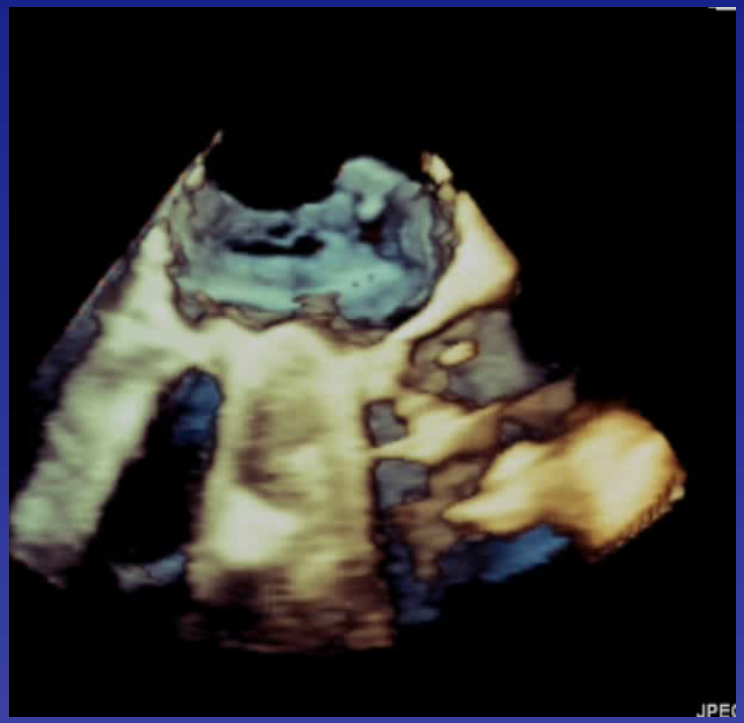
Mitra-Clip

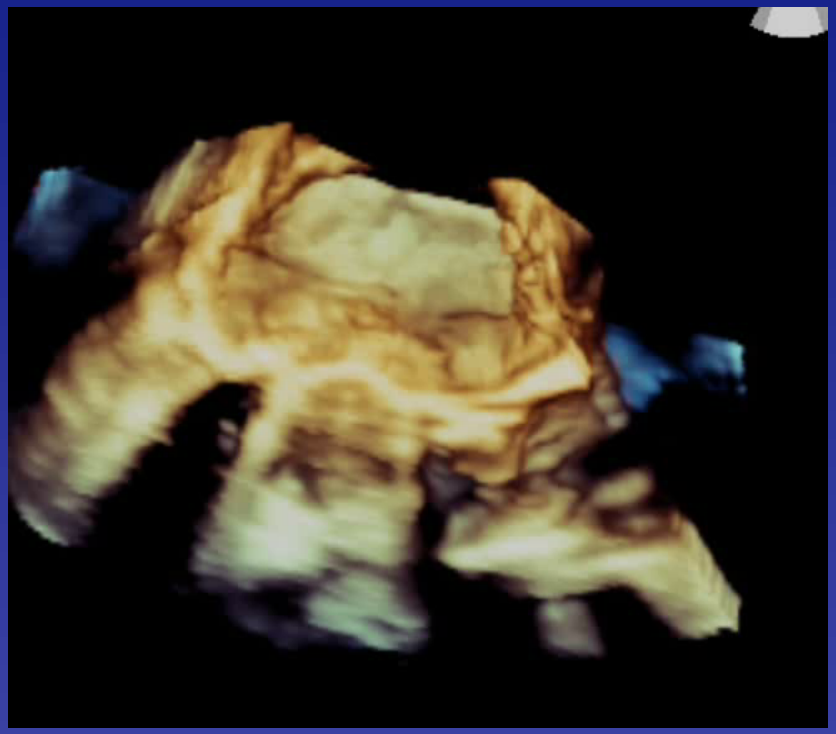


Chiusura Leak Paraprotesici

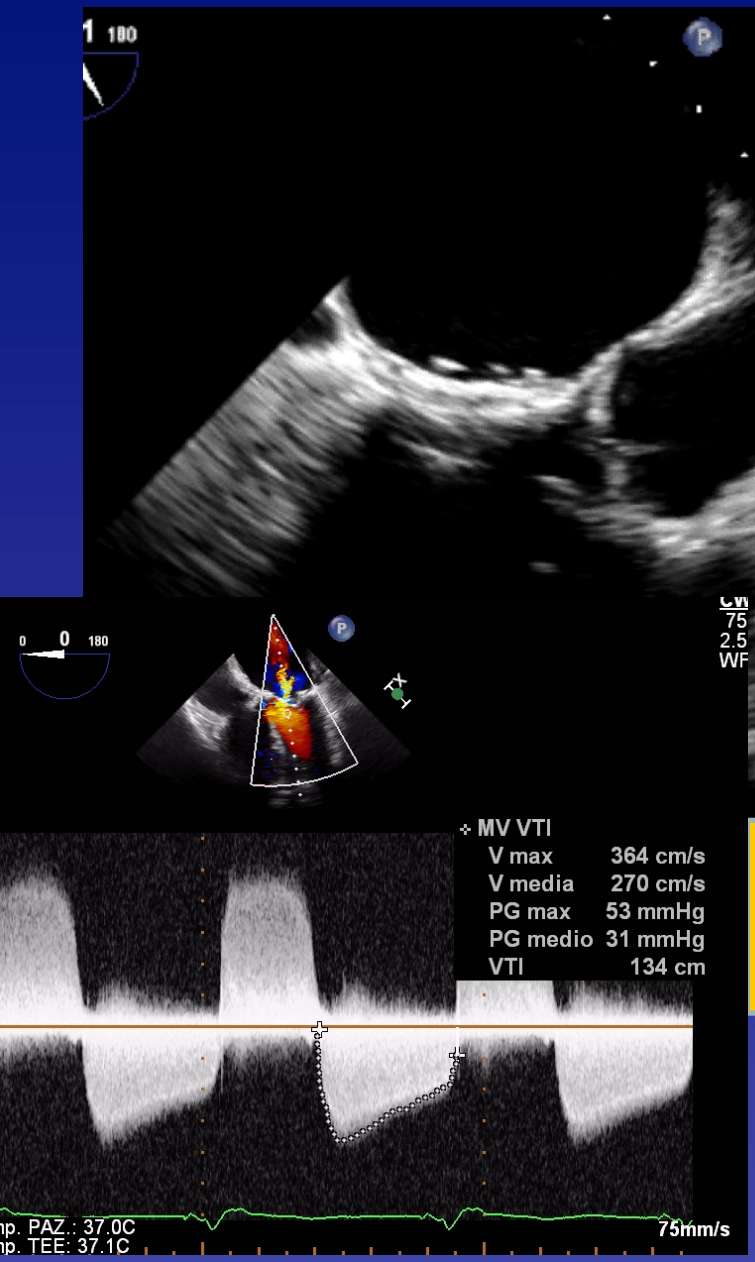


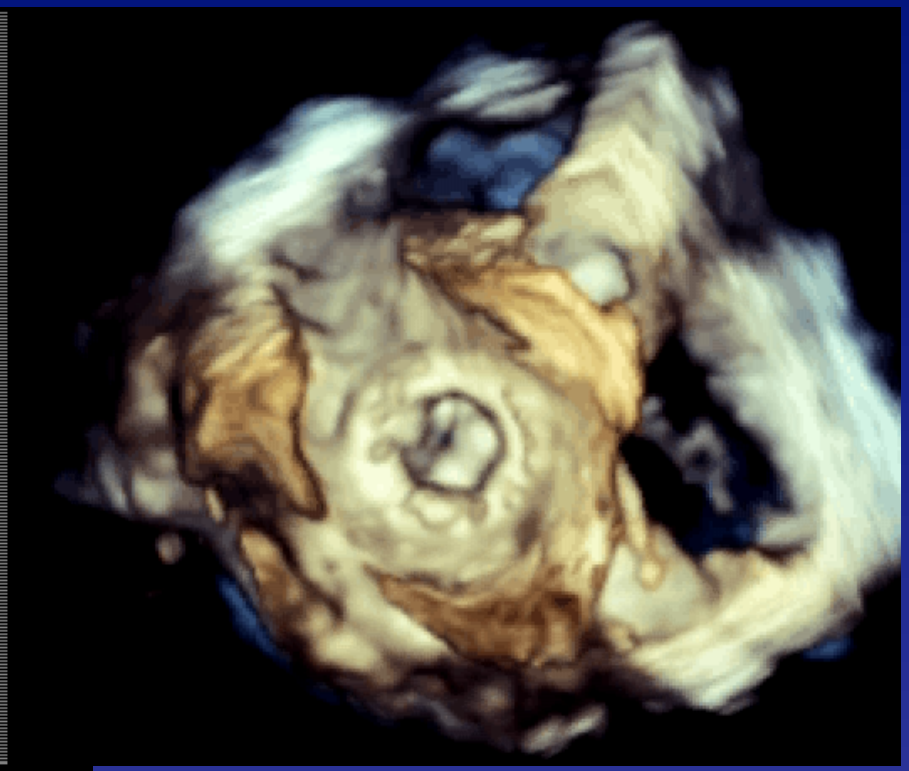
ECO 3DTEE
TAVI
in pazienti con Protesi Mitralica





Basale : Valve in Valve Protesi Mitralica

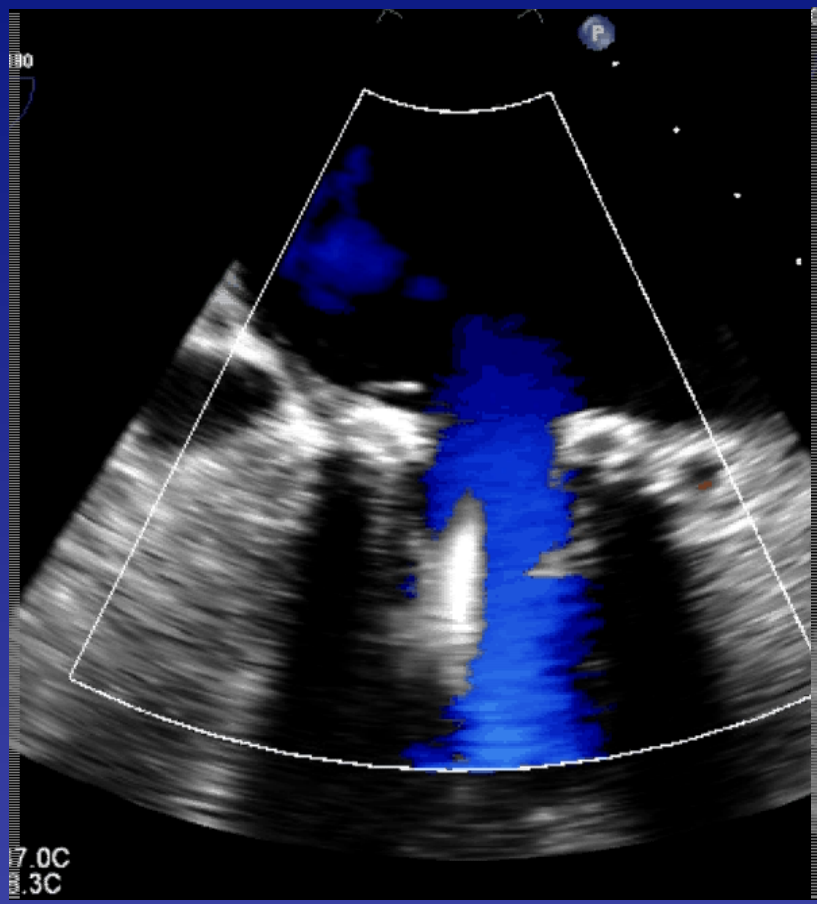


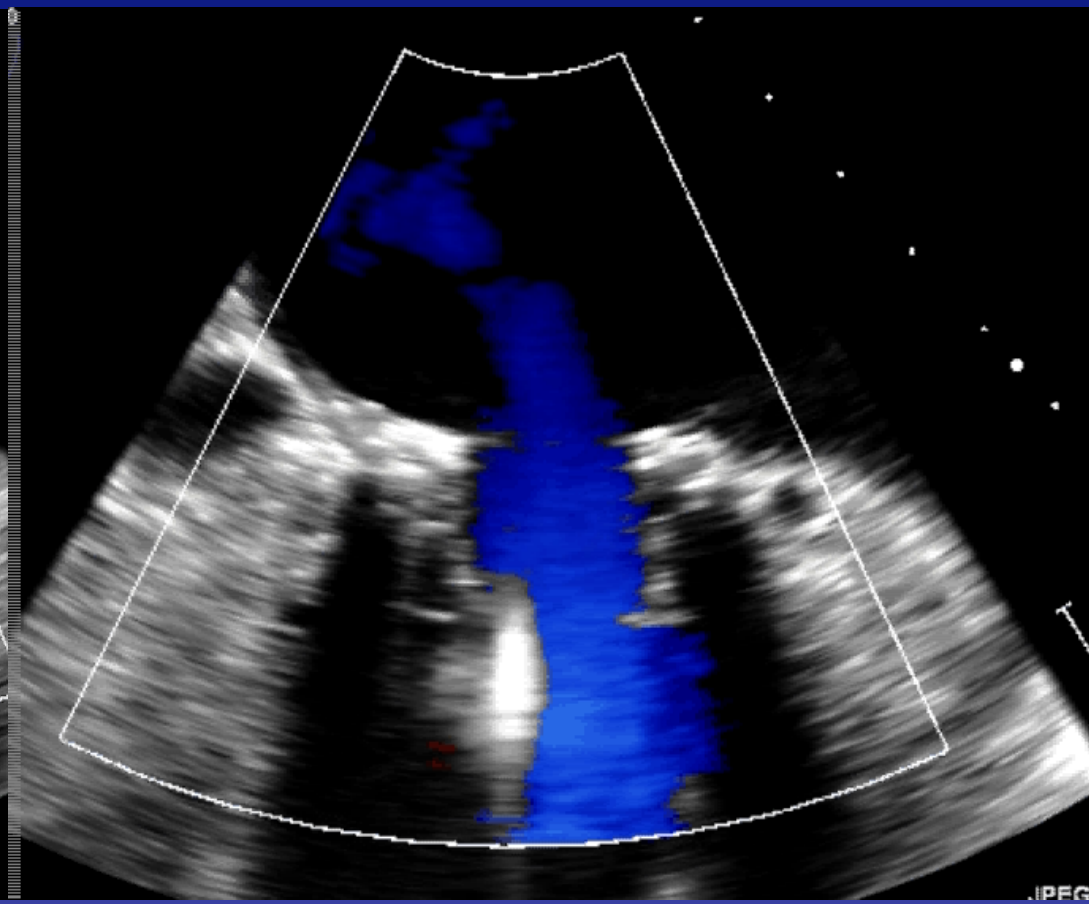


3D INDISPENSABILE

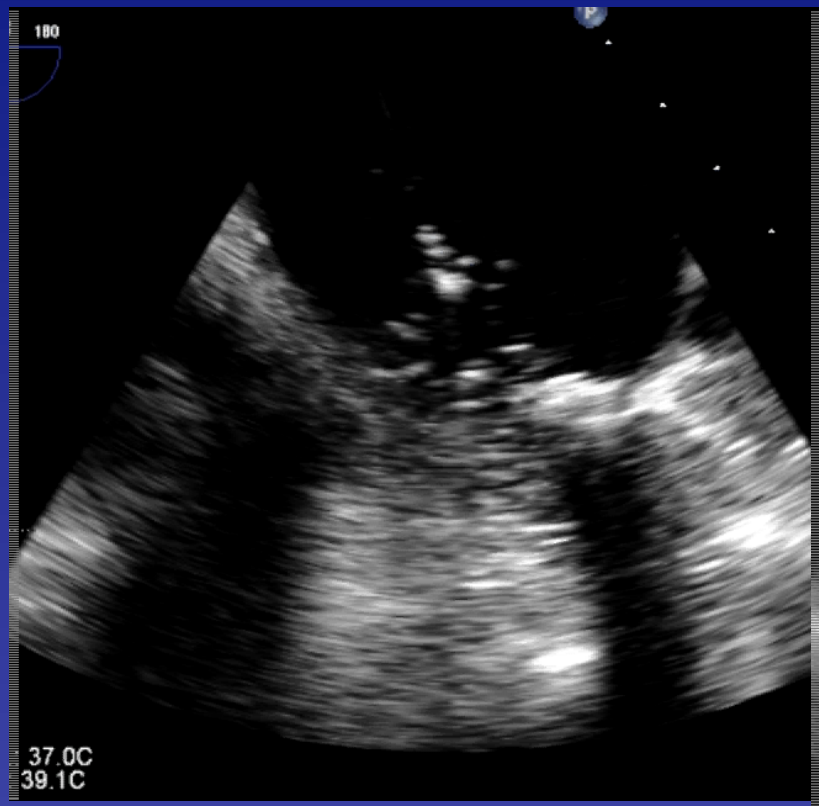
Area 0.5 cmq;
grad medio 30 mmHg; EPA

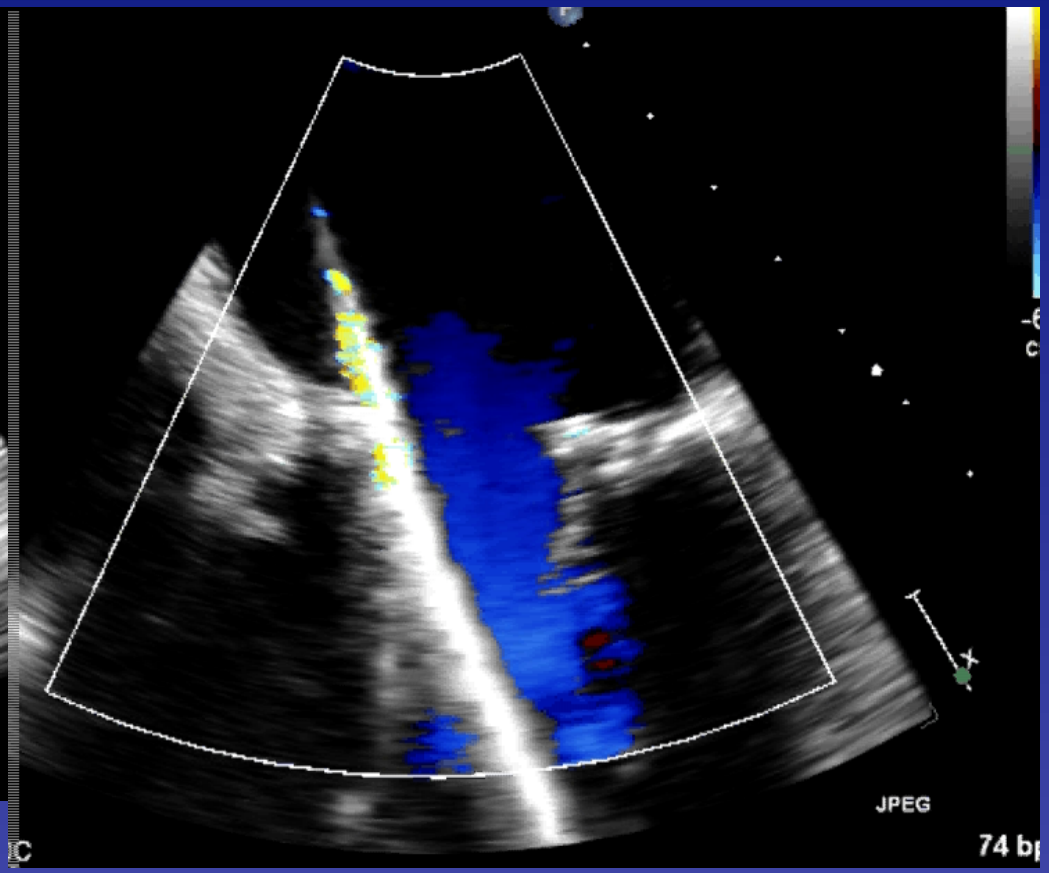
Impianto



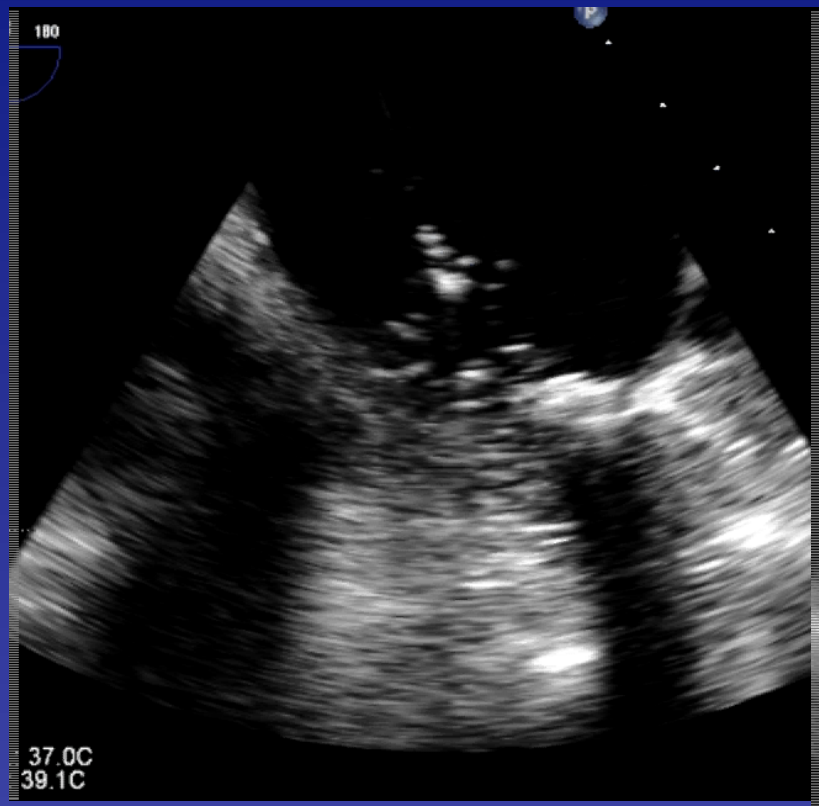


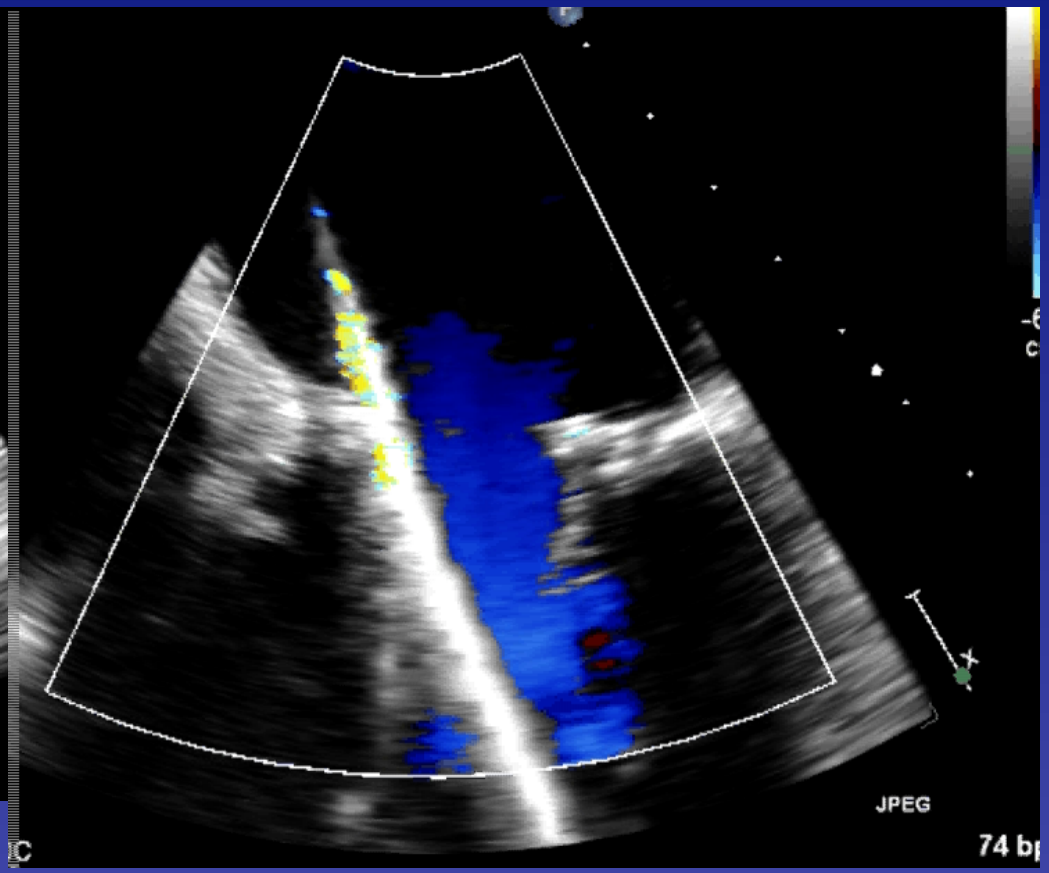
Impianto
Re-Ballooning per leaks



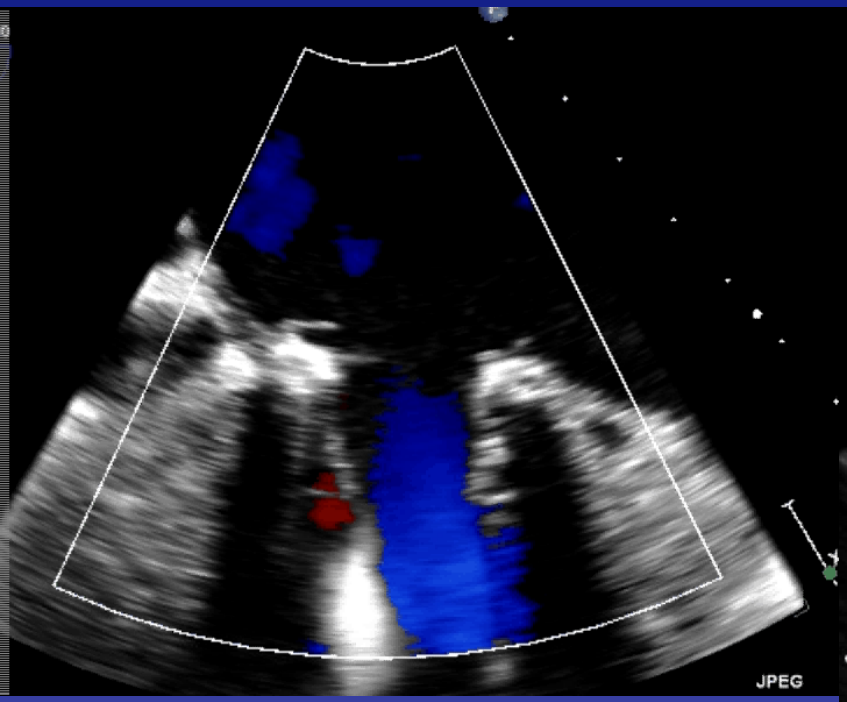


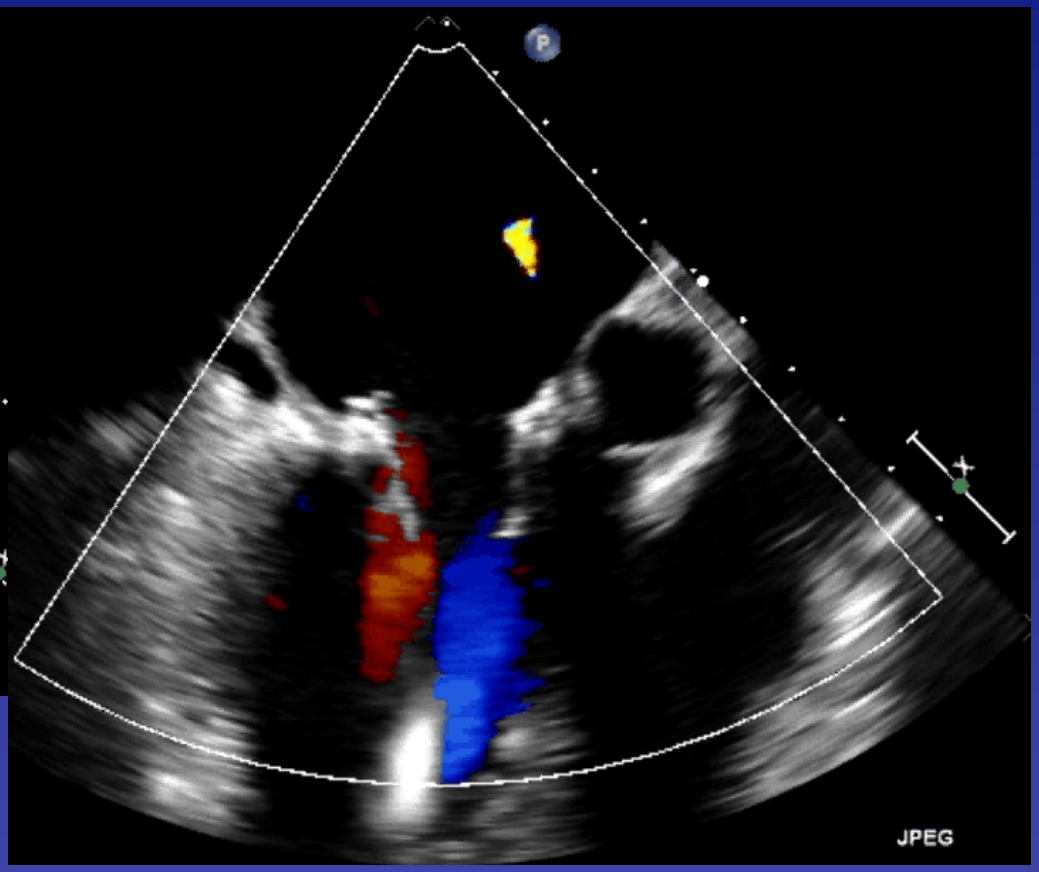
Impianto
Re-Ballooning per leaks



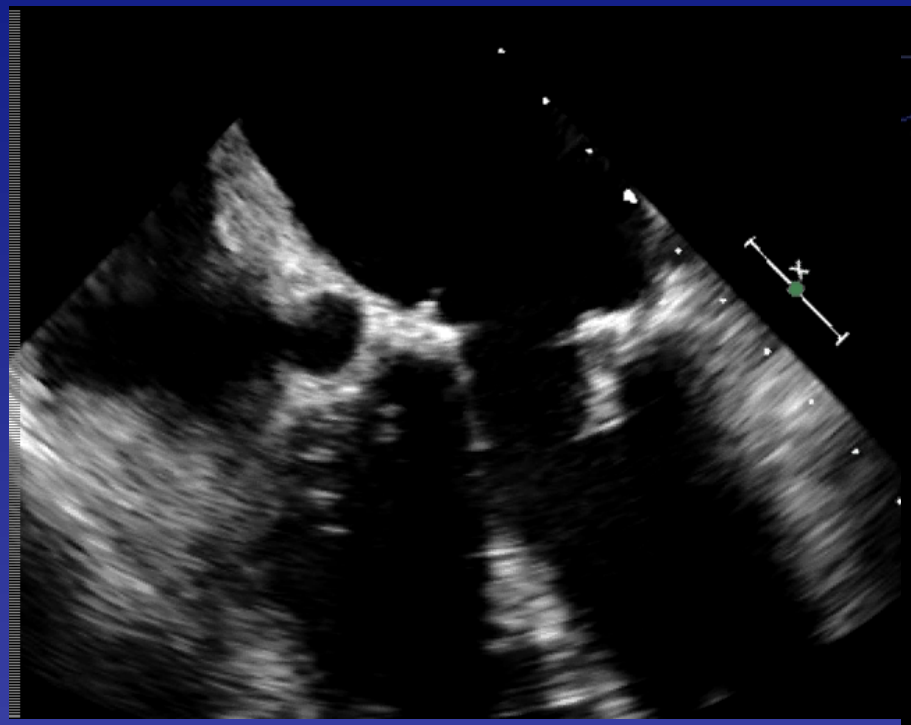


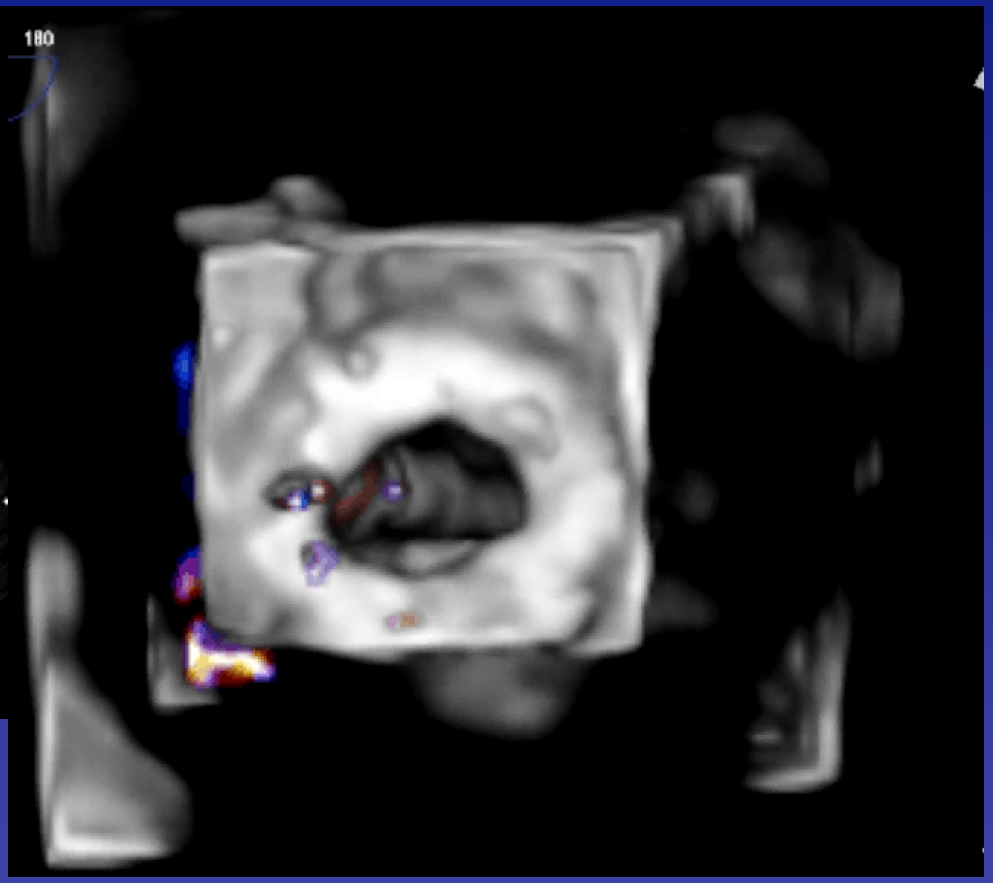
Impianto: risultato finale dopo 2° ballooning





Impianto Risultato finale:
Grad medio 4 mmHg
Rigurgito paraprotesico minimo





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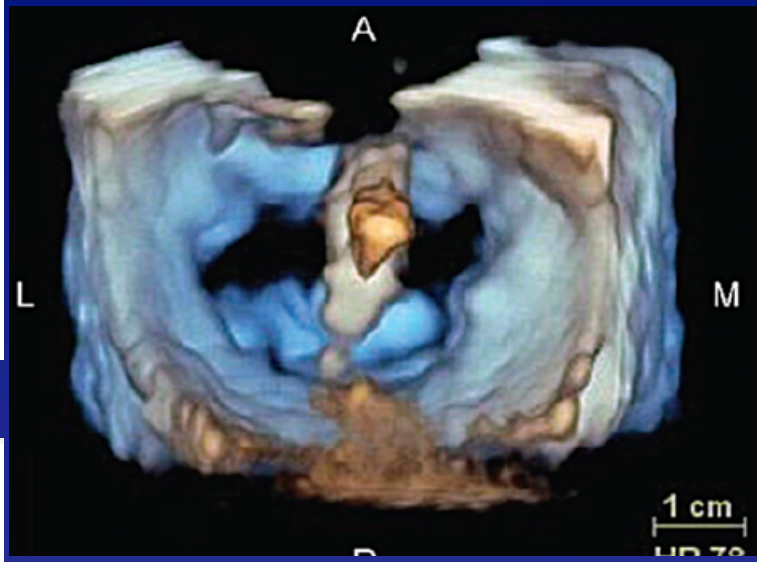
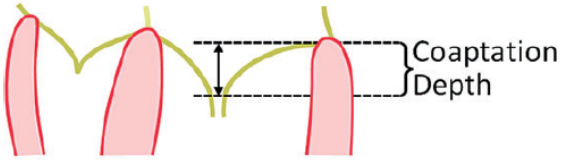
Recommendations for transoesophageal echocardiography: EACVI update 2014

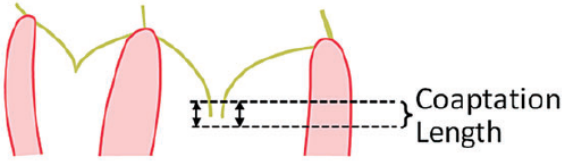
Frank A. Flachskampf[1]*, Patrick F. Wouters[2], Thor Edvardsen[3], Artur Evangelista[4], Gilbert Habib[5], Piotr Hoffman[6], Rainer Hoffmann[7], Patrizio Lancellotti[8], and Mauro Pepi[9], for the European Association of Cardiovascular Imaging



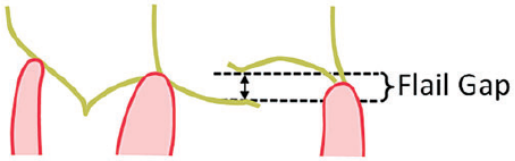
FMR Coaptation Depth
The measurement should be taken in the 4C view where the coaptation depth is greatest.



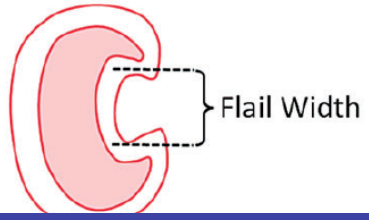
FMR Coaptation Length
The measurement should be taken in the 4C view where the coaptation length is shortest.

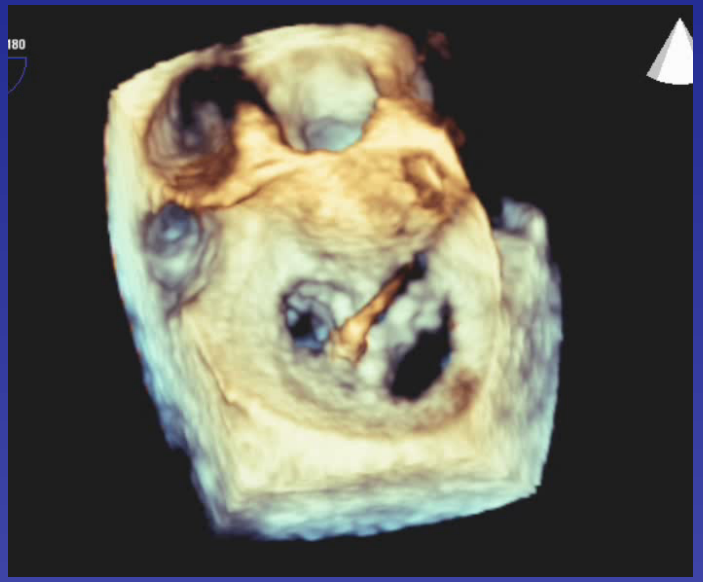


DMR Flail Gap
This should be taken in the view (LAX, 4C, 5C) where the flail gap is largest.



DMR Flail Width
This measurement should be taken in the transgastric short axis view where the flail width is largest.





Patients selection for MitraClip: Time to move to transthoracic echocardiographic screening?

Paola Gripari [a,1], Francesco Maffessanti [a,*,1], Gloria Tamborini [a], Manuela Muratori [a], Laura Fusini [a], Sarah Ghulam Ali [a], Cristina Ferrari [a], Francesco Alamanni [a,b], Antonio L. Bartorelli [a,b], Cesare Fiorentini [a,b], Mauro Pepi [a]

[a] Centro Cardiologico Monzino, IRCCS, Milan, Italy
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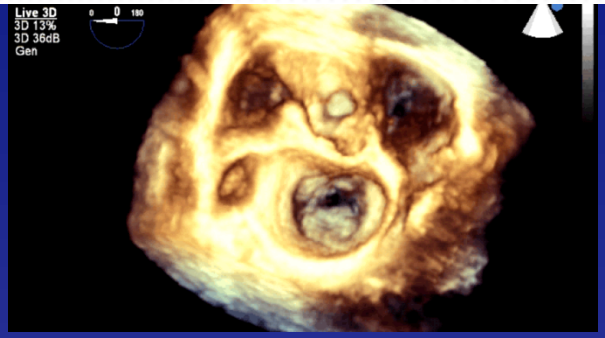
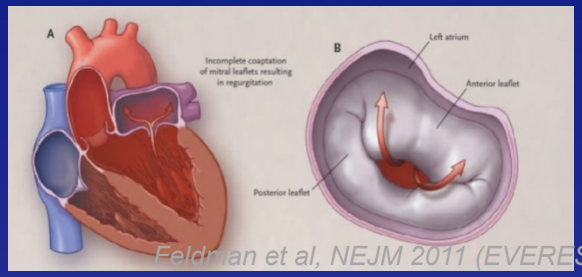
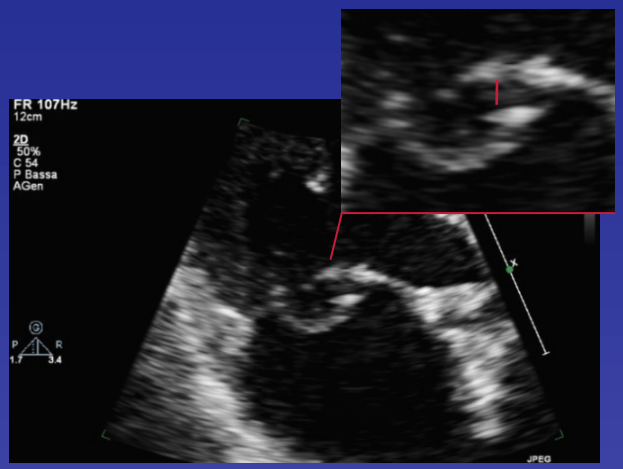
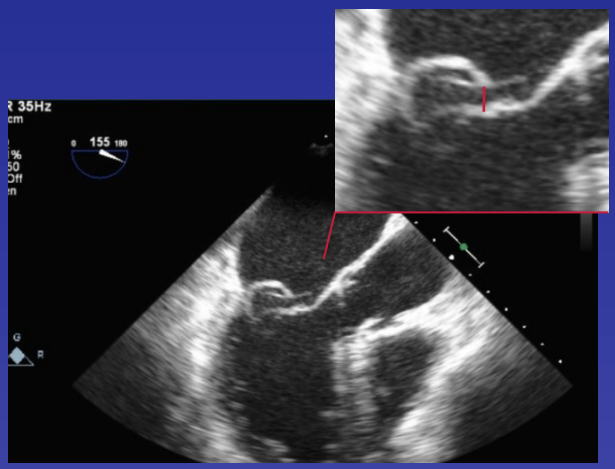


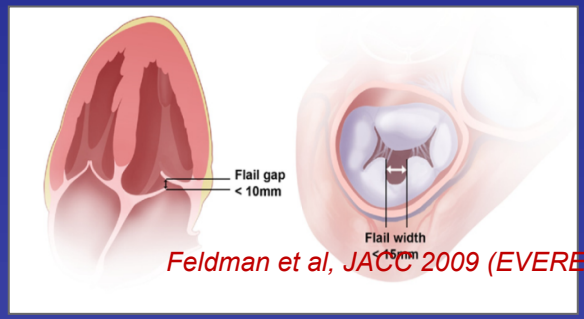


Feldman et al, NEJM 2011 (EVEREST II)

Flail Gap and Width







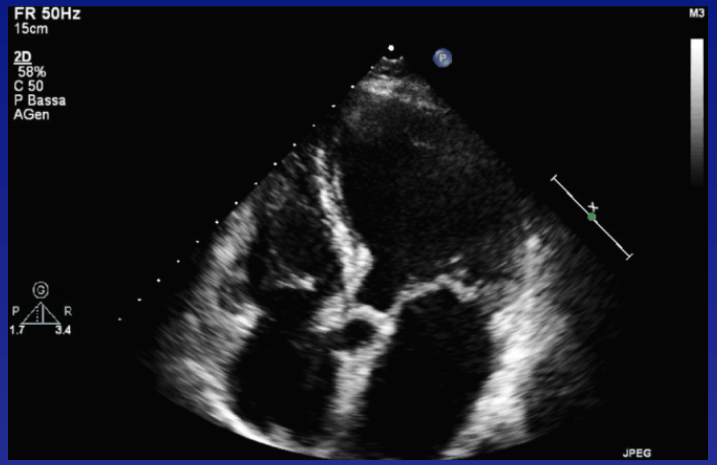
Feldman et al, JACC 2009 (EVEREST)

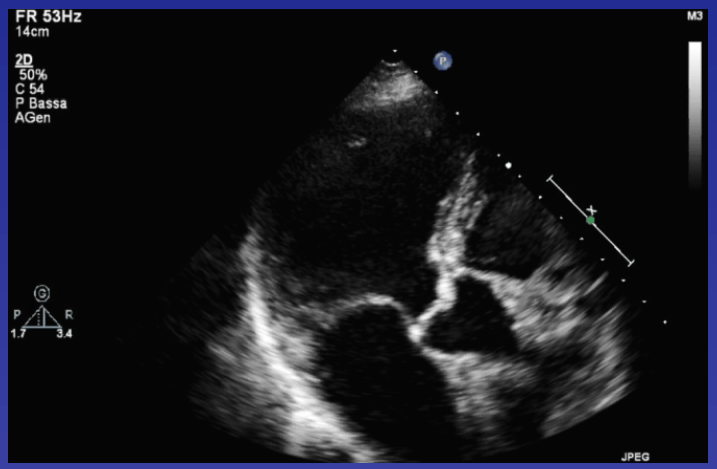
Anatomic criteria Degenerative MR

Example TTE vs TEE

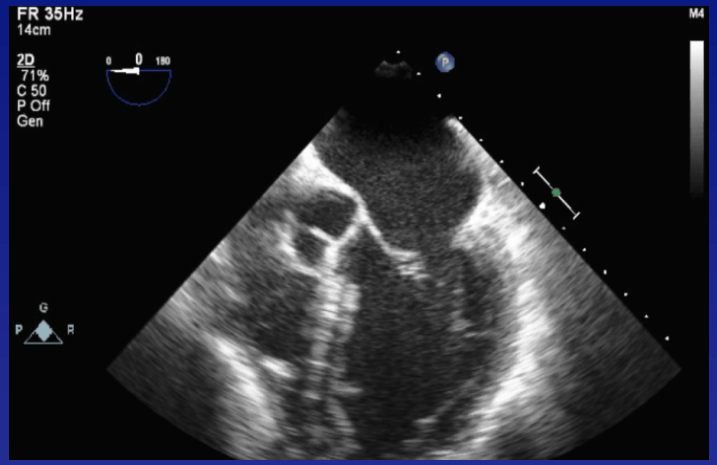
Degenerative MR
MV prolapse (P2 flail)

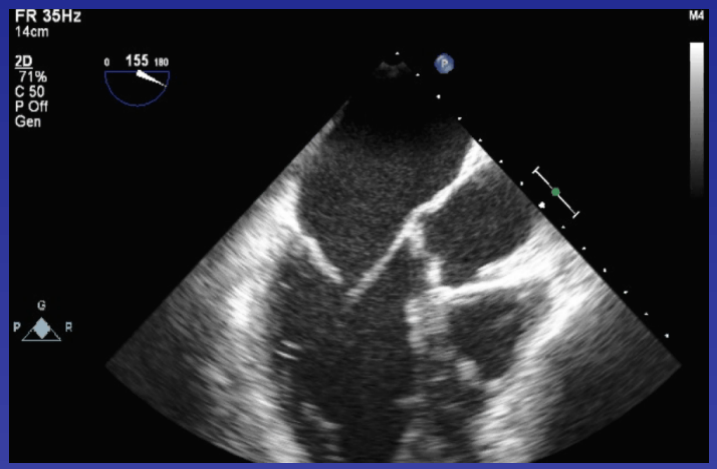
TTE



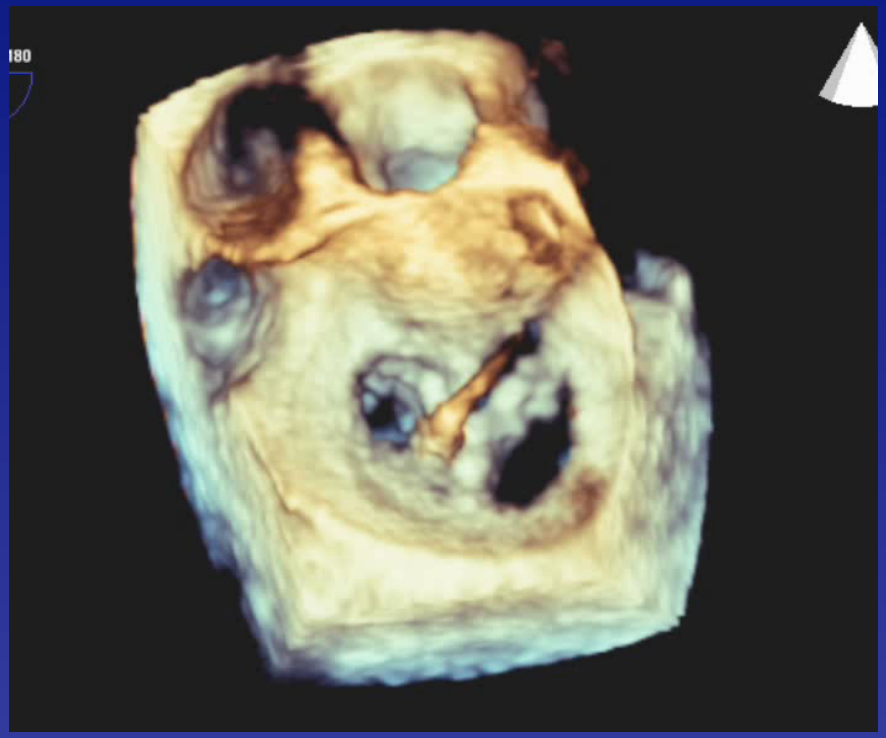


TEE



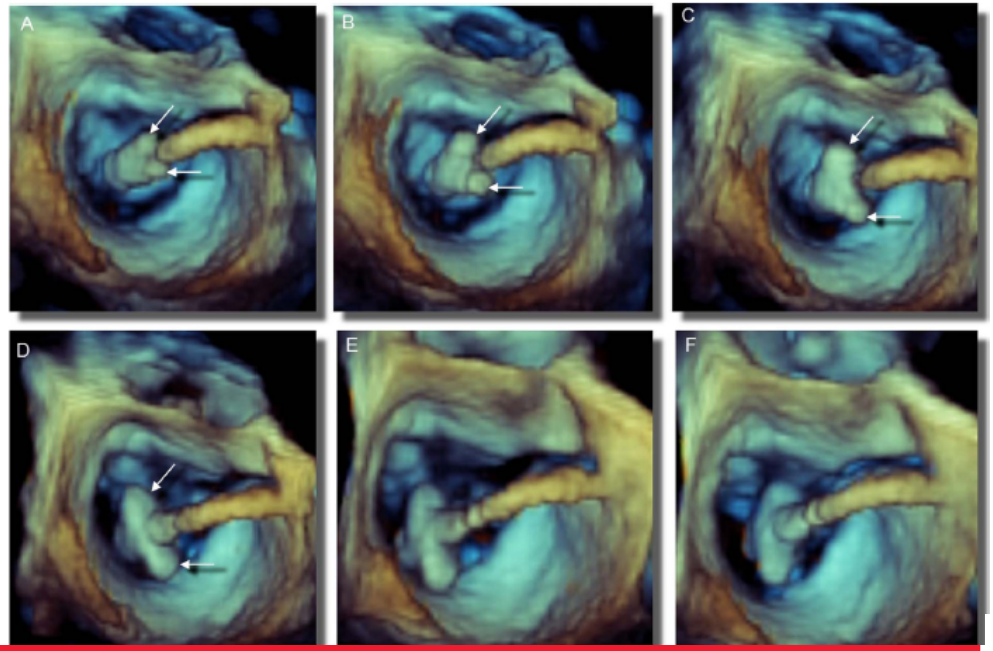


Inserzione clip

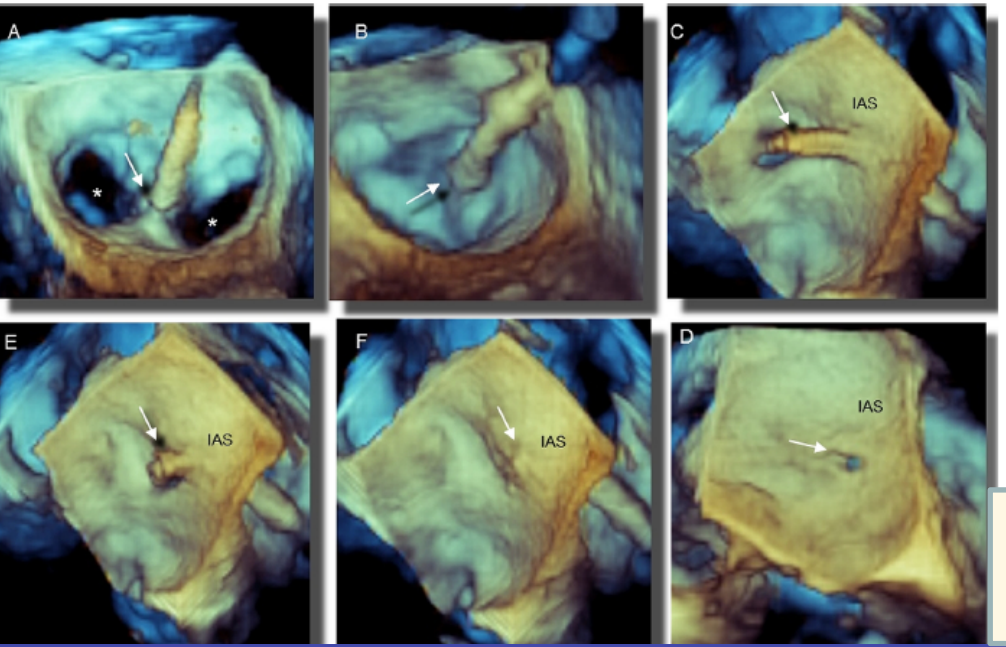


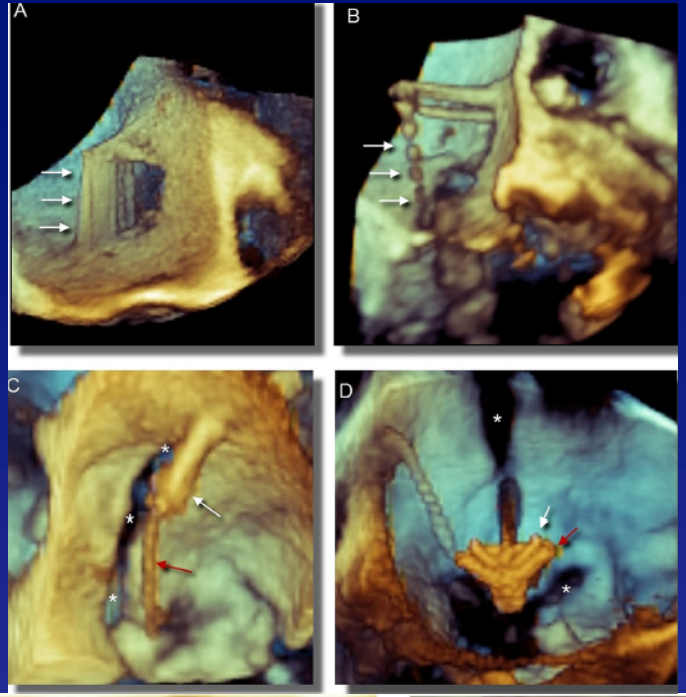
- Durante tutta la procedura indispensabile per definire l'esatto posizionamento della clip

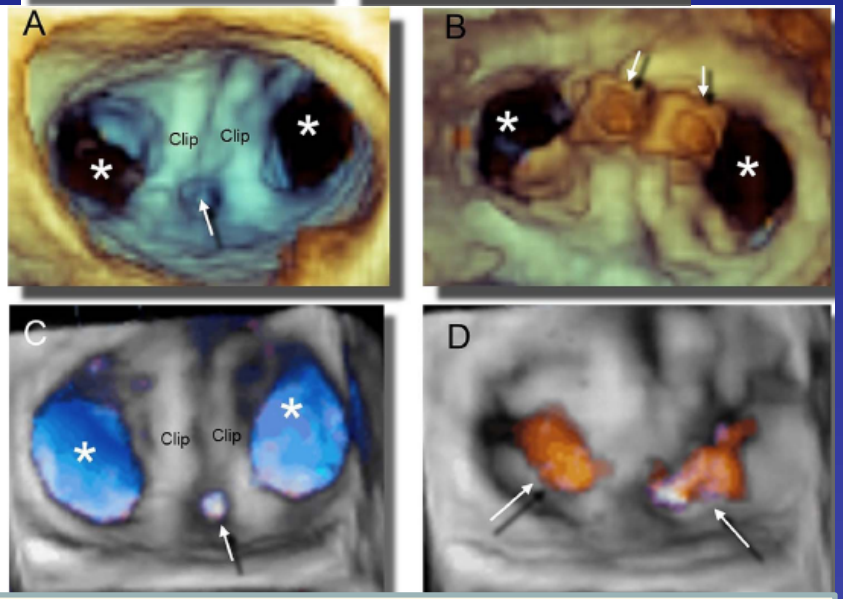
3D INDISPENSABILE



Education in Heart







Faletra Heart 2013

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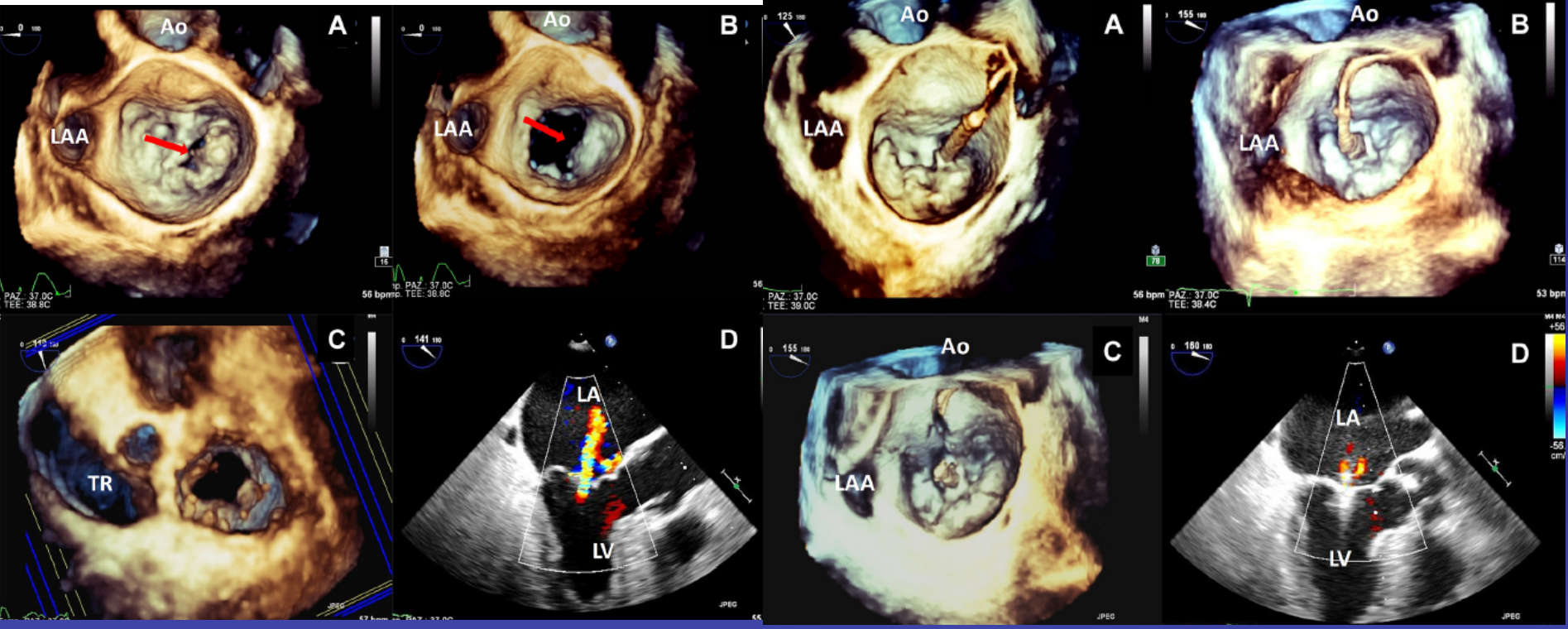
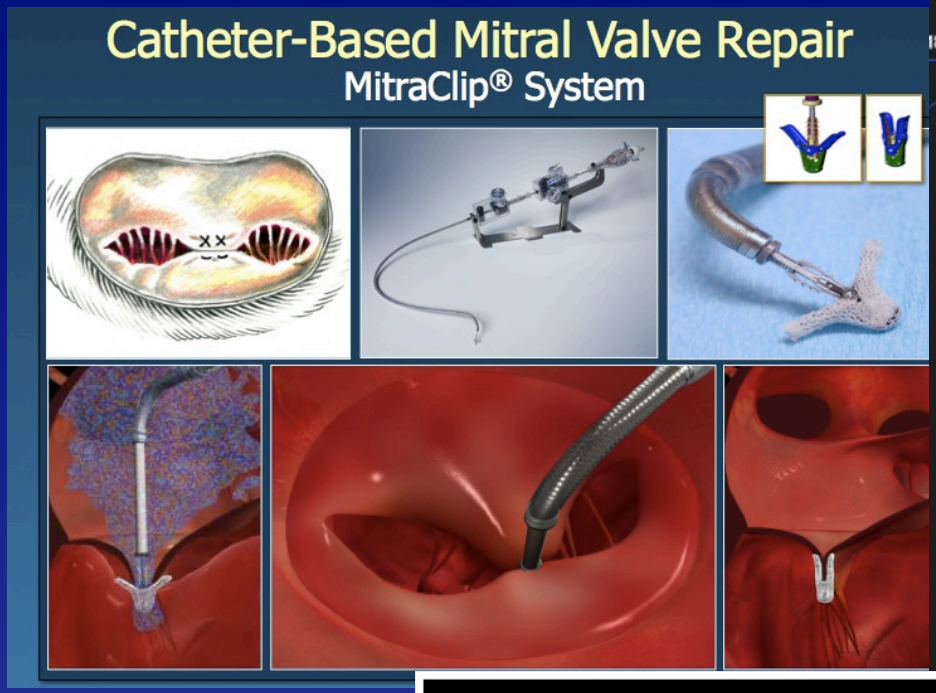
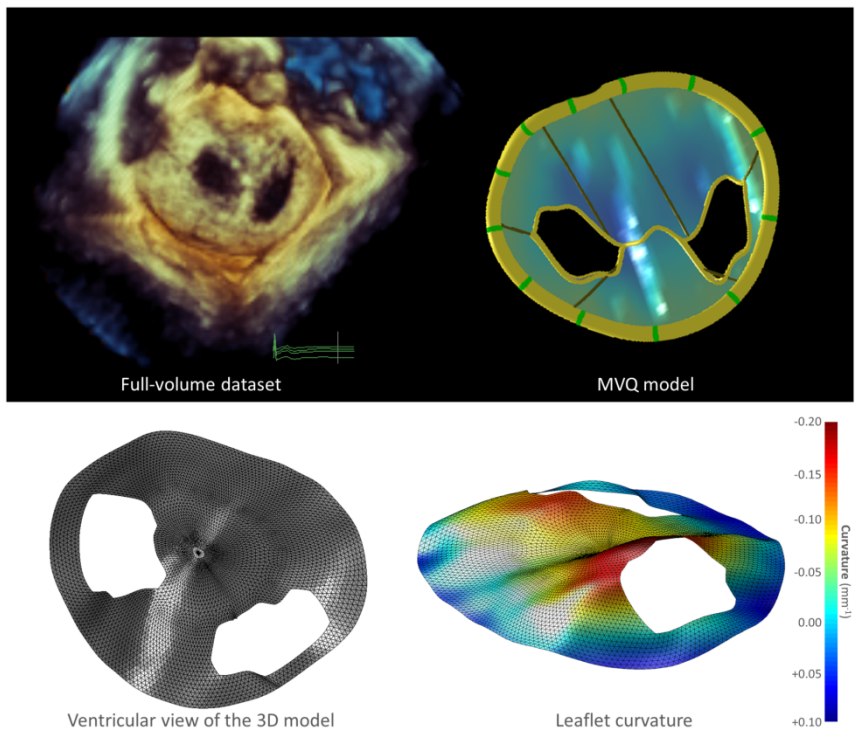
IMAGES IN INTERVENTION

MitraClip Implantation in a Previous Surgical Mitral Valve Edge-to-Edge Repair

Vera E. Bottari, MD,* Gloria Tamborini, MD,* Antonio L. Bartorelli, MD,*† Francesco Alamanni, MD,*† Mauro Pepi, MD*







Novel 3D evaluation and geometric assessment of MitraClip results

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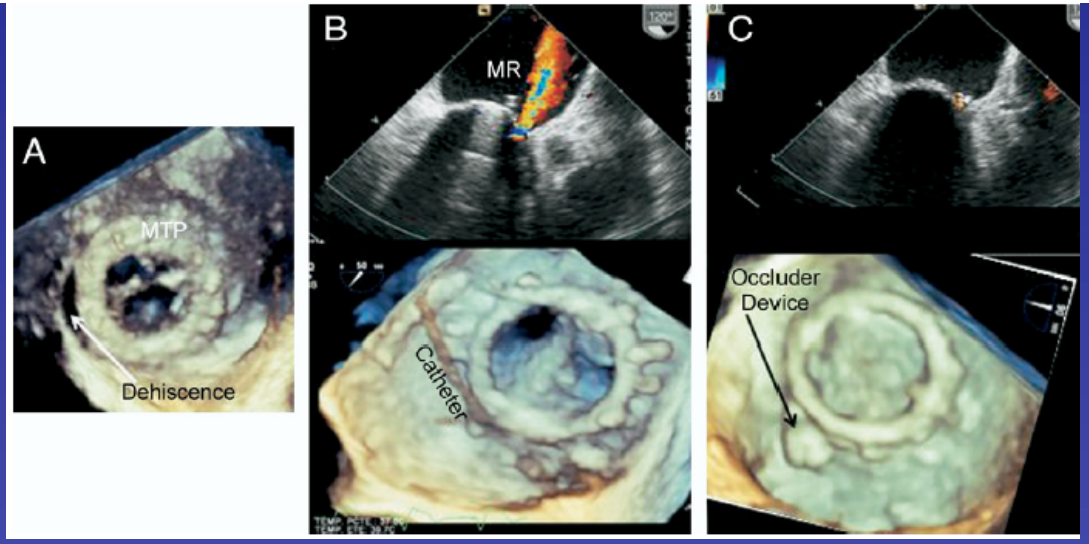
Cardiac Imaging

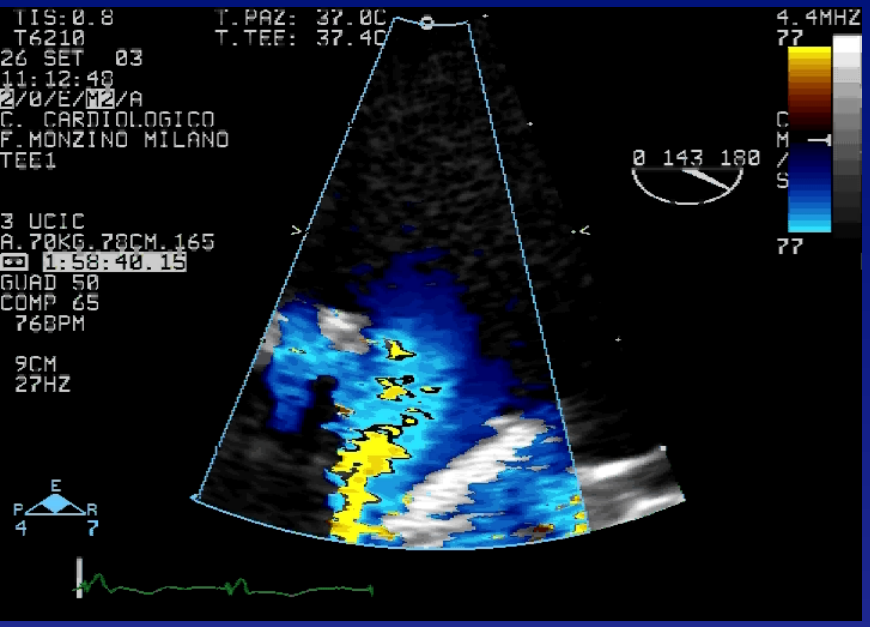
Real-Time 3-Dimensional Transesophageal Echocardiography in the Evaluation of Post-Operative Mitral Annuloplasty Ring and Prosthetic Valve Dehiscence

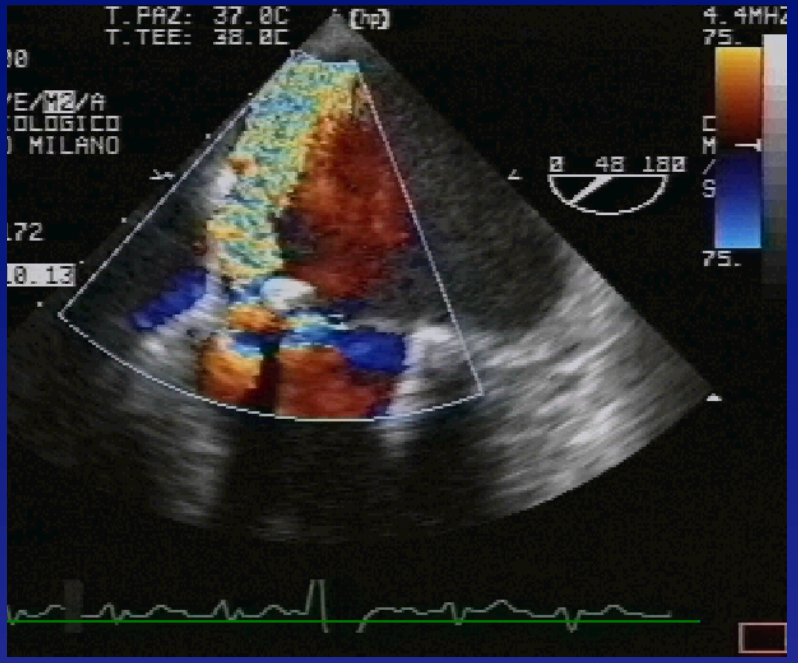
Itzhak Kronzon, MD,* Lissa Sugeng, MD,† Gila Perk, MD,* David Hirsh, MD,*
Lynn Weinert, RDCS,† Miguel Angel Garcia Fernandez, MD,† Roberto M. Lang, MD‡
New York, New York; Chicago, Illinois; and Madrid, Spain

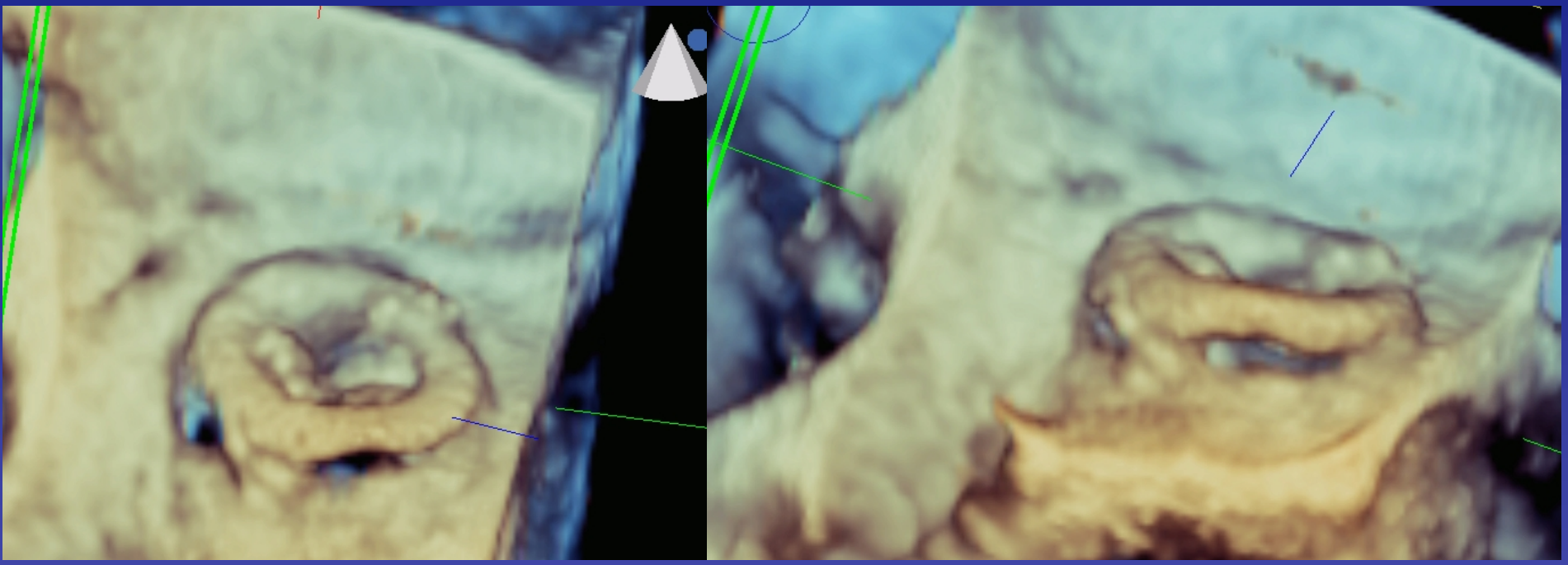
Conclusions In mitral valve dehiscence, RT 3D TEE provides additional information about the exact anatomic characteristics of the dehiscence that can be used to help in planning the most appropriate corrective intervention. (J Am Coll Cardiol 2009;53:1543–7) © 2009 by the American College of Cardiology Foundation



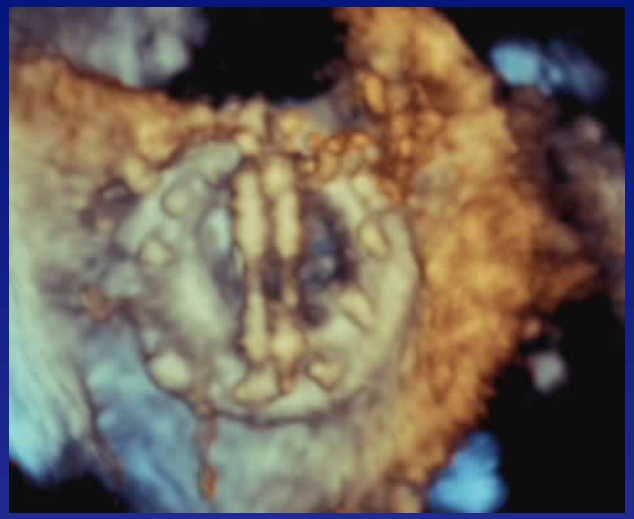
3D INDISPENSABILE


TIS:0.8
T6210
26 SET 03
11:12:48
2/0/E/M2/A
C. CARDIOLOGICO
F.MONZINO MILANO
TEE1
3 UCIC
A.70KG.78CM.165
1:58:40.15
GUAD 50
COMP 65
76BPM
9CM
27HZ
T.PAZ: 37.0C
T.TEE: 37.4C
4.4MHZ
77
77
0 143 180


T.PAZ: 37.0C
T.TEE: 38.0C
4.4MHZ
75.
75.
0 48 180

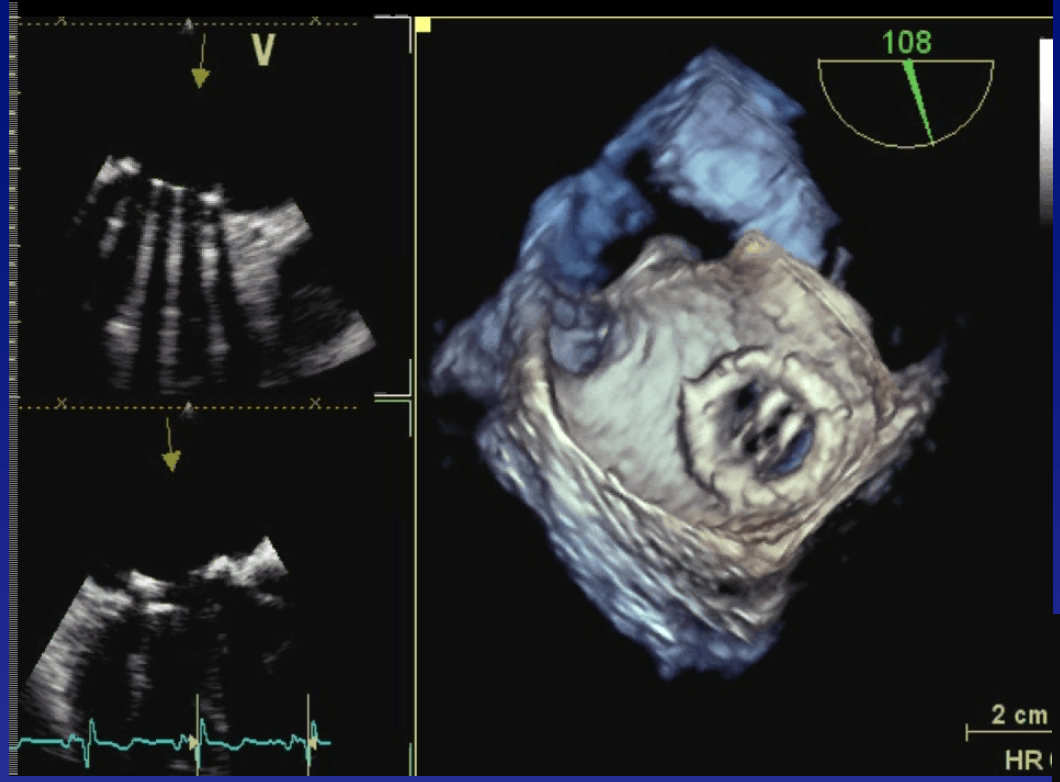


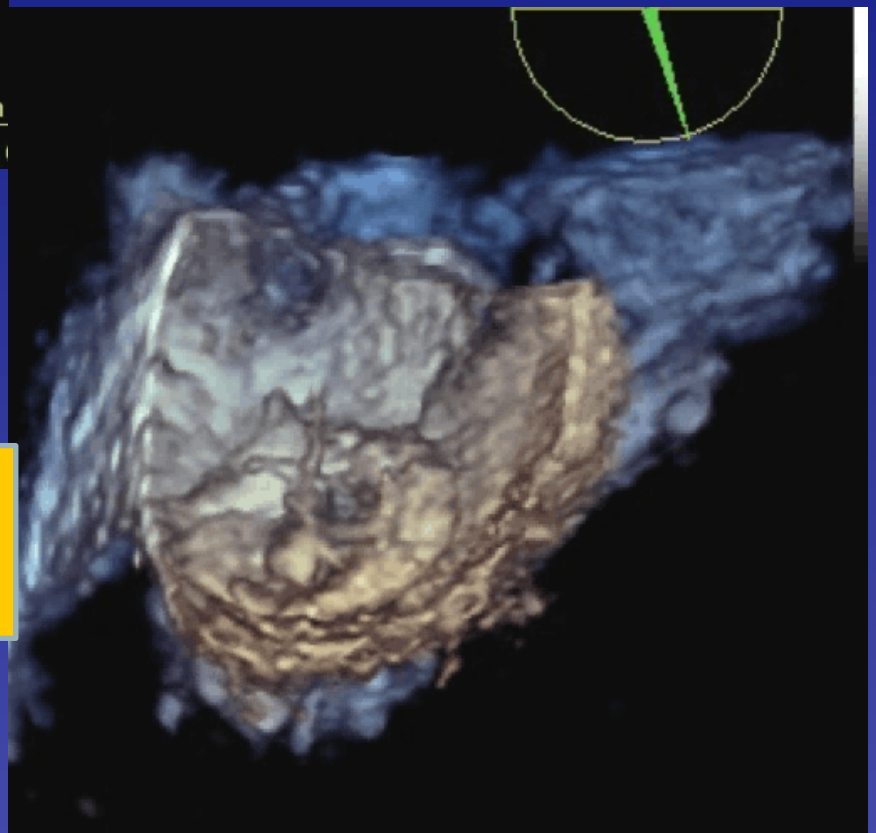
PROSTHETIC VALVE EVALUATION



Prosthetic valves can also be reconstructed and their sitting and function evaluated.

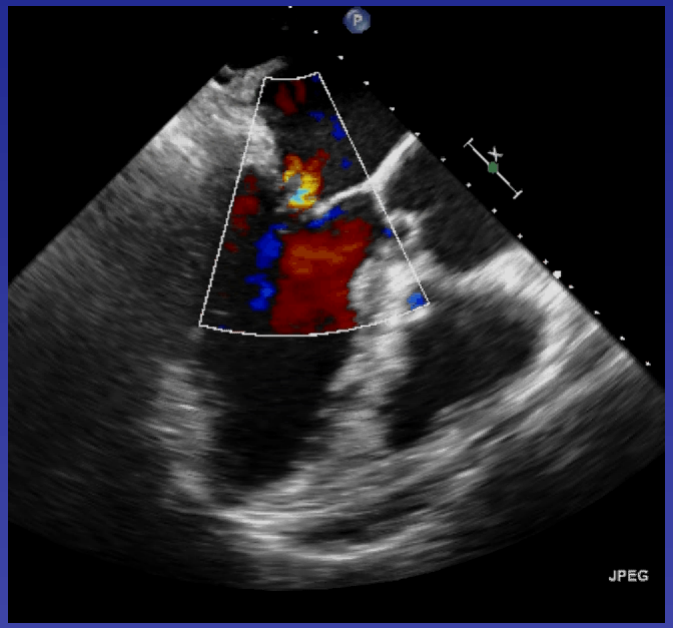
3D UTILE



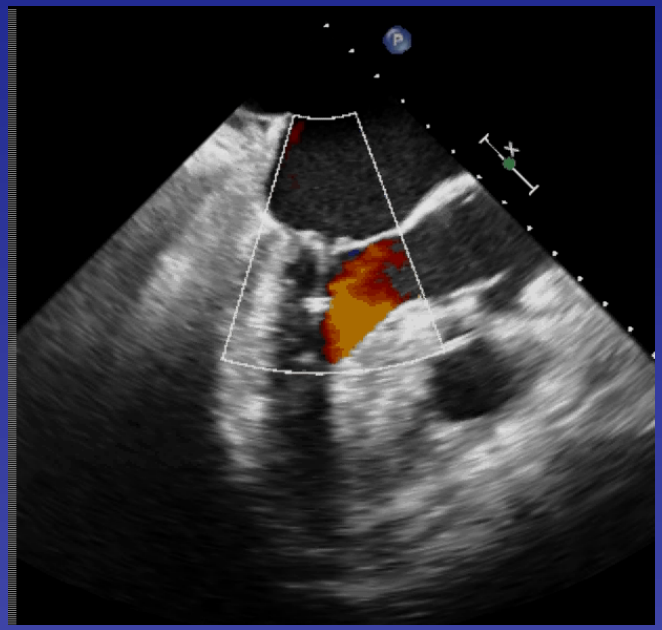


3D INDISPENSABILE

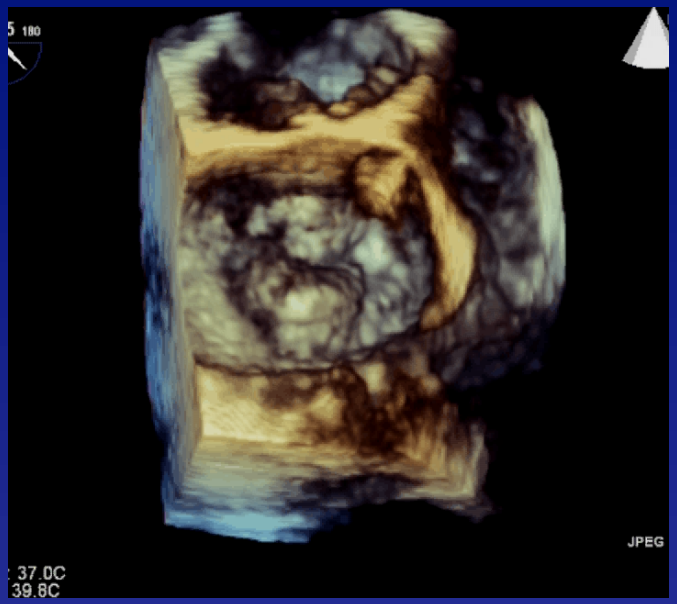
Basale

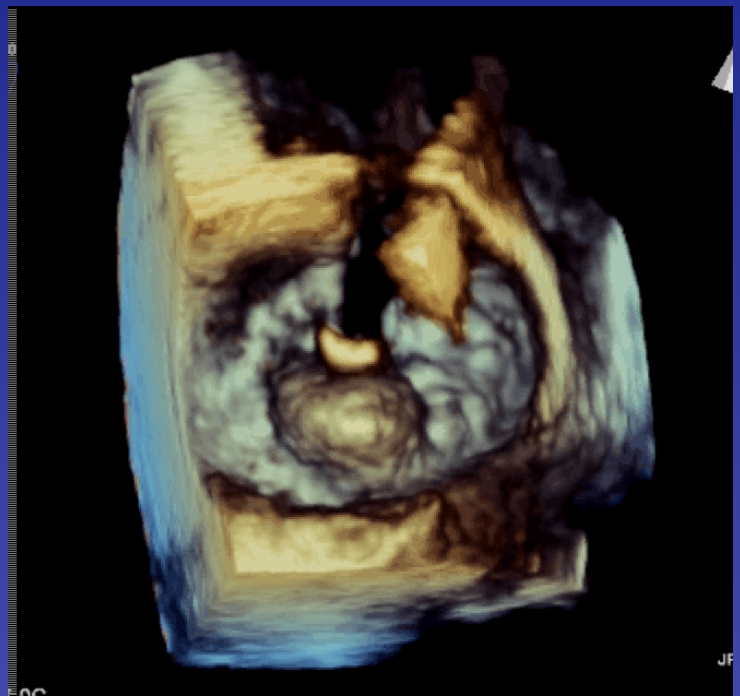


Post.impianto

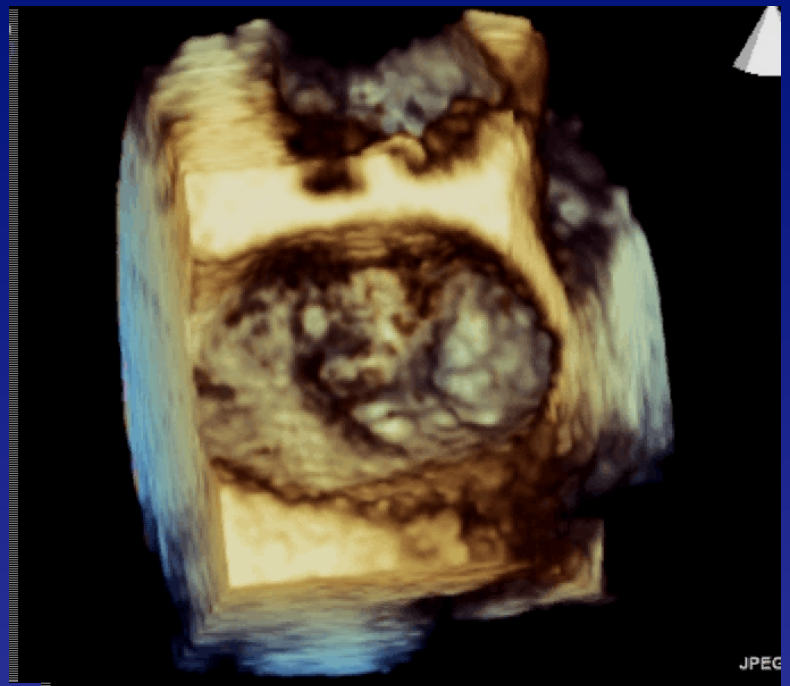


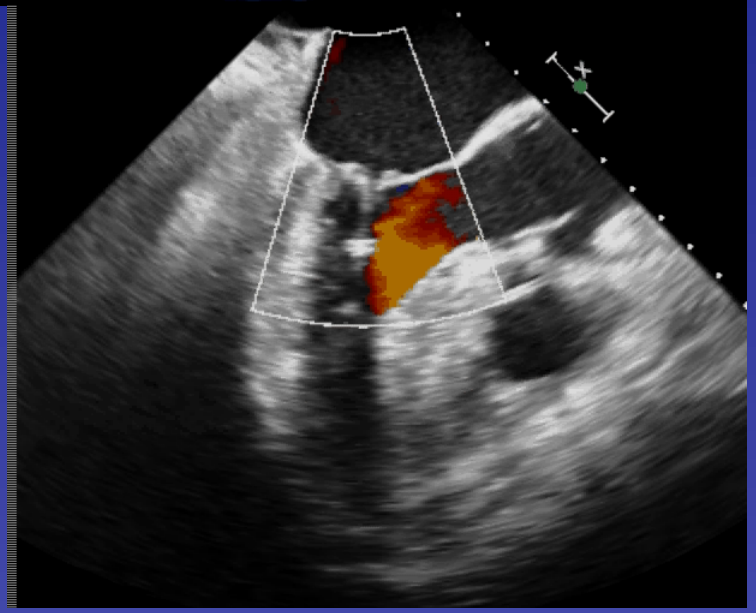
Basale





Post.impianto





SVILUPPO ECOCARDIOGRAFIA
Solo tecnica o “rivoluzione” nelle applicazioni?

Ulteriore miglioramento
Imaging / 3D

→ NUOVE PROCEDURE

Le nuove tecnologie di Imaging
contribuiscono /affiancano
lo sviluppo delle nuove procedure

Ogni Nuova procedura
di fatto si avvale (e cresce) dell’occhio
Indiscreto (non come innocent bystander)
dell’ECO

Il mondo corre verso il 3D

- Stampa 3D Industria : Utile >>> Indispensabile
- Cinema/immagini …. Utile ????
- Tecnologia : Stampa 3D arti per bambini amputati in guerra ….
- Utile !!!!!

Ad ogni scoperta notevole la gente domanda a che serva, e non ha torto; essa, infatti, può misurare il valore di un oggetto solo attraverso la sua utilità.

Johann Wolfgang Goethe, Massime e riflessioni, 1833 (postumo)