



PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

ROMA

Centro Congressi
di Confindustria

**Auditorium
della Tecnica**

9ª Edizione

30 Settembre

1 Ottobre

2022



TOPICS IN CARDIOCHIRURGIA E DINTORNI

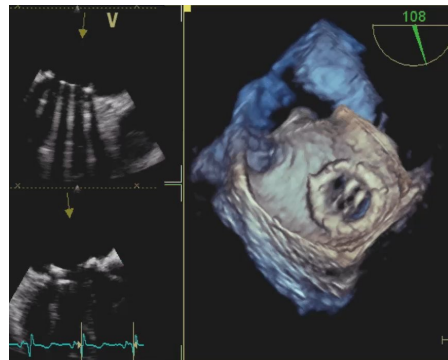
Disfunzione di protesi meccanica

Dr. Manuela Muratori

Centro Cardiologico Monzino U.O. Ecocardiografia



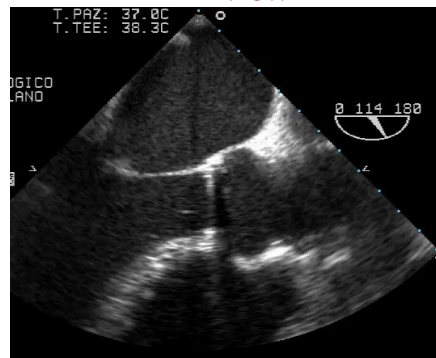
Mitral Bileaflet Prosthesis
3D Left Atrial view



Mitral Bileaflet Prosthesis:
Fluoroscopy



Aortic Monodisc Prosthesis
2D view



Aortic Monodisc Prosthesis:
Fluoroscopy

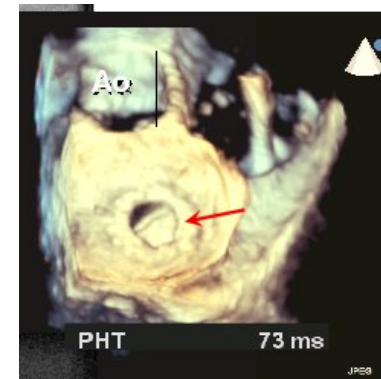
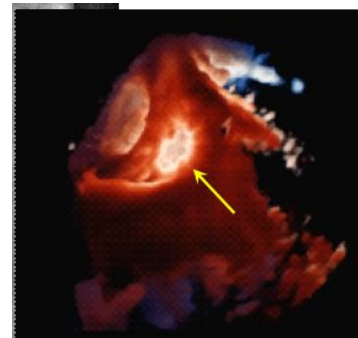
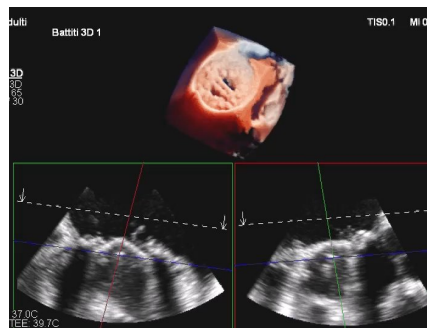




- *Obstruction (Thrombus/Pannus)*

- Paravalvular leak(s)

- Endocarditis

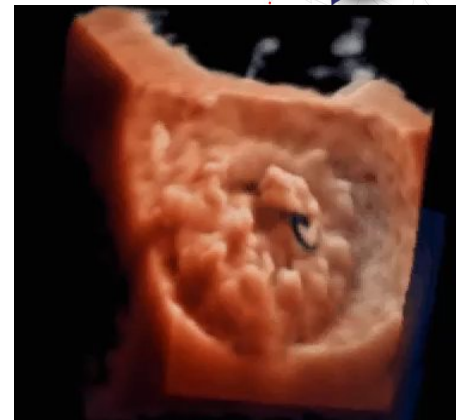




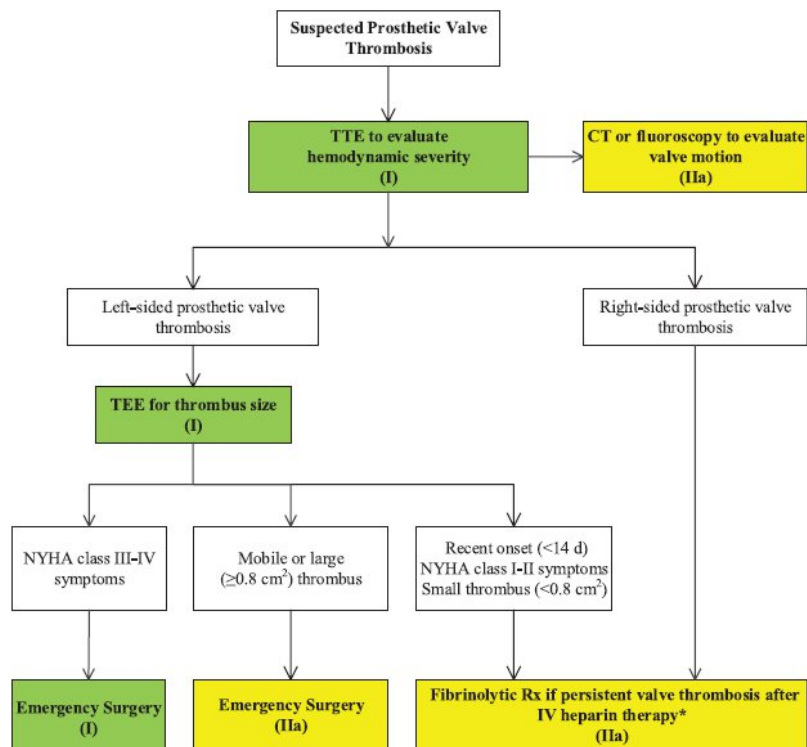
2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

Recommendation for Mechanical Prosthetic Valve Thrombosis Diagnosis and Follow-Up

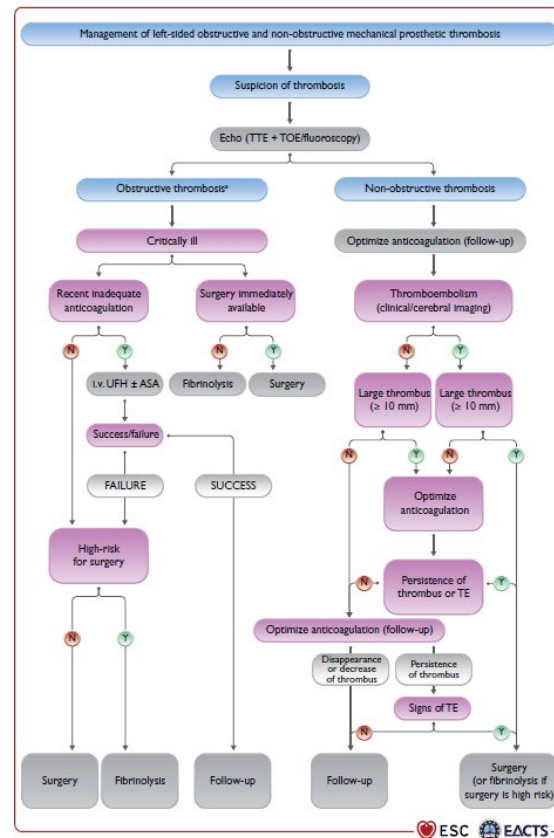
COR	LOE	RECOMMENDATION
I	B-NR	Urgent evaluation with multimodality imaging is indicated in patients with suspected mechanical prosthetic valve thrombosis to assess valvular function, leaflet motion, and the presence and extent of thrombus



2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines



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



Diagnosing Prosthetic Mitral Valve Thrombosis and the Effect of the Type of Prosthesis

Piero Montorsi, MD, Dario Cavoretto, MD, Alessandro Parolari, MD, PhD, Manuela Muratori, MD, Marina Alimento, MD, and Mauro Pepi, MD

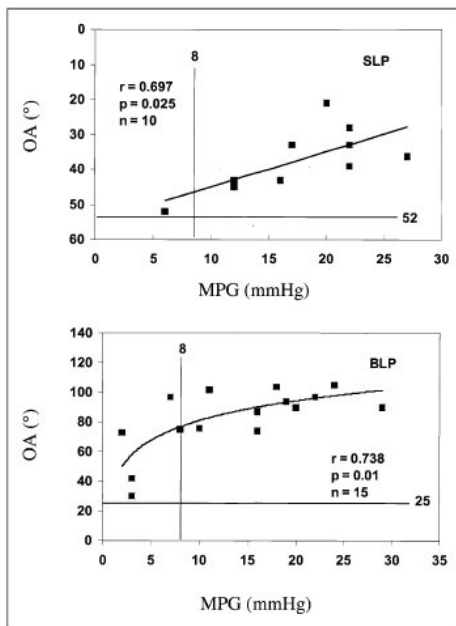


FIGURE 1. Correlation between opening angle (OA) and mean pressure gradient (MPG) in SLP and BLP.

In summary, up to 24% of patients with proved PMVT have normal Doppler mean pressure gradients at rest. This finding is more likely to occur in BLP than in SLP. CF correctly identifies these cases and therefore should always be part of the diagnostic workup for PMVT.

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
 (Am J Cardiol 2006;97:94-100)

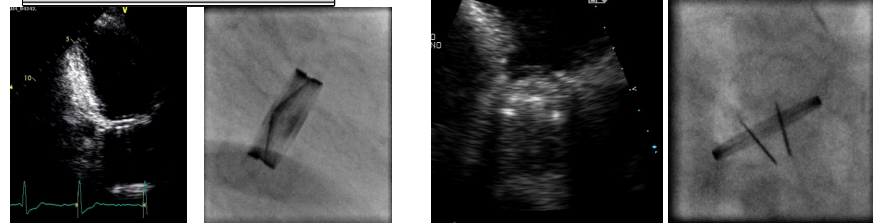
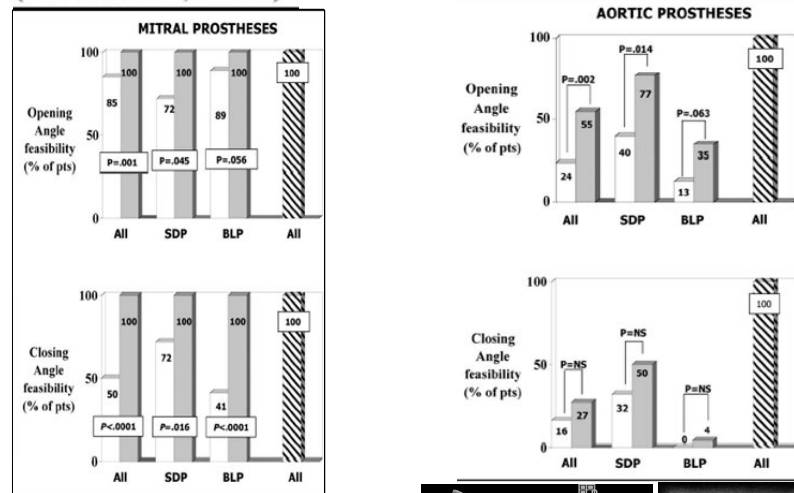


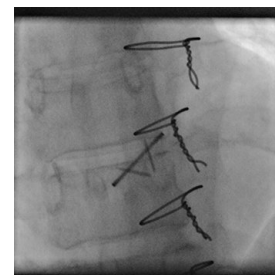
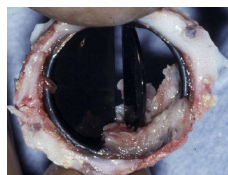
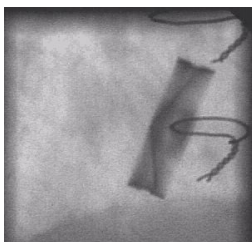
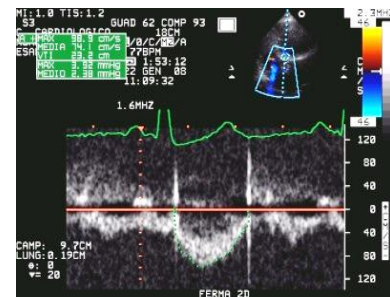
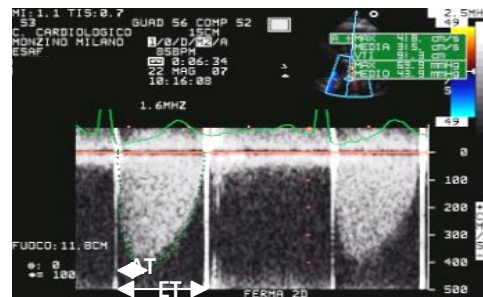
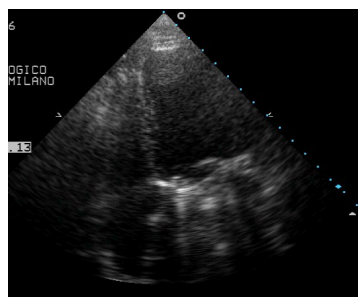
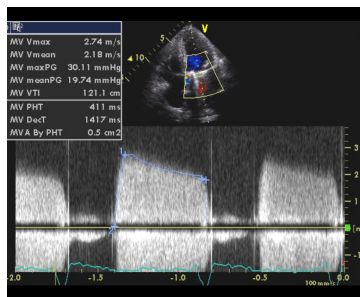


Table 8 Doppler parameters of prosthetic mitral valve function

	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

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 AT (ms)	Triangular, early peaking <80	Triangular to intermediate 80-100	Rounded, symmetrical contour >100

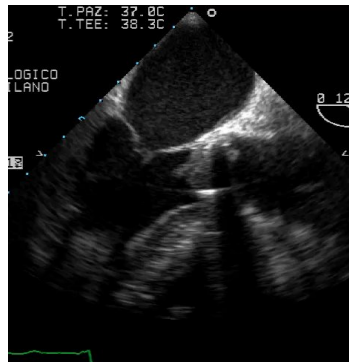
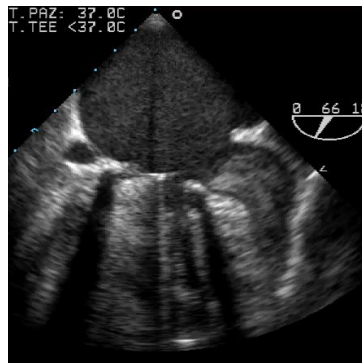




2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

Recommendation for Mechanical Prosthetic Valve Thrombosis Intervention

COR	LOE	RECOMMENDATION
I	B-NR	Urgent initial treatment with either slow-infusion low-dose fibrinolytic therapy or emergency surgery is recommended for patients with a thrombosed left-sided mechanical prosthetic heart valve presenting with symptoms of valve obstruction


TABLE 4

Fibrinolysis Versus Surgery for Prosthetic Valve Thrombosis

Favor Surgery

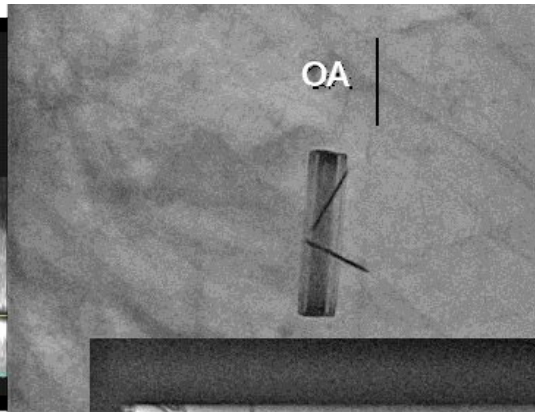
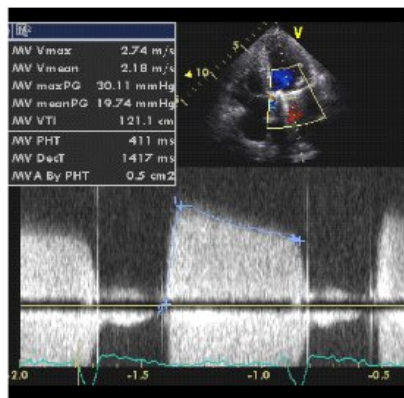
Favor Fibrinolysis

Readily available surgical expertise	No surgical expertise available
Low surgical risk	High surgical risk
Contraindication to fibrinolysis	No contraindication to fibrinolysis
Recurrent valve thrombosis	First-time episode of valve thrombosis
NYHA class IV	NYHA class I-III
Large clot ($>0.8 \text{ cm}^2$)	Small clot ($\leq 0.8 \text{ cm}^2$)
Left atrial thrombus	No left atrial thrombus
Concomitant CAD in need of revascularization	No or mild CAD
Other valve disease	No other valve disease
Possible pannus	Thrombus visualized
Patient choice	Patient choice



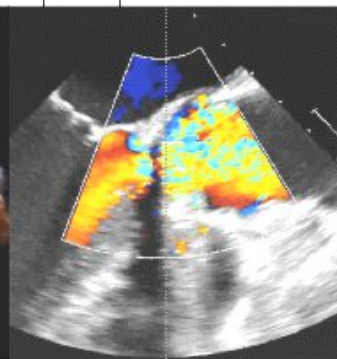
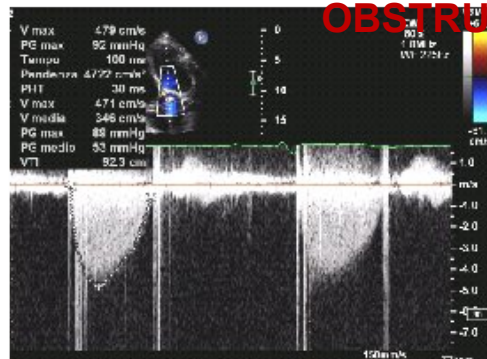
MITRAL BILEAFLET PROSTHETIC VALVE OBSTRUCTION

O-PVD



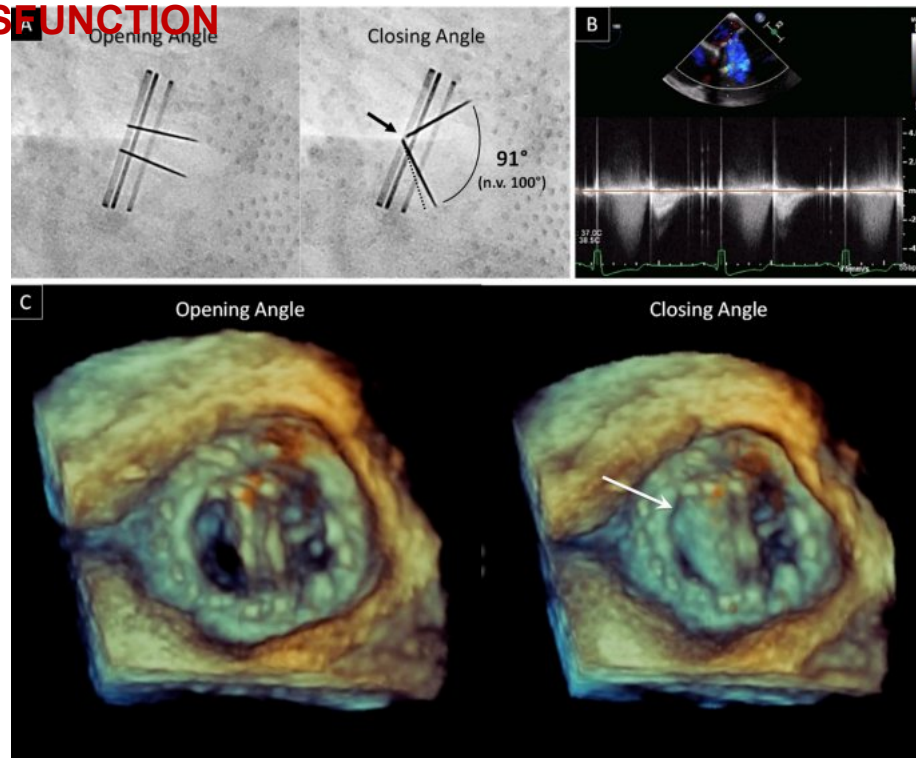
AORTIC BILEAFLET PROSTHETIC VALVE PANNUS OBSTRUCTION

O-PVD



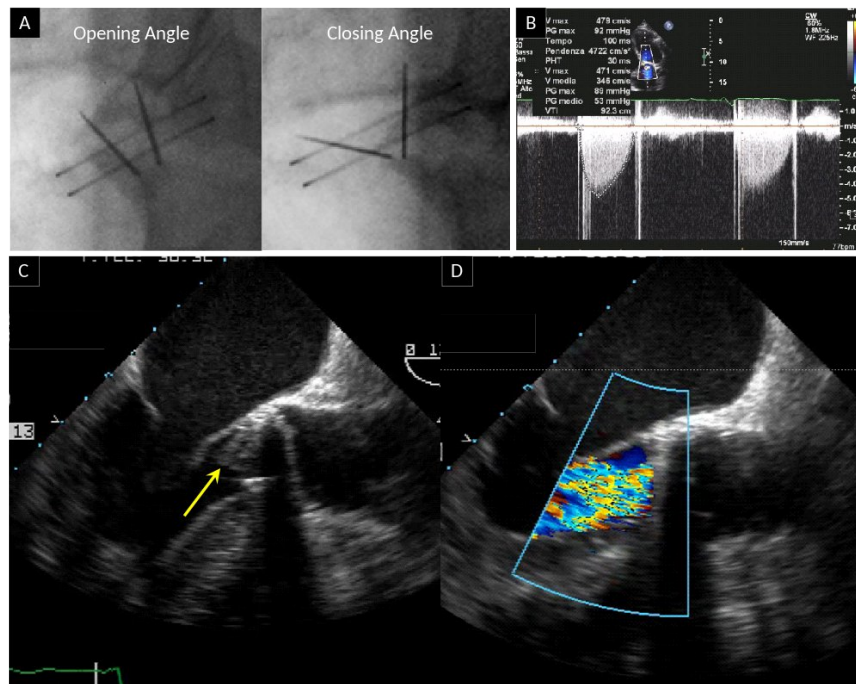


MITRAL BILEAFLET PROSTHETIC VALVE CLOSING DYSFUNCTION





AORTIC BILEAFLET PROSTHETIC VALVE CLOSING DYSFUNCTION

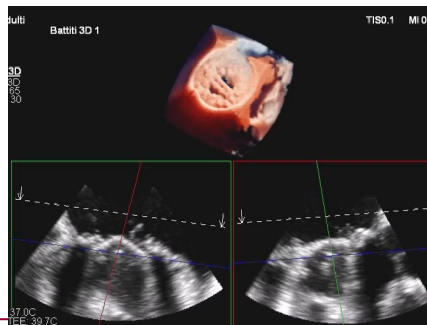
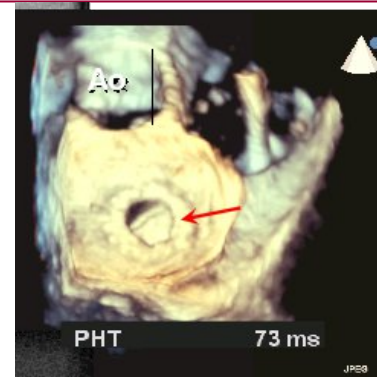
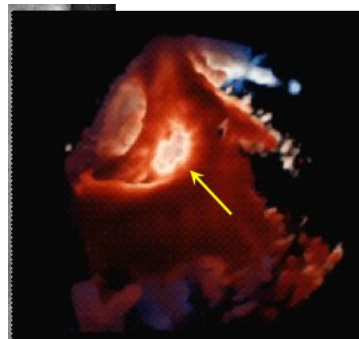




- Obstruction (Thrombus/Pannus)

- *Paravalvular leak(s)*

- Endocarditis

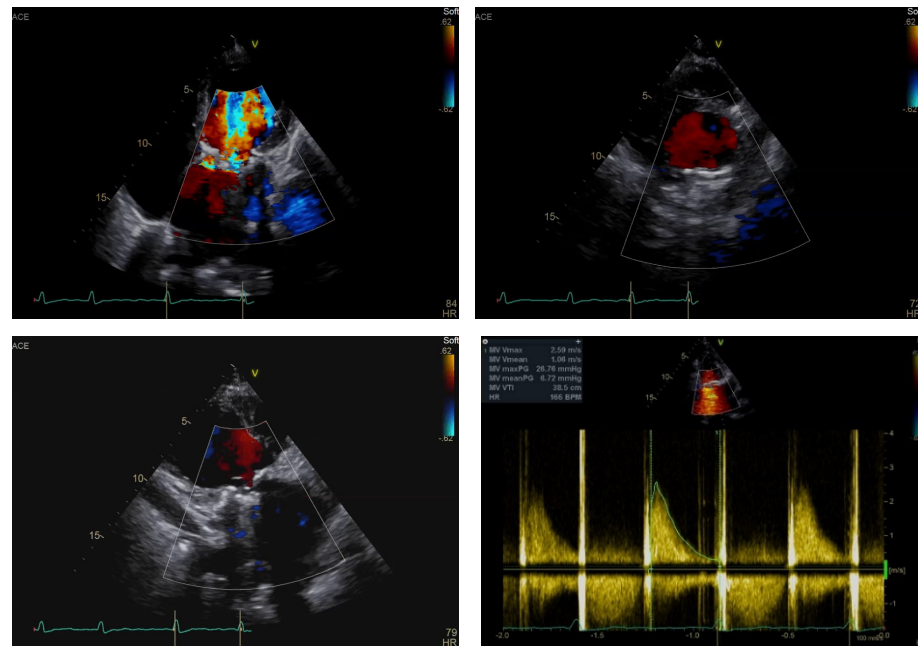




- Dyspnea, heart failure associated to pulmonary hypertension and hemolysis are the classical clinical presentation of a significant mitral PVL.
- TTE is the first line examination, but it is often limited in the mitral PVL assessment, and requires the use of multiple transducer positions, including off axis views.
- Detection of regurgitation with TTE is more difficult for PV in the mitral positions, particularly in mechanical valves, because of shielding and reverberations of the PV.

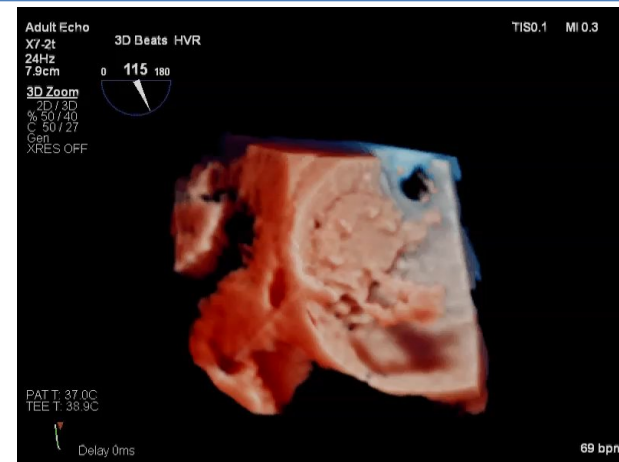
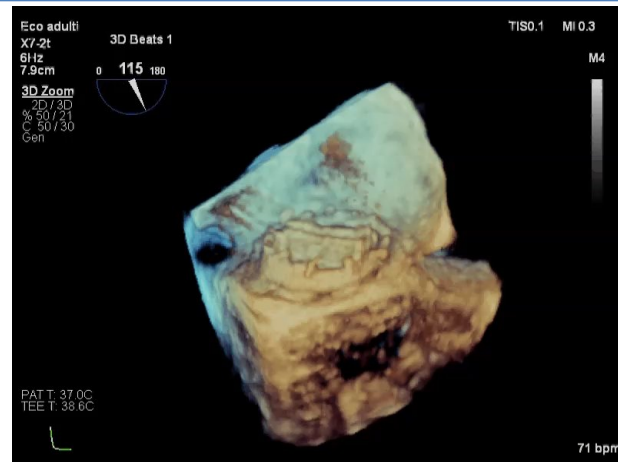
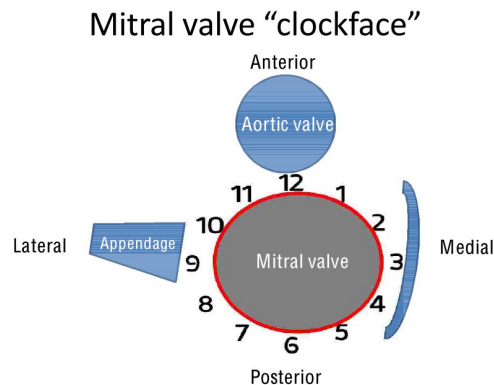
Table 9 Transthoracic echocardiographic findings suggestive of significant prosthetic MR in mechanical valves with normal pressure half-time

Finding	Sensitivity	Specificity	Comments
Peak mitral velocity ≥ 1.9 m/s*	90%	89%	Also consider high flow, PPM
$VTI_{PMV}/VTI_{LVO} \geq 2.5^*$	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



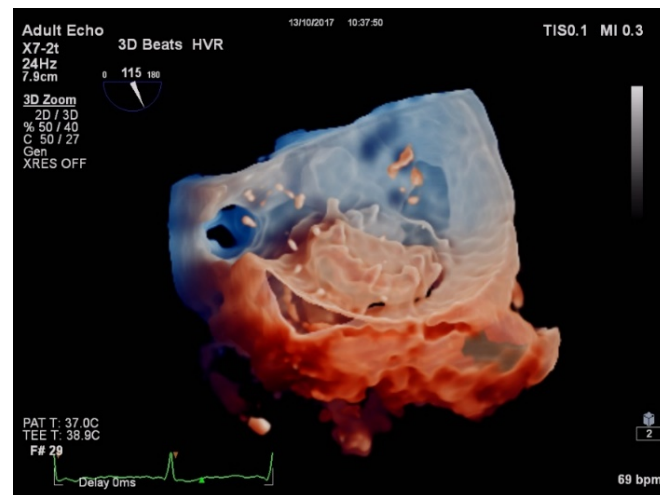
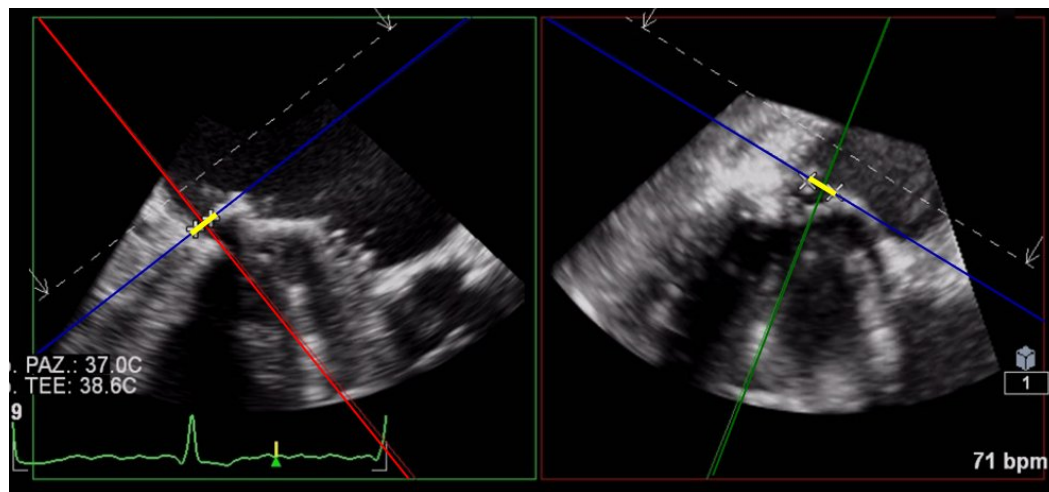


- 3D TEE allows to get a panoramic view of the suture ring and discs and may also show the exact number, site, size, and shape (circular, linear, crescent, or irregular) of the PVLs.
- The latest developments of the photorealistic 3D rendering make it even easier to interpret the features of the PVL and to reach a better overall understanding of the PVD.
- One of these post-processing imaging tools, the trans-illumination, makes it possible to change the lightening conditions and therefore to improve contrast, to change shadows and to add more depth perception





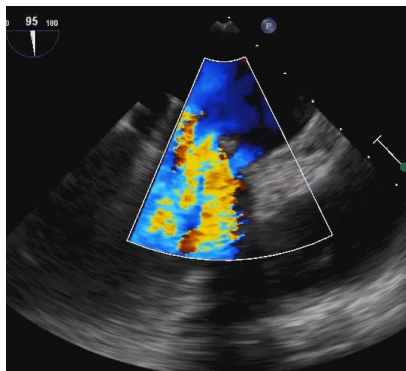
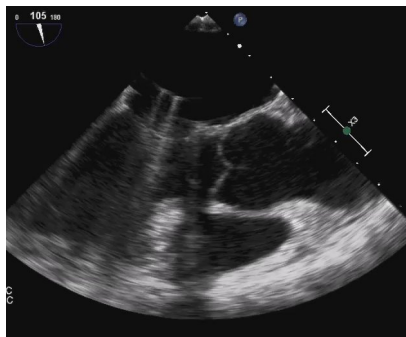
- 3D is also very important to define the dimensions of the defects: using a system of perpendicular planes crossing the defects we can measure the dimensions of the defects and then we can help the interventionist in the choice of the device for the percutaneous closure
- The transparency peels away layers to see the flow



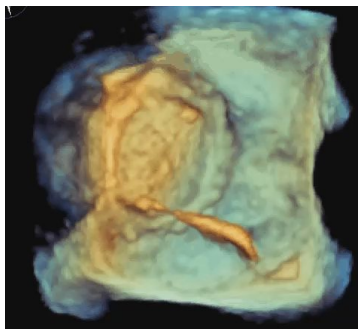
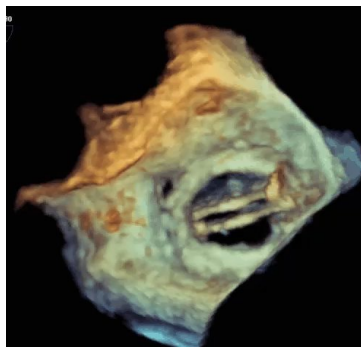


3D TEE allows for real-time imaging of the catheters within the heart, thus facilitating the maneuvers of the interventionist and the correct positioning of the occluders during the procedure of percutaneous closure.

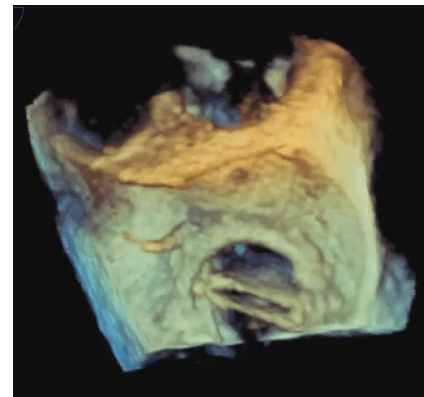
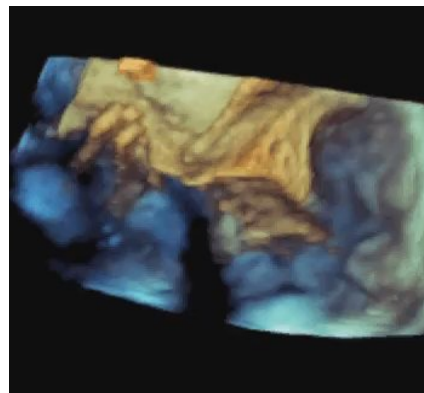
2D TEE

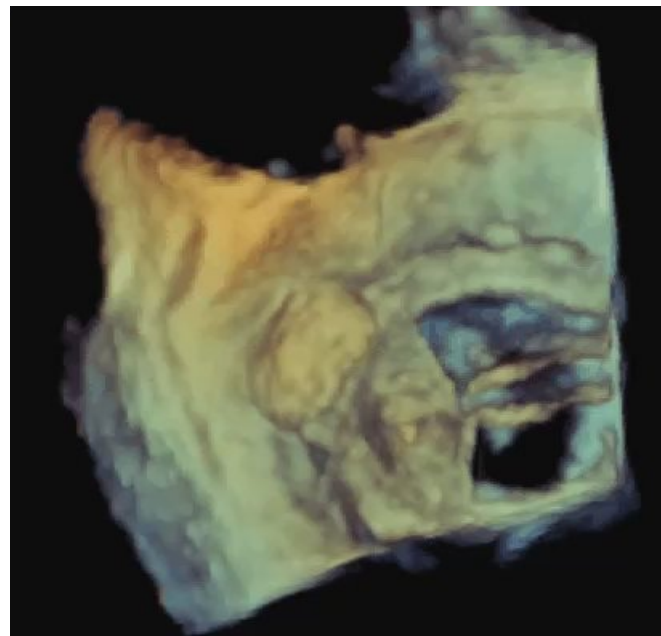
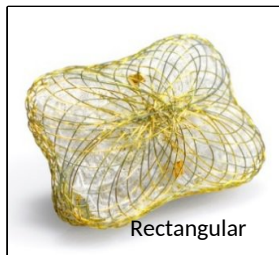


3D TEE



3D TEE

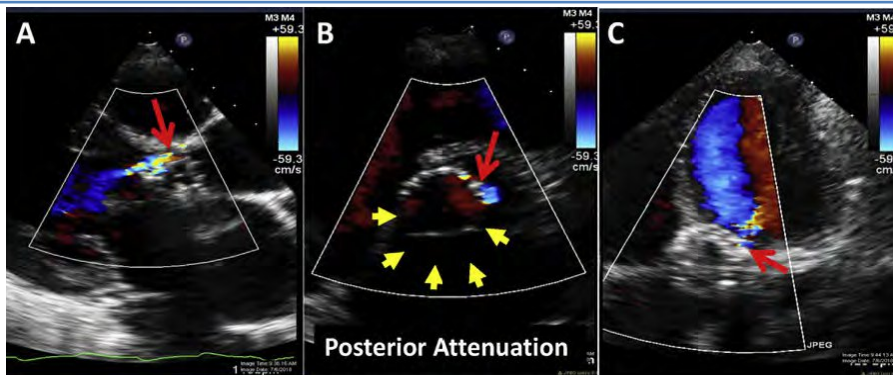




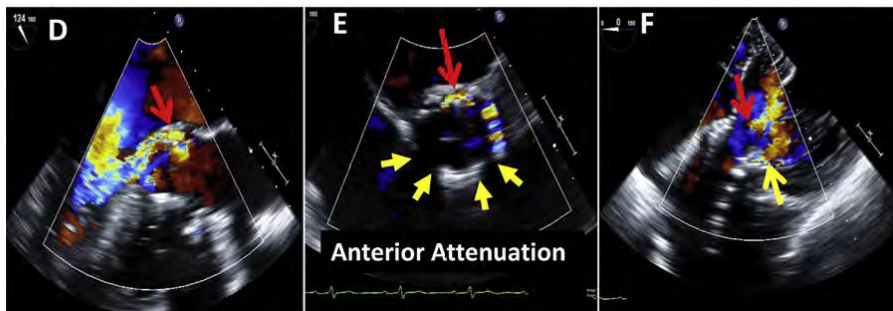


TEE is very useful in detecting a PVL in a posterior position (corresponding to the non-coronary sinus), because this region is closer to the transducer in contrast with the anterior region, hidden by reverberation produced by the annulus.

TTE:
Anterior Leak



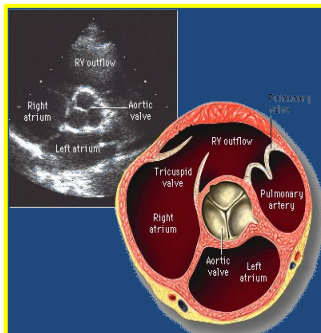
TEE:
Posterior Leak





- TEE assessment of an aortic valve prosthesis is more limited than the assessment of the mitral prosthesis
- TTE is used to represent the aortic PVLs in a clockwise fashion.
- TTE o'clock representation of the Valsalva aortic sinus does not correspond to TEE or to the surgical view representation and then PVL can be misleading when the patient goes to TEE or surgery.

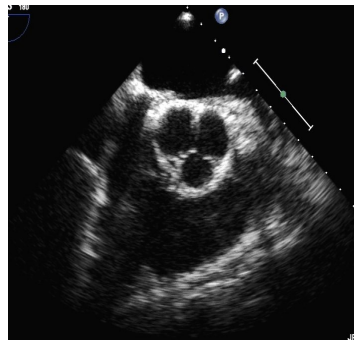
2D TTE



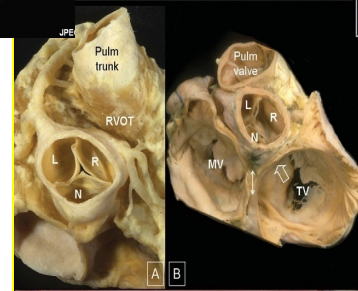
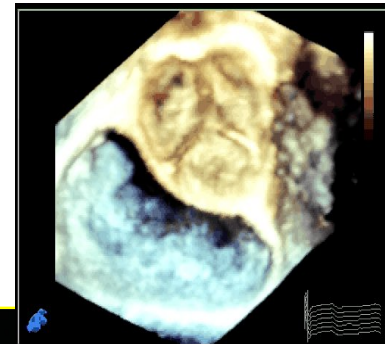
PSAX



2D TEE



3D TEE

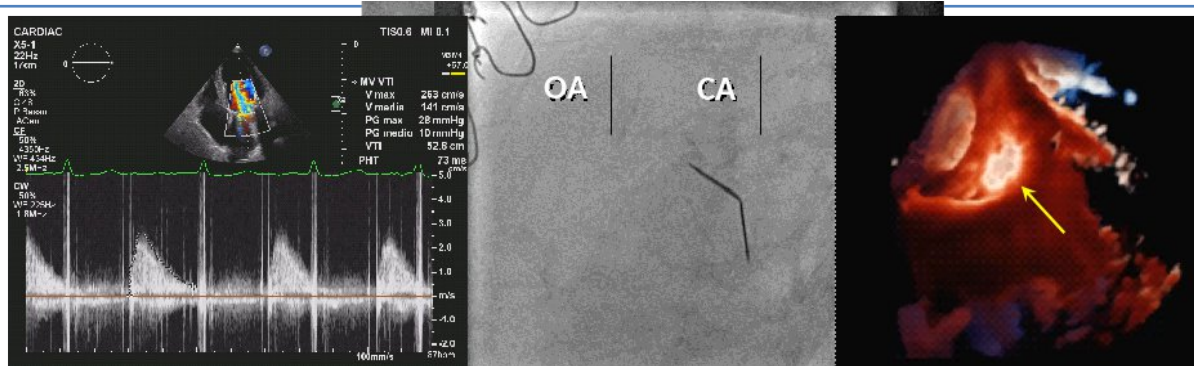




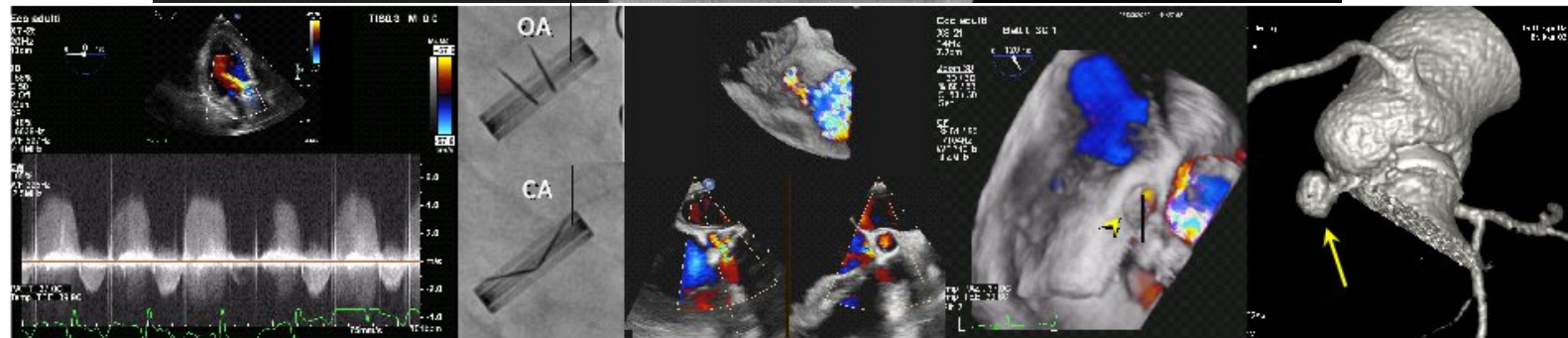
Fluoroscopy is very useful to clarify an intra versus PVL regurgitation in the bileaflet PV.

In fact, in case of a regurgitation of unknown origin, normal closing and opening prosthetic angles, can exclude the case of intra-prosthetic regurgitation and leads us to the PVL diagnosis

P-PVD

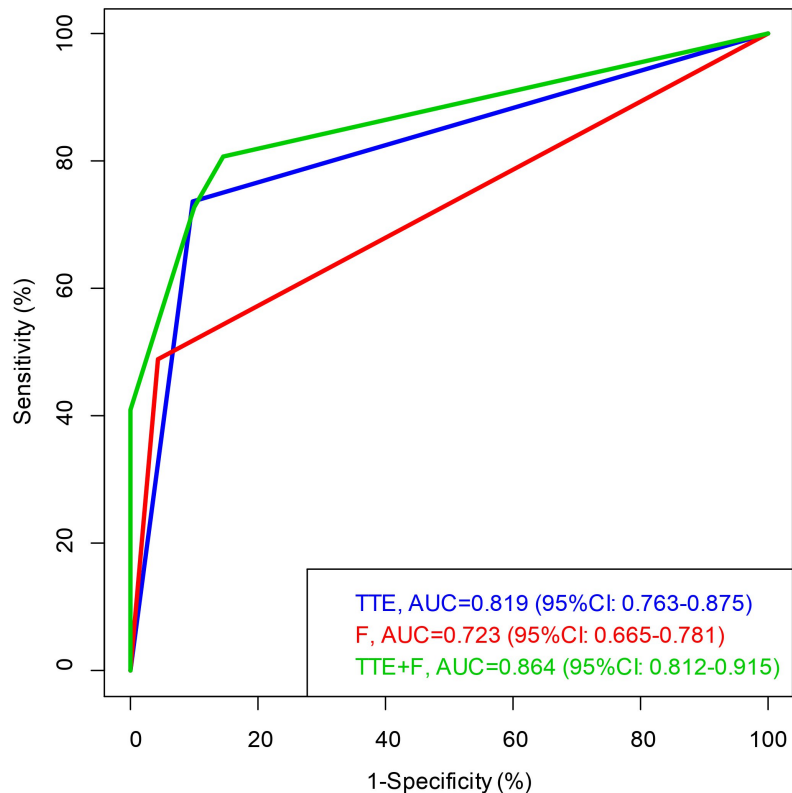


P-PVD

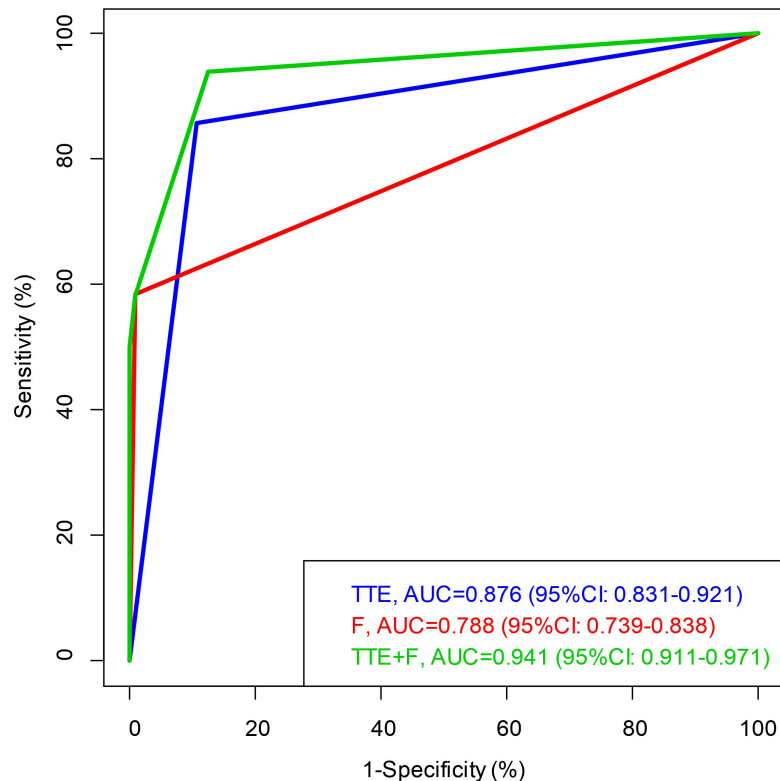




Mitral Prosthetic Valve



Aortic Prosthetic Valve

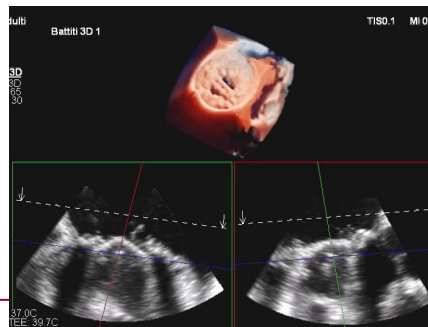
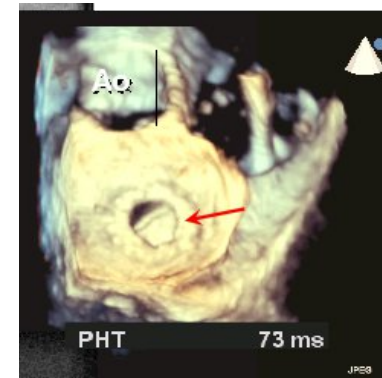
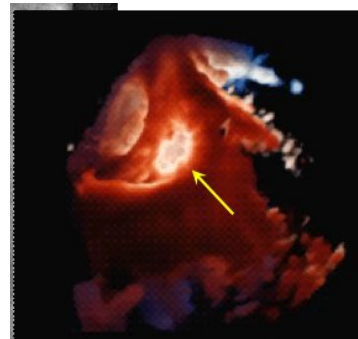




- Obstruction (Thrombus/Pannus)

- Paravalvular leak(s)

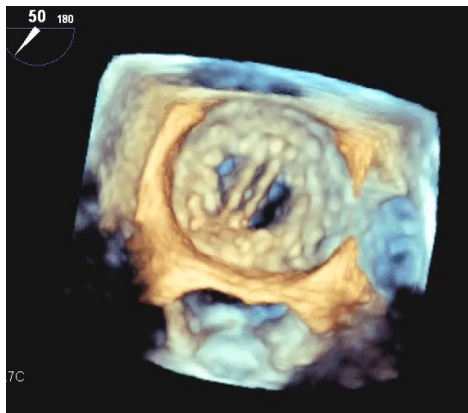
- *Endocarditis*



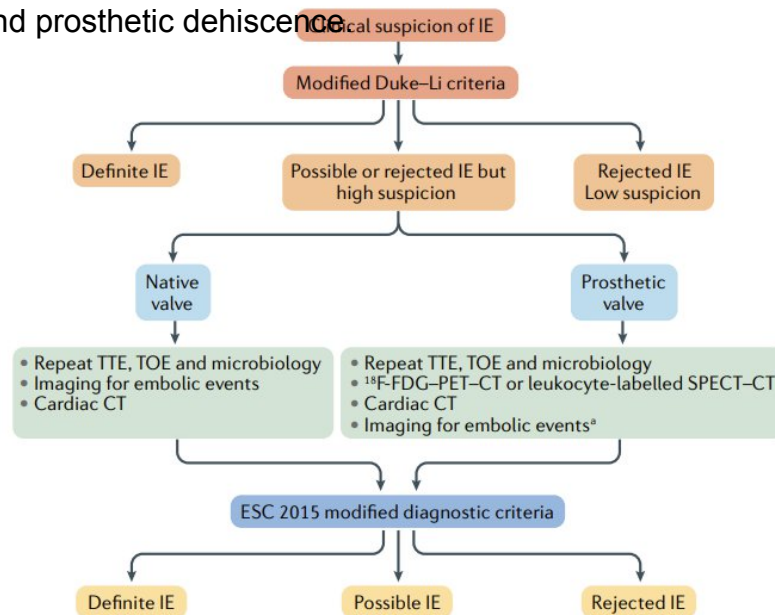
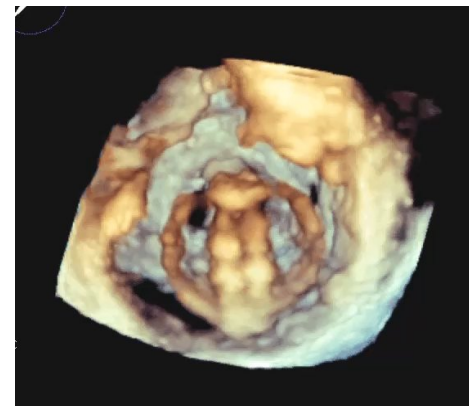


- PVE is the most severe form of infective endocarditis and occurs in 1–6% of patients with mechanical and/or biological PV
- A negative TTE can be frequently observed in mechanical prosthesis due to prosthetic reverberations and shadowing
- TEE is the gold standard, especially for the detection of vegetations and the measurement of its length, which both have a major impact on the risk of embolism and on the indication of early surgery. TEE is also preferable to TTE in localizing PVL and in the assessment of leaflet malfunction and prosthetic dehiscence

Atrial view

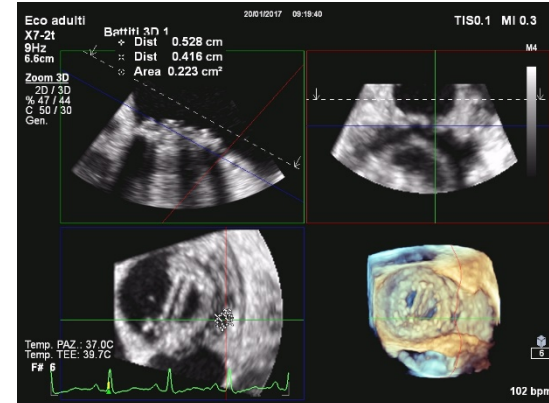
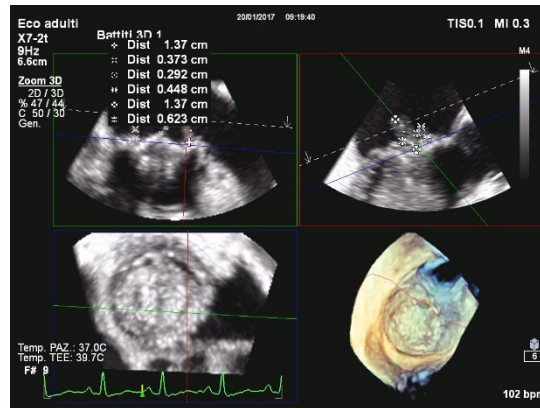
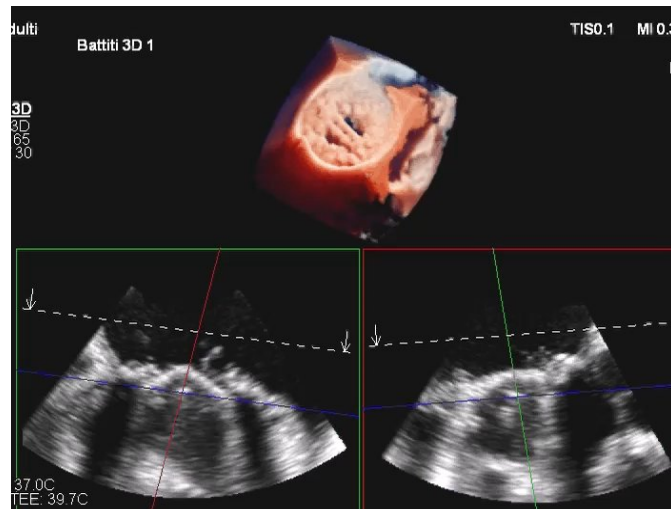


Ventricular view





- 3D TEE provides incremental anatomic information allowing for a far better visualization of cardiac anatomy. Therefore, it helps in assessing paravalvular's extension of infection, prosthetic dehiscence, and in measuring the diameter of vegetations or paravalvular leak(s)





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