

Corso di Ecocardiografia
a numero chiuso

IL PERCORSO CLINICO
DEL PAZIENTE CON PROTESI
VALVOLARE, VALVOLE
ARTIFICIALI PERCUTANEE

MILANO, Atahotel Executive
28 - 29 Ottobre 2010



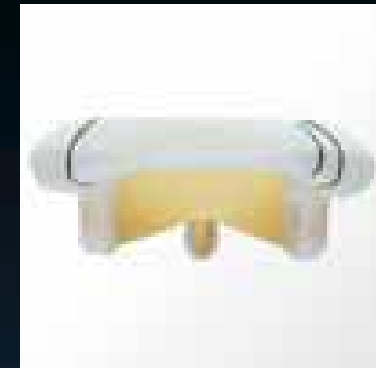
STUDIO DELLE PROTESI CON ECOCARDIOGRAFIA TRANSTORACICA E TRANSESOFAGEA *(la scelta della finestra, i metodi di studio, i tranelli)*

Dr. Manuela Muratori



Protesi valvolari

Modelli protesici



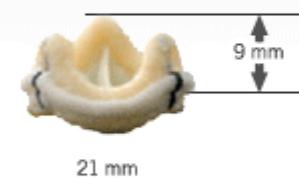
VENTRICULAR PROTRUSION



Mitral Valve - Low Stent Posts & Base

- Reduces risk of LV outflow tract obstruction in the mitral position
- Improves implantability
- Valve holder handle provides the option for stent post deflection
- Reduces potential for suture looping

AORTIC PROTRUSION



Aortic Valve - Low Stent Posts & Base

- Reduces risk of aortic wall protrusion
- Provides optimal ostia clearance in the aortic position
- Enhances primary aortic closure

AORTIC PROTRUSION



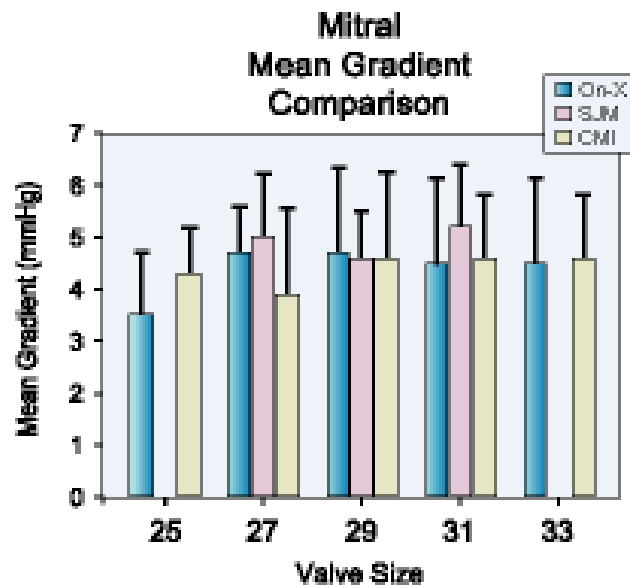
Supra Valve - Low Stent Posts & Base

- Silicone ring shaped to provide anatomical fit
- Cuff is optimized for supraannular implant

Protesi valvolari

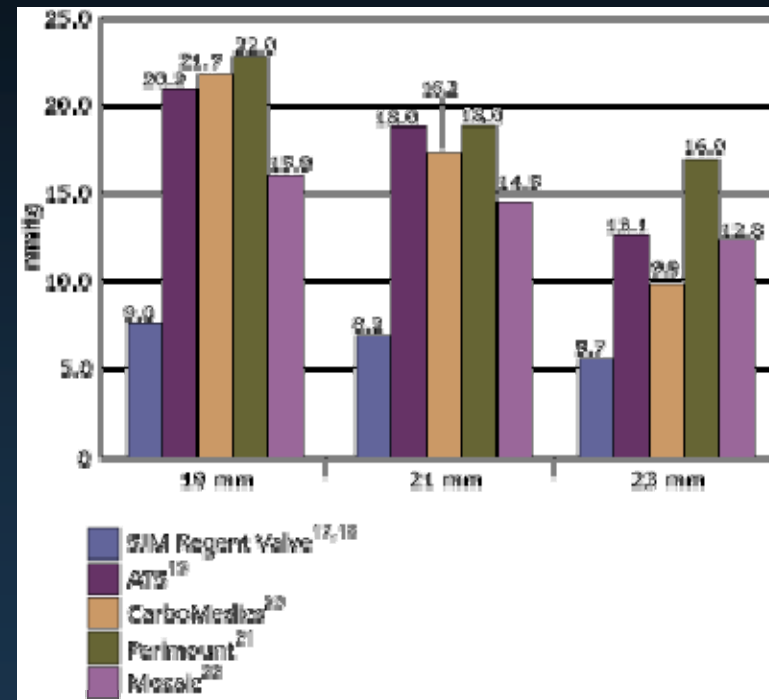
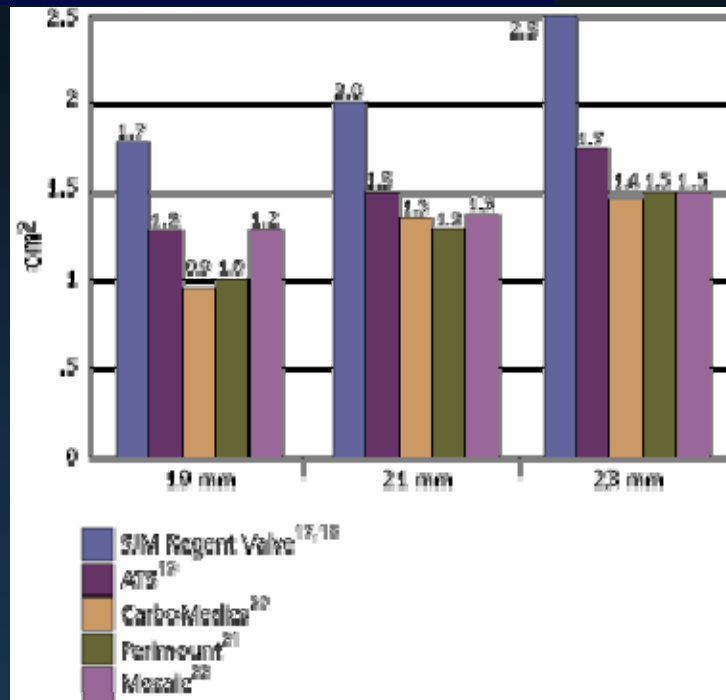
Valutazione ecodoppler protesi mitralica: size vs gradiente medio

Type	Peak velocity (m/s)	Mean gradient (mm Hg)	Area mean (cm)	Area range (cm)
Starr-Edwards	1.8 ± 0.4	4.6 ± 2.4	2.1	1.2-2.5
Bjork-Shiley	1.6 ± 0.3	5.0 ± 2.0	2.4	1.6-3.7
St Jude Medical	1.6 ± 0.3	5.0 ± 2.0	2.9	1.8-4.4
Medtronic-Hall	1.7 ± 0.3	3.1 ± 0.9	2.4	1.5-3.9
OmniScience	1.8 ± 0.3	3.3 ± 0.9	1.9	1.6-3.1
Hancock	1.5 ± 0.3	4.3 ± 2.1	1.7	1.3-2.7
Carpentier-Edwards	1.8 ± 0.2	6.5 ± 2.1	2.5	1.6-3.5
Homograft	1.8 ± 0.4	6.4 ± 3.0	2.2	1.9-2.9



Protesi valvolari

Valutazione ecodoppler protesi aortica: modelli e size vs DP e EOA



Protesi valvolari

Table 2 Essential parameters in the comprehensive evaluation of prosthetic valve function

	Parameter
Clinical information	Date of valve replacement Type and size of the prosthetic valve Height, weight, body surface area Symptoms and related clinical findings
Imaging of the valve	Blood pressure and heart rate Motion of leaflets or occluder Presence of calcification on the leaflets or abnormal echo densities on the various components of the prosthesis Valve sewing ring integrity and motion
Doppler echocardiography of the valve	Contour of the jet velocity signal Peak velocity and gradient Mean pressure gradient VTI of the jet DVI Pressure half-time in MV and TV. EOA* Presence, location, and severity of regurgitation†
Other echocardiographic data	LV and RV size, function, and hypertrophy LA and right atrial size Concomitant valvular disease Estimation of pulmonary artery pressure
Previous postoperative studies, when available	Comparison of above parameters is particularly helpful in suspected prosthetic valvular dysfunction

MV, Mitral valve; TV, tricuspid valve.

*EOA using the continuity equation; needs to be compared with normal Doppler values of the valve type and size.

†Transthoracic Doppler is less sensitive to detection of valvular regurgitation in mitral and tricuspid prostheses; TEE is frequently needed for a more definitive assessment.

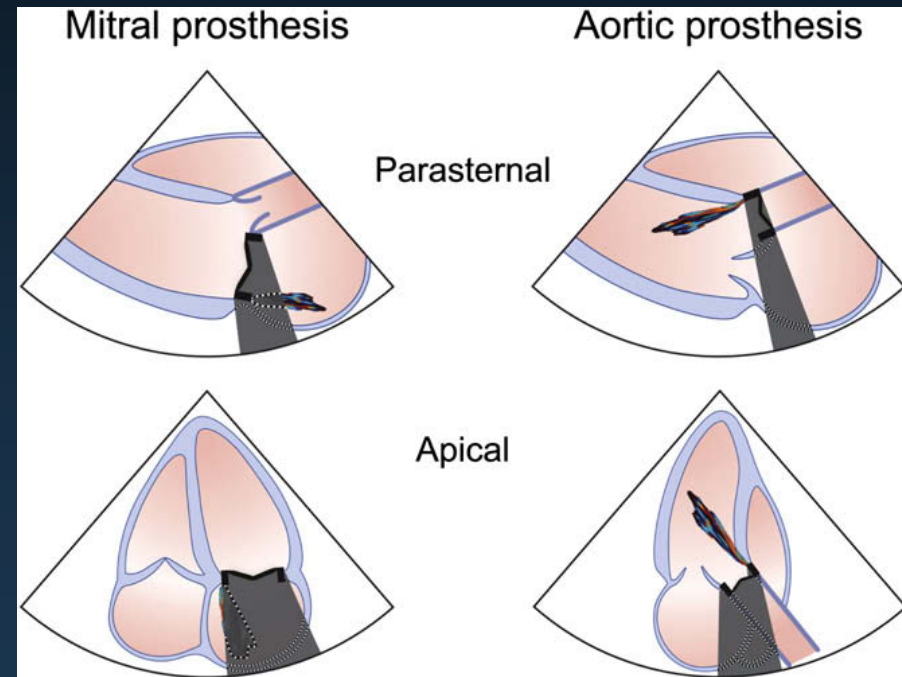
Recommendations for Evaluation of Prosthetic Valves With Echocardiography and Doppler Ultrasound

A Report From the American Society of Echocardiography's Guidelines and Standards Committee and the Task Force on Prosthetic Valves, Developed in Conjunction With the American College of Cardiology Cardiovascular Imaging Committee, Cardiac Imaging Committee of the American Heart Association, the European Association of Echocardiography, a registered branch of the European Society of Cardiology, the Japanese Society of Echocardiography and the Canadian Society of Echocardiography, Endorsed by the American College of Cardiology Foundation, American Heart Association, European Association of Echocardiography, a registered branch of the European Society of Cardiology, the Japanese Society of Echocardiography, and Canadian Society of Echocardiography

Protesi valvolari

Utilizzo dell'ecocardiografia transtoracica

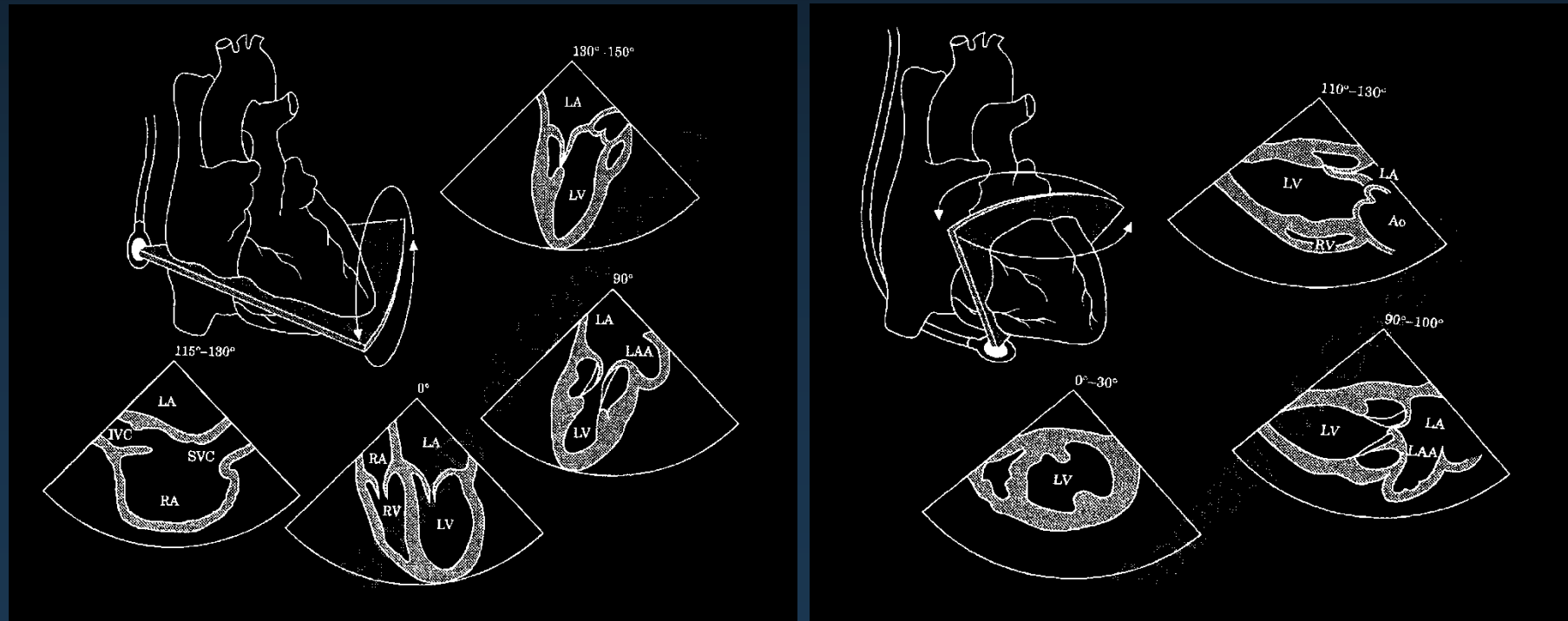
- LA VALUTAZIONE M-B-mode E DOPPLER E' SPESSO IN GRADO DI FORNIRE ADEGUATE INFORMAZIONI CIRCA LA FUNZIONALITA' PROTESICA
- D'ALTRA PARTE L'APPARATO DI SOSTEGNO E GLI ELEMENTI MOBILI POSSONO DARE LUOGO A FENOMENI DI RIVERBERO, ARTEFATTI, MASCHERAMENTO DI FLUSSO E PERTANTO PUO' DETERMINARE
- DIFFICOLTA' NELLA VISUALIZZAZIONE DI VEGETAZIONI, TROMBOSI O PANNO, E NELL' IDENTIFICARE E QUANTIFICARE RIGURGITI INTRA O PARA-PROTESICI



Protesi valvolari

Esame TE nella valutazione: delle protesi mitraliche

- LA POSIZIONE DEL TRASDUTTORE IN ESOFAGO CONSENTE DI EVITARE FENOMENI DI MASCHERAMENTO E I RIVERBERI SUL VERSANTE ATRIALE DELLA PROTESI MITRALICA E TRICUSPIDALE, RISOLVENDO I LIMITI DELL'APPROCCIO TRANSTORACICO
- PROIEZIONI DALL'ESOFAGO MEDIO -BASSO DALLA SEZIONE 4-CAMERE ALLA 2 CAMERE ATTRAVERSO PIANI INTERMEDI



Protesi valvolari

Esame TE nella valutazione delle protesi aortiche

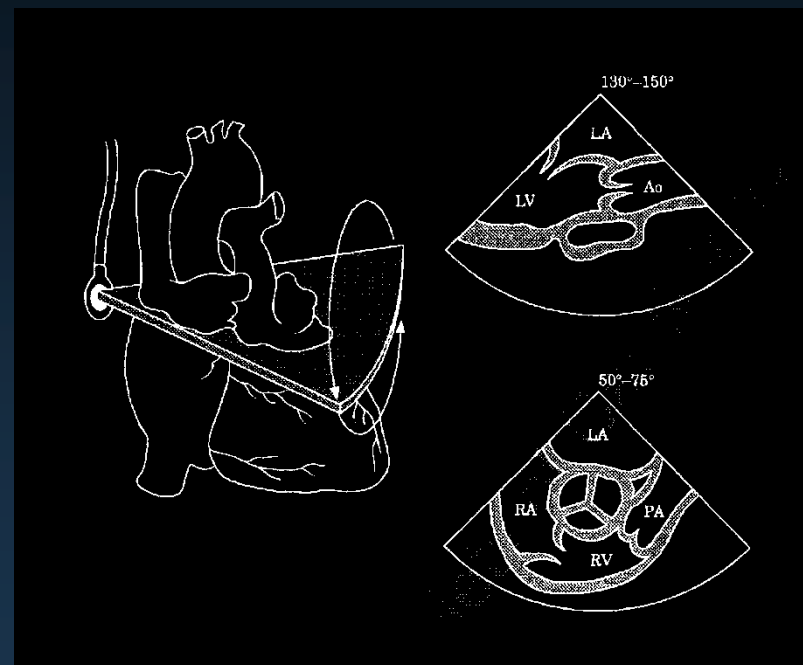
- IL VANTAGGIO DELLA TEE NELLO STUDIO DELLE PROTESI AORTICHE NON E' COSI' EVIDENTE COME PER LE PROTESI MITRALICHE

- **LIMITI**

- *DIFFICOLTA' NELLA VALUTAZIONE DELL'ANELLO, SOPRATTUTTO IN PRESENZA DI PROTESI MITRALICA PER FENOMENI DI MASCHERAMENTO*

- *SCARSA VISUALIZZAZIONE DELL'ELEMENTO MOBILE PER DIFFICILE ALLINEAMENTO DEL FASCIO ULTRASONORO*

- *IL RIGURGITO PROTESICO AORTICO NON E' SEMPRE FACILMENTE VISUALIZZABILE PER MASCHERAMENTO DEL TRATTO DI EFFLUSSO*



Protesi valvolari

La disfunzione protesica

- **OSTRUZIONE**
 - *TROMBOSI*
 - *PANNO*
- **ENDOCARDITE** (*meccaniche, biologiche*)
- **DISTACCO** (*meccaniche, biologiche*)
- **DEGENERAZIONE** (*biologiche*)

Protesi valvolari

La trombosi valvolare protesica

- LA TROMBOGENICITA' DELLE PROTESI VALVOLARI RIMANE UN PROBLEMA COMUNE STIMATO TRA 0,1-4 % ANNUO
- LA TROMBOSI NELLE PROTESI BIOLOGICHE E' UN FENOMENO RARO, CHE SI VERIFICA COMUNEMENTE NEL PERIODO POST-OPERATORIO PRECOCE QUANDO L'ENDOTELIZZAZIONE DELLA ZONA DELLA SUTURA NON E' ANCORA COMPLETO.

Protesi valvolari

La trombosi valvolare protesica

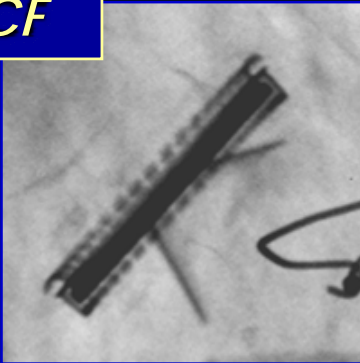
■ MANIFESTAZIONI CLINICHE

- *EMBOLIZZAZIONE SISTEMICA*
- *OSTRUZIONE : quadro clinico variabile da modesta astenia e dispnea a shock cardiogeno e/o edema polmonare acuto*
- *ANEMIA EMOLITICA*

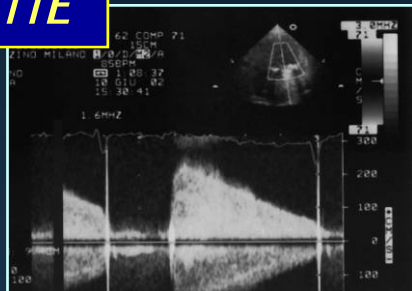
Protesi valvolari

Trombosi protesica: diagnosi

CF



TTE



TEE

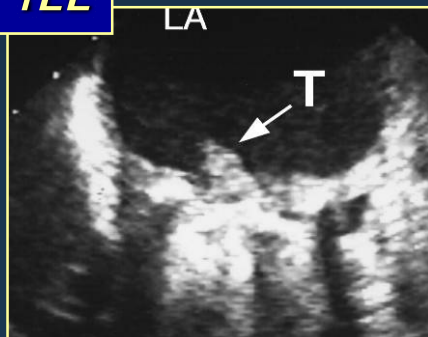


Table 1 Echocardiographic signs of obstructive prosthetic valve thrombosis

- ▶ Reduced valve mobility
- ▶ Presence of thrombus
- ▶ Abnormal transprosthetic flow
- ▶ Central prosthetic regurgitation
- ▶ Elevated transprosthetic gradients
- ▶ Reduced effective prosthetic area

Heart 2007;93:137-142

Protesi valvolari

Trombosi protesica: diagnosi

Recommendations for Evaluation of Prosthetic Valves With Echocardiography and Doppler Ultrasound

Table 7 Echocardiographic and Doppler parameters in evaluation of prosthetic mitral valve function (stenosis or regurgitation)

Doppler echocardiography of the valve	Peak early velocity
	Mean gradient
	Heart rate at the time of Doppler
	Pressure half-time
	DVI*: VTI_{PrMV}/VTI_{LVO}
	EOA*
	Presence, location, and severity of regurgitation†
Other pertinent echocardiographic and Doppler parameters	LV size and function
	LA size‡
	RV size and function
	Estimation of pulmonary artery pressure

PrMV, Prosthetic mitral valve.

*These indices are used when further information is needed about valve function. EOA is calculated using the continuity equation.

†Often needs transesophageal echocardiographic evaluation because of acoustic shadowing.

‡May be difficult in the presence of shadowing or reverberation from the valve.

Table 8 Doppler parameters of prosthetic mitral valve function

	Normal*	Possible stenosis‡	Suggests significant stenosis* ‡
Peak velocity (m/s)† §	<1.9	1.9-2.5	≥2.5
Mean gradient (mm Hg)† §	≤5	6-10	>10
VTI_{PrMV}/VTI_{LVO} † §	<2.2	2.2-2.5	>2.5
EOA (cm ²)	≥2.0	1-2	<1
PHT (ms)	<130	130-200	>200

PHT, Pressure half-time; *PrMV*, prosthetic mitral valve.

*Best specificity for normality or abnormality is seen if the majority of the parameters listed are normal or abnormal, respectively.

†Slightly higher cutoff values than shown may be seen in some bioprosthetic valves.

‡Values of the parameters should prompt a closer evaluation of valve function and/or other considerations such as increased flow, increased heart rate, or PPM.

§These parameters are also abnormal in the presence of significant prosthetic MR.

Protesi valvolari

Role of Cine-Fluoroscopy, Transthoracic, and Transesophageal Echocardiography in Patients With Suspected Prosthetic Heart Valve Thrombosis

Piero Montorsi, MD, Francesca De Bernardi, MD, Manuela Muratori, MD,
Dario Cavoretto, MD, and Mauro Pepi, MD

TEE was actually required in 15% of the cases. Thus, CF and TTE are quick, effective, and complementary diagnostic tools to diagnose PVT in most patients. TEE still remains the gold standard technique in selected cases.

formofunzionamento protesico

(Am J Cardiol 2000;85:58-64)

Prosthetic Mitral Valve Thrombosis: Can Fluoroscopy Predict the Efficacy of Thrombolytic Treatment?

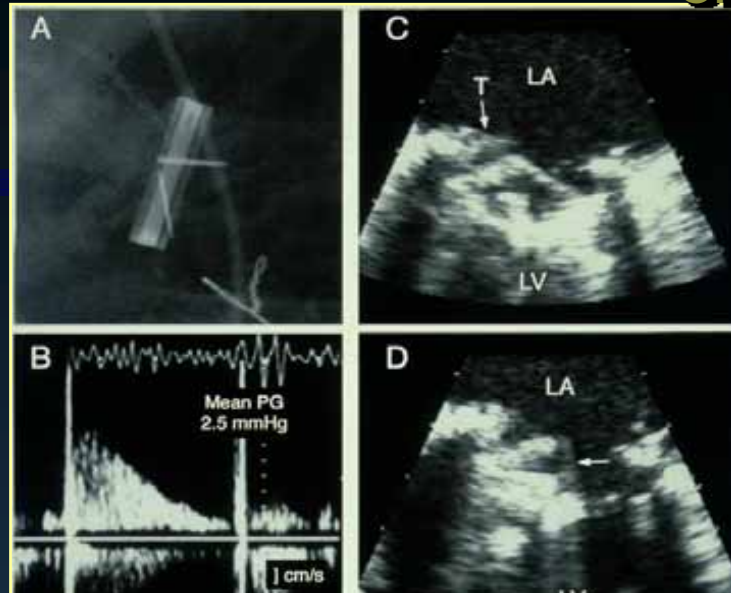
Piero Montorsi, Dario Cavoretto, Marina Alimento, Manuela Muratori and Mauro Pepi

Circulation 2003;108:II-79-II-84

Conclusions—F can predict result of T in mitral PVT. PVT with F evidence of hypomobile leaflet always recovers regardless of symptom duration and extent of disc motion reduction, suggesting that the small amount of thrombus needed to interfere with disc motion in bileaflet prostheses remains sensitive to T even after a long time. PVT with F evidence of blocked leaflet has a favorable response to T only in case of early PVT. Late PVT with blocked leaflet does not respond to T, suggesting a larger and stratified thrombus and the coexistence of pannus and, in our series, always required surgery. However, if a hypomobile leaflet coexists, T may be used to restore normal movement of hypomobile leaflet so that to improve patient clinical and hemodynamic condition before operation. (*Circulation*. 2003;108[suppl II]:II-79-II-84.)

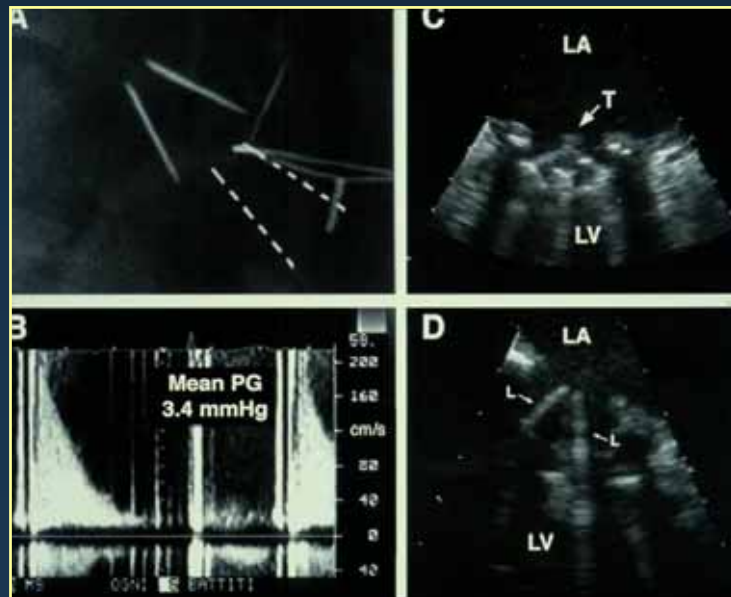
Protesi valvolari

CF/TTE/ETE nella trombosi di protesi mitralica



Carbomedics Mitral Prosthesis

- CF +
- Doppler: Normal DP
- TEE: thrombus +

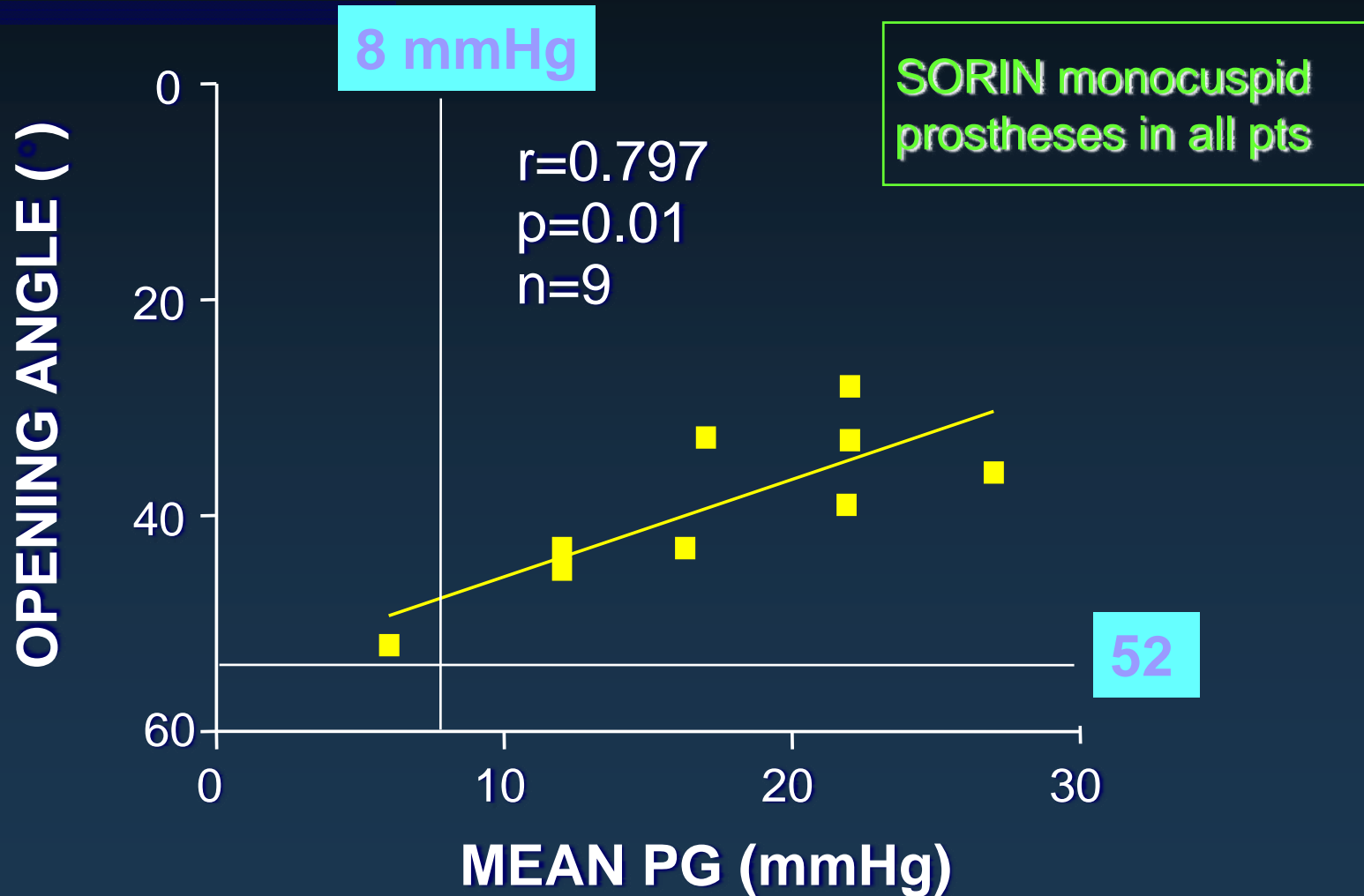


St Jude Mitral Prosthesis

- CF slightly +
- Doppler: Normal
- TEE: small thrombus

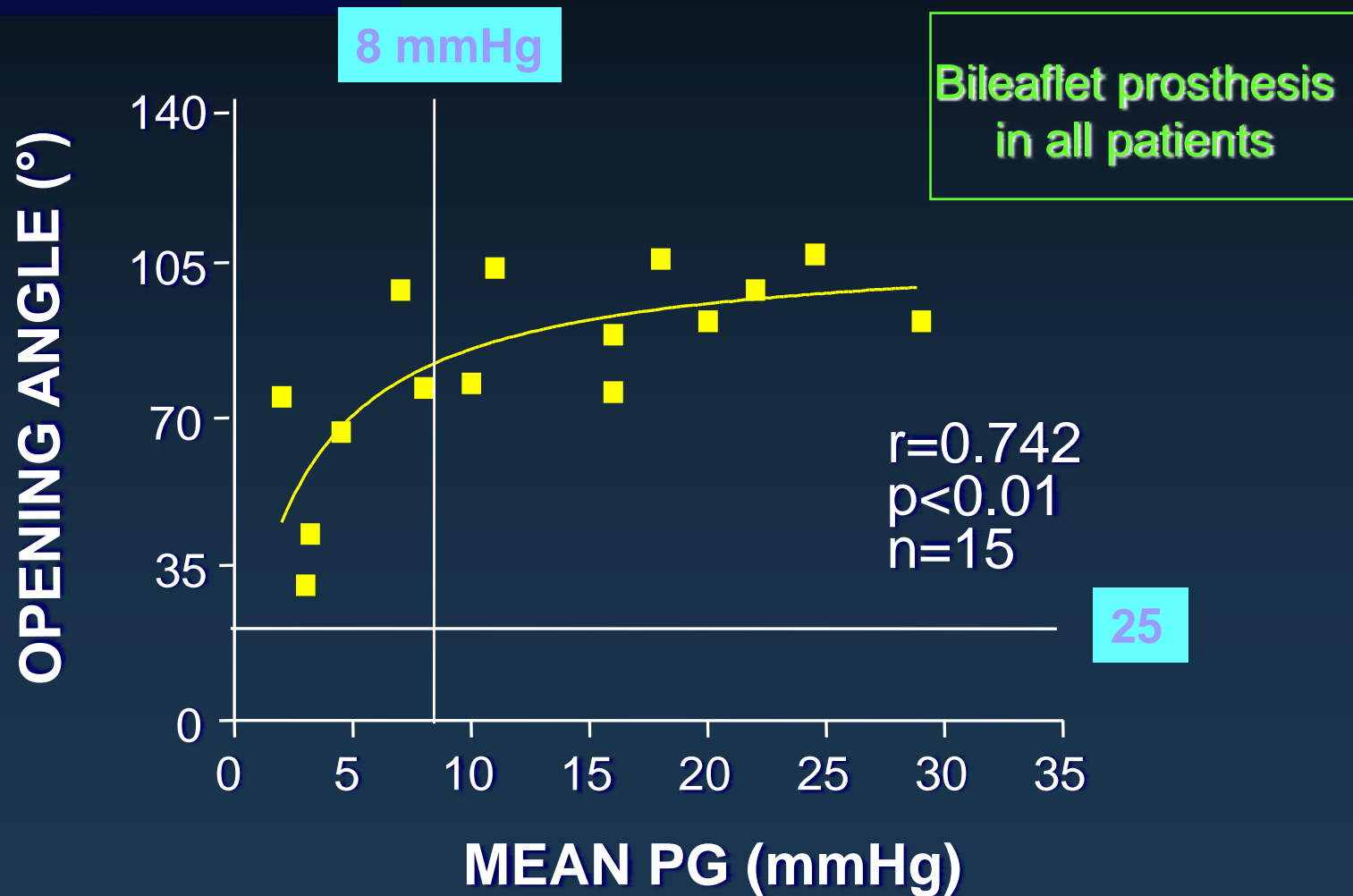
PROSTHETIC MITRAL VALVE THROMBOSIS

EFFECT OF PROSTHESIS TYPE ON DOPPLER GRADIENT



PROSTHETIC MITRAL VALVE THROMBOSIS

EFFECT OF PROSTHESIS TYPE ON DOPPLER PRESSURE GRADIENT



Feasibility and Diagnostic Accuracy of Quantitative Assessment of Mechanical Prostheses Leaflet Motion by Transthoracic and Transesophageal Echocardiography in Suspected Prosthetic Valve Dysfunction

Manuela Muratori, MD*, Piero Montorsi, MD, Giovanni Teruzzi, MD, Fabrizio Celeste, MD, Elisabetta Doria, MD, Francesco Alamanni, MD, and Mauro Pepi, MD

TEE were rarely able to identify closing angles. In conclusion, quantitative evaluation of mitral leaflet(s) motion may be accurately achieved with TTE and TEE, leading to increased diagnostic efficacy of prosthetic valve dysfunction. In the aortic position, TTE and TEE allow a quantitative evaluation of leaflet(s) dynamics only in a minority of patients and cinefluoroscopy still remains the first-choice technique. © 2006 Elsevier Inc. All rights reserved. (Am J Cardiol 2006;97:94–100)

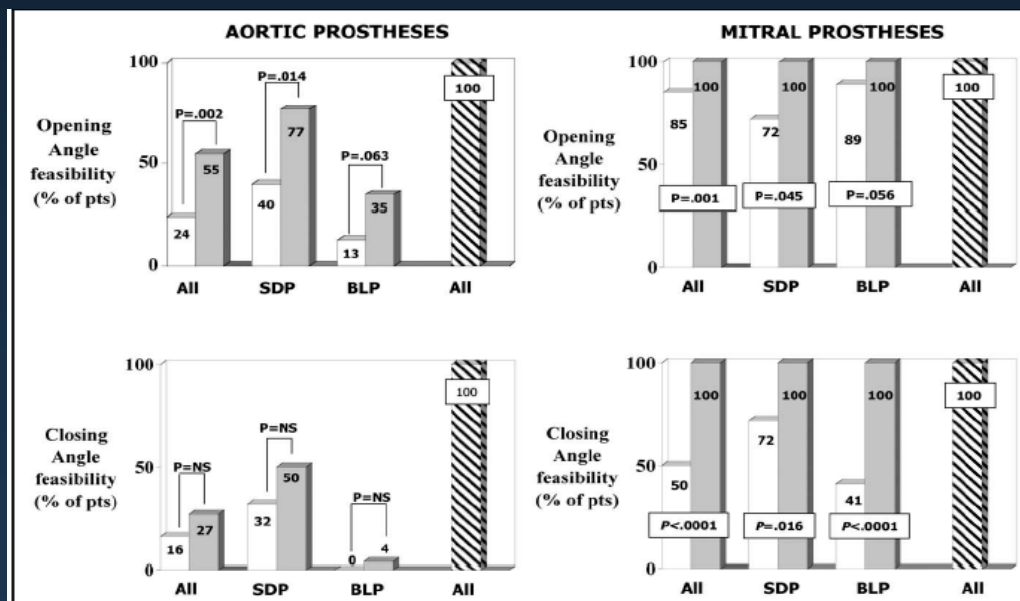


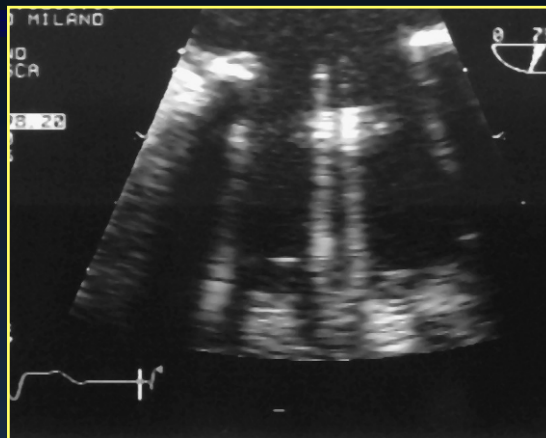
Figure 3. Feasibility of opening angle and closing angle measurements of TTE (white bars), TEE (gray bars), and cinefluoroscopy (dashed gray bars) in aortic and mitral prostheses. BLP = bileaflet prosthesis; SDP = single-disk prosthesis.

OA e CA in Mitral Bileaflet Prostheses

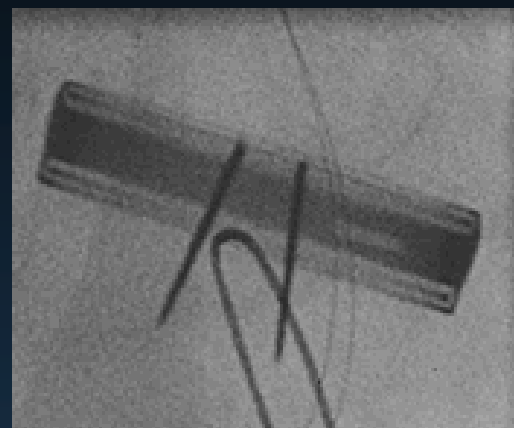
TTE: OA°



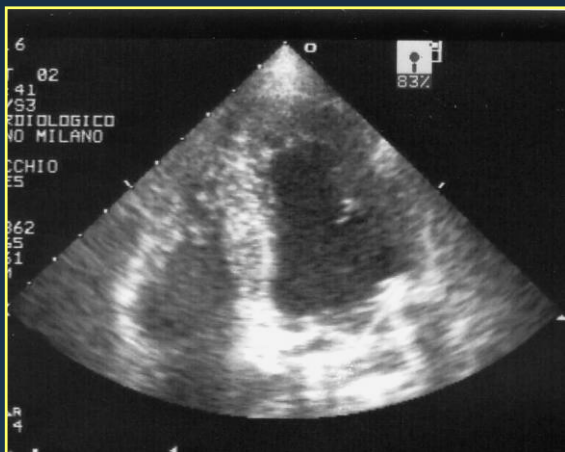
TEE: OA°



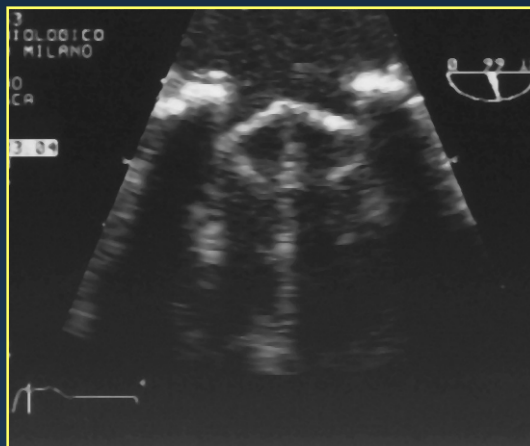
CF: OA°



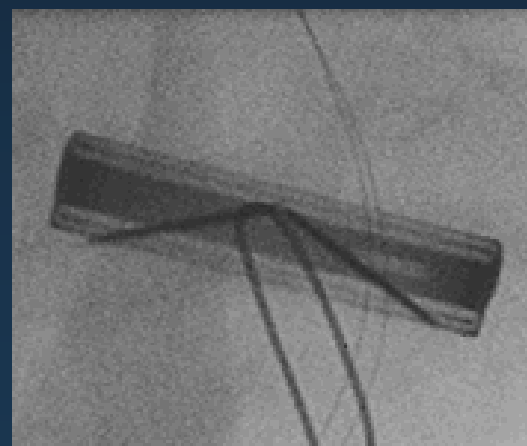
TTE: CA°



TEE: CA°



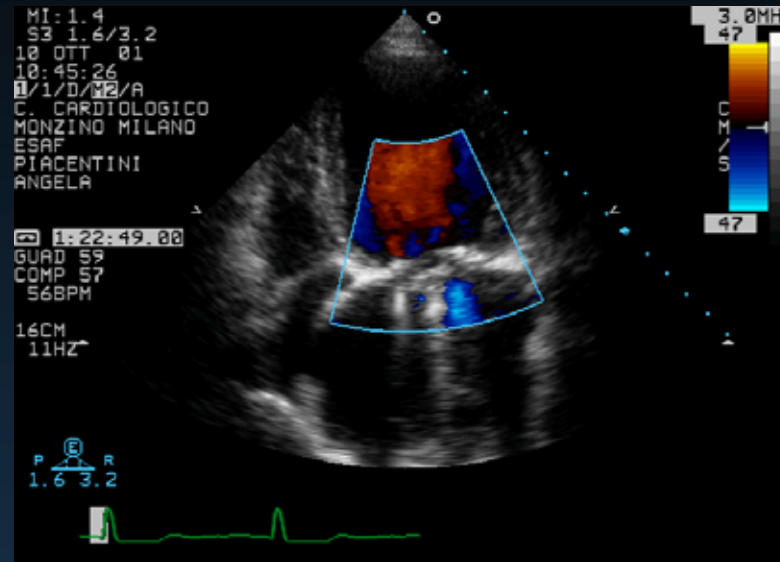
CF: CA°



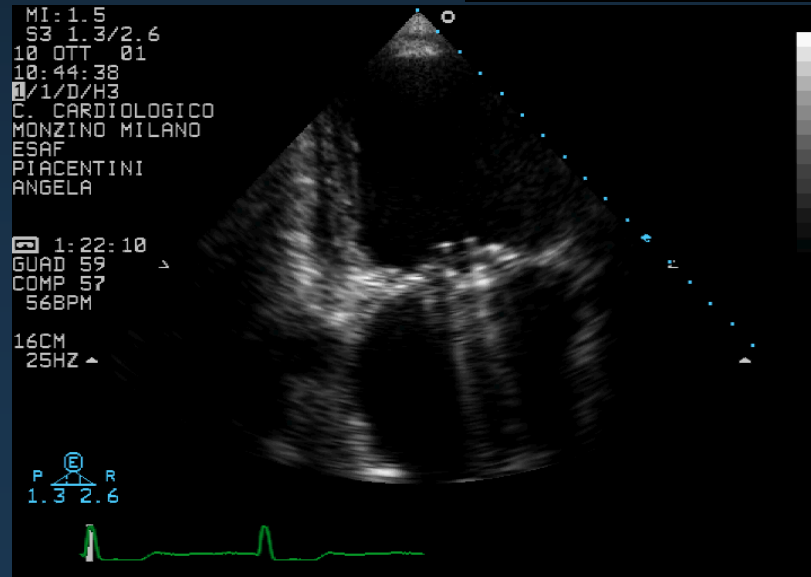
Protesi valvolari

Normofunzionamento protesi MITRALICA BIDISCO

TTE



TTE



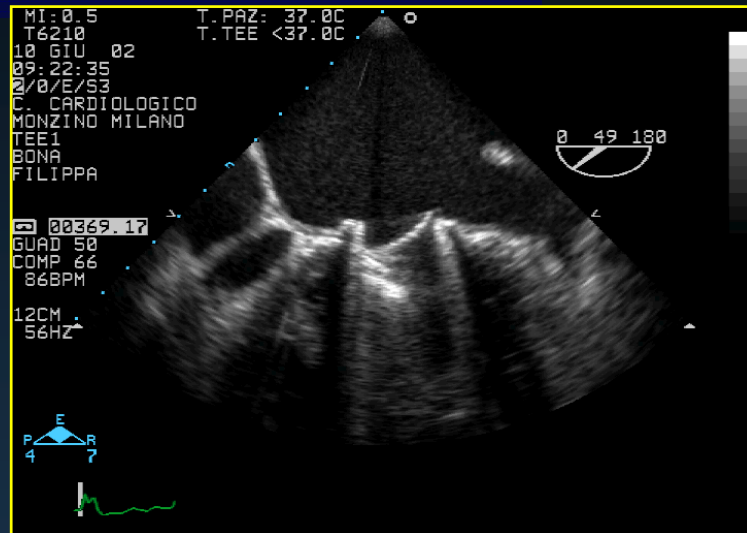
TEE



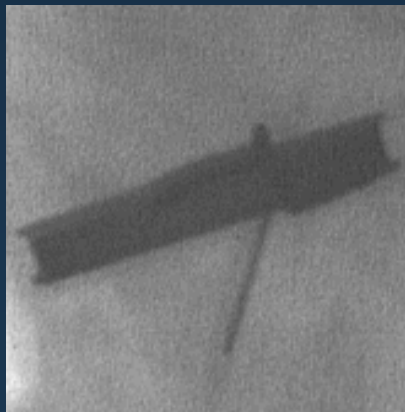
Protesi valvolari

Normofunzionamento protesi MITRALICA MONODISCO

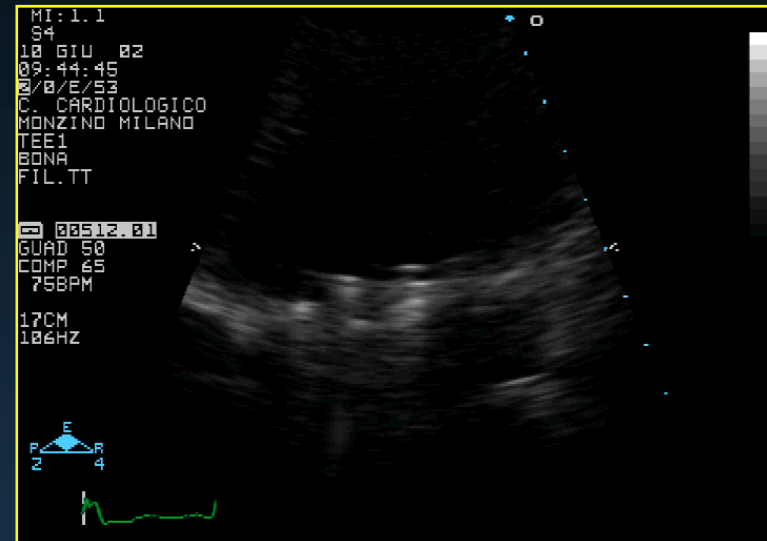
TEE



CF: OA°



TTE

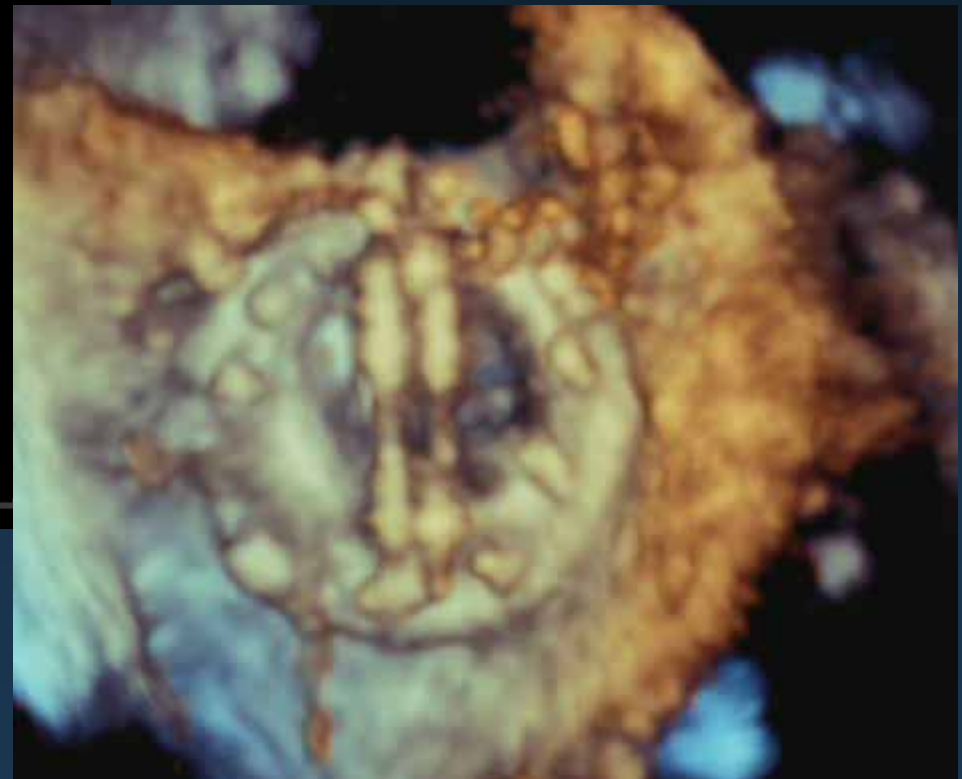


CF: CA°



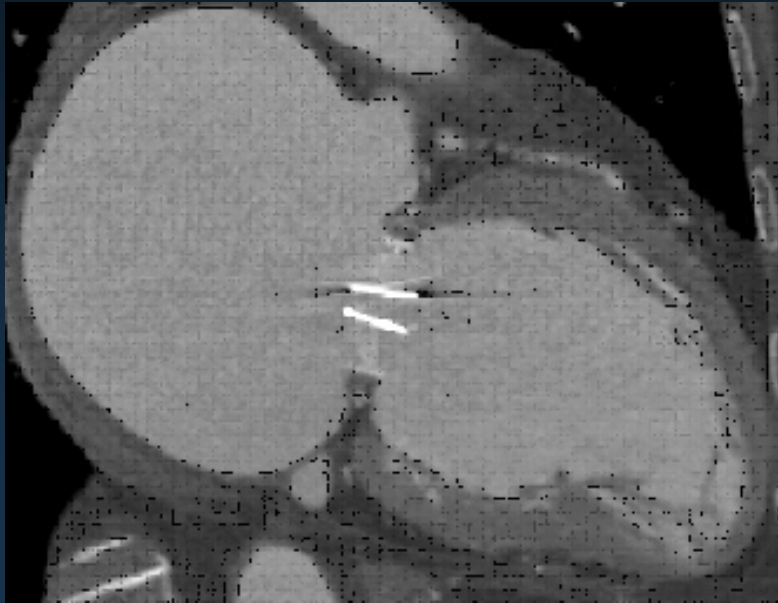
Protesi valvolari

ECO 3 DIMENSIONALE: PROTESI MITRALICA BIDISCO

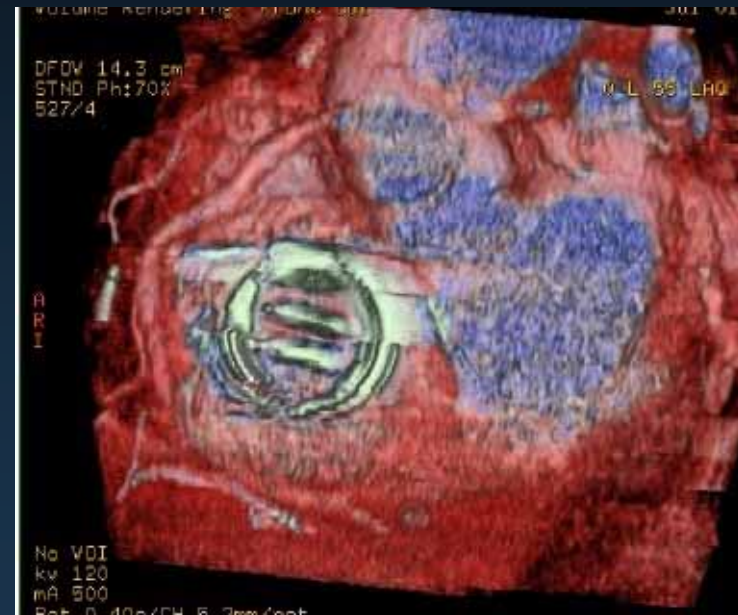


Protesi valvolari

TAC: PROTESI MITRALICE E TRICUSPIDALICA



Protesi mitralica



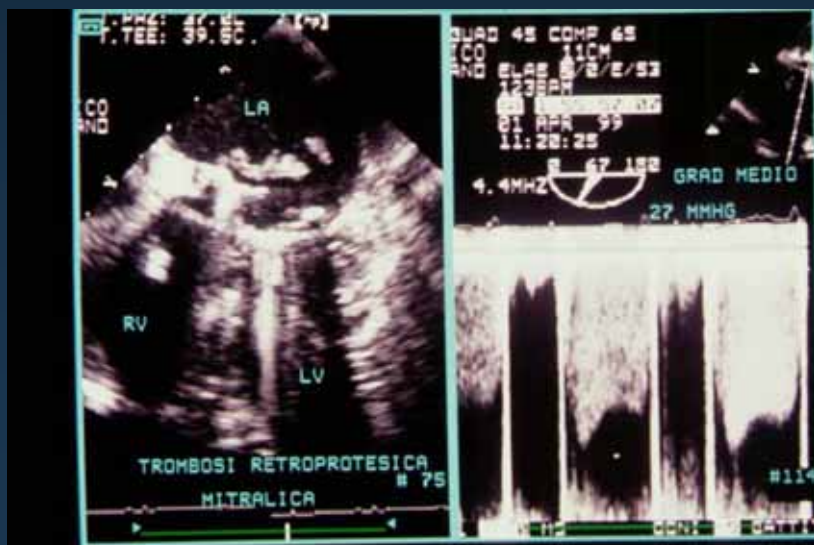
Protesi tricuspidalica

Protesi valvolari

ETE nella trombosi di protesi mitralica



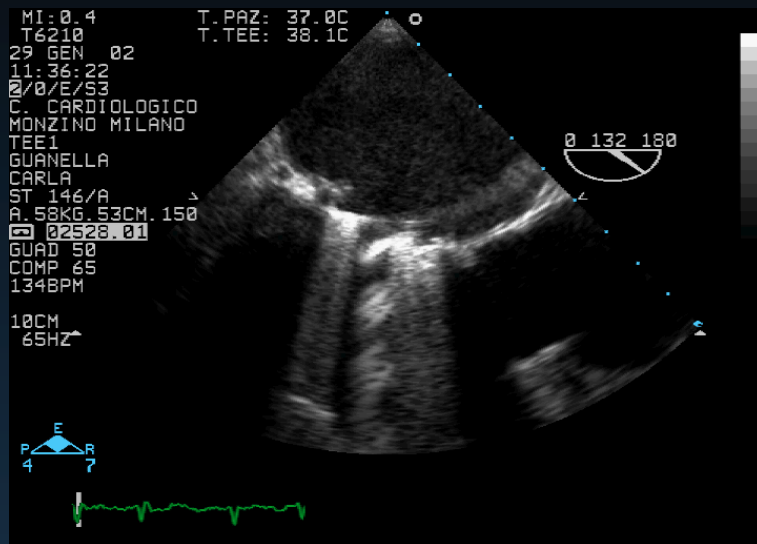
TROMBOSI INTRAPROTESICA
MITRALICA



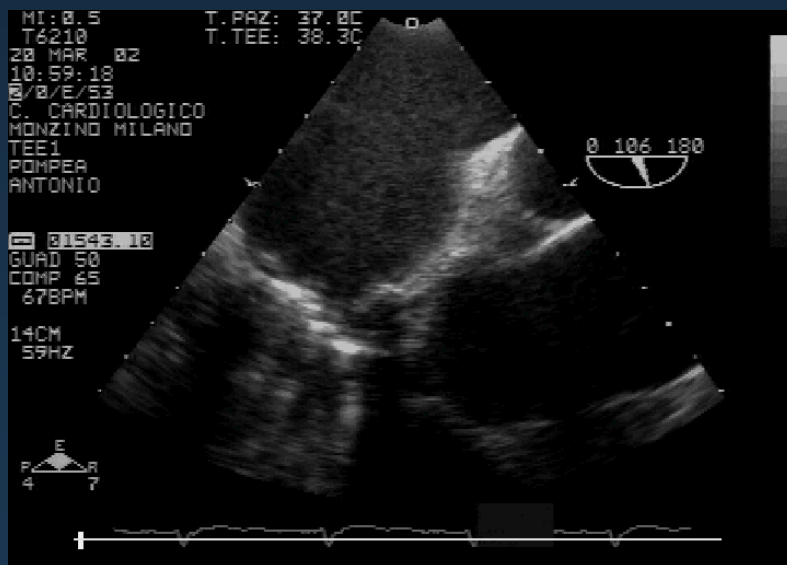
TROMBOSI RETROPROTESICA
MITRALICA

Protesi valvolari

ETE nella trombosi di protesi mitralica

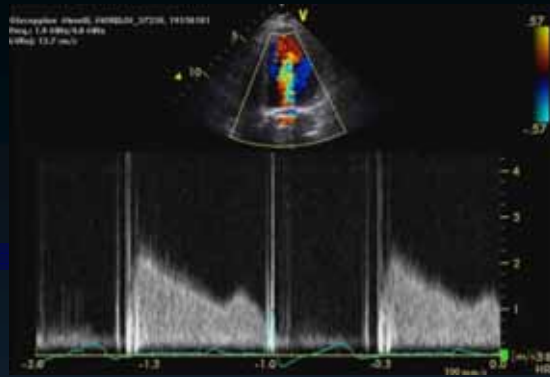


PANNO - TROMBO IN PROTESI
MONODISCO

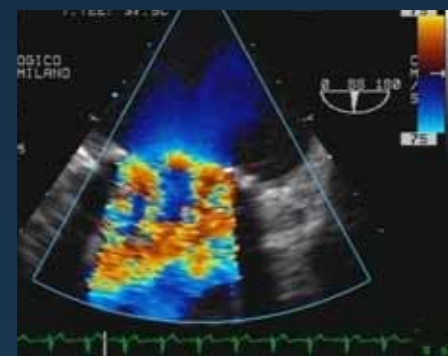
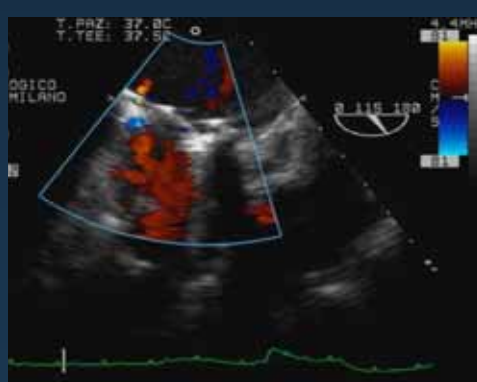
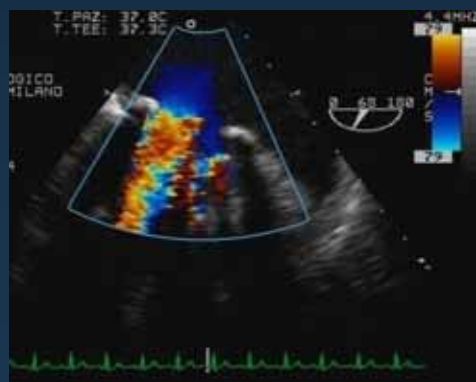
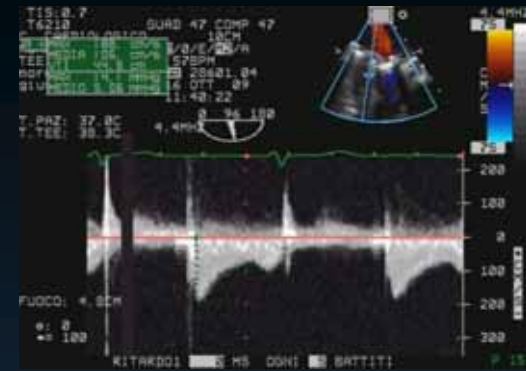


TROMBOSI IN PROTESI BIDISCO

Pre-trombolisi

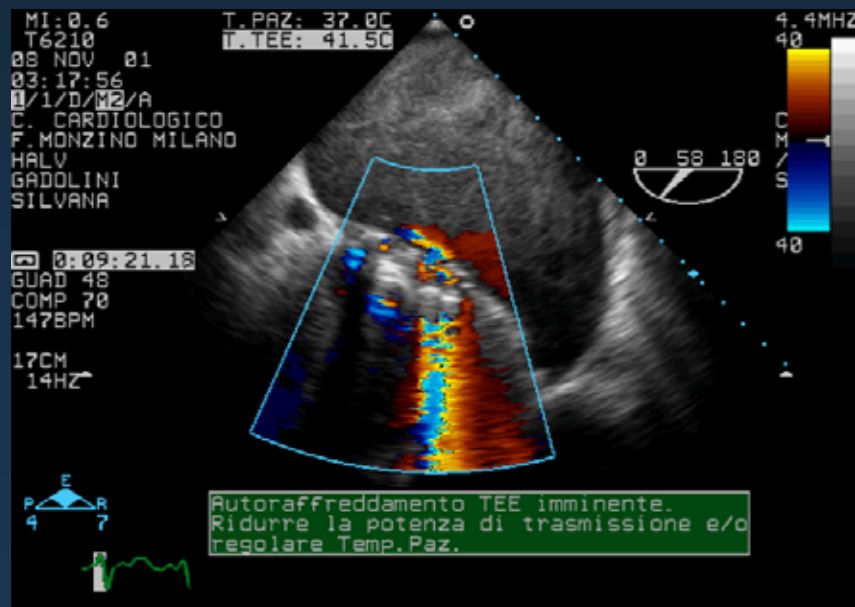
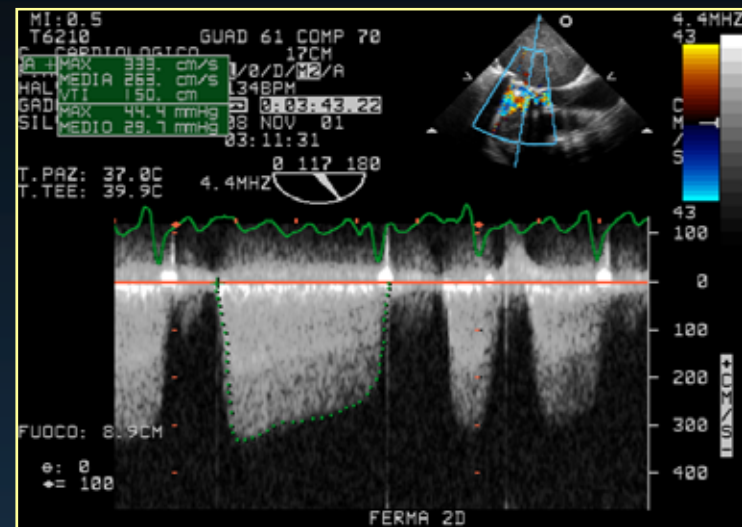
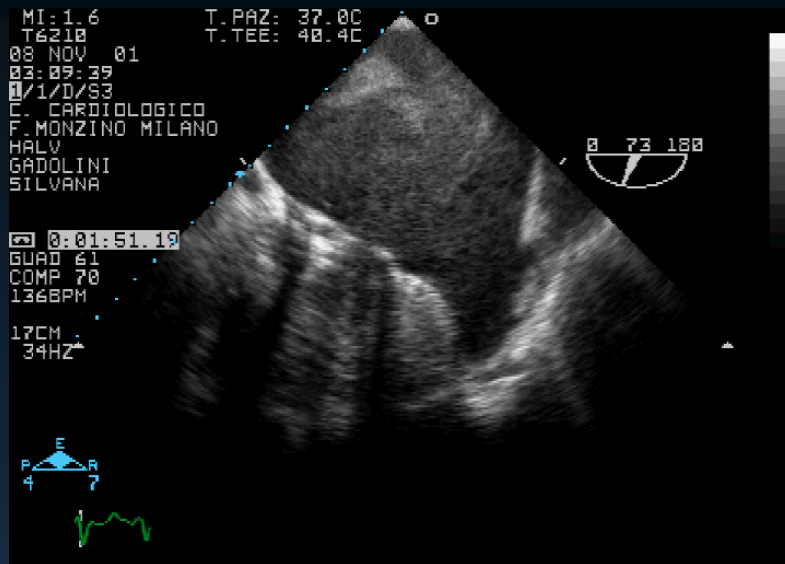


Post-trombolisi



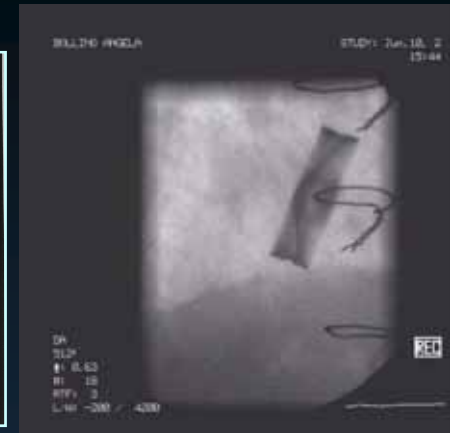
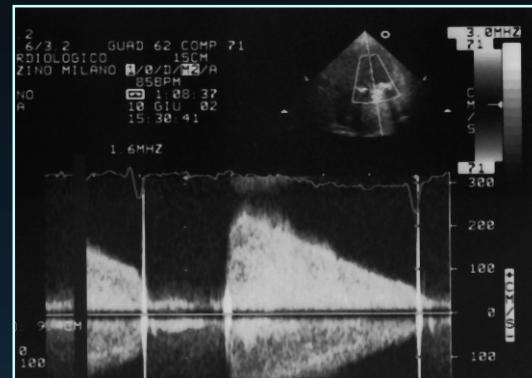
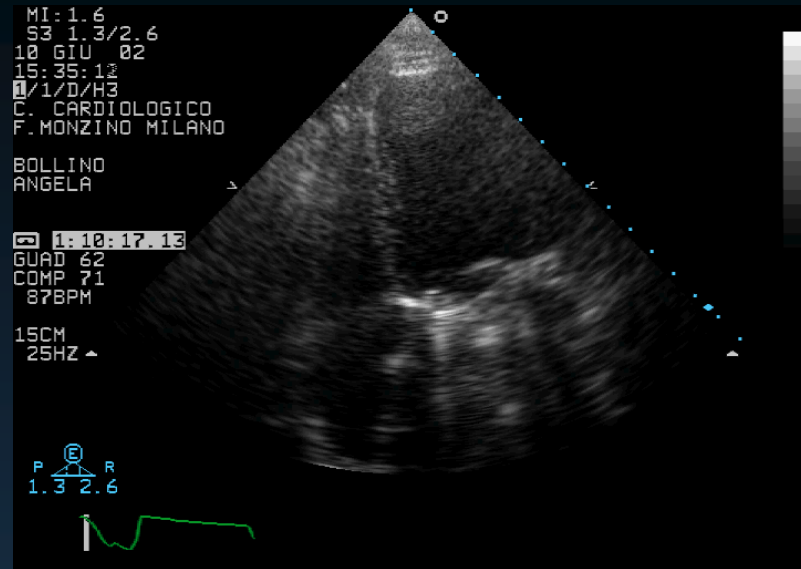
Protesi valvolari

ETE nella trombosi di protesi mitralica

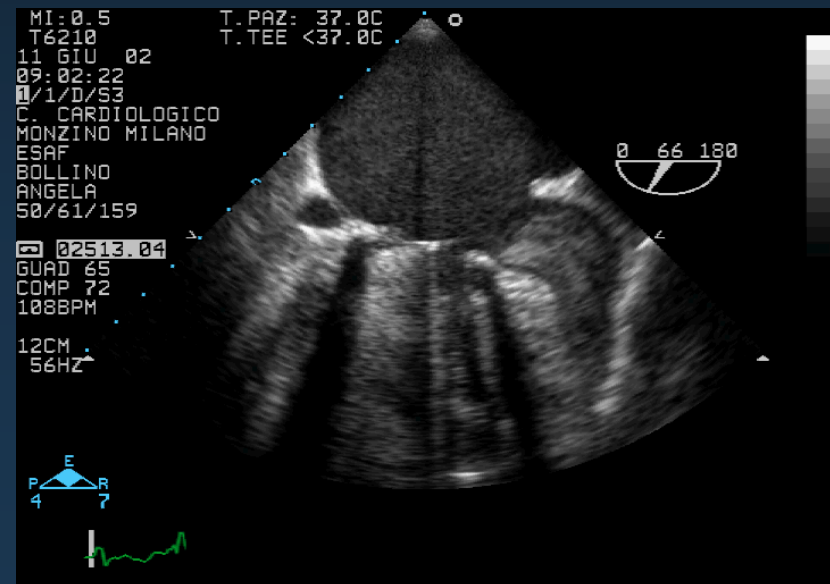
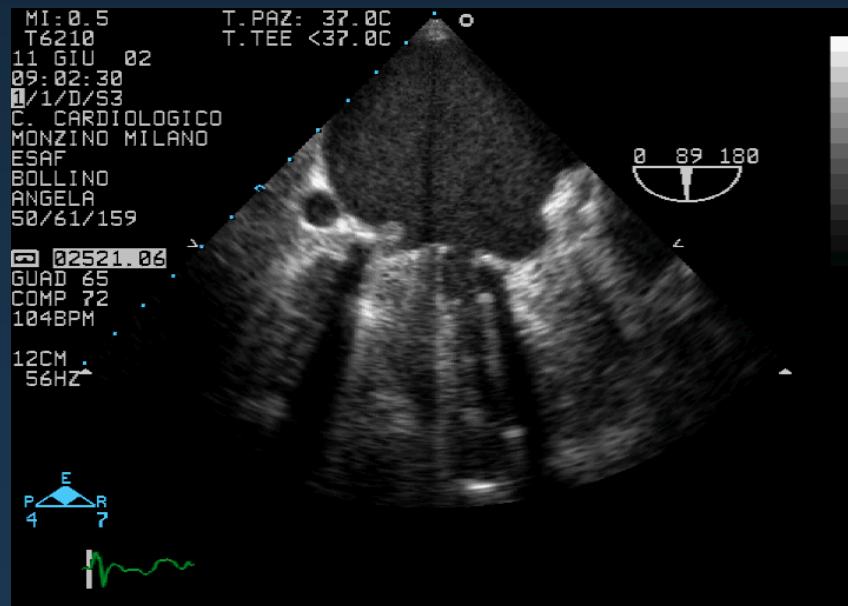


Protesi valvolari

ETT ETE nella trombosi di protesi mitralica



A.B. 50 y, Sorin 29. INR 1,2. Mean Gradient: 12 mmHg;
PHT 261 msec



Protesi valvolari

Table 4 Doppler echocardiographic evaluation of prosthetic aortic valves

	Parameter
Doppler echocardiography of the valve	Peak velocity/gradient Mean gradient Contour of the jet velocity; AT DVI EOA
Pertinent cardiac chambers	Presence, location, and severity of regurgitation LV size, function, and hypertrophy

Trombosi protesica: diagnosi

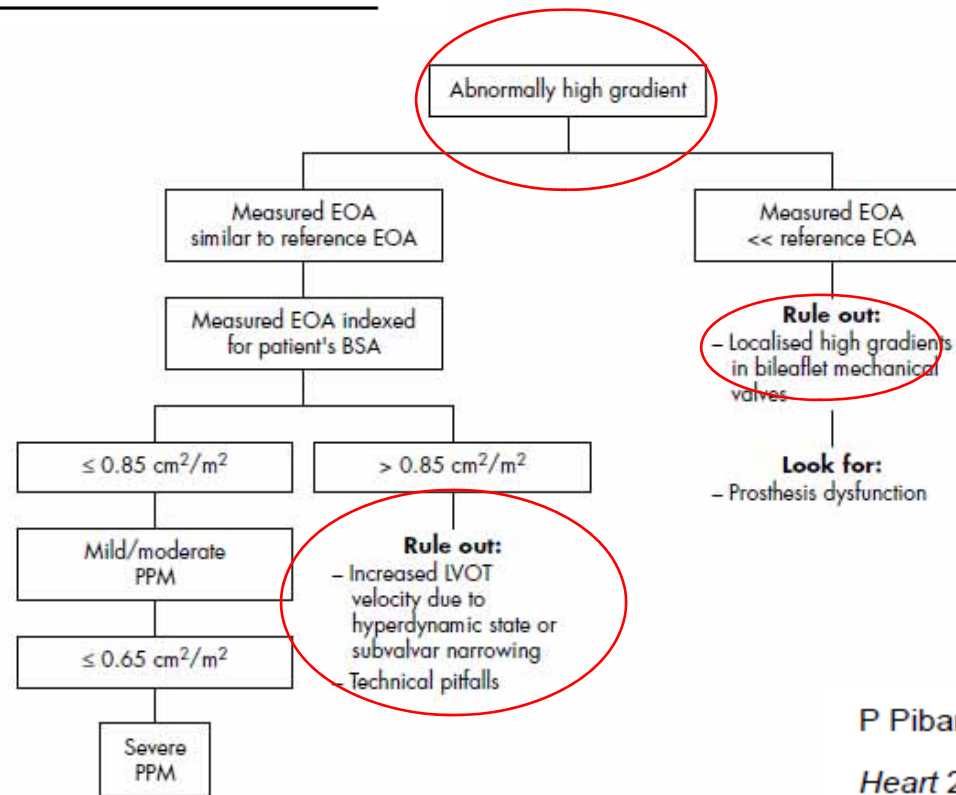


Figure 7 Algorithm used for evaluating abnormally high transvalvar pressure gradients after aortic valve replacement. LVOT, left ventricular outflow tract; PPM, prosthesis-patient mismatch. Reproduced and modified from Dumesnil and Pibarot⁴⁵ with permission from Marcel Dekker Inc.

P Pibarot and J G Dumesnil

Heart 2006;92:1022-1029; c

Feasibility and Diagnostic Accuracy of Quantitative Assessment of Mechanical Prostheses Leaflet Motion by Transthoracic and Transesophageal Echocardiography in Suspected Prosthetic Valve Dysfunction

Manuela Muratori, MD*, Piero Montorsi, MD, Giovanni Teruzzi, MD, Fabrizio Celeste, MD, Elisabetta Doria, MD, Francesco Alamanni, MD, and Mauro Pepi, MD

TEE were rarely able to identify closing angles. In conclusion, quantitative evaluation of mitral leaflet(s) motion may be accurately achieved with TTE and TEE, leading to increased diagnostic efficacy of prosthetic valve dysfunction. In the aortic position, TTE and TEE allow a quantitative evaluation of leaflet(s) dynamics only in a minority of patients and cinefluoroscopy still remains the first-choice technique. © 2006 Elsevier Inc. All rights reserved. (Am J Cardiol 2006;97:94–100)

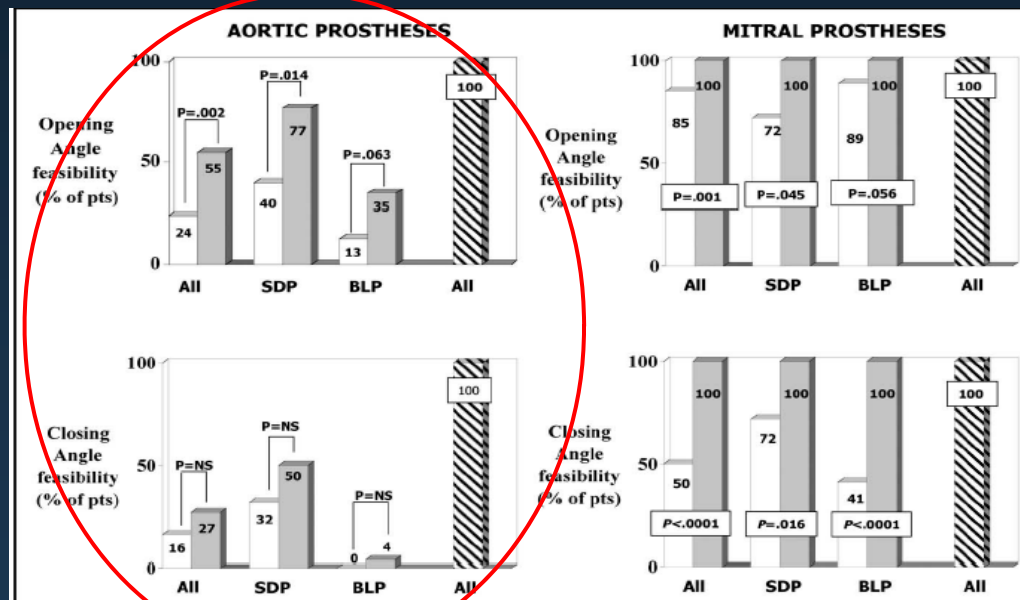
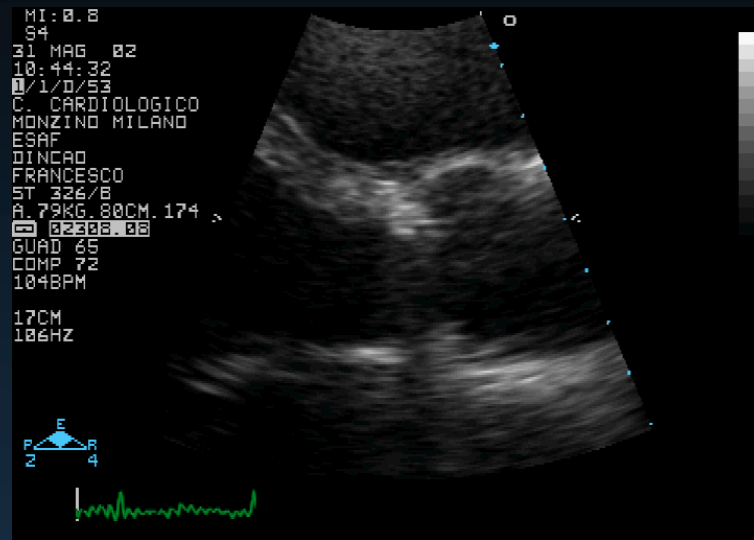


Figure 3. Feasibility of opening angle and closing angle measurements of TTE (white bars), TEE (gray bars), and cinefluoroscopy (dashed gray bars) in aortic and mitral prostheses. BLP = bileaflet prosthesis; SDP = single-disk prosthesis.

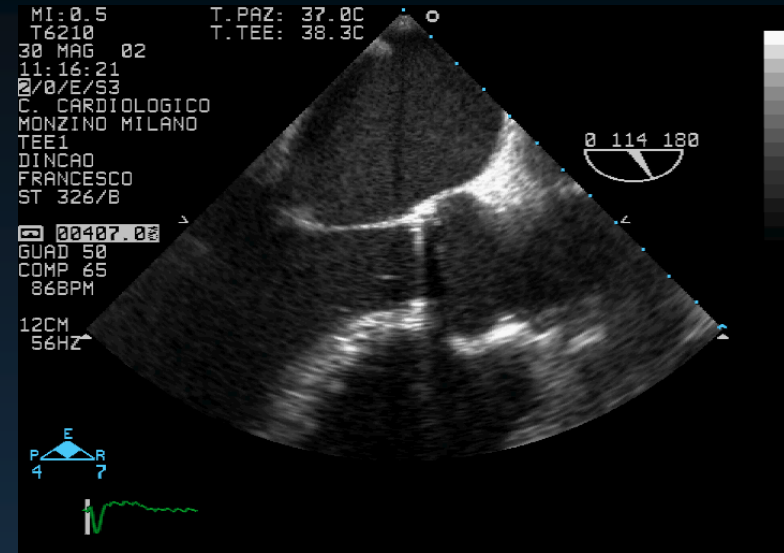
Protesi valvolari

Normofunzione protesi AORTICA MONODISCO E BIDISCO

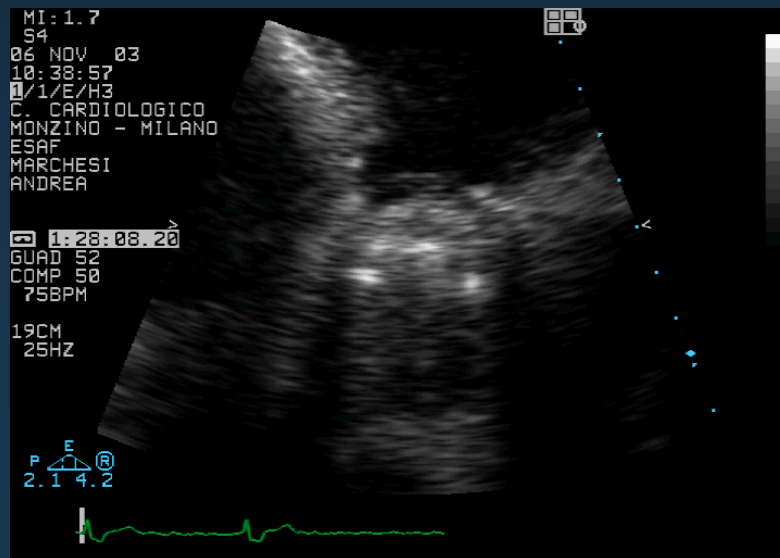
TTE: MONODISCO



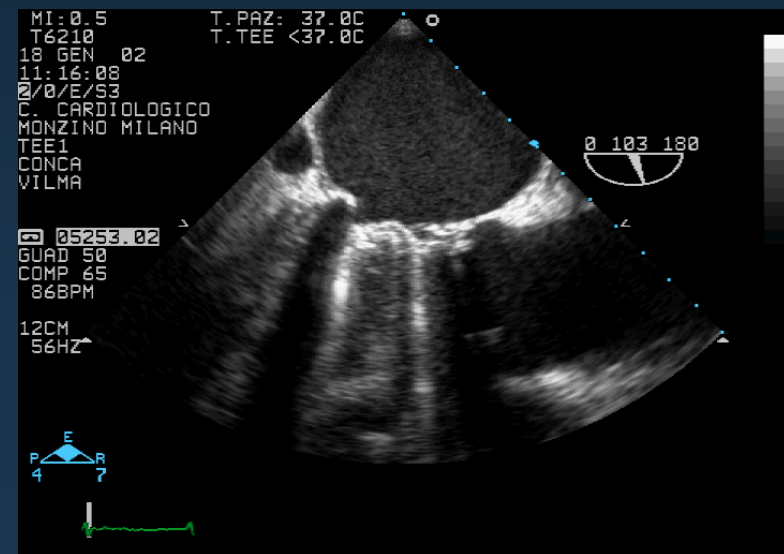
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TTE: BIDISCO

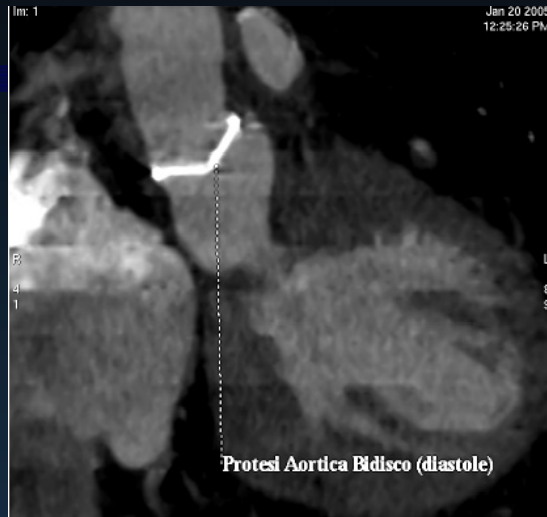


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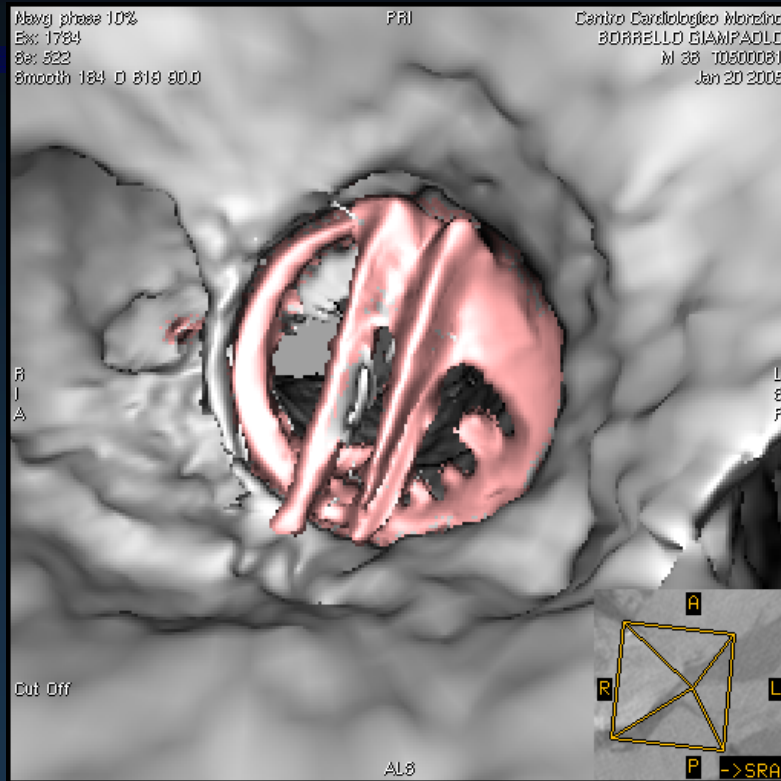
Protesi valvolari

TAC: PROTESI AORTICA NORMOFUNZIONANTE

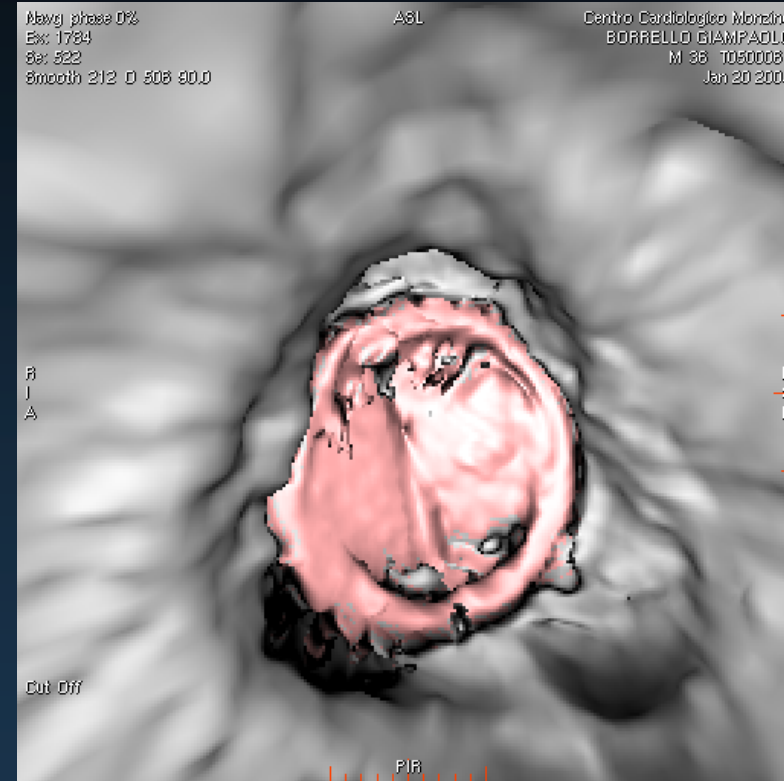


Protesi valvolari

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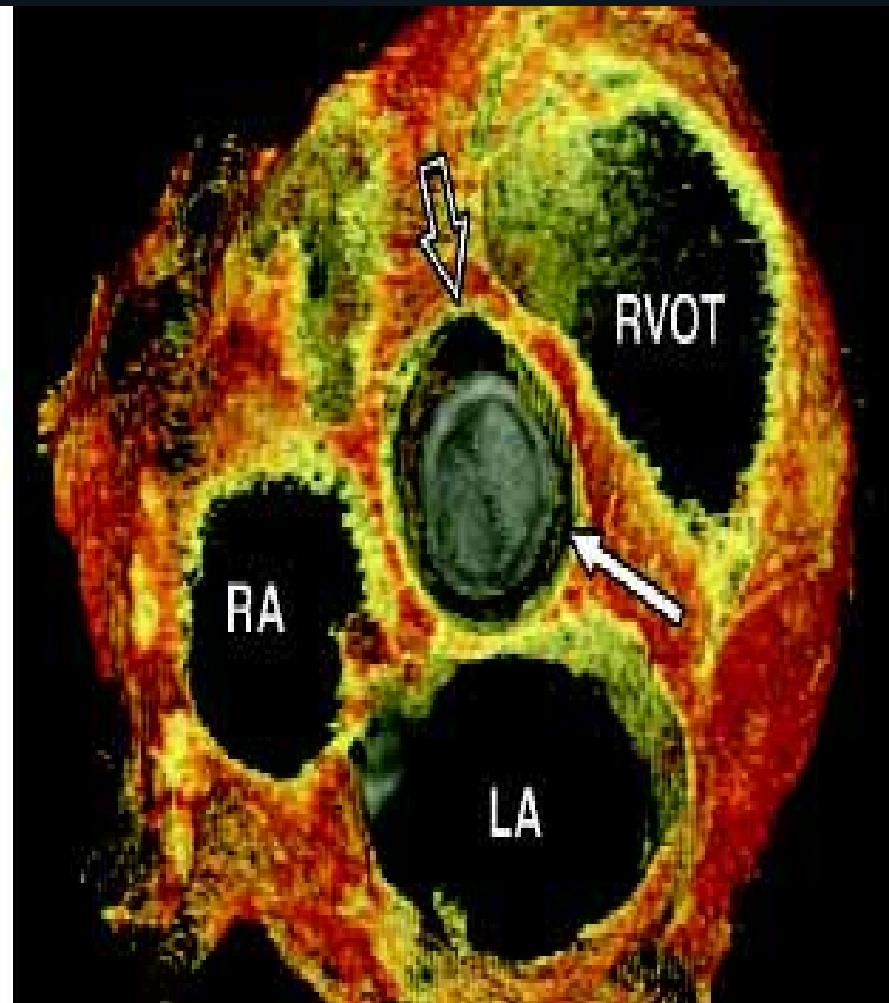
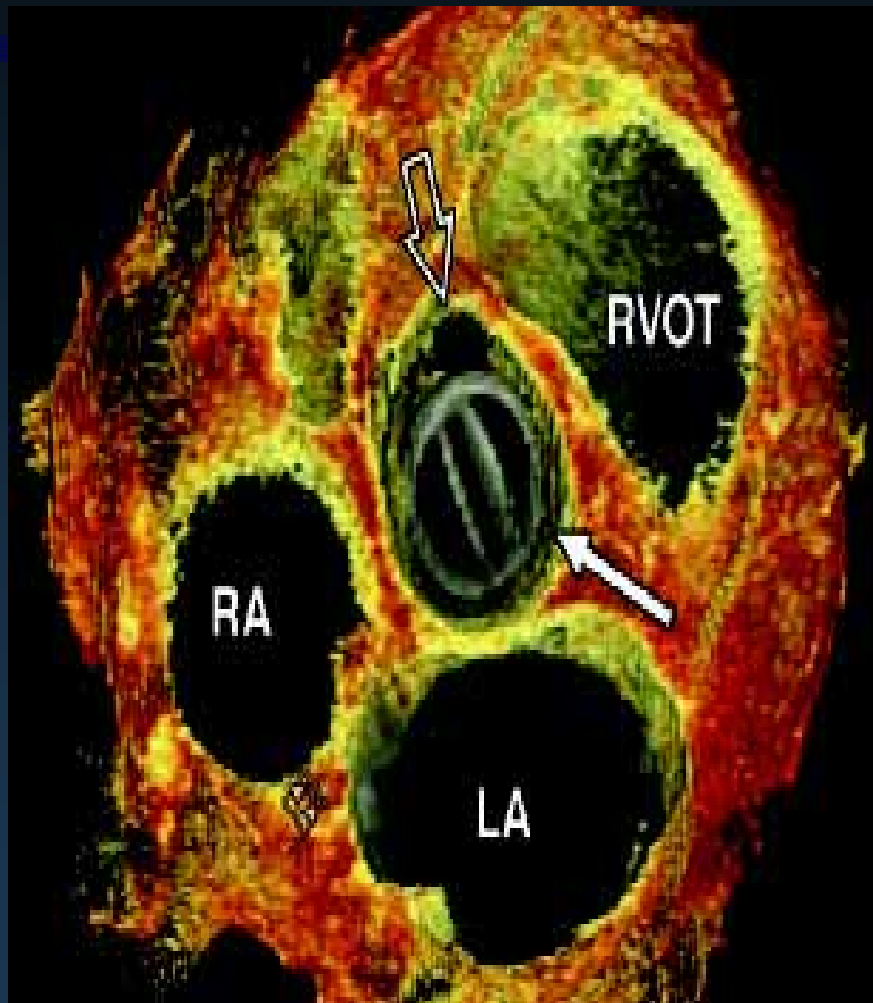
Dall'aorta ascendente



Dal tratto di efflusso VS

Protesi valvolari

TAC: PROTESI AORTICA NORMOFUNZIONANTE



Protesi valvolari

La trombosi valvolare protesica panno-trombo

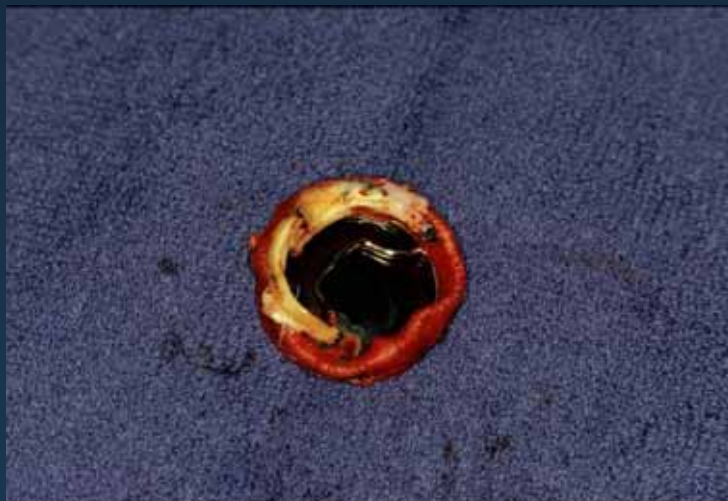
- 24 ostruzioni protesiche (14 Trombo; 10 Pannus)
- Trombo :
 - impianto più recente,
 - minor durata dei sintomi
 - inadeguata anticoagulazione
 - dimensioni maggiori rispetto al panno (2,8 cm vs 1,2 cm)
 - massa soft alla TEE (92% vs 29% of pannus)
 - bassa videodensità
 - alterata motilità protesica nel 100% (TEE)
- Panno : prevalente in posizione AORTICA (70% vs 21%)
 - Alterata motilità protesica nel 60% alla TEE
 - Adeguata anticoagulazione

Barbetses et al. JACC 1998

Protesi valvolari

valutazione trombosi protesica:
PANNO
PROTESICO

panno vs. trombo



Protesi valvolari

Trombosi protesica AORTICA: diagnosi

Table 4 Doppler echocardiographic evaluation of prosthetic aortic valves

	Parameter
Doppler echocardiography of the valve	Peak velocity/gradient Mean gradient Contour of the jet velocity; AT DVI EOA
Pertinent cardiac chambers	Presence, location, and severity of regurgitation LV size, function, and hypertrophy

Table 5 Doppler parameters of prosthetic aortic valve function in mechanical and stented biologic valves*

Parameter	Normal	Possible stenosis	Suggests significant stenosis
Peak velocity (m/s) [†]	<3	3-4	>4
Mean gradient (mm Hg) [†]	<20	20-35	>35
DVI	≥0.30	0.29-0.25	<0.25
EOA (cm ²)	>1.2	1.2-0.8	<0.8
Contour of the jet velocity through the PrAV	Triangular, early peaking	Triangular to intermediate	Rounded, symmetrical contour
AT (ms)	<80	80-100	>100

PrAV, Prosthetic aortic valve.

*In conditions of normal or near normal stroke volume (50-70 mL) through the aortic valve.

†These parameters are more affected by flow, including concomitant AR.

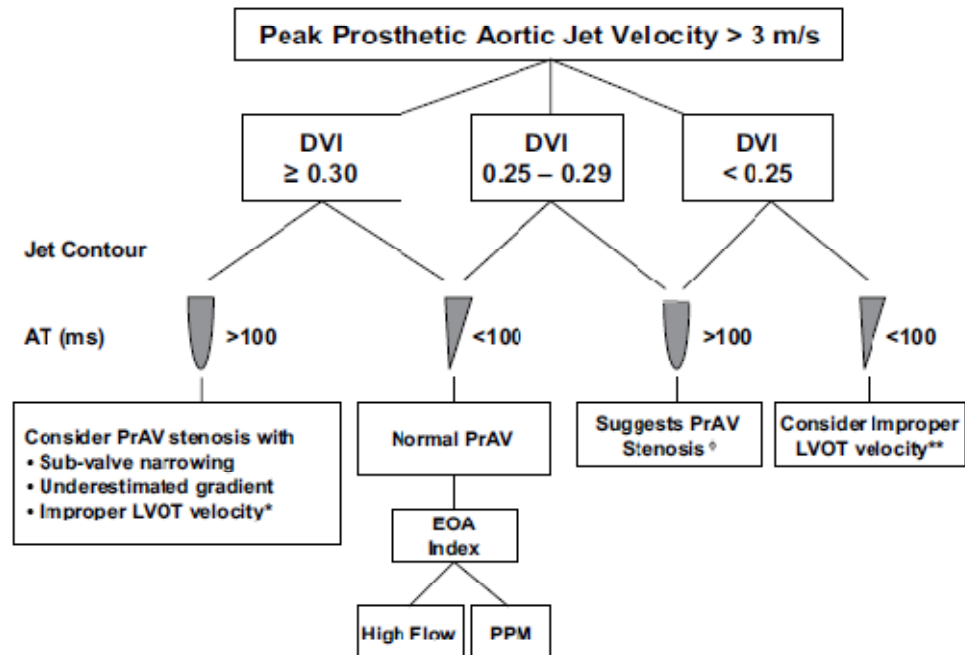
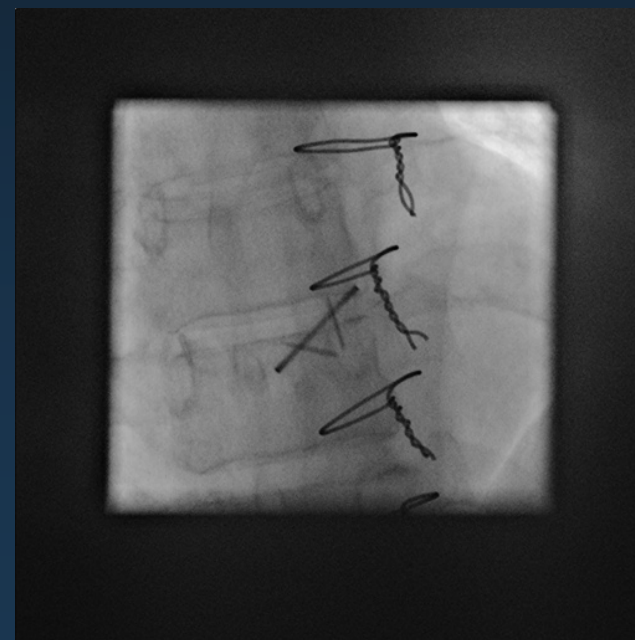
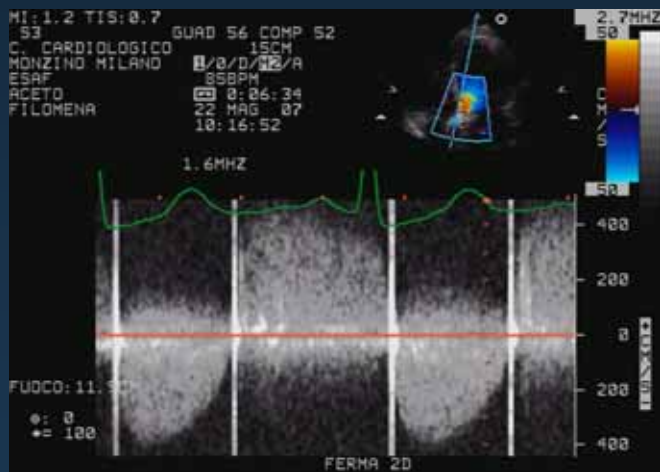
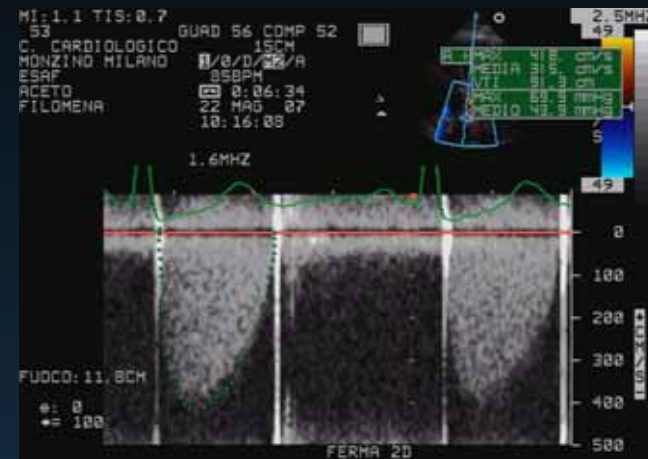
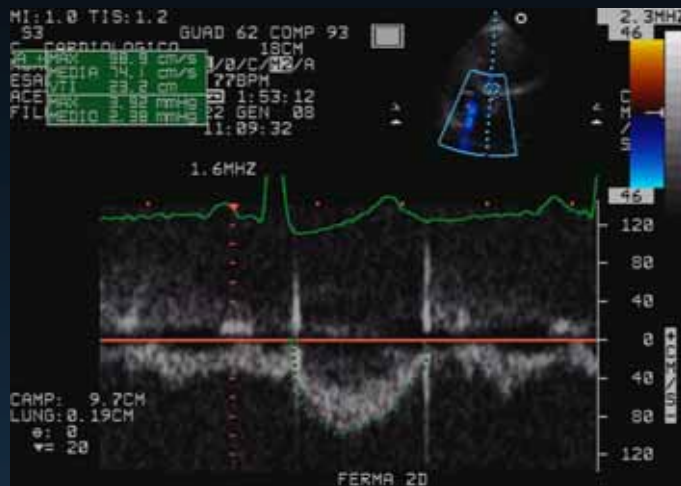


Figure 10 Algorithm for evaluation of elevated peak prosthetic aortic jet velocity incorporating DVI, jet contour, and AT. *PW Doppler sample too close to the valve (particularly when jet velocity by CW Doppler is ≥4 m/s). **PW Doppler sample too far (apical) from the valve (particularly when jet velocity is 3-3.9 m/s). †Stenosis further substantiated by EOA derivation compared with reference values if valve type and size are known. Fluoroscopy and TEE are helpful for further assessment, particularly in bileaflet valves. AVR, Aortic valve replacement.

Protesi valvolari

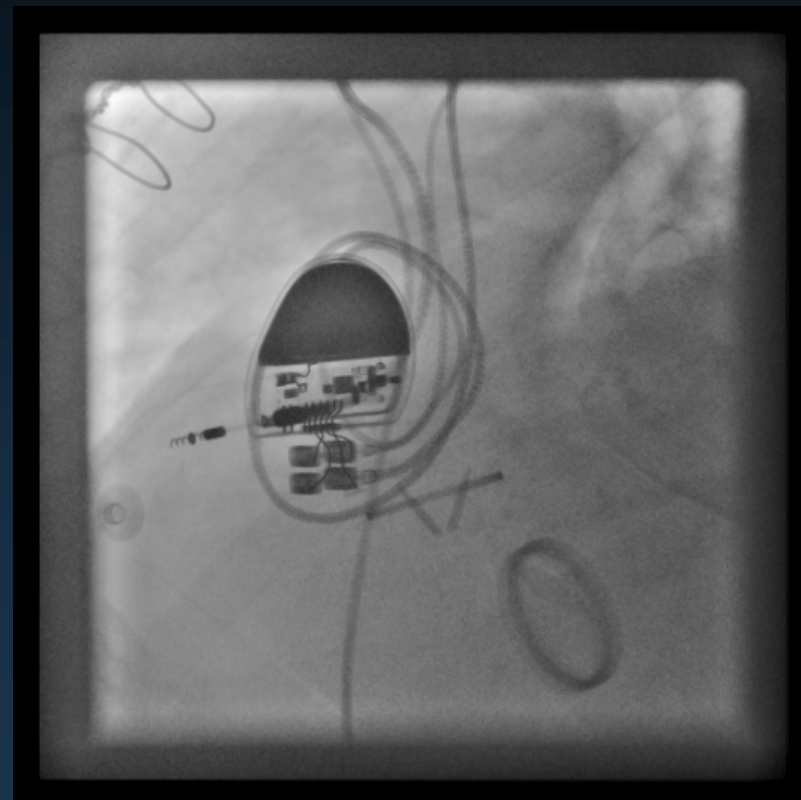
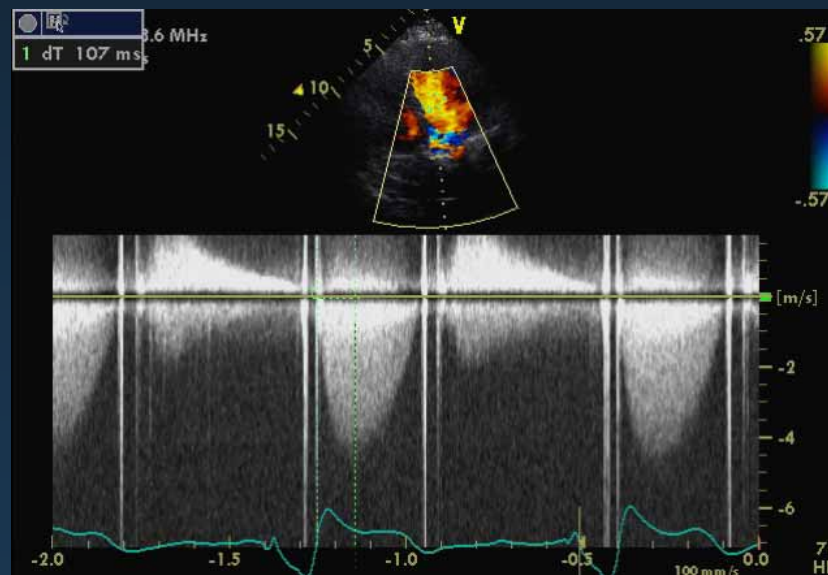
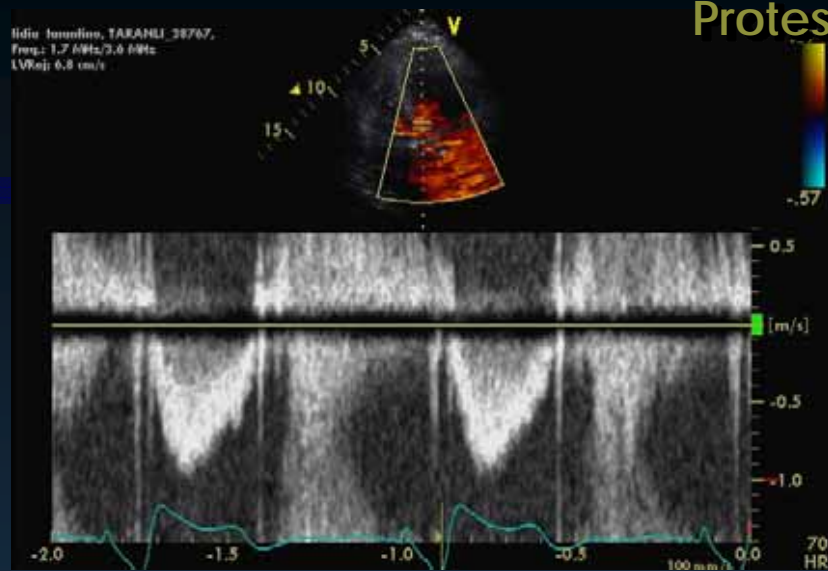
Protesi valvolare aortica



St Jude 19: DVI 0,25; AT 100 msec

Protesi valvolari

Protesi valvolare aortica

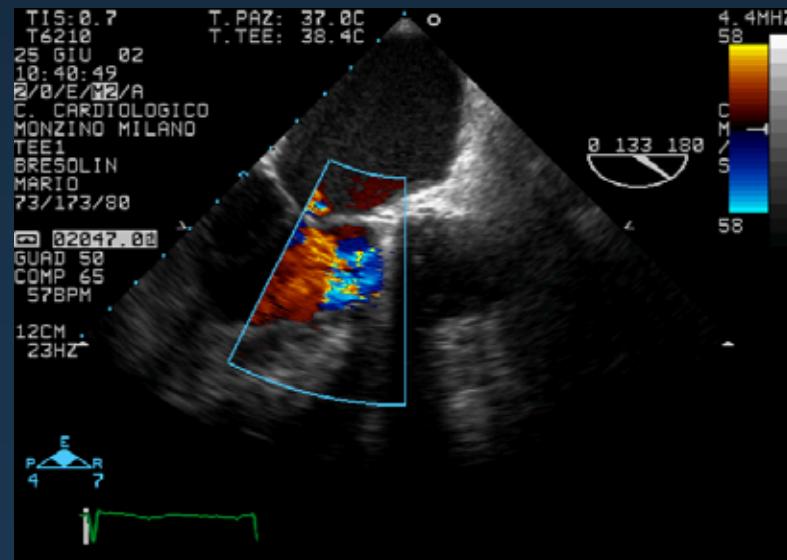
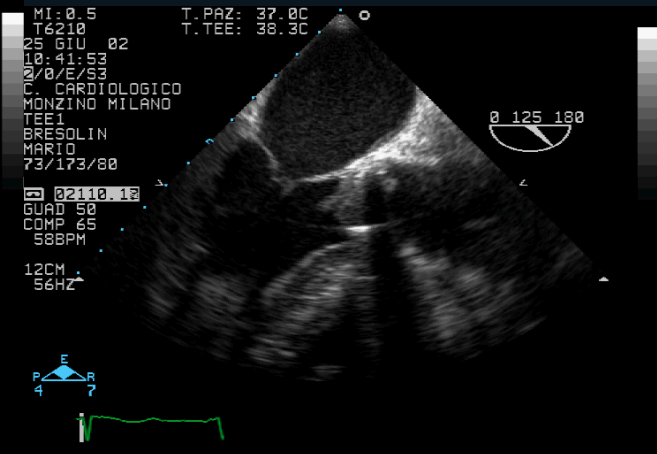
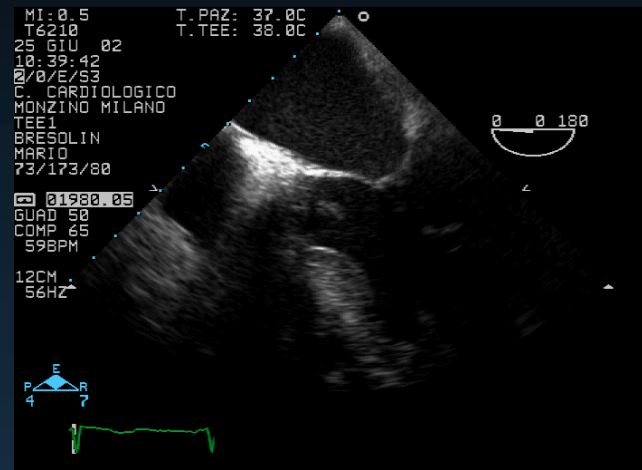
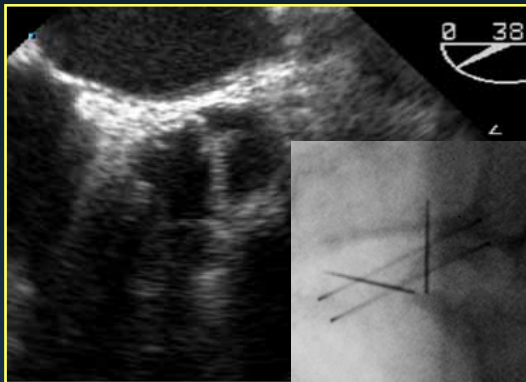
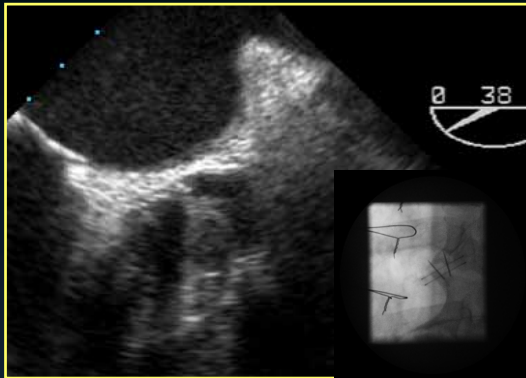


Carbomedics 21: DVI 0,21; AT 107 msec

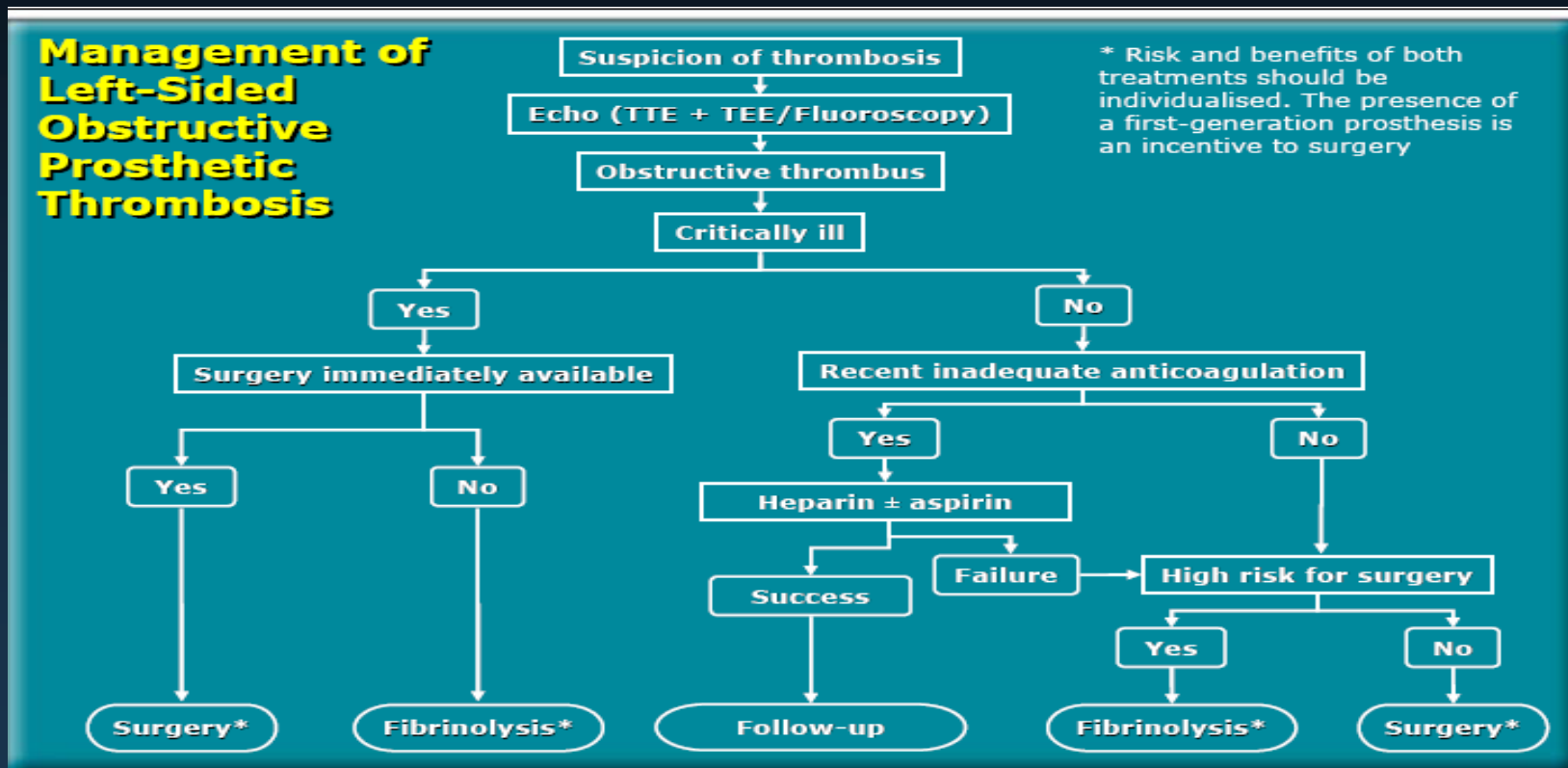
Protesi valvolari

ETE nella trombosi di protesi aortica

B.M. 73 y, Sorin 21. INR 1,2. NYHA III. Mean Gradient: 76 mmHg



La disfunzione protesica: trombosi/panno



Protesi valvolari

Trombosi PROTESI TRICUSPIDALICA

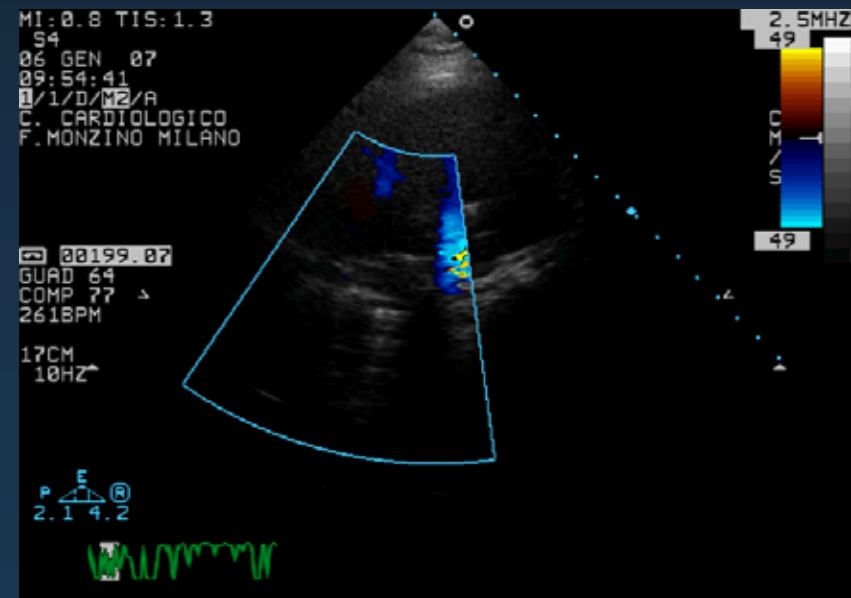
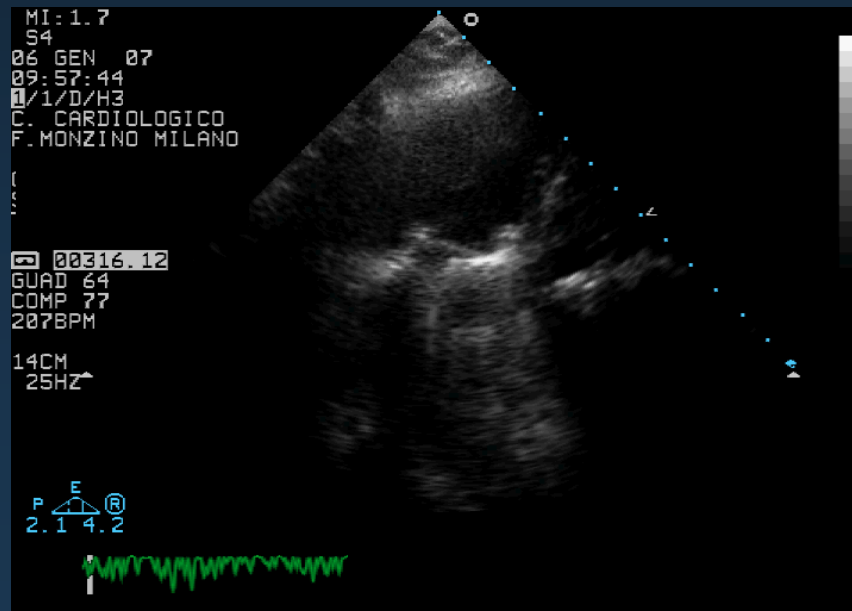
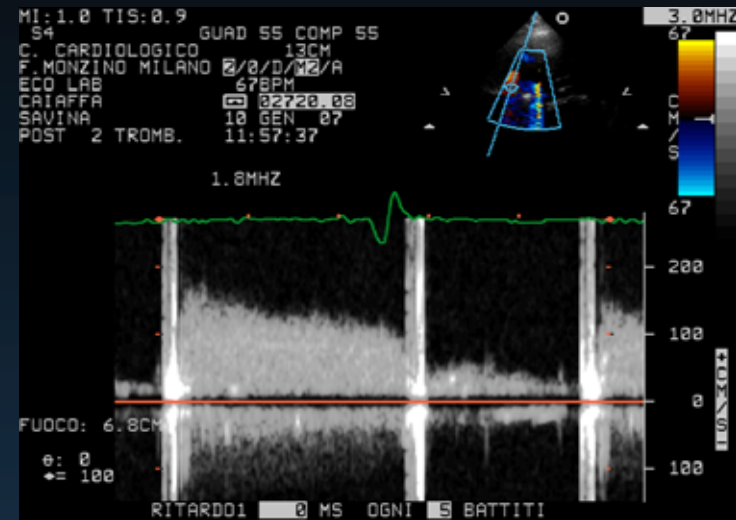
Table 15 Doppler parameters of prosthetic tricuspid valve function

	Consider valve stenosis*
Peak velocity†	>1.7 m/s
Mean gradient†	≥6 mm Hg
Pressure half-time	≥230 ms
EOA and VTI_{PrTV}/VTI_{LVO}	No data yet available for tricuspid prostheses

PrTV, Prosthetic tricuspid valve.

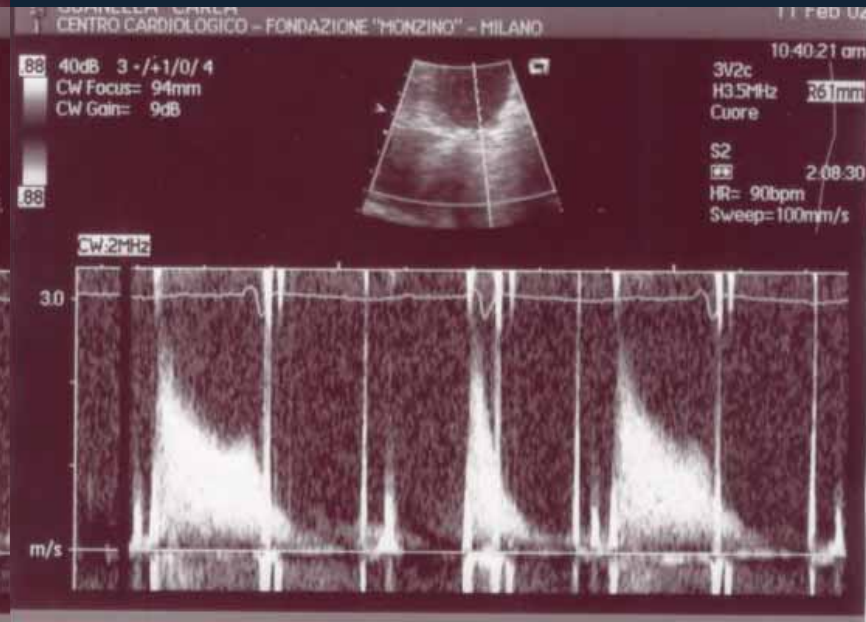
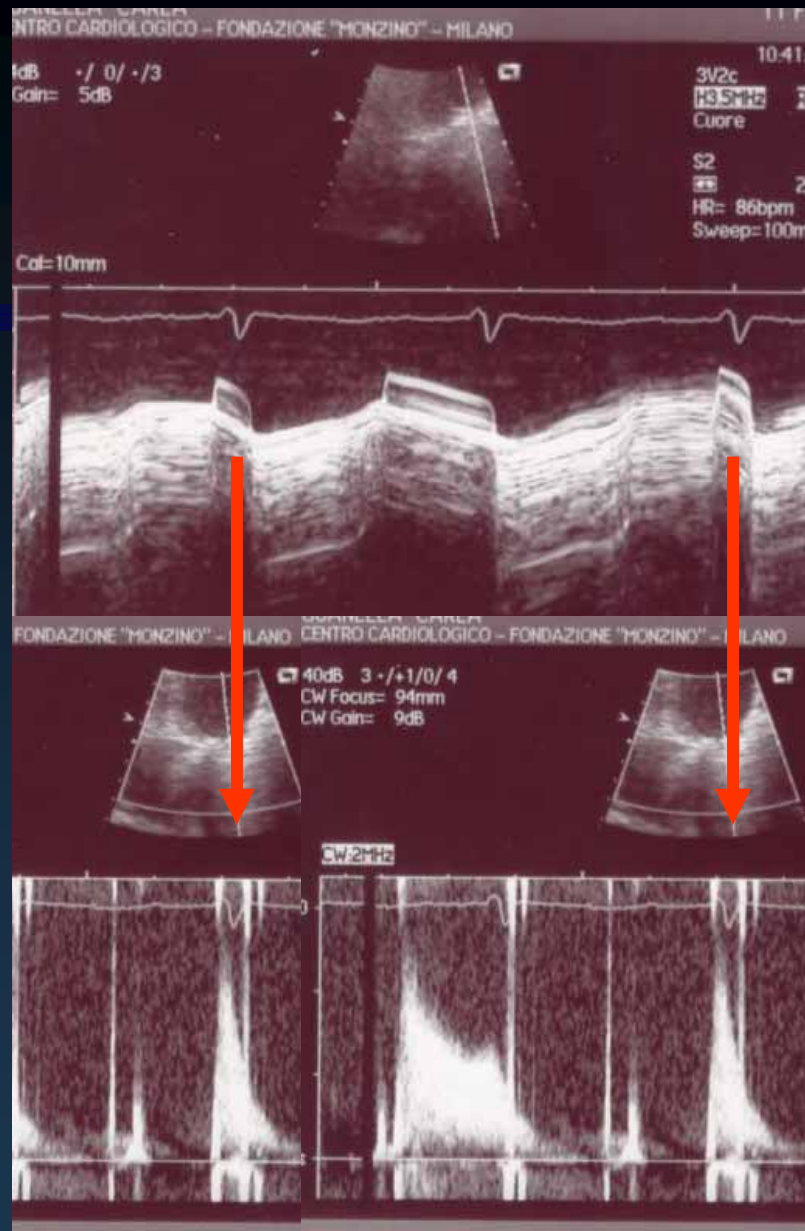
*Because of respiratory variation, average ≥5 cycles.

†May be increased also with valvular regurgitation.



Intermittent opening in
Sinus Rhythm (end-
diastolic opening)

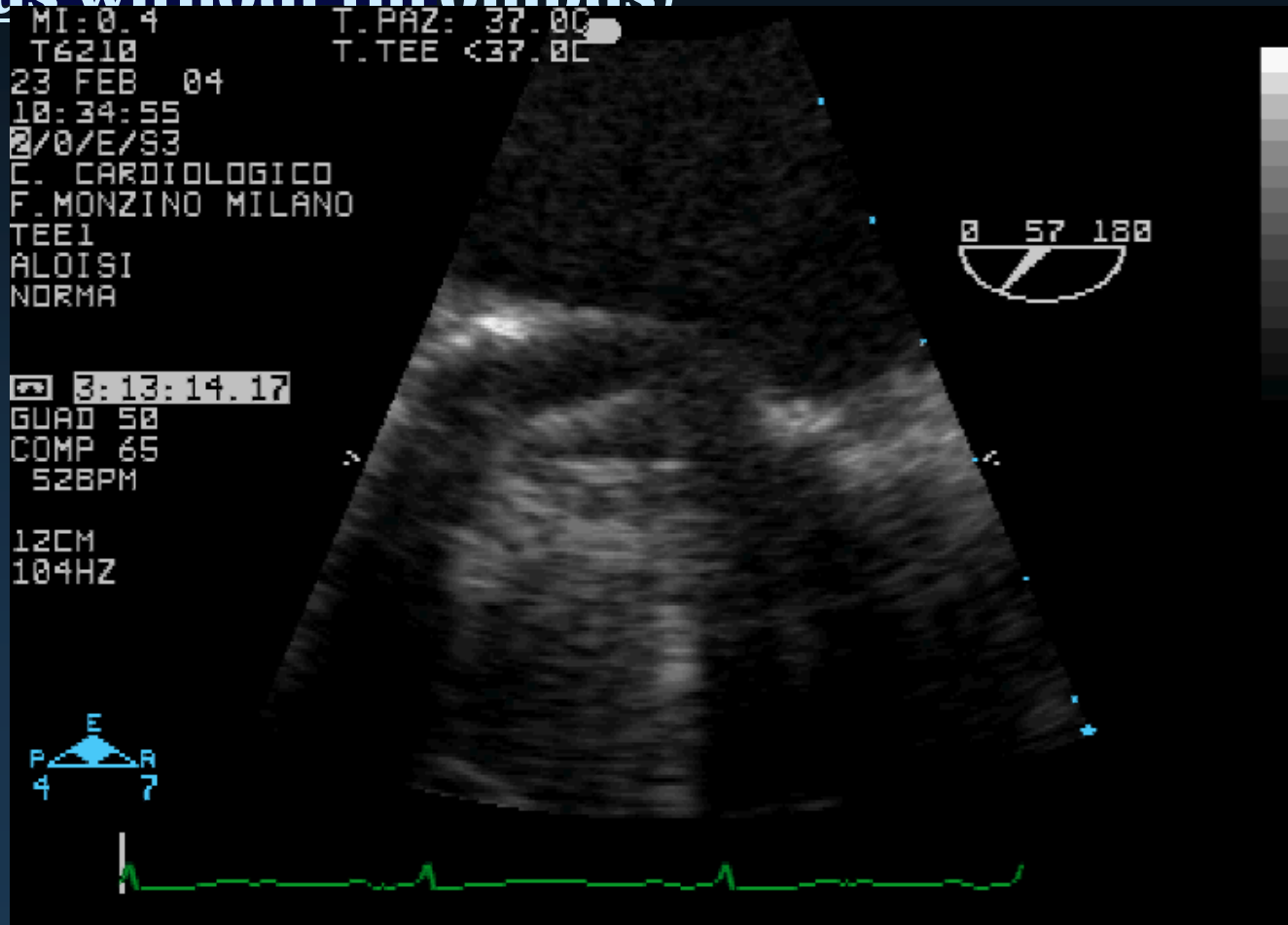
M-Mode e Doppler



MITRAL PROSTHESIS : TRANSTHORACIC ECHO

Intermittent opening in sinus Rhythm ; small thrombus; no changes in leaflet dynamics after optimal anticoagulation, despite regression of the small thrombus (6 months follow-up: mean gradient 12 mmHg); NYHA II >>>> surgery:

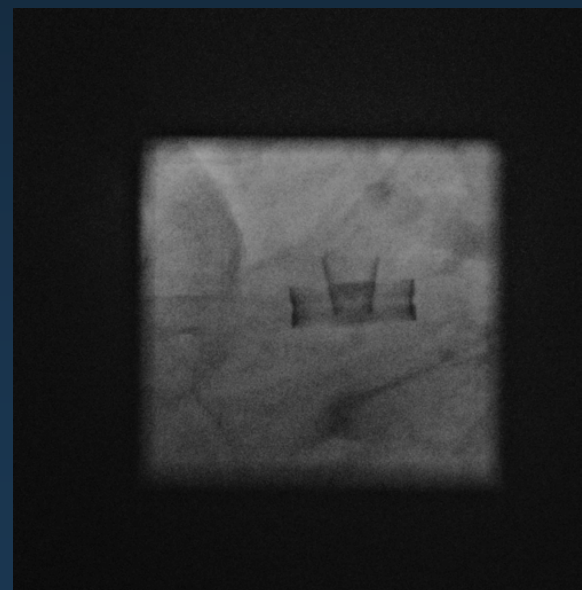
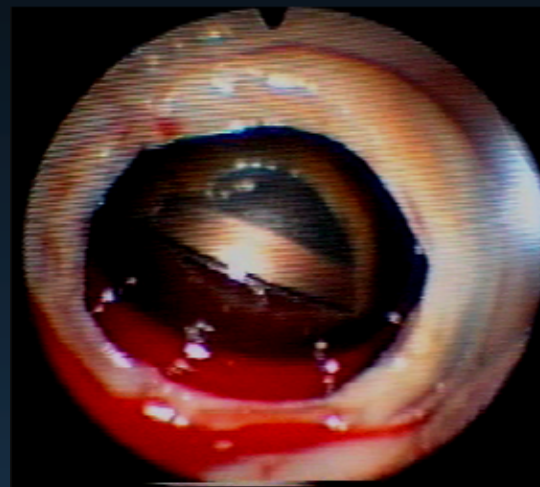
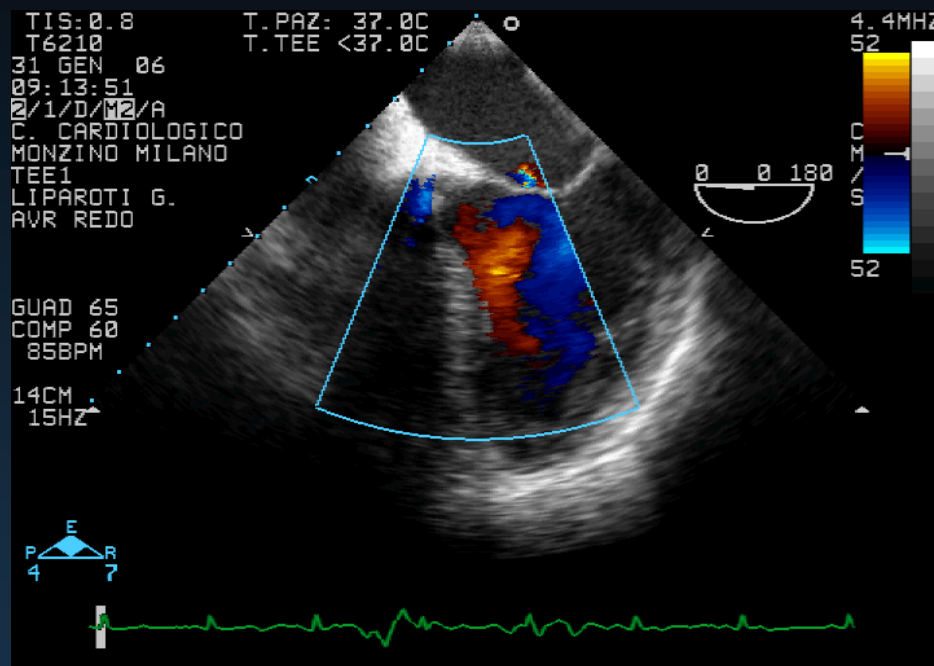
Pannus without thrombus)



Protesi valvolari

ETE nella trombosi di protesi aortica

PANNO IN PROTESI AORTICA



Protesi valvolari

La disfunzione protesica

- **OSTRUZIONE**

- *TROMBOSI (Meccaniche)*

- *PANNO (Meccaniche)*

- **ENDOCARDITE** (*meccaniche, biologiche*)

- **DISTACCO** (*meccaniche, biologiche*)

- **DEGENERAZIONE** (*biologiche*)

ENDOCARDITE SU PROTESI

- RAPPRESENTA IL 7-25% DEI CASI DI ENDOCARDITE BATTERICA
- ENDOCARDITE **PRECOCE** : entro 1 anno

INCIDENZA 0,5 %

- ENDOCARDITE **TARDIVA** : oltre 1 anno

INCIDENZA ANNUA 0,5 %

Protesi valvolari

ETE: endocardite su protesi valvolari

TABLE II Echocardiographic Findings in 33 Prostheses with Endocarditis Proved by Surgery or Autopsy

	Transthoracic			Transesophageal		
	Normal	Questionable	Abnormal	Normal	Questionable	Abnormal
Aortic position (n = 21)	6	6	9	3	1	17
Bioprosthesis (n = 11)	2	3	6	1	0	10
Mechan. device (n = 10)	4	3	3	2	1	7
Mitral position (n = 12)	6	3	3	2	0	10
Bioprosthesis (n = 6)	2	2	2	1	0	5
Mechan. device (n = 6)	4	1	1	1	0	5
Total (n = 33)	12 (36%)	9 (27%)	12 (36%)	5 (15%)	1 (3%)	27 (82%)

Comparison of transthoracic and transesophageal echocardiography for total valves: chi-square 15.05, $p < 0.001$.
 Mechan. = mechanical.

Protesi valvolari

Valutazione endocardite su protesi

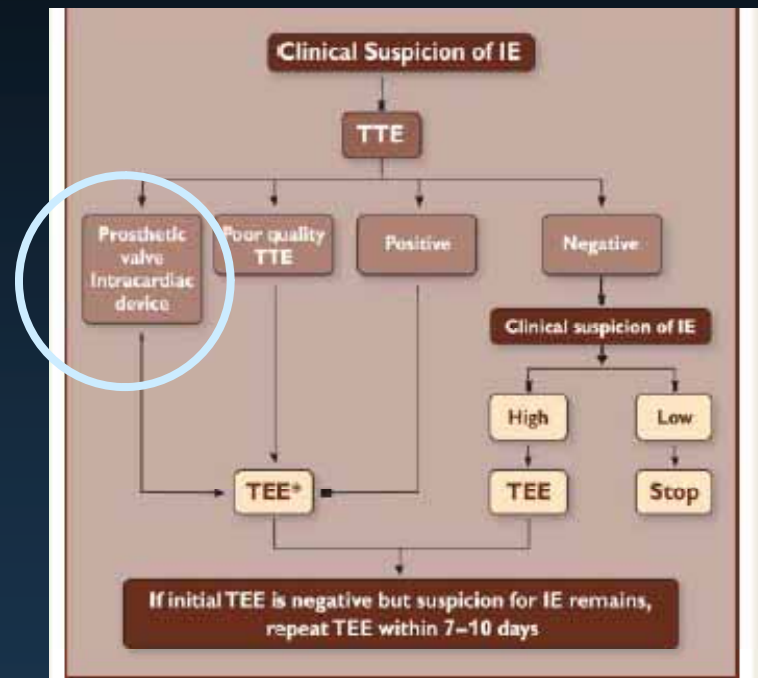


Figure 1 Indications for echocardiography in suspected infective endocarditis. IE = infective endocarditis; TEE = transoesophageal echocardiography; TTE = transthoracic echocardiography. *TEE is not mandatory in isolated right-sided native valve IE with good quality TTE examination and unequivocal echocardiographic findings.

Analisi ecocardiografica

- **VEGETAZIONI**: masse oscillanti sessili o peduncolate adese alla struttura valvolare->ostruzione e/o insufficienza intraprotetica
- **DEISCENZA PROTESICA**: rigurgito paraprotetico/rocking protesico (40%; >15 gradi)
- **ASCESSO PERIPROTESICO** (anulus, radice aortica)
- **TRAGITTI FISTOLOSI**

Protesi valvolari

Diagnosi di endocardite

SUPERIORITA' TEE vs TTE

- vicinanza anatomica
- alta frequenza del trasduttore (risoluzione 1-2 mm)
- versante atriale protesi mitraliche
- versante posteriore protesi aortiche
- studio complicanze (ascesso)

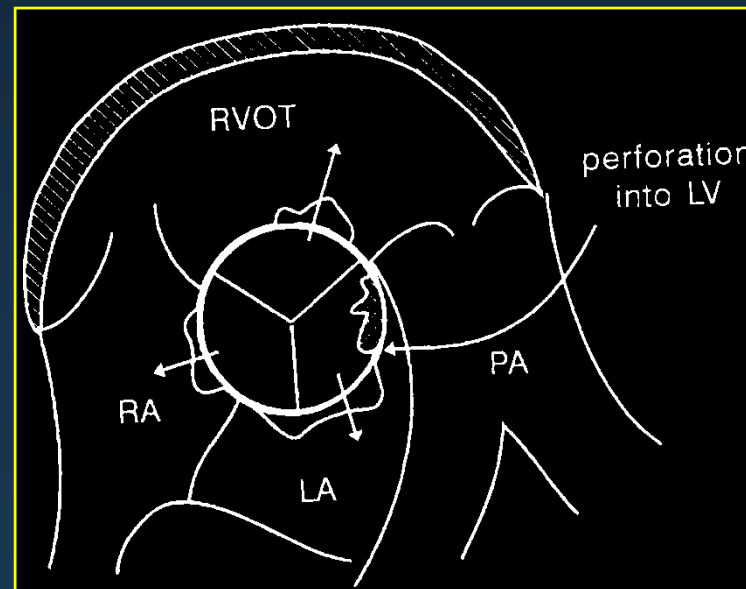
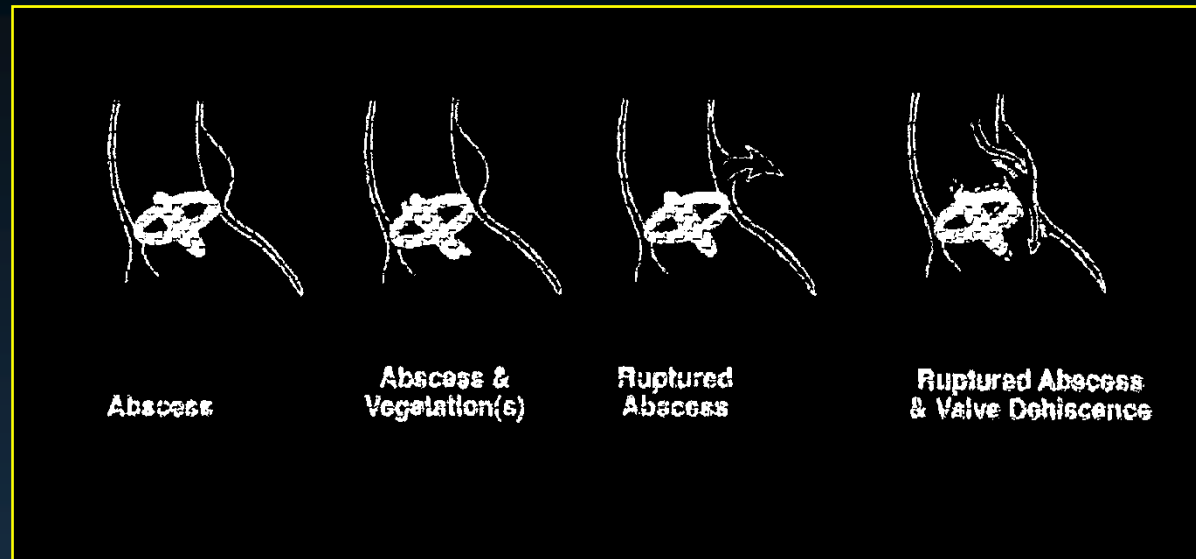
LIMITI TEE

- versante anteriore protesi aortiche(LVOT)

LIMITI TEE-TTE

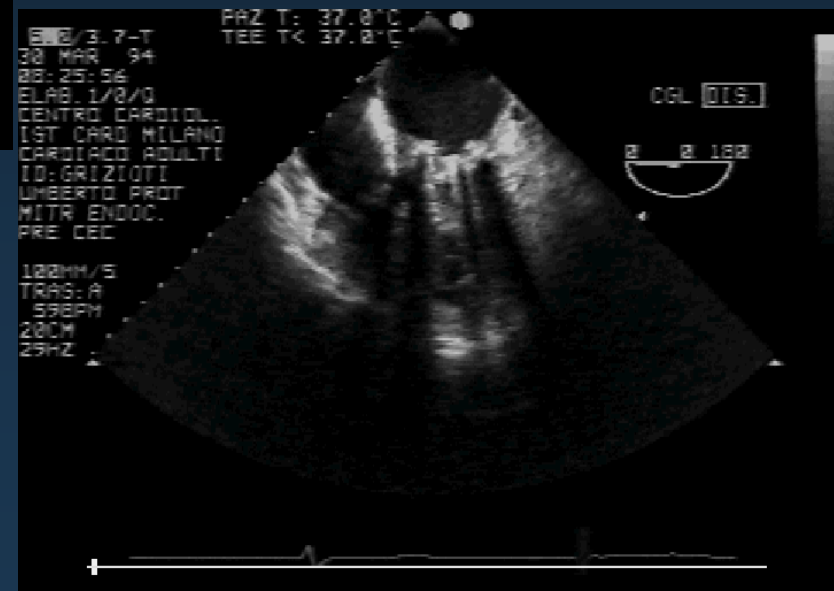
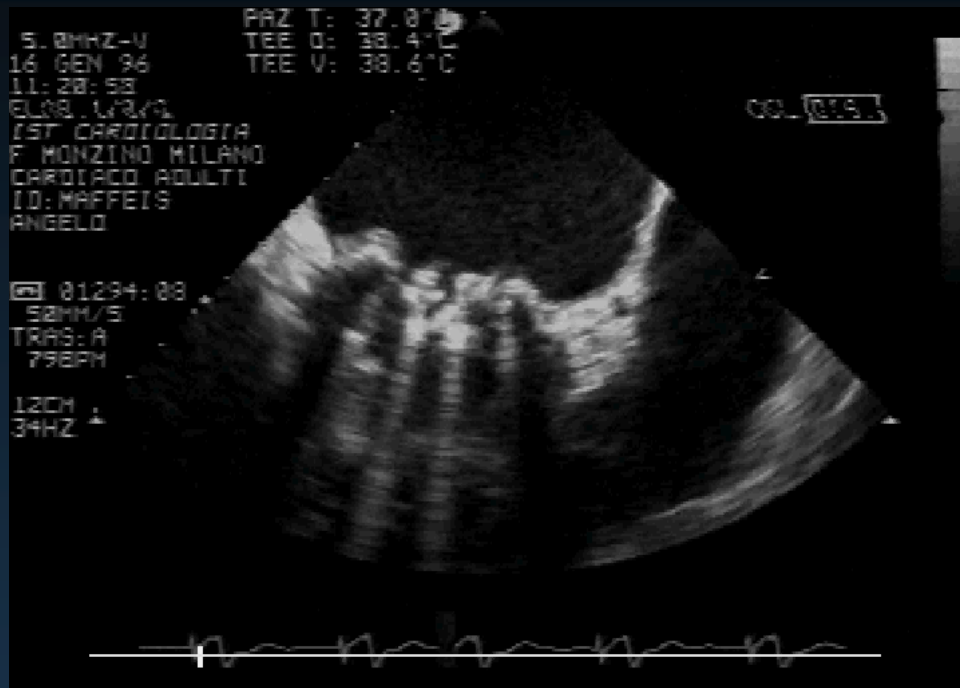
- doppie protesi

Ascesso periprotetico aortico



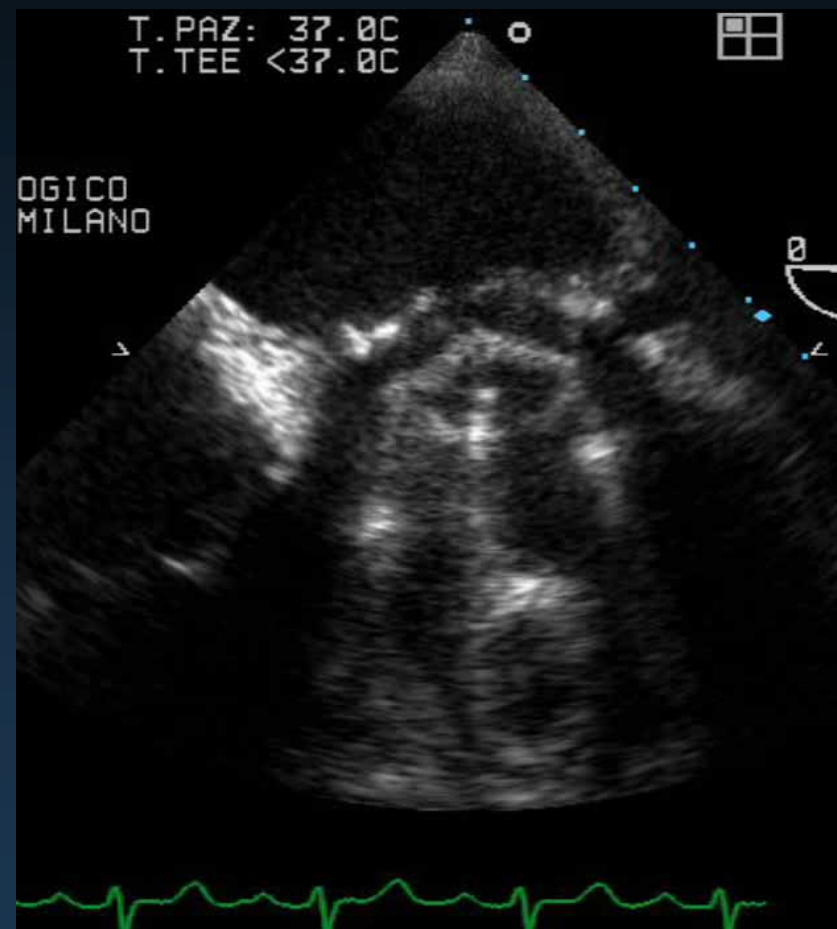
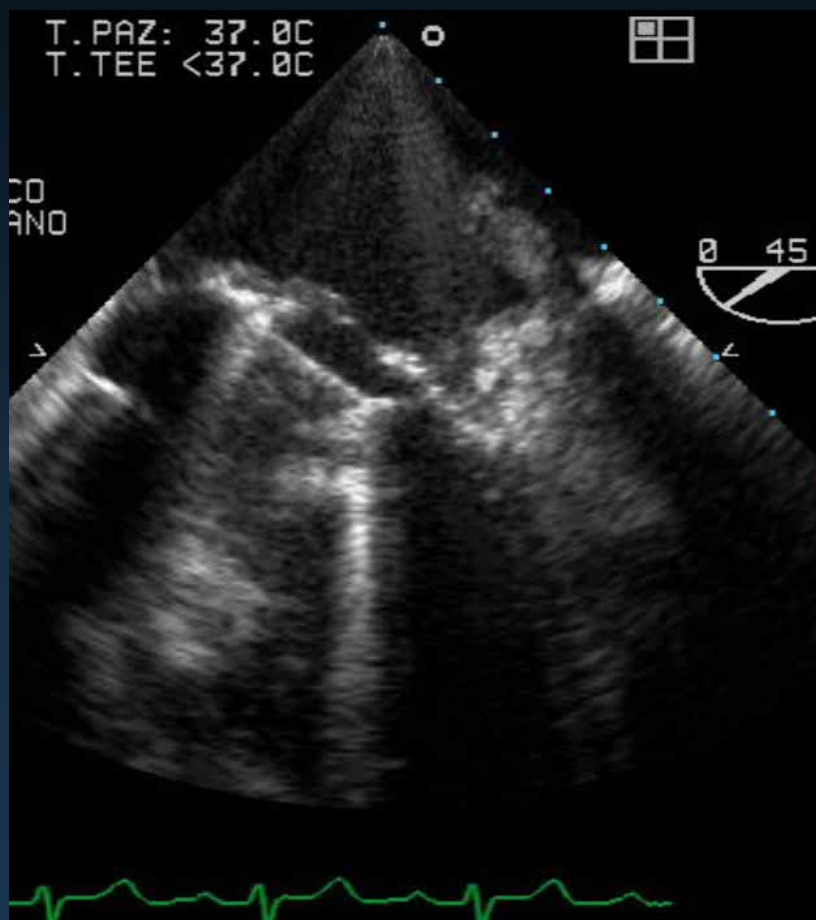
Protesi valvolari

EFE: valutazione endocardite su protesi mitralica



Protesi valvolari

EFE: valutazione endocardite su protesi mitralica



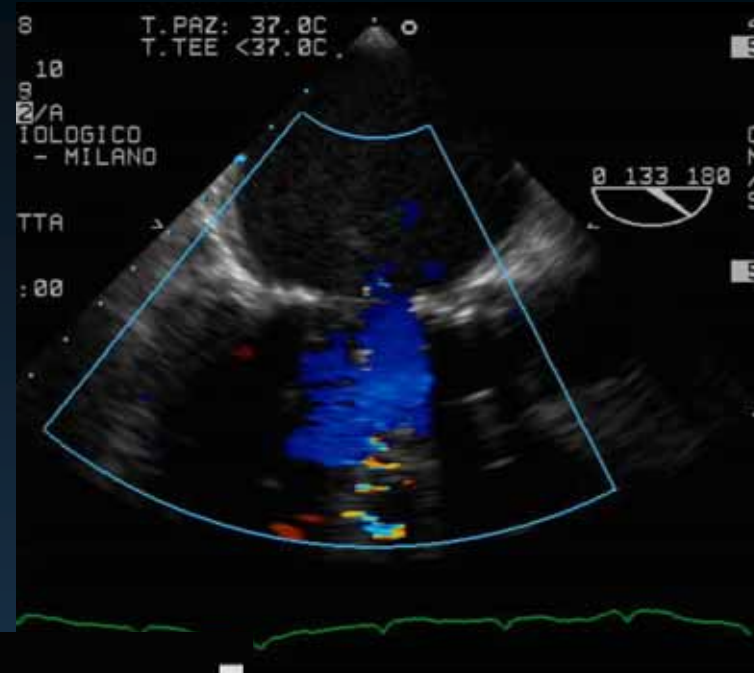
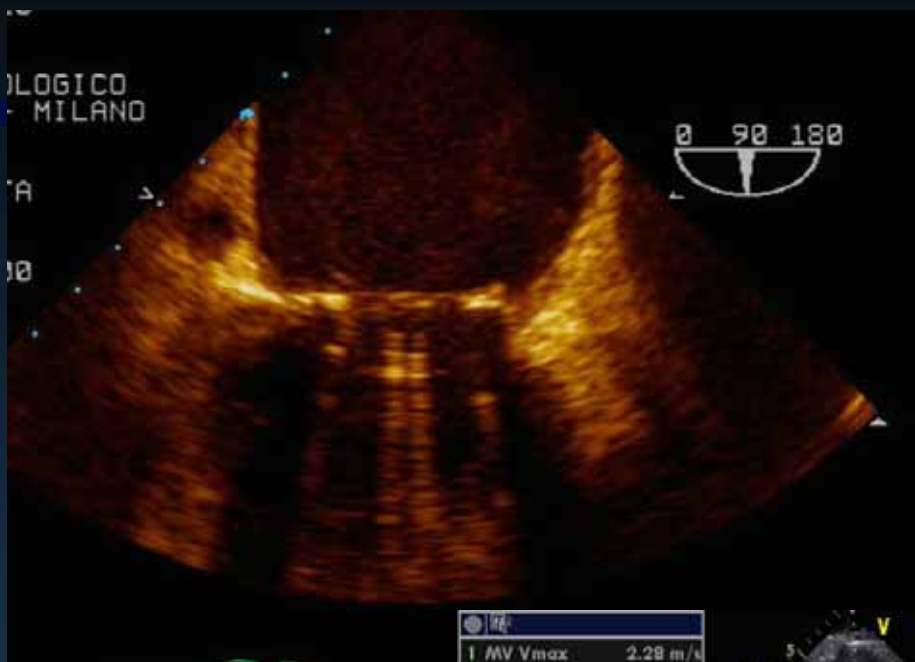
Protesi valvolari

Endocardite su protesi aortica TTE/TEE

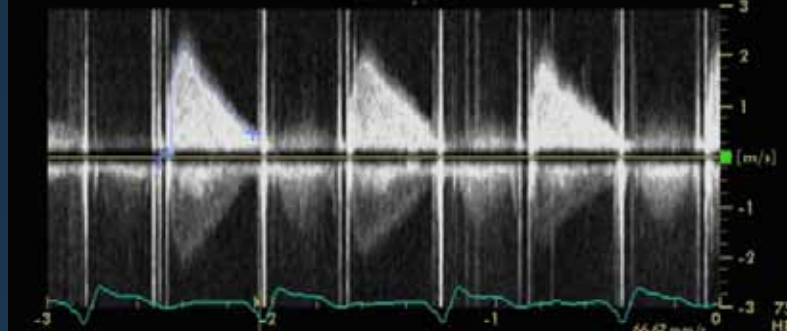
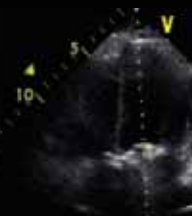


Protesi valvolari

Endocardite su protesi mitralica



MV Vmax	2.28 m/s
MV Vmean	1.30 m/s
MV maxPG	20.88 mmHg
MV meanPG	8.26 mmHg
MV VTI	49.8 cm



Protesi valvolari

ETE in disfunzione protesica

- **OSTRUZIONE**
 - *TROMBOSI (Meccaniche e Biologiche)*
 - *PANNO (Meccaniche)*
- **ENDOCARDITE** (*meccaniche, biologiche*)
- **DISTACCO** (*meccaniche, biologiche*)
- **DEGENERAZIONE** (*biologiche*)

Protesi valvolari

ETE nel rigurgito paraprotetico

■ SIGNIFICATIVI RIGURGITI PARAPROTESICI :

ENDOCARDITE

CEDIMENTO SUTURE

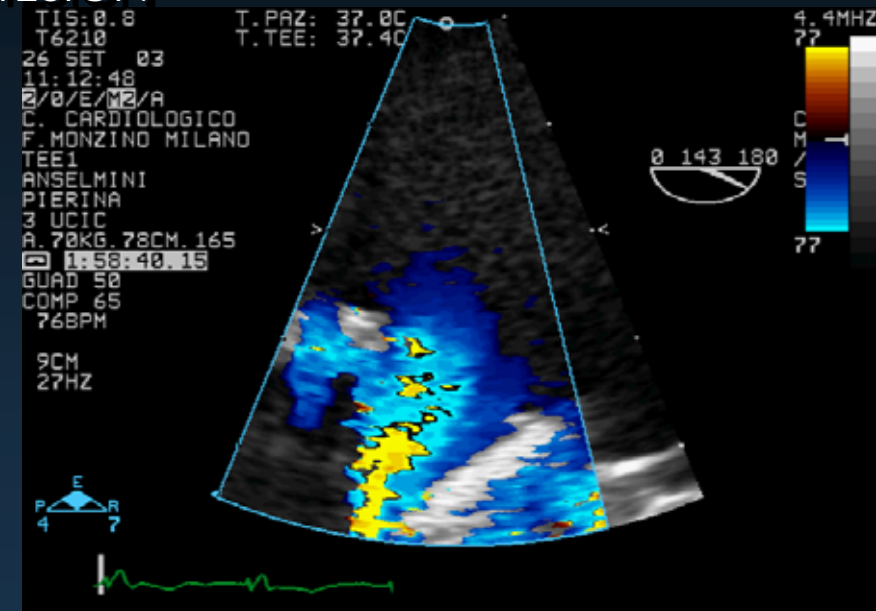
DEGENERAZIONE DI BIOPROTESI

■ TEE MULTIPLANA:

BASCULAMENTO

DROP OUT DI ECHI

COLOR-DOPPLER: RICERCA CIRCONFERENZIALE DELLA CONVERGENZA DI FLUSSO



Protesi valvolari

rigurgito paraprotetico mitralico

Table 9 Transthoracic echocardiographic findings suggestive of significant prosthetic MR in mechanical valves with normal pressure half-time

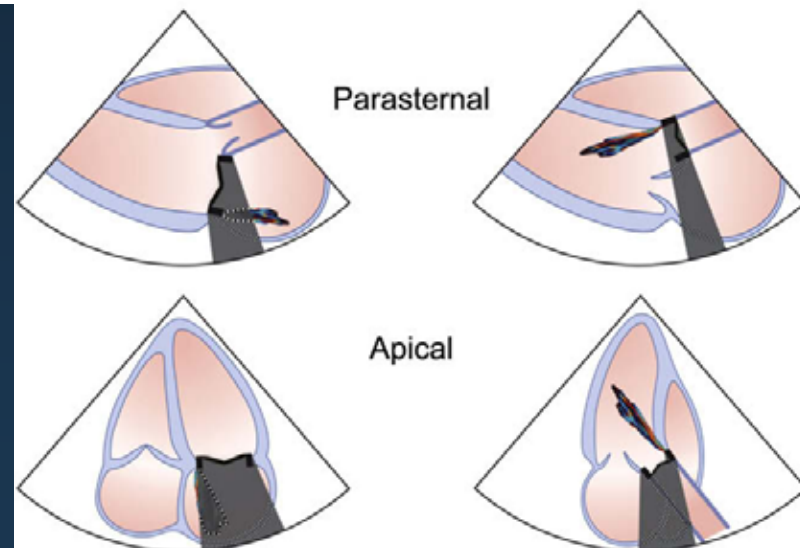
Finding	Sensitivity	Specificity	Comments
Peak mitral velocity ≥ 1.9 m/s*	90%	89%	Also consider high flow, PPM
$VTI_{PrMV}/VTI_{LVO} \geq 2.5^*$	89%	91%	Measurement errors increase in atrial fibrillation due to difficulty in matching cardiac cycles; also consider PPM
Mean gradient ≥ 5 mmHg*	90%	70%	At physiologic heart rates; also consider high flow, PPM
Maximal TR jet velocity > 3 m/s*	80%	71%	Consider residual postoperative pulmonary hypertension or other causes
LV stroke volume derived by 2D or 3D imaging is $>30\%$ higher than systemic stroke volume by Doppler	Moderate sensitivity	Specific	Validation lacking; significant MR is suspected when LV function is normal or hyperdynamic and VTI_{LVO} is <16 cm
Systolic flow convergence seen in the left ventricle toward the prosthesis	Low sensitivity	Specific	Validation lacking; technically challenging to detect readily

PrMV, Prosthetic mitral valve.

*Data from Olmos et al.¹⁴⁸ When both peak velocity and VTI ratio are elevated with a normal pressure half-time

Mitral prosthesis

Aortic prosthesis



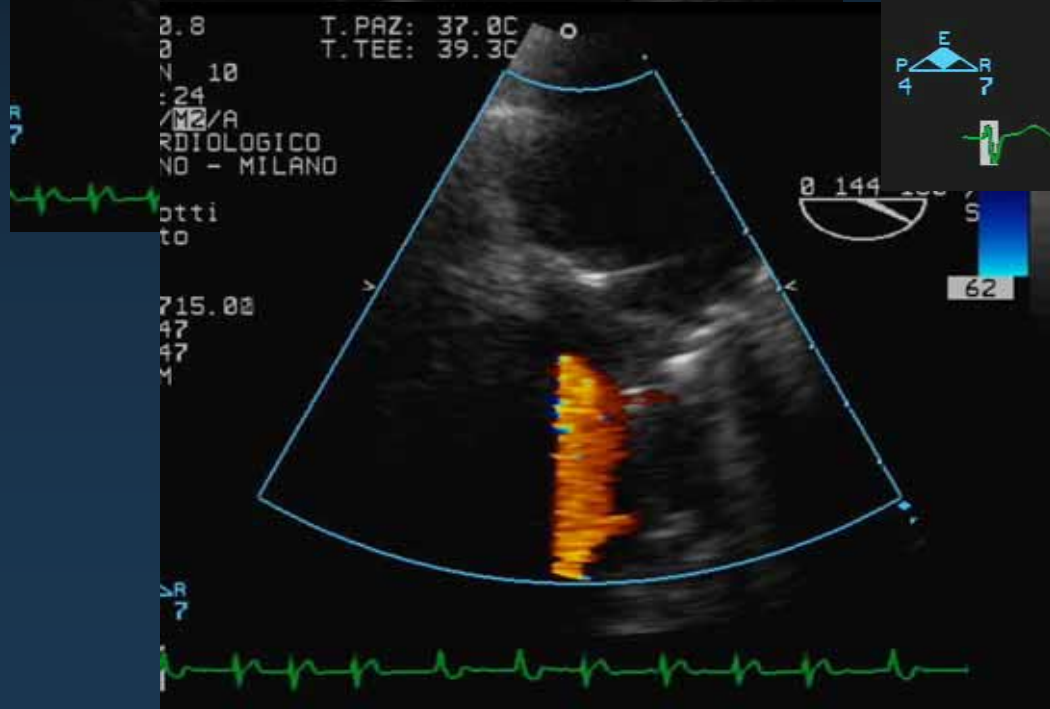
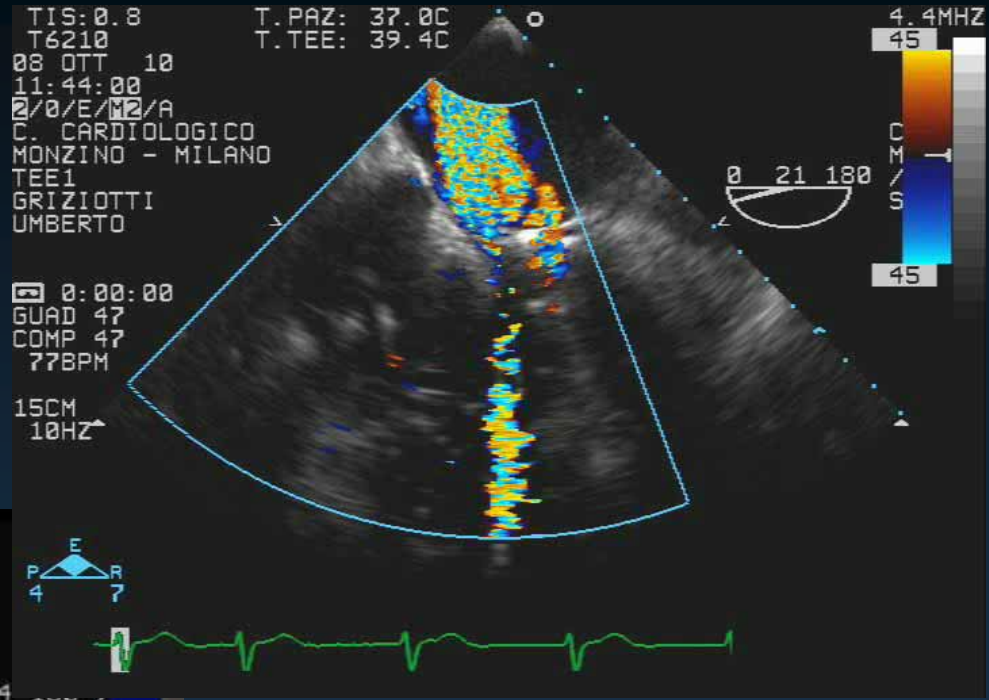
Protesi valvolari

rigurgito paraprotetico mitralico



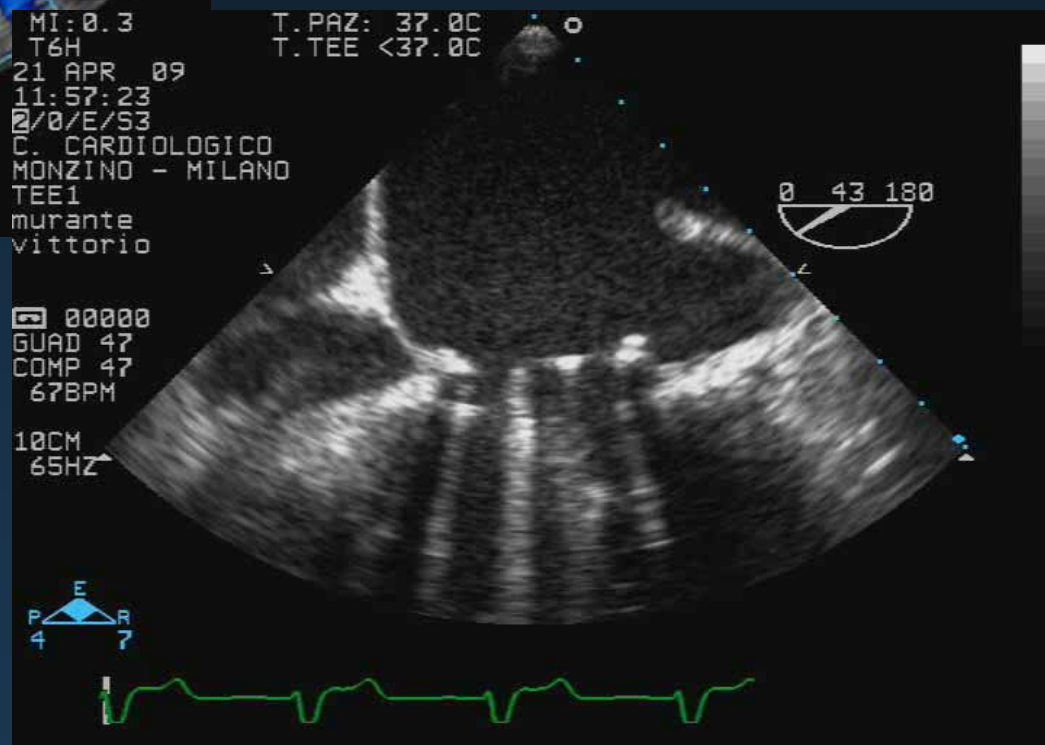
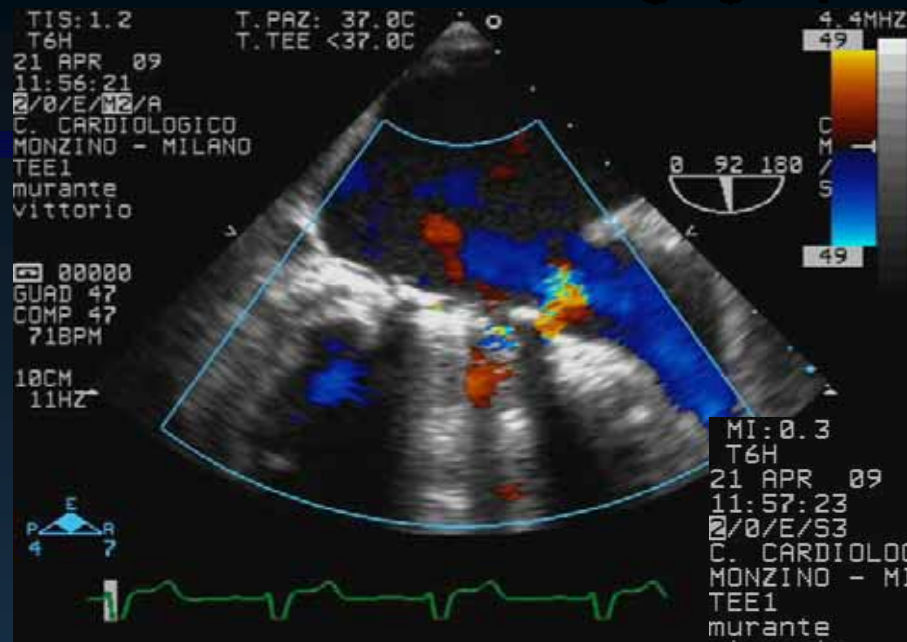
Protesi valvolari

rigurgito paraprotetico mitralico



Protesi valvolari

rigurgito paraprotetico mitralico



Protesi valvolari

ETE nel rigurgito paraprotetico

Natural history of early aortic paraprosthetic regurgitation: A five-year follow-up

Loukianos S. Rallidis, MD, Ioannis E. Moysakakis, MD, Ignatios Ikonomidis, MD, and Petros Nihoyannopoulos, MD, FACC, FESC *London, United Kingdom*

Conclusions Paraprosthetic aortic leaks detected early after surgery, in the absence of valve infection, are common, are usually small, and have a benign course. However, the development of new, usually severe, regurgitation should raise the suspicion of prosthetic valve endocarditis or bioprosthetic valve failure. (*Am Heart J* 1999;138:351-7.)

Outcome of Mild Periprosthetic Regurgitation Detected by Intraoperative Transesophageal Echocardiography

Daniel J. O'Rourke, MD, MS, FACC,* Robert T. Palac, MD, MS, FACC,†
David J. Malenka, MD, FACC,† Charles A. S. Marrin, MB, BS,‡ Brenda E. Arbuckle, BA,†
Jonathan F. Plehn, MD, FACC§

White River Junction, Vermont; Lebanon, New Hampshire; and Roslyn, New York

CONCLUSIONS Trivial or mild PPR is a frequent finding on intraoperative TEE. Smaller body size and the use of a bioprosthetic valve are significantly associated with PPR. The clinical significance and natural history of PPR is benign in most cases. (*J Am Coll Cardiol* 2001;38:163-6) © 2001 by the American College of Cardiology

Protesi valvolari

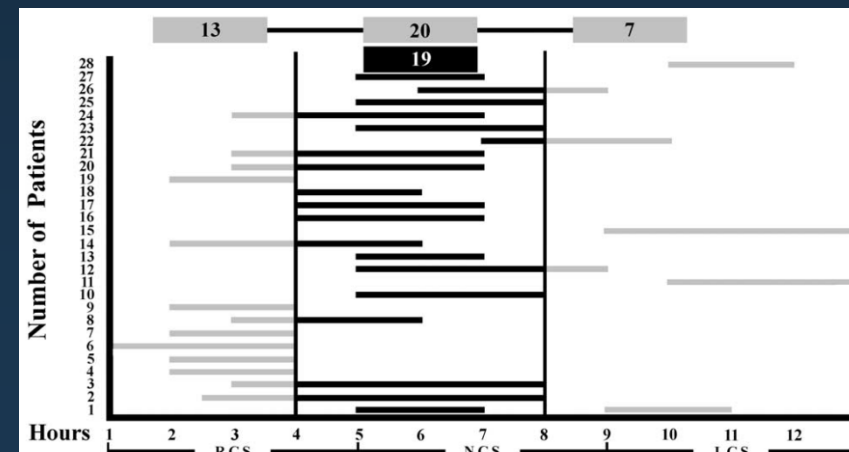
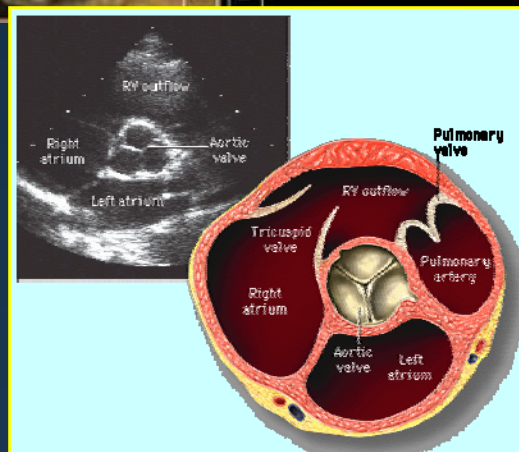
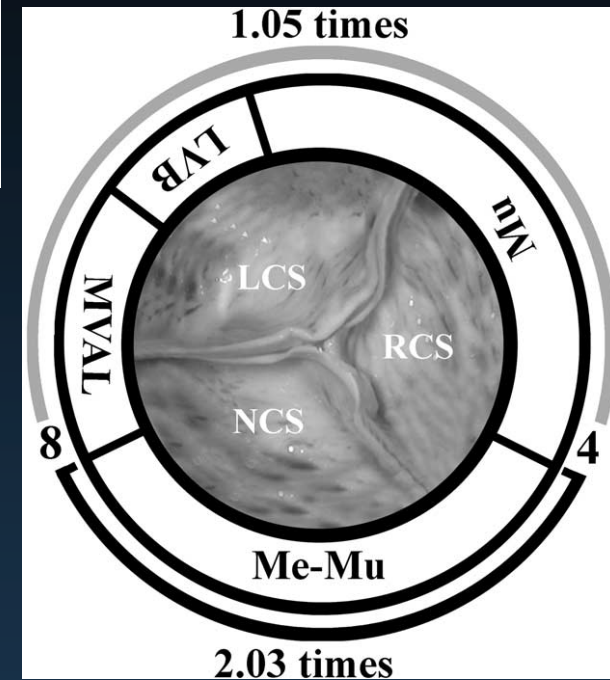
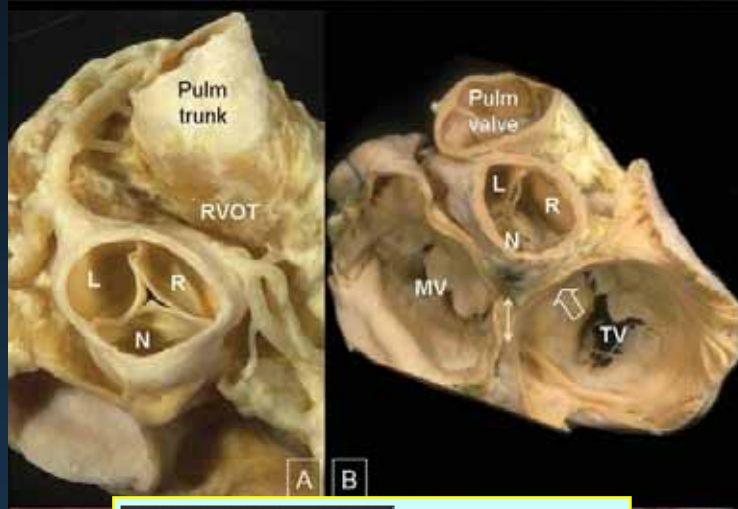
Il rigurgito paraprotetico aortico

Aortic Valve Periprosthetic Leakage: Anatomic Observations and Surgical Results

Giuseppe De Cicco, MD, Roberto Lorusso, MD, PhD, Andrea Colli, MD, Francesco Nicolini, MD, Claudio Fragnito, MD, Teresa Grimaldi, MD, Bruno Borrello, MD, Alessandro Maria Budillon, MD, Tiziano Gherli, MD, and Cesare Beghi, MD

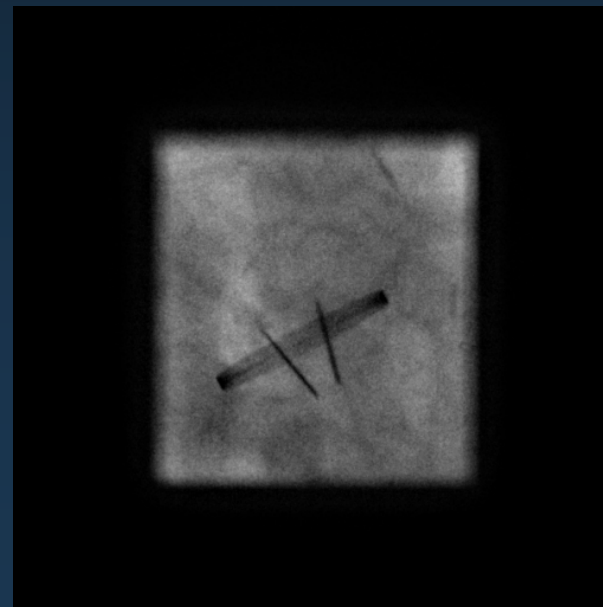
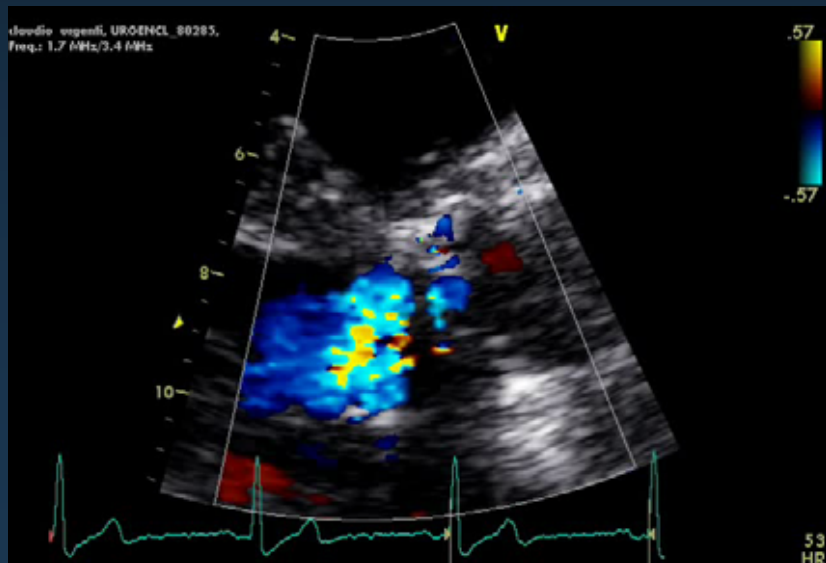
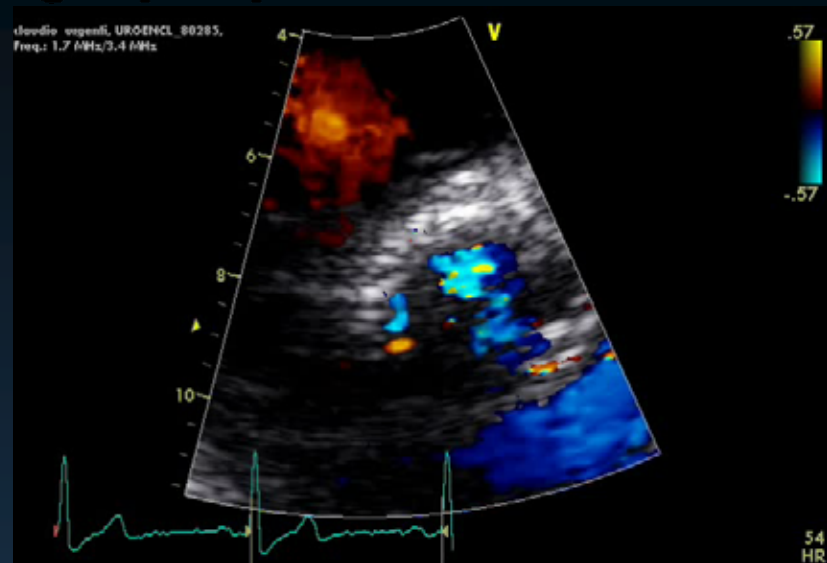
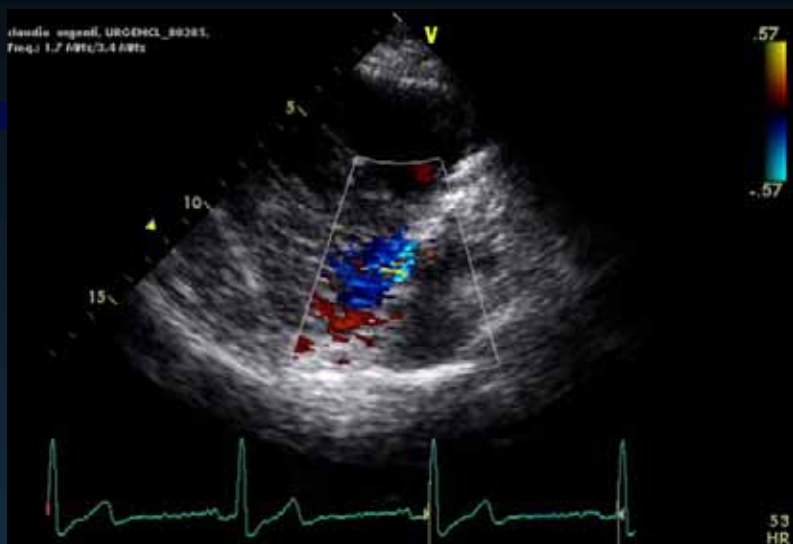
Cardiac Surgery Unit, Civic Hospital, Brescia, Department of Cardiac Surgery, University of Parma, Parma, and Department of Cardiology, University of Modena and Reggio Emilia, Modena, Italy

(Ann Thorac Surg 2005;79:1480-5)
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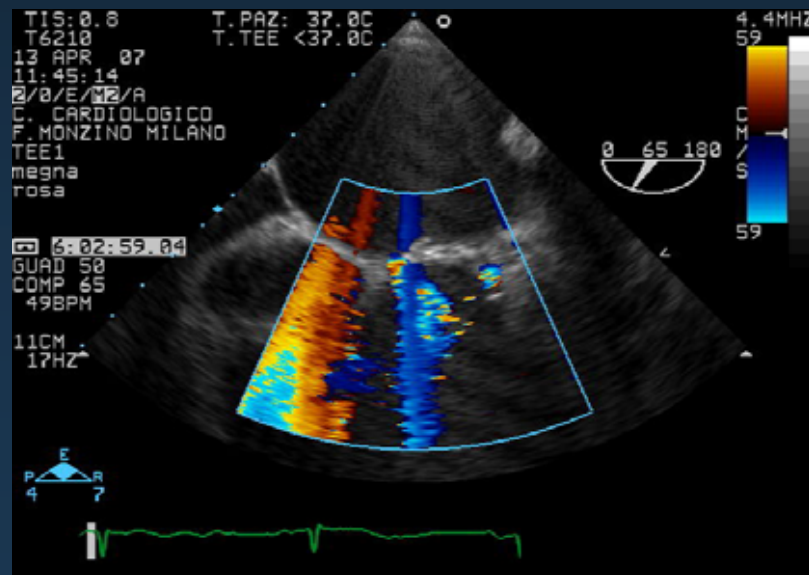
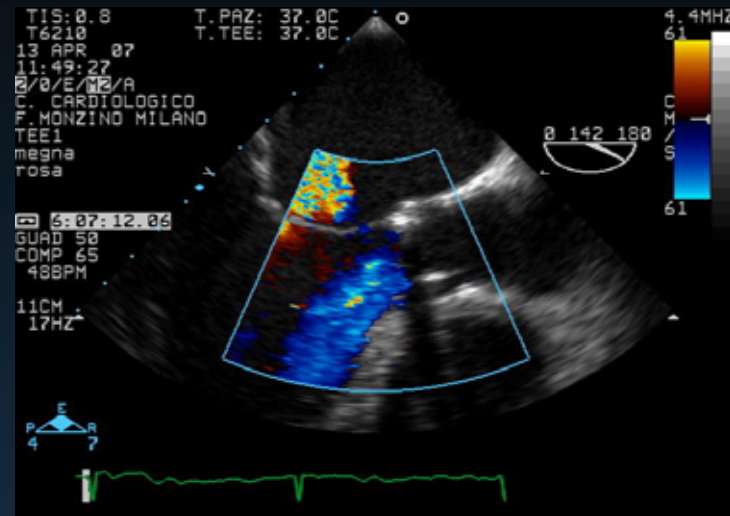
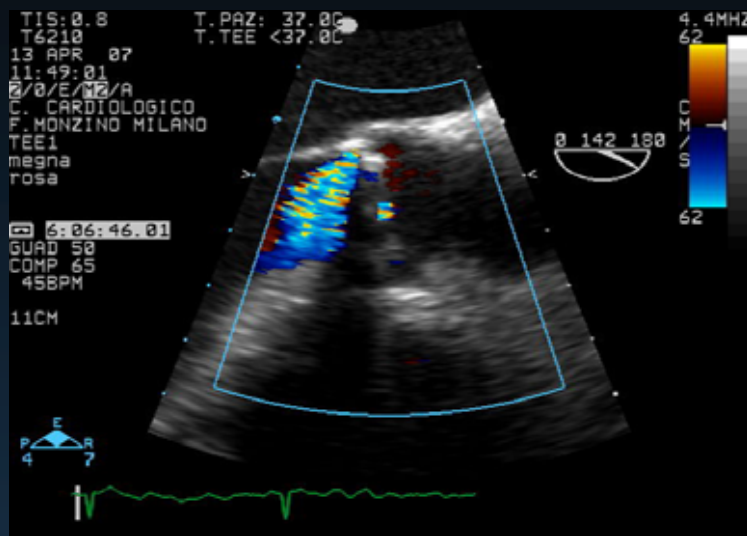
Protesi valvolari

ETE nel rigurgito paraprotetico aortico



Protesi valvolari

ETE nel rigurgito paraprotetico aortico



Protesi valvolari

ETE nel rigurgito paraprotetico valvola percutanea

