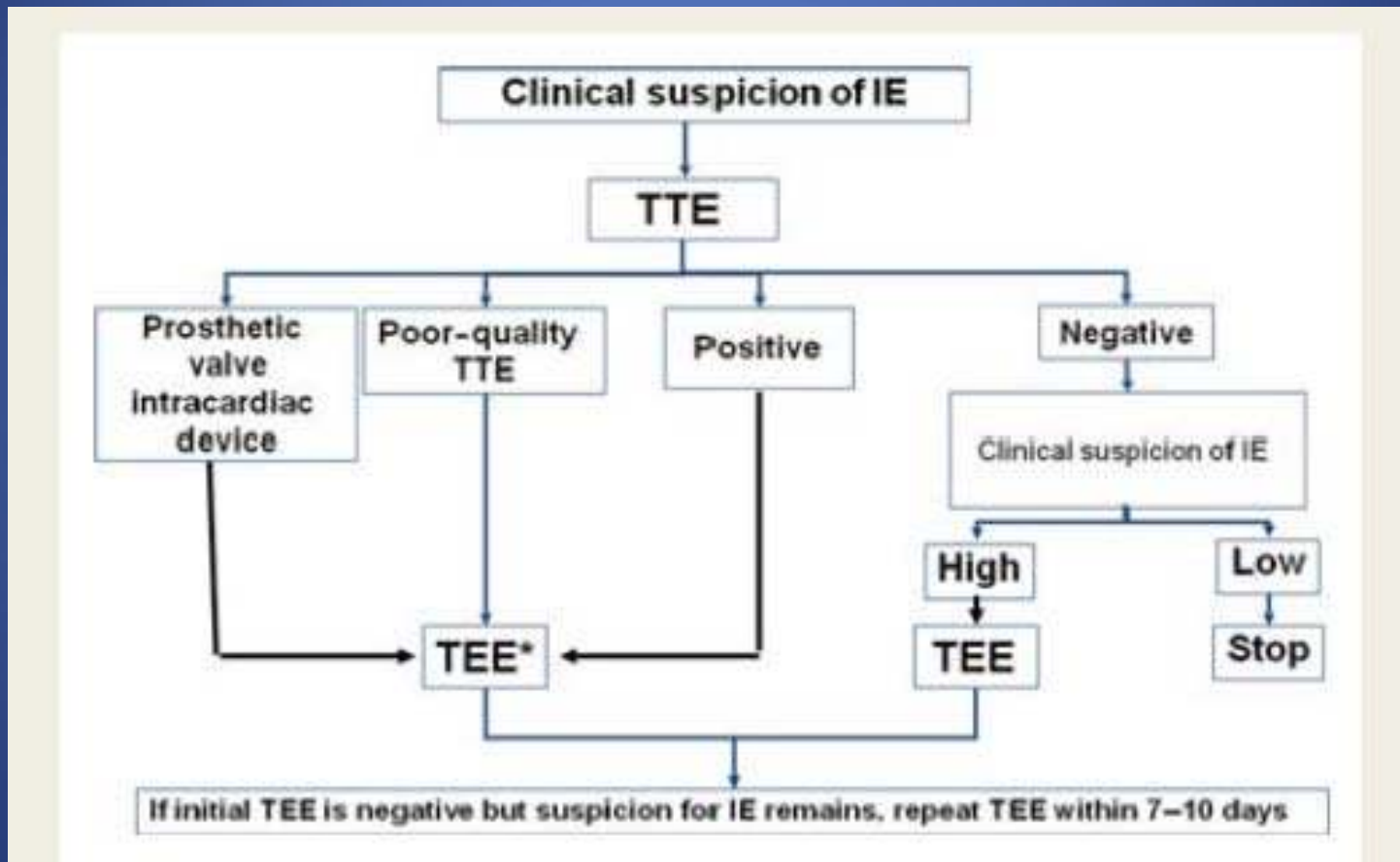


Recommendations for the practice of echocardiography in infective endocarditis

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2010; 11: 202-219

Role of Echo in the Diagnosis and Management of IE



Anatomic and echo definitions

	Surgery / Necropsy	Echocardiography
Vegetation	Infected mass attached to an endocardial structure or an implanted intracardiac material	Oscillating or non oscillating intracardiac mass or other endocardial structures or non implanted intracardiac material
Abscess	Perivalvular cavity with necrosis and purulent material not communicating with the cardiovascular lumen	Thickened non-hogeneous perivalvular area with echodense or echolucent appearance
Pseudoaneurysm	Perivalvular cavity communicating with the cardiovascular lumen	Pulsatile perivalvular echo-free space with colour-Doppler flow detected
Perforation	Interruption of endocardial tissue continuity	Interruption of endocardial tissue continuity traversed by colour Doppler flow
Fistula	Communication between 2 neighbouring cavities through a perforation	Colour-Doppler communication between 2 neighbouring cavities through a perforation
Valve aneurysm	Saccular outpouching of valvular tissue	Saccular bulging of valvular tissue
Dehiscence of a prosthetic valve	Dehiscence of the prosthesis	Paravalvular regurgitation identified by TTE/TTE with or without rocking motion of the prosthesis

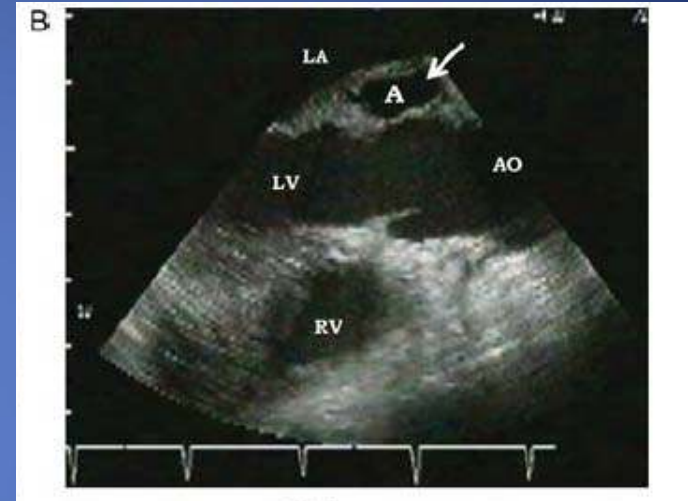
Echocardiographic criteria for IE

- Vegetations
 - Hallmark lesion of IE
- Abscess and perivalvular involvement
 - Aortic valve and prosthetic valve: more frequent
 - Perivalvular complications: pseudoaneurysm and fistulization
- New dehiscence of a prosthetic valve

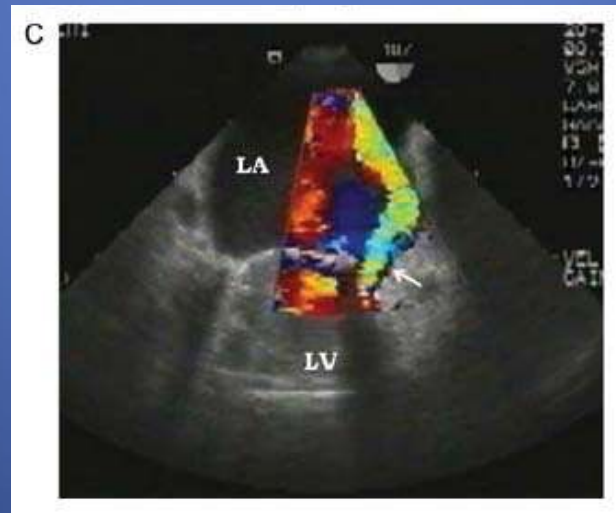
Main Echo Criteria for IE (TEE)



Vegetations



Abscess



New prosthetic regurgitation

Limitations and Pitfalls of Echo for Diagnosis of IE

1. Both the sensitivity and specificity of TTE and TEE are not 100%.
2. A negative echo exam does not rule out IE.
3. Repeat TTE/TEE maybe necessary in some situations.
4. Results of the echo study must interpreted with caution, taking into account the clinical presentation and the likelihood of IE.

Echocardiography is not 100% sensitive for the diagnosis of infective endocarditis

- A negative echocardiogram may be observed in about 15% of infective endocarditis.
- The most frequent explanations :
 - Very small vegetations
 - Difficulties in identifying vegetations in the presence of pre-existing severe lesions.(mitral valve prolapse, degeneration lesions, and prosthetic valves)
 - When vegetations are non-oscillating and/or atypically located.
 - At the very early stage of the disease
 - When vegetations are not yet present or too small to be identified.
- A repeat examination has to be performed 7-10 days after the 1st examination in case of high level of clinical suspicion or even earlier when justified by clinical presentation.

Echocardiography is not 100% specific for the diagnosis of infective endocarditis

- False diagnosis of IE may occur in several situations:
 - It is difficult to differentiate between vegetations and thrombi, prolapse cusp, cardiac tumor, myxomatous changes, Lambl's excrescences, strands, or non-infective vegetations (marantic endocarditis)
- Non-infective vegetations are impossible to differentiate from infective vegetations.

- (i) TTE is recommended as the first-line imaging modality in suspected IE;**
- (ii) TEE is recommended in patients with high clinical suspicion of IE and a normal TTE;**
- (iii) TEE should be considered in the majority of adult patients with suspected IE, even in cases with positive TTE;**
- (iv) Repeat TTE/TEE within 7–10 days is recommended in case of initially negative examination when clinical suspicion of IE remains high;**
- (v) TEE is not indicated in patients with a good-quality negative TTE and low clinical suspicion of IE.**

Indications and timing of surgery in IE

- Heart failure
 - The most frequent indication: 40-60% of IE
 - Acute regurgitation
- Uncontrolled infection
 - Abscess, pseudoaneurysm and fistula
- Preventive of embolism
 - Vegetations > 10mm : high risk of embolism

Indications for surgery: native IE

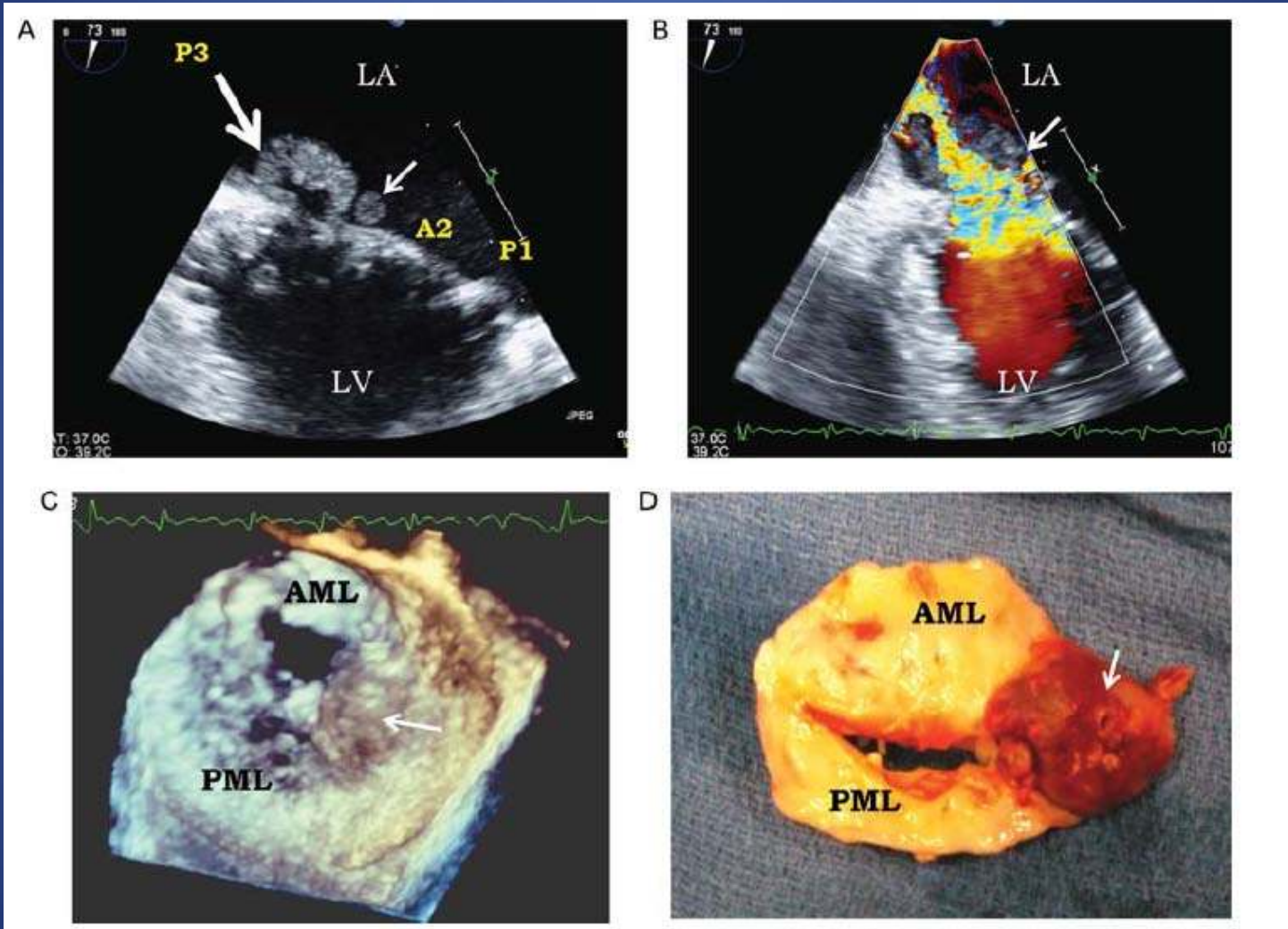
Recommendations: Indications for surgery	Timing	Level of evidence	
A. HEART FAILURE			
• Aortic or mitral IE with severe acute regurgitation or valve obstruction causing refractory pulmonary oedema or cardiogenic shock	Emergency	I	B
• Aortic or mitral IE with fistula into a cardiac chamber or pericardium causing refractory pulmonary oedema or cardiogenic shock	Emergency	I	B
• Aortic or mitral IE with severe acute regurgitation and persisting HF or echocardiographic signs of poor hemodynamic tolerance (early mitral closure or pulmonary hypertension)	Urgent	I	B
• Aortic or mitral IE with severe acute regurgitation and no HF	Elective	IIa	B
B. UNCONTROLLED INFECTION			
• Locally uncontrolled infection	Urgent	I	B
• Persisting fever and positive blood culture > 7-10 days		I	B
• Infection caused by fungi or multiresistant organisms	Urgent/elective	I	B
C. PREVENTION of EMBOLISM			
• Aortic or mitral IE with large vegetations (>10 mm) following one or more embolic episodes, despite appropriate antibiotic treatment	Urgent	I	B
• Aortic or mitral IE with large vegetations (10 mm) and other predictors of complicated course (HF, persistent infection, abscess)	Urgent	I	C
• Isolated very large vegetations (>15 mm)	Urgent	IIb	C

Echo findings suggestive of early surgery for IE with heart failure

- Extensive obstructive valve lesions
- Massive regurgitation
- Associated abscess and pseudoaneurysm

Vegetation and pseudoaneurysm

fistula



abscess

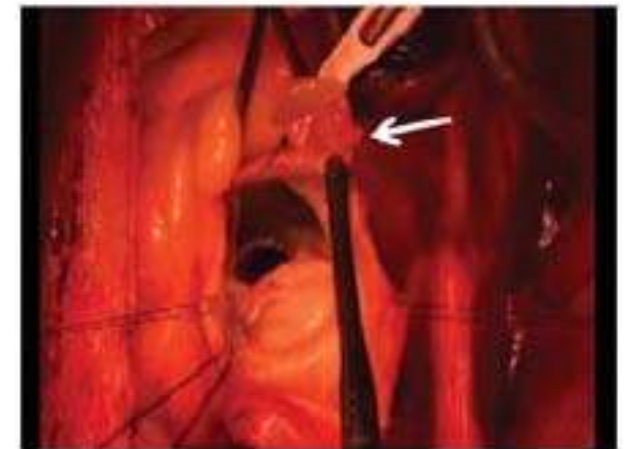
A



B

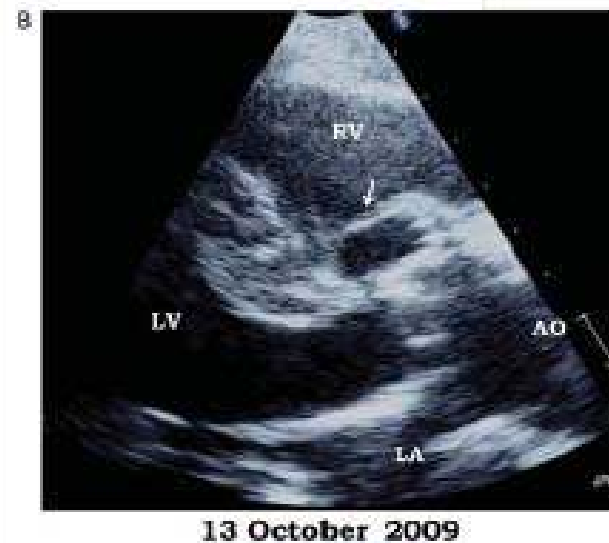
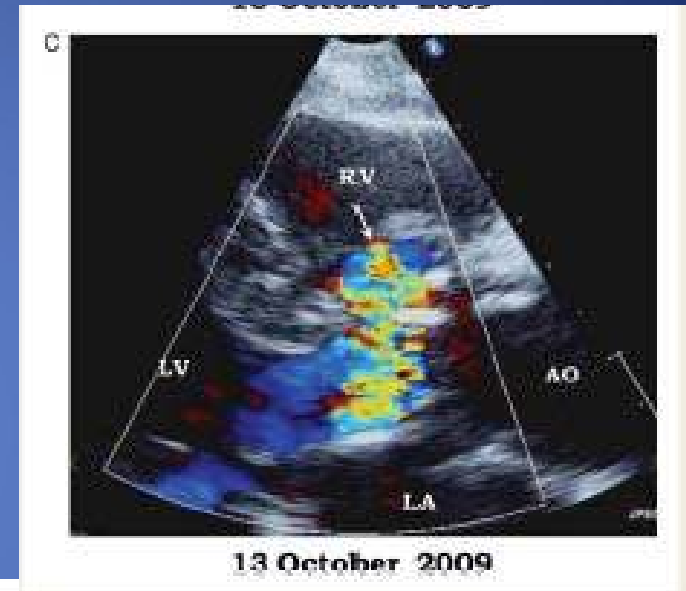


C

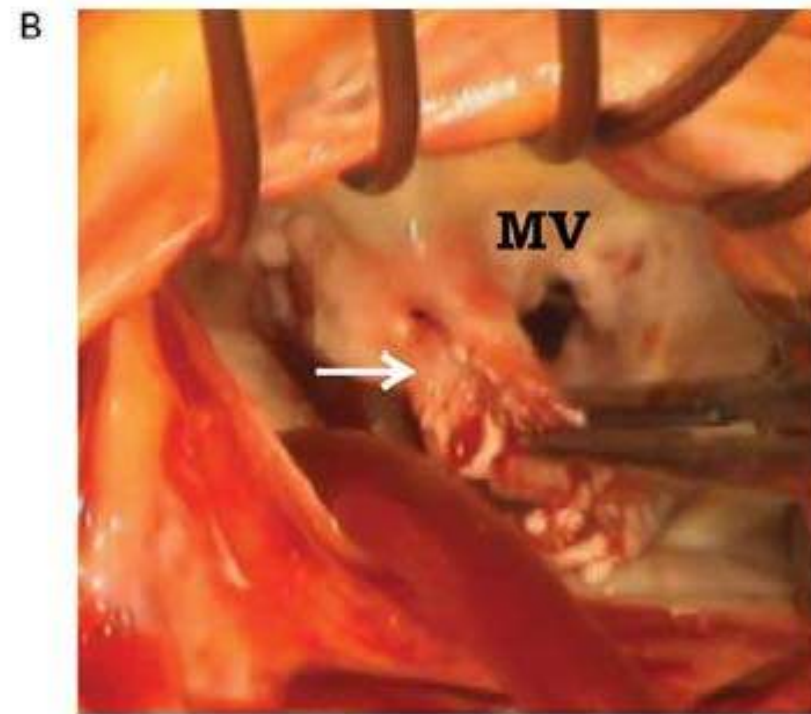
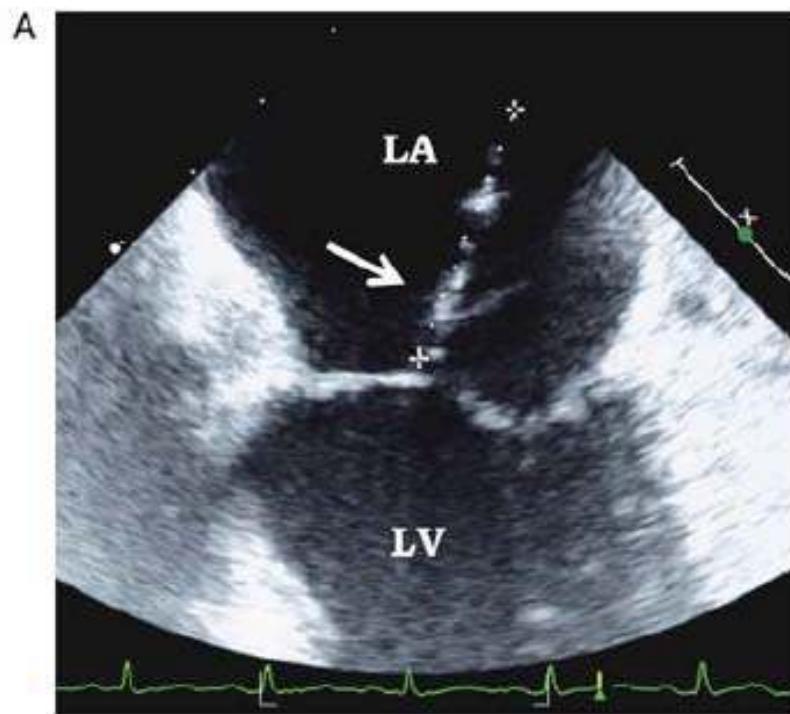


Perforation and aneurysm of anterior mitral leaflet

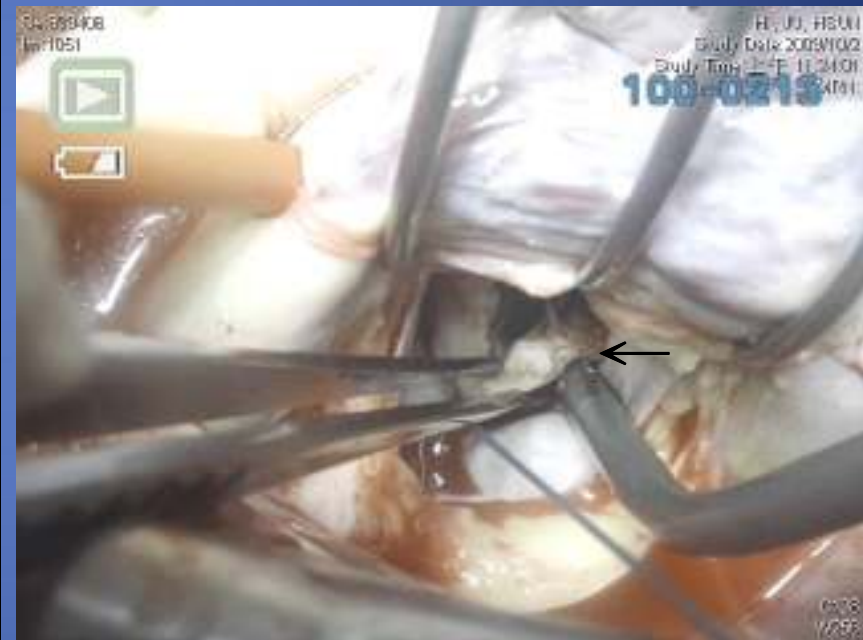
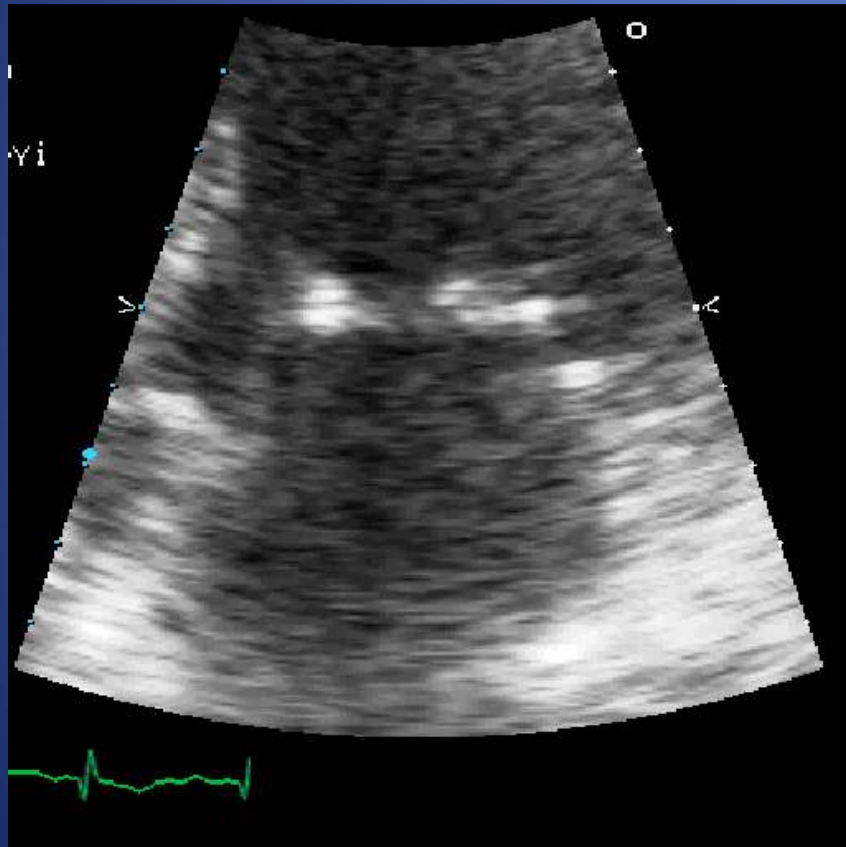
Evolution of anterior aortic bioprosthetic abscess



Echo vs Anatomy



Echo vs Anatomy



Prognosis Assessment at Admission

- Perivalvular complications
- Severe native or prosthetic regurgitation or obstruction
- Low LVEF
- Pulmonary hypertension
- Large vegetations
- Premature mitral valve closure or other signs of elevated diastolic pressures

The above echo findings have been associated with a worse prognosis of IE.

Echo follow up under therapy

- Echo must be used to follow up of patients with IE under antibiotic therapy
- The number, type and timing of repeated exams depend on
 - The clinical presentation
 - The type of organisms
 - The initial echographic findings
- *Weekly TTE for non-complicated streptococcal native IE*
- *More frequent TTE and TEE for post-op staphylococcal early PVE*

Follow up after discharge and long-term prognosis

- To monitor the development of secondary heart failure, the recent ESC guidelines commended
 - Baseline TTE at the completion of antibiotic therapy
 - 1,3,6 and 12 months during the first year following completion of therapy
 - Repeated TEE is usually not necessary after discharge, except
 - In selected patients with incomplete surgical treatment
 - Persistent valve or prosthetic dysfunction

Intraoperative echocardiography

- Intraoperative TEE should be performed in all cases of IE requiring surgery
- Pre-pump TEE
 - Helpful to determine the best surgical approach by identify the mechanism of regurgitation* and the extension of the lesions outside the valve tissue
- Post-pump TEE
 - Evaluation of immediate surgical results
 - To assess the result of valve repair** and complex perivalvular repair

Prosthetic valve IE

Prosthetic valve IE

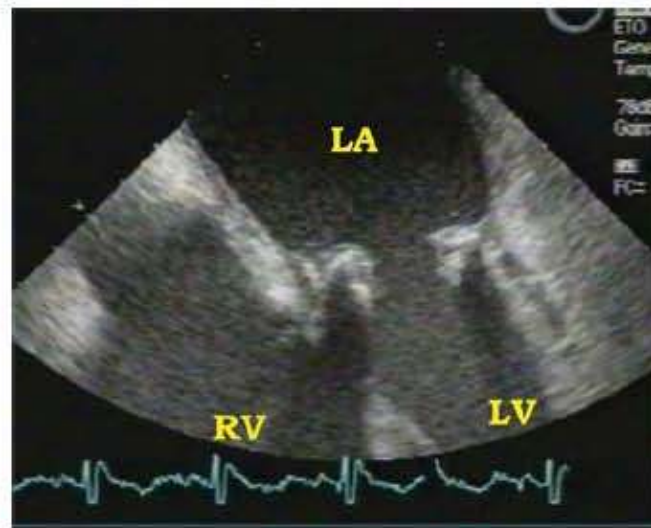
- The most severe form of IE
- 1-6% of patients with prosthetic valve
- 10-30% of all cases of IE
- Similar incidence of mechanical and bioprosthetic valves
- Characters:
 - Low incidence of vegetations
 - High incidence of abscesses and perivalvular complications

Prosthetic valve IE

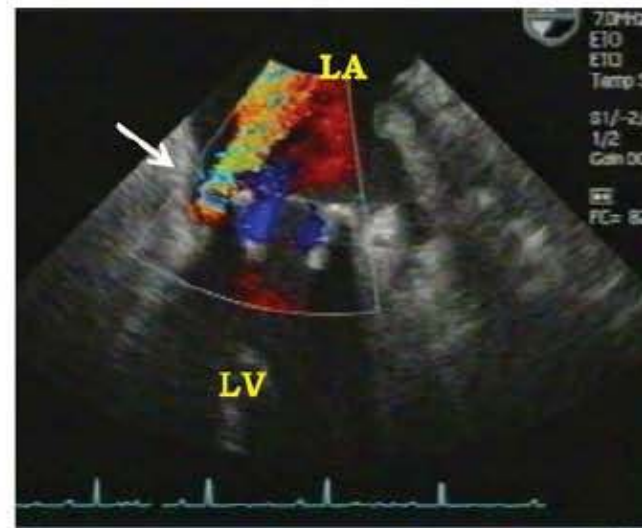
- In mechanical valve IE
 - Usually involving the junction between the sewing ring and the annulus
 - Perivalvular abscess, dehiscence, pseudoaneurysms and fistula
- In bioprosthetic IE
 - Frequently located in the leaflets
 - Cusps rupture, perforation and vegetations

Echo for Prosthetic valve IE

- TEE is mandatory for PVE.*
- The value of TTE and TEE is lower in PVE than in NVE
 - The presence of intracardiac material may hinder the presentation of vegetation and abscesses**
 - Difficult to differentiate between thrombus or strand and a vegetation and between bioprosthetic degeneration and infective lesions
 - The diagnosis of abscesses is more difficult, particularly in the early post-op period after valve replacement***



27 October 2006



13 November 2006

Figure 10 Evolution of a mitral bioprosthetic valve endocarditis. Left panel: initial evaluation showing an apparently normal bioprosthesis. Right panel: second evaluation performed because of persistent fever, showing the presence of a new periprosthetic mitral regurgitation (arrow). LV, left ventricle; LA, left atrium; RV, right ventricle.

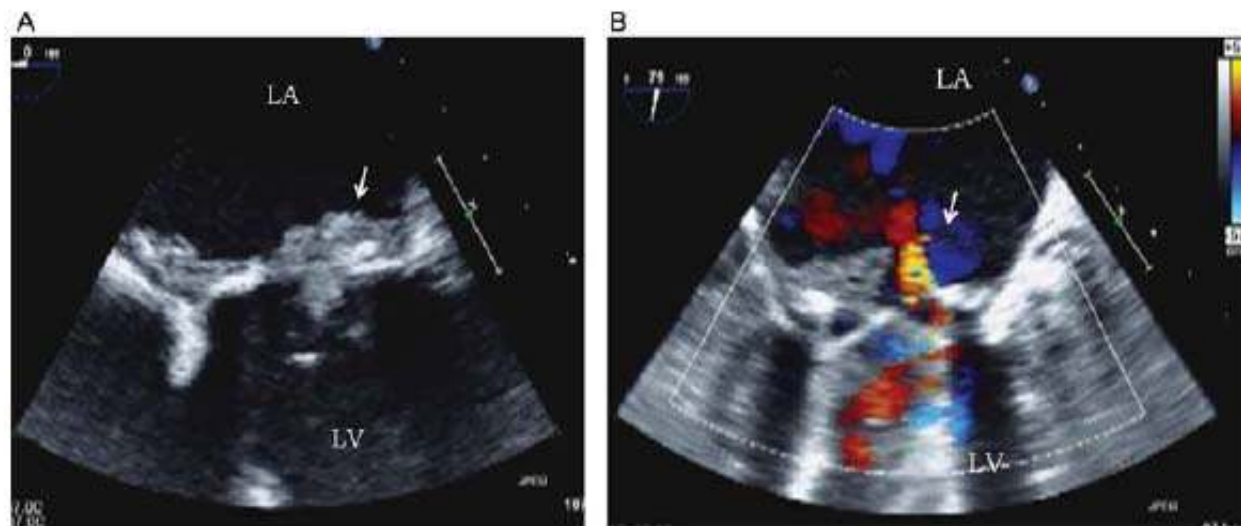


Figure 11 Mitral prosthetic valve endocarditis with prosthetic obstruction (transoesophageal echocardiography). (A) Large vegetation prolapsing into the mitral mechanical prosthetic valve (arrow). (B) Central regurgitation associated with the absence of the physiological regurgitant jets (arrow). LV, left ventricle; LA, left atrium; RV, right ventricle.

Prosthetic valve IE

- Findings associated with poor outcome and needed for surgery
 - Severe regurgitation or obstruction
 - Periprosthetic complications
 - Large vegetations
- In non-complicated PVE treated medically, repeated echo exam is necessary to detect progressive prosthetic dysfunction

Cardiac device-related IE(CDRIE)

Cardiac device-related IE(CDRIE)

- Incidence: ICD > pacemaker implantation
- Local device infection
 - Infection limited in the pocket of device
- CDRIE
 - Infection extend to electrode leads, valvular apparatus or endocardial surface
 - Mechanism: contamination by local bacteriological flora at the time of device implantation, replacement or other any sort of manipulation

Cardiac device-related IE

- Echocardiographic findings
 - Vegetations may attached to the electrode leads, the tricuspid leaflets and the endocardial walls
- TTE: poor sensitivity and poor predictive value for the detection of cardiac device vegetations
 - Presence of reverberations of lead echos
 - Atypical location of vegetations
 - Inadequate transthoracic acoustic windows of older patients
- A normal echo exam cannot rule out CDRIE
 - Repeat TEE within 7 days when clinical suspicion is high and the exam of TEE is negative

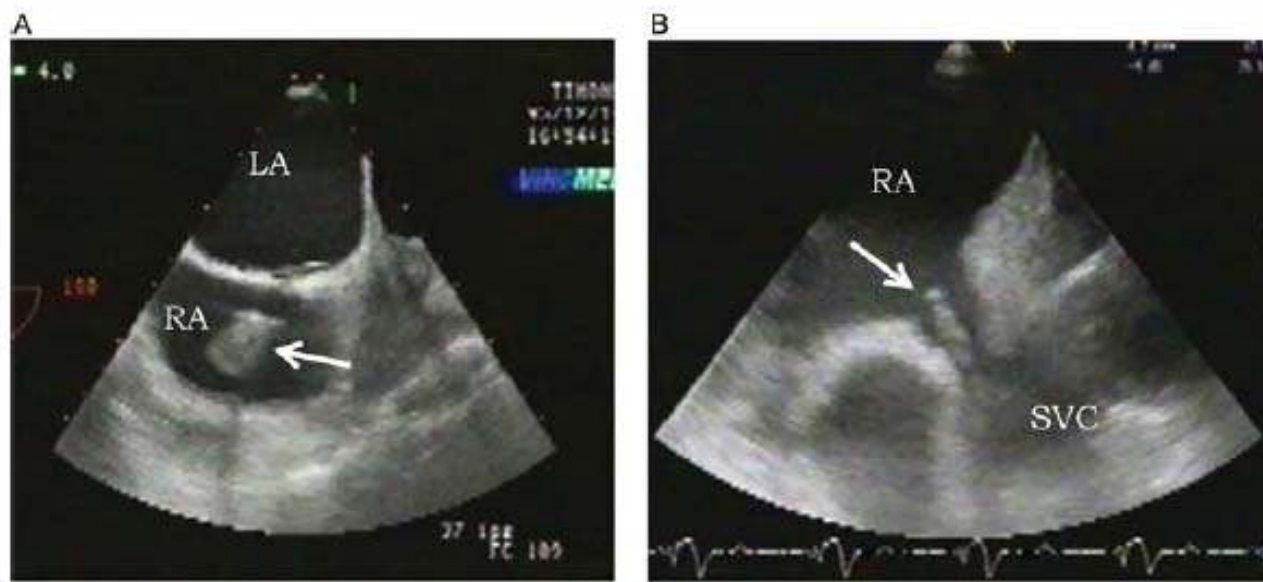


Figure 12 Pacemaker lead infective endocarditis (transoesophageal echocardiography). (A) Typical vegetation on a pacemaker lead (arrow). (B) Thickening of the pacemaker lead with a sleeve-like appearance (arrow). RA, right atrium; LA, left atrium; SVC, superior vena cava.

Cardiac device-related IE

- Surgery may be considered with very large vegetations(>25mm)
- TTE and TEE should be repeated after device extraction and the existence of residual vegetations and tricuspid valve lesions rule out
- Careful examination of the RV, TV, RA and the distal SVC is essential.

Right heart IE

Right heart IE

- Mostly involve the tricuspid valve
- Echocardiographic method and findings
 - Right ventricle inflow view
 - Subcostal view
 - Key echo findings: a vegetation on the tricuspid valve, rarely on the pulmonary valve
 - Routine TEE:
 - questioned ??
 - But useful in detecting the perivalvular abscess and unusual location, ex infection on the Eustachian valve or on the Chiari network

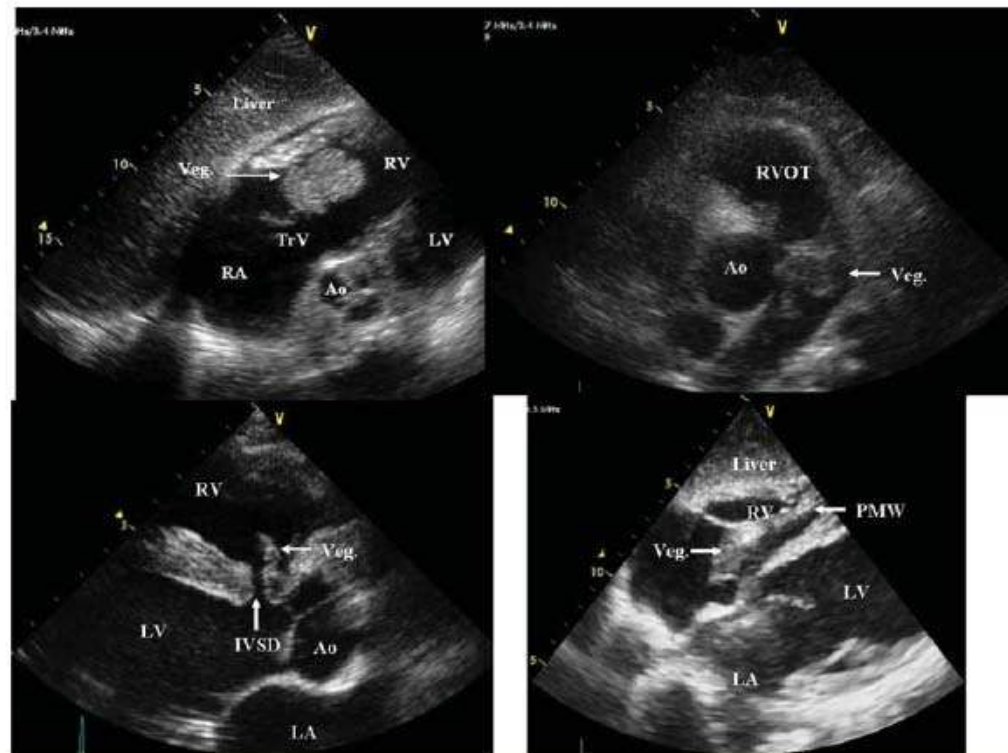


Figure 13 Cases of right-sided infective endocarditis (see text for details). AO, aorta; LV, left ventricle; LA, left atrium; RV, right ventricle; Veg, vegetation; PMW, pacemaker wire; IVSD, interventricular septal defect; TrV, tricuspid valve.