



ESC GUIDELINES

Guidelines previas 2009



2015 ESC Guidelines for the management of infective endocarditis

The Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC)

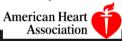
Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM)

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Guidelines previas 2005

Circulation

October 13, 2015



AHA Scientific Statement

Infective Endocarditis in Adults: Diagnosis, Antimicrobial Therapy, and Management of Complications

A Scientific Statement for Healthcare Professionals From the American Heart Association

Endorsed by the Infectious Diseases Society of America

Larry M. Baddour, MD, FAHA, Chair; Walter R. Wilson, MD; Arnold S. Bayer, MD;
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Patrick O'Gara, MD, FAHA; Kathryn A. Taubert, PhD, FAHA; on behalf of the American Heart
Association Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease of the Council on
Cardiovascular Disease in the Young, Council on Clinical Cardiology, Council on Cardiovascular
Surgery and Anesthesia, and Stroke Council



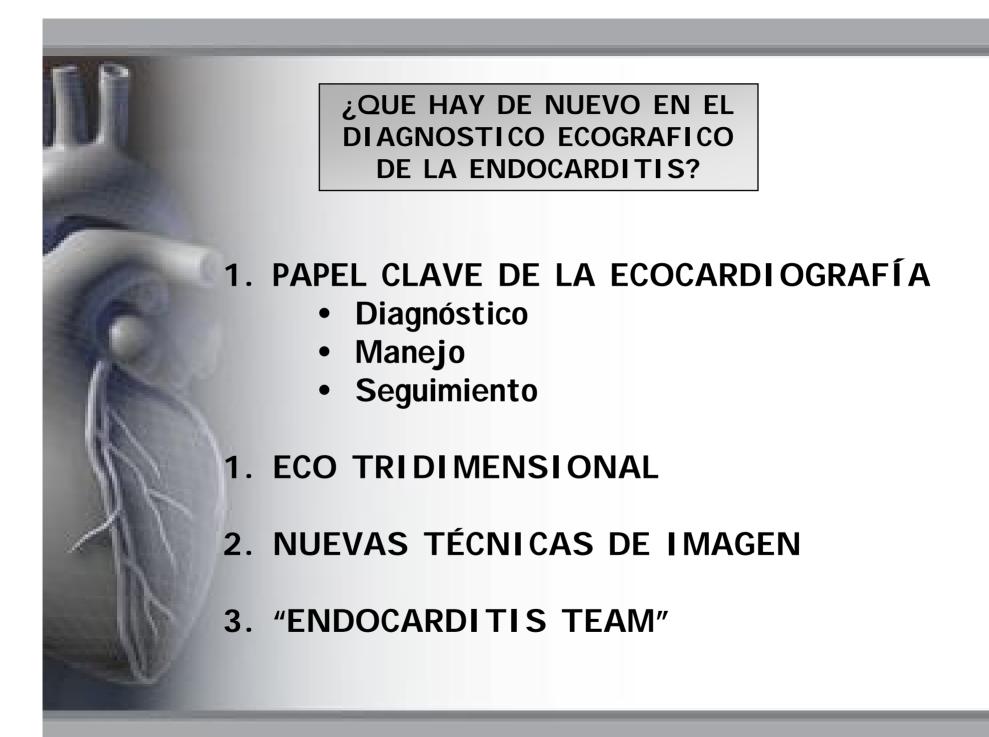


Table 10	Role of	echocardiogra	phy in	infective
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endocarditis	According to the second	a : 3	b	- ··		
	Recommendations	Classa	Levelb	Ref. ^c		
	A. Diagnosis					
	 TTE is recommended as the first-line imaging modality in suspected IE. 	1	В	64,65		
	TOE is recommended in all patients with clinical suspicion of IE and a negative or non-diagnostic TTE.	1	В	64, 68–71		
<u> </u>	TOE is recommended in patients with clinical suspicion of IE, when a prosthetic heart valve or an intracardiac device is present.	1	В	64,71		
	 Repeat TTE and /or TOE within 5-7 days is recommended in case of initially negative examination when clinical suspicion of IE remains high. 	-	С			
×	Echocardiography should be considered in Staphylococcus aureus bacteraemia.	lla	В	66,67		
	TOE should be considered in patients with suspected IE, even in cases with positive TTE, except in isolated right-sided native valve IE with good quality TTE examination and unequivocal echocardiographic findings.	lla	С			

ECO EN EL DIAGNÓSTICO DE EI



- 66. Rasmussen RV, Host U, Arpi M, Hassager C, Johansen HK, Korup E, Schonheyder HC, Berning J, Gill S, Rosenvinge FS, Fowler VG Jr, Moller JE, Skov RL, Larsen CT, Hansen TF, Mard S, Smit J, Andersen PS, Bruun NE. Prevalence of infective endocarditis in patients with Staphylococcus aureus bacteraemia: the value of screening with echocardiography. Eur J Echocardiogr 2011;12: 414–420.
- Incani A, Hair C, Purnell P, O'Brien DP, Cheng AC, Appelbe A, Athan E. Staphylococcus aureus bacteraemia: evaluation of the role of transoesophageal echocardiography in identifying clinically unsuspected endocarditis. Eur J Clin Microbiol Infect Dis 2013:32:1003–1008.



ECO EN EL DIAGNÓSTICO DE ENDOCARDITIS INFECCIOSA

TTE should be performed in all cases of suspected IE (Class I; Level of Evidence B).

ÚNICA RECOMENDACIÓN A EN TODAS LAS GUÍAS



Echocardiography should be performed expeditiously in patients suspected of having IE ($Class\ I$; $Level\ of\ Evidence\ A$). Clase I, Nivel de evidencia A

*Done in a quick and efficient way (Merriam-Webster)

Expeditivo. Adj: que tiene facilidad en dar expediente o salida en un negocio, sin muchos miramientos, evitando trámites (RAE)



Table 10 Role of echocardiography in infective endocarditis

Ţ	B. Follow-up under medical therapy				
	Repeat TTE and/or TOE are recommended as soon as a new complication of IE is suspected (new murmur, embolism, persisting fever, HF, abscess, atrioventricular block).	-	В	64,72	
	 Repeat TTE and/or TOE should be considered during follow-up of uncomplicated IE, in order to detect new silent complications and monitor vegetation size. The timing and mode (TTE or TOE) of repeat examination depend on the initial findings, type of microorganism, and initial response to therapy. 	lla	В	64,72	

ECO EN EL SEGUIMIENTO CON TTO MÉDICO





- 1. TEE should be done if initial TTE images are negative or inadequate in patients for whom there is an ongoing suspicion for IE or when there is concern for intracardiac complications in patients with an initial positive TTE (Class I; Level of Evidence B).
- 2. If there is a high suspicion of IE despite an initial negative TEE, then a repeat TEE is recommended in 3 to 5 days or sooner if clinical findings change (*Class I; Level of Evidence B*).
- 3. Repeat TEE should be done after an initially positive TEE if clinical features suggest a new development of intracardiac complications (Class I; Level of Evidence B).

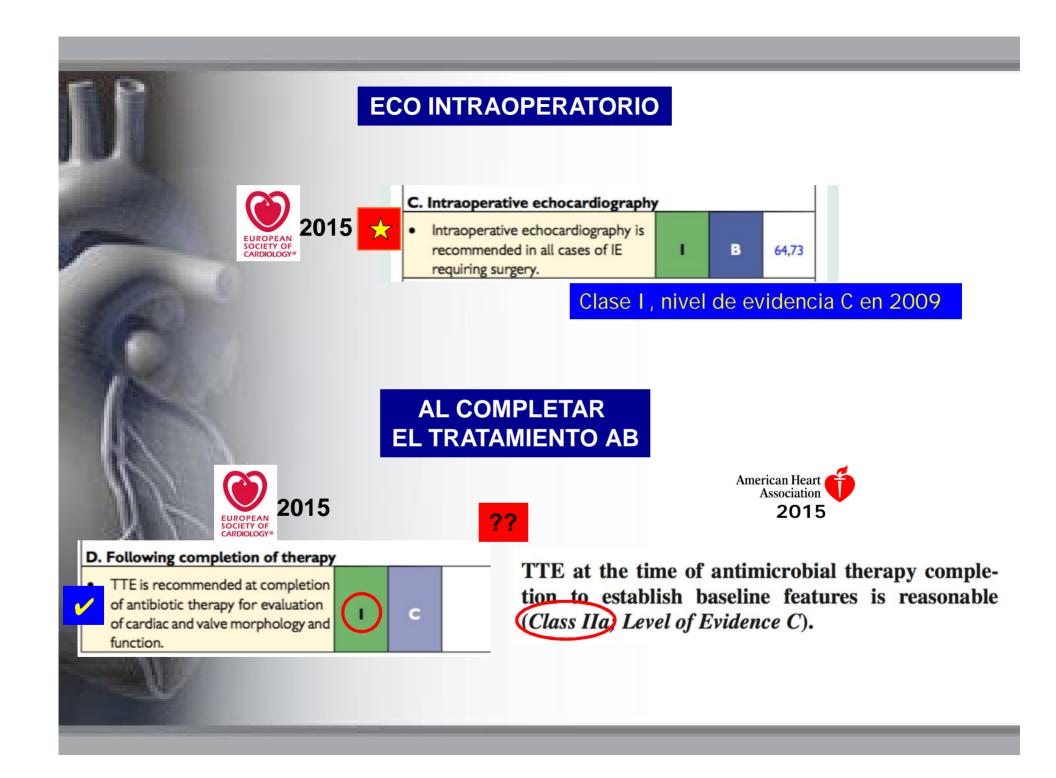
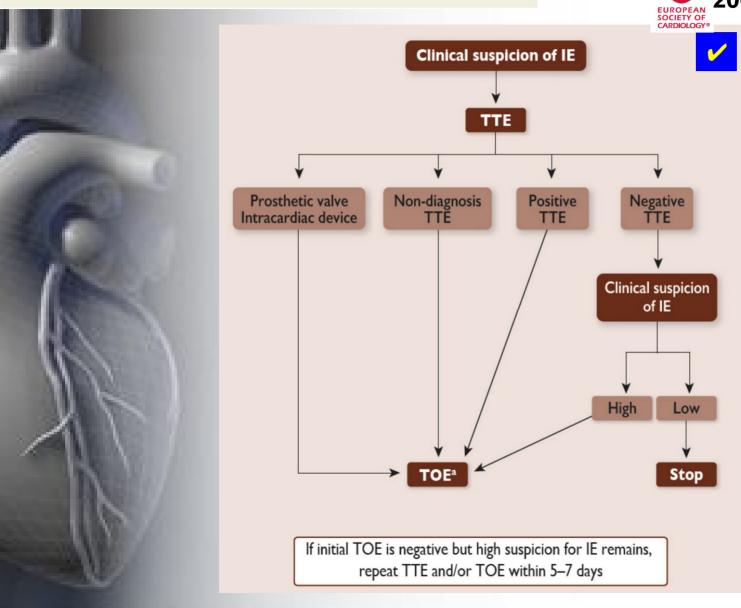
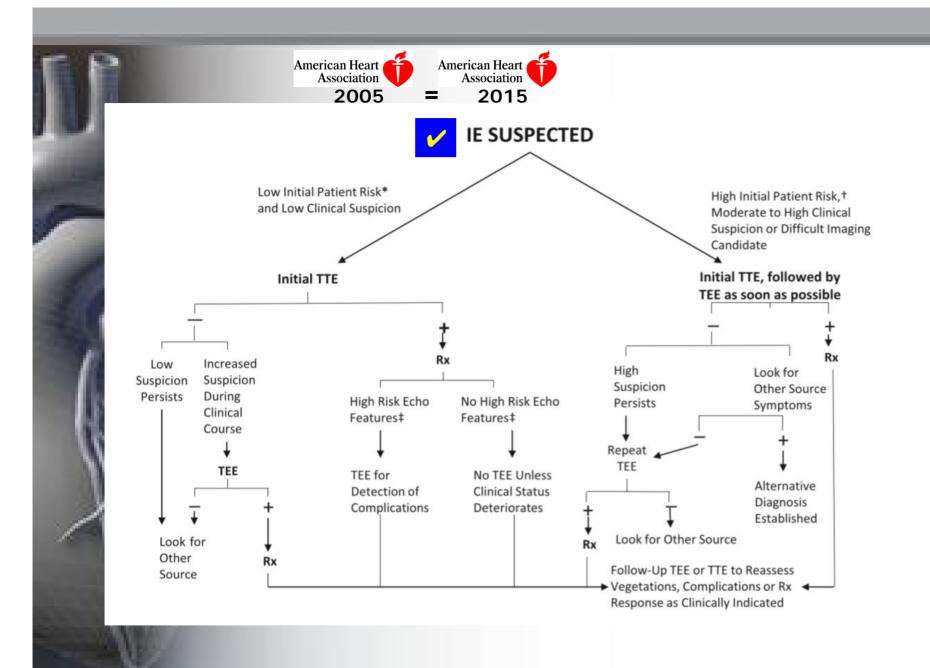


Figure I Indications for echocardiography in suspected infective endocarditis.









2015

Table 14 Definitions of the terms used in the European Society of Cardiology 2015 modified criteria for the diagnosis of infective endocarditis

Major criteria

I. Blood cultures positive for IE

 Typical microorganisms consistent with IE from 2 separate blood cultures:



- Viridans streptococci, Streptococcus gallolyticus (Streptococcus bovis), HACEK group, Staphylococcus aureus; or
- Community-acquired enterococci, in the absence of a primary focus; or
- Microorganisms consistent with IE from persistently positive blood cultures:
- ≥2 positive blood cultures of blood samples drawn > 12 h apart; or
- All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 h apart); or
- c. Single positive blood culture for Coxiella burnetii or phase I IgG antibody titre >1:800

2. Imaging positive for IE

- a. Echocardiogram positive for IE:
- · Vegetation;
- ·Abscess, pseudoaneurysm, intracardiac fistula;
- · Valvular perforation or aneurysm;
- · New partial dehiscence of prosthetic valve.
- b. Abnormal activity around the site of prosthetic valve implantation detected by ¹⁸F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.
- c. Definite paravalvular lesions by cardiac CT.

Minor criteria

- Predisposition such as predisposing heart condition, or injection drug use.
- 2. Fever defined as temperature >38°C.
- Vascular phenomena (including those detected by imaging only): major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and laneway's lesions.
- Immunological phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor.
- Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.





2005

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2015

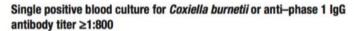
Table 3. Definition of Terms Used in the Modified Duke Criteria for the Diagnosis of IE*

2000

Major criteria

Blood culture positive for IE

Typical microorganisms consistent with IE from 2 separate blood cultures: Viridans streptococci, *Streptococcus bovis*, HACEK group, *Staphylococcus aureus*; or community-acquired enterococci in the absence of a primary focus, or microorganisms consistent with IE from persistently positive blood cultures defined as follows: at least 2 positive cultures of blood samples drawn >12 h apart or all 3 or a majority of ≥4 separate cultures of blood (with first and last sample drawn at least 1 h apart)



Evidence of endocardial involvement

Echocardiogram positive for IE (TEE recommended for patients with prosthetic valves, rated at least possible IE by clinical criteria, or complicated IE [paravalvular abscess]; TTE as first test in other patients) defined as follows: oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation; abscess; or new partial dehiscence of prosthetic valve or new valvular regurgitation (worsening or changing or pre-existing murmur not sufficient)



Minor criteria

Predisposition, predisposing heart condition, or IDU

Fever, temperature >38°C

Vascular phenomena, major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway lesions



Immunological phenomena: glomerulonephritis, Osler nodes, Roth spots, and rheumatoid factor

Microbiological evidence: positive blood culture but does not meet a major criterion as noted above (excludes single positive cultures for coagulase-negative staphylococci and organisms that do not cause endocarditis) or serological evidence of active infection with organism consistent with IE

Echocardiographic minor criteria eliminated

Table 14 Definitions of the terms used in the European Society of Cardiology 2015 modified criteria for the diagnosis of infective endocarditis

Major criteria

- I. Blood cultures positive for IE
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- Viridans streptococci, Streptococcus gallolyticus (Streptococcus bovis), HACEK group, Staphylococcus aureus; or
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- Predisposition such as predisposing heart condition, or injection drug use.
- 2. Fever defined as temperature >38°C.
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- Immunological phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor.
- Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.



CRITERIOS DIAGNOSTICOS MAYORES EN IMAGEN

2. Imaging positive for IE

- a. Echocardiogram positive for IE:
 - Vegetation;
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 - · Valvular perforation or aneurysm;
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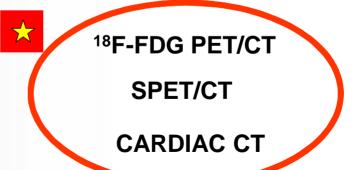




Figure 3 European Society of Cardiology 2015 algorithm for 2015 diagnosis of infective endocarditis. Clinical suspicion of IE Modified Duke criteria (Li) Possible/rejected IE but Rejected IE **Definite IE** high suspicion Low suspicion **Prosthetic Native** valve valve I - Repeat echo (TTE + TOE)/microbiology I - Repeat echo 2 - 18 F-FDG PET/CT or Leucocytes labeled SPECT/CT (TTE + TOE)/microbiology 2 - Imaging for embolic events^a 3 - Cardiac CT 3 - Cardiac CT 4 - Imaging for embolic events^a ESC 2015 modified diagnostic criteria^b **Definite IE** Possible IE Rejected IE

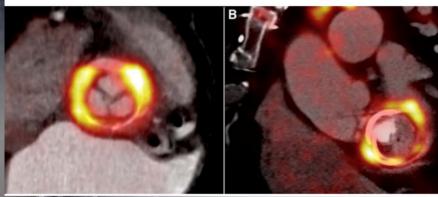


Valvular Heart Disease

Improving the Diagnosis of Infective Endocarditis in Prosthetic Valves and Intracardiac Devices With ¹⁸F-Fluordeoxyglucose Positron Emission Tomography/ Computed Tomography Angiography

Initial Results at an Infective Endocarditis Referral Center

María N. Pizzi, MD; Albert Roque, MD; Nuria Fernández-Hidalgo, MD, PhD;
Hug Cuéllar-Calabria, MD; Ignacio Ferreira-González, MD, PhD;
María T. González-Alujas, MD, PhD; Gerard Oristrell, MD; Laura Gracia-Sánchez, MD;
Juan J. González, PhD; José Rodríguez-Palomares, MD; Manuel Galiñanes, MD, PhD;
Olga Maisterra-Santos, MD; David Garcia-Dorado, MD, PhD; Joan Castell-Conesa, MD, PhD;
Benito Almirante, MD, PhD; Santiago Aguadé-Bruix, MD; Pilar Tornos, MD, PhD



Editorial

Positron Emission Tomography/Computed Tomography
Imaging in Device Infective Endocarditis
Ready for Prime Time

Patrizio Lancellotti, MD, PhD; Gilbert Habib, MD, PhD; Cécile Oury, PhD; Alain Nchimi, MD, PhD

Conclusions—¹⁸F-FDG PET/CT improves the diagnostic accuracy of the modified DC in patients with suspected IE and prosthetic valves or cardiac devices. PET/CTA yielded the highest diagnostic performance and provided additional diagnostic benefits. (Circulation. 2015;132:1113-1126. DOI: 10.1161/

Circulation September 22, 2015

Table II Anatomical and echocardiographic definitions



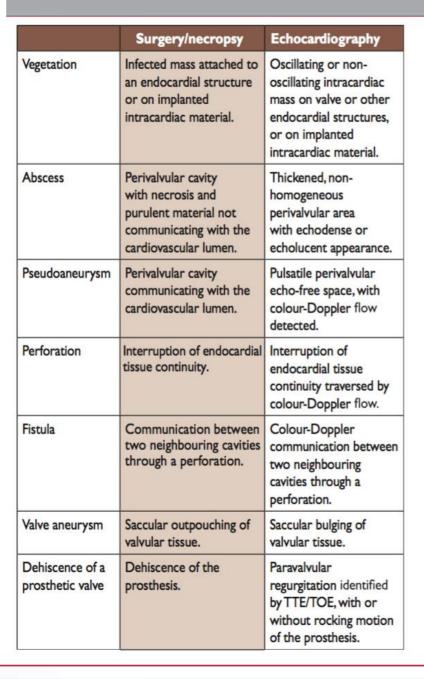


Table 15 Predictors of poor outcome in patients with infective endocarditis

Patient characteristics

- Older age
- Prosthetic valve IE
- · Diabetes mellitus
- Comorbidity (e.g., frailty, immunosuppression, renal or pulmonary disease)

Clinical complications of IE

- · Heart failure
- Renal failure
- >Moderate area of ischaemic stroke
- Brain haemorrhage
- Septic shock

Microorganism

- · Staphylococcus aureus
- Fungi
- · Non-HACEK Gram-negative bacilli

Echocardiographic findings

- Periannular complications
- · Severe left-sided valve regurgitation
- · Low left ventricular ejection fraction
- · Pulmonary hypertension
- Large vegetations
- · Severe prosthetic valve dysfunction
- Premature mitral valve closure and other signs of elevated diastolic pressures





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PREDICTORES ECOCARDIOGRAFICOS DE MAL PRONÓSTICO

Echocardiographic findings

- Periannular complications
- · Severe left-sided valve regurgitation
- · Low left ventricular ejection fraction
- Pulmonary hypertension
- Large vegetations
- Severe prosthetic valve dysfunction
- Premature mitral valve closure and other signs of elevated diastolic pressures

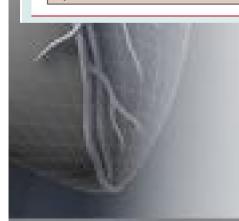




Table 4. Use of Echocardiography During Diagnosis and **Treatment of Endocarditis**

Early

Echocardiography as soon as possible (<12 h after initial evaluation)

TEE preferred; obtain TTE views of any abnormal findings for later comparison

TTE if TEE is not immediately available

TTE may be sufficient in small children

Repeat echocardiography

TEE after positive TTE as soon as possible in patients at high risk for complications

TEE 3-5 d after initial TEE if suspicion exists without diagnosis of IE or with worrisome clinical course during early treatment of IE

Intraoperative

Prepump

Identification of vegetations, mechanism of regurgitation, abscesses, fistulas, and pseudoaneurysms

Postpump

Confirmation of successful repair of abnormal findings

Assessment of residual valve dysfunction

Elevated afterload if necessary to avoid underestimating valve insufficiency or presence of residual abnormal flow

Completion of therapy

Establish new baseline for valve function and morphology and ventricular size and function

TTE usually adequate; TEE or review of intraoperative TEE may be needed for complex anatomy to establish new baseline

TEE indicates transesophageal echocardiography; and TTE, transthoracic echocardiography.









Real-time three-dimensional (3D) TOE allows the analysis of 3D volumes of cardiac structures in any possible plane. A recent study has shown that conventional TOE underestimates vegetation size and that 3D TOE is a feasible technique for the analysis of vegetation morphology and size that may overcome the shortcomings of conventional TOE, leading to a better prediction of the embolic risk in IE.⁷⁶ 3D TOE is particularly useful in the assessment of perivalvular extension of the infection, prosthetic valve dehiscence and valve perforation.⁷⁷ Although in clinical practice 3D TOE is increasingly performed along with conventional TOE in many centres, at present 3D TOE should still be regarded as a supplement to standard echocardiography in most cases.











3D Echocardiography and Other Imaging Modalities

Although newer imaging modalities are undergoing preliminary evaluation, echocardiography will continue to be pivotal in patients with IE for the foreseeable future. In this regard, early investigations^{64,65} of 3D TEE have demonstrated advantages over 2-dimensional TEE (which is routinely used) to better detect and delineate vegetations and to identify IE complications and their relationships with surrounding structures. Unfortunately, the lower temporal and lateral resolution with 3D echocardiography compared with 2-dimensional echocardiography leads to an overestimation of vegetation size and technically challenging visualization of fast-moving structures.



ECO TRIDIMENSIONAL



3D son ultrasonidos.....

Limitaciones sónicas 2D=Limitaciones 3D

- ·Aire,
- •grasa,
- •mal contacto sonda...

Alineación US-estructura (Resolución lateral)

- •I mágenes óptimas "en face" (estructuras perpendiculares al haz de ultrasonidos)
- Mitral y tabique IA

Combinamos e integramos 2D y 3D

2D >>resolución temporal

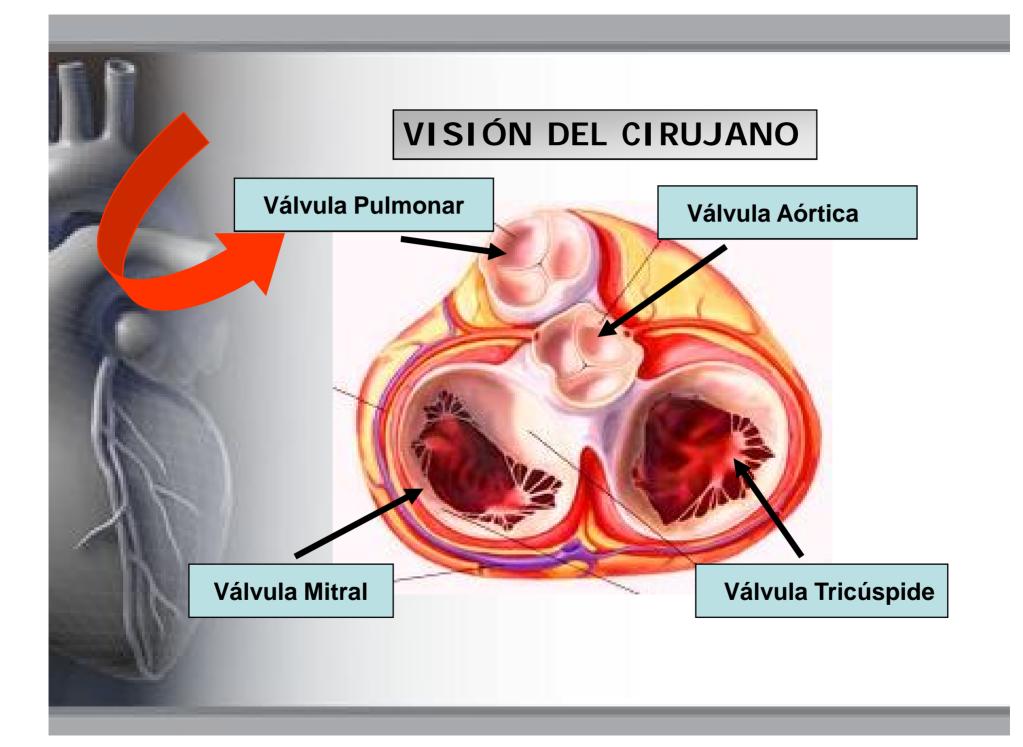
3D >>>>resolución espacial

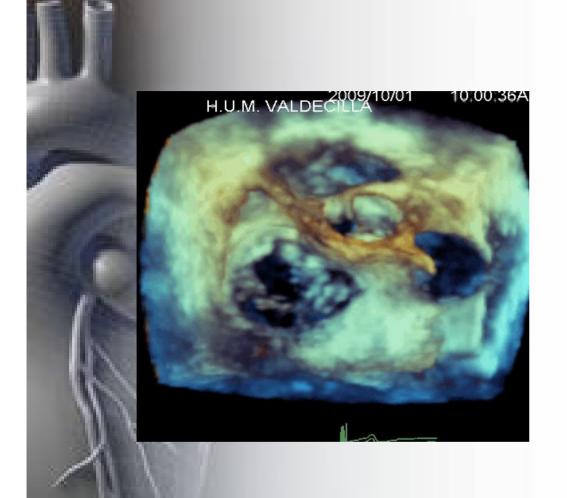
ECO TRIDIMENSIONAL

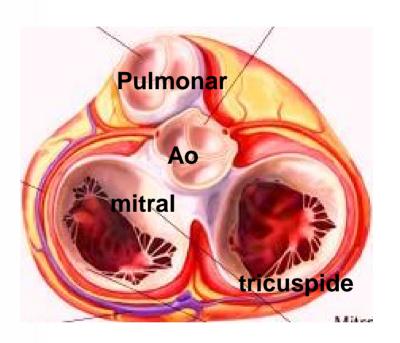
ECO 3D son ultrasonidos

3D y 2D son complementarios

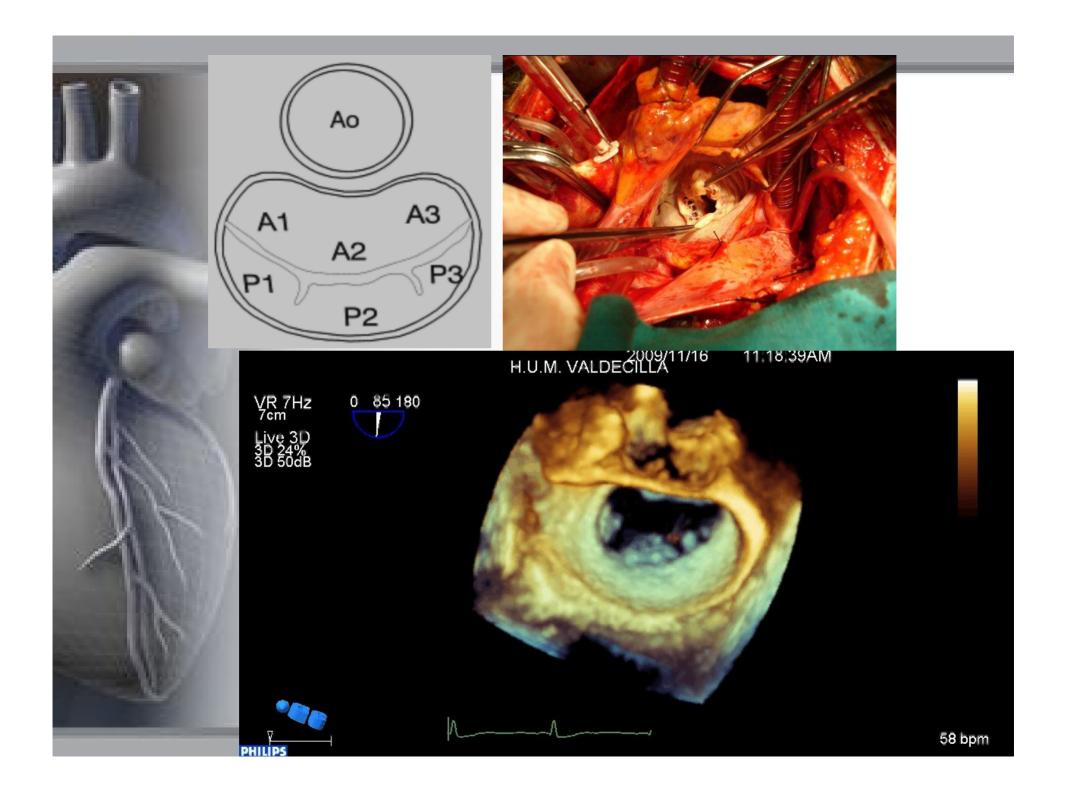


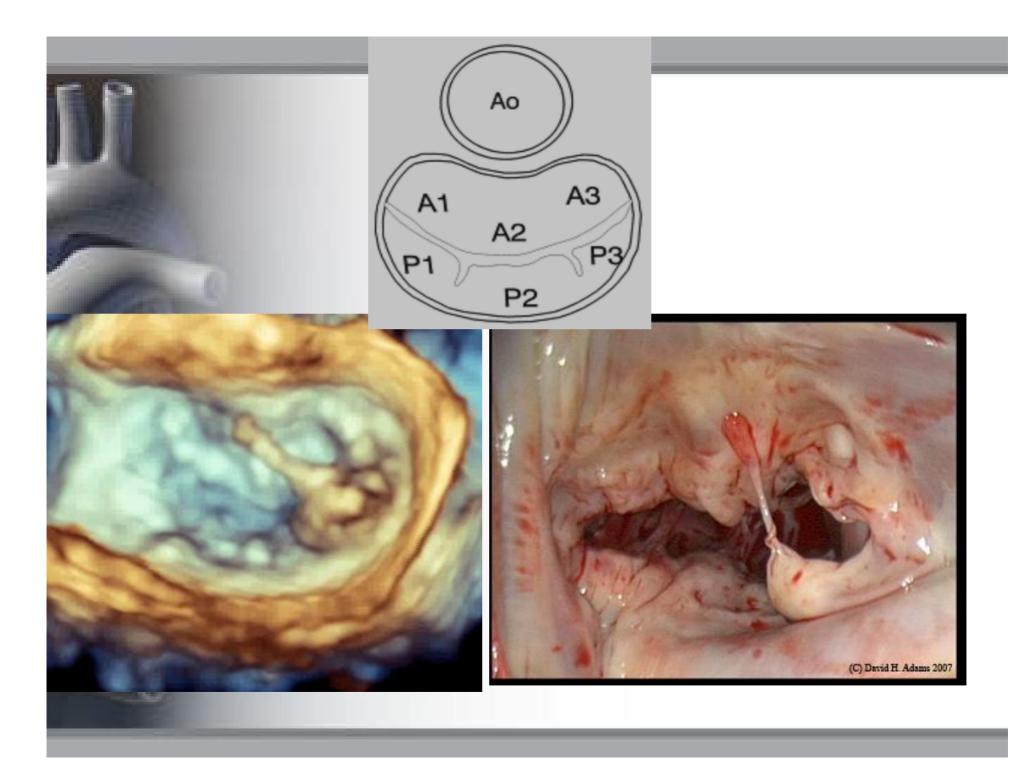




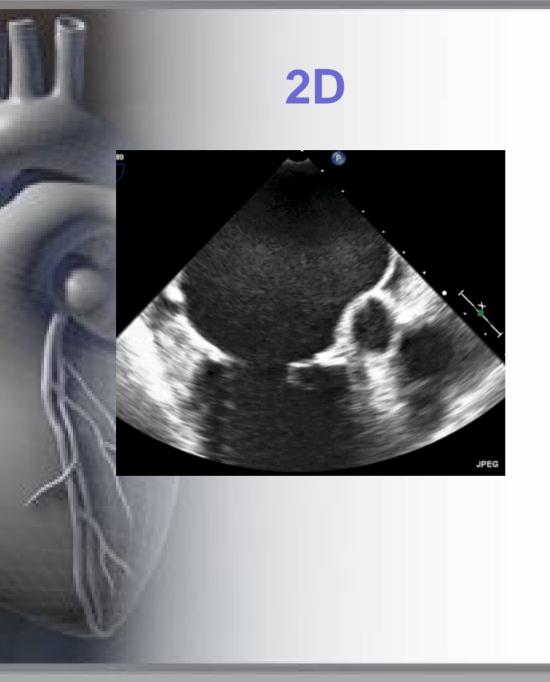


VISIÓN DEL CIRUJANO

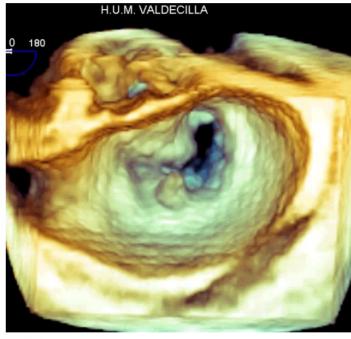


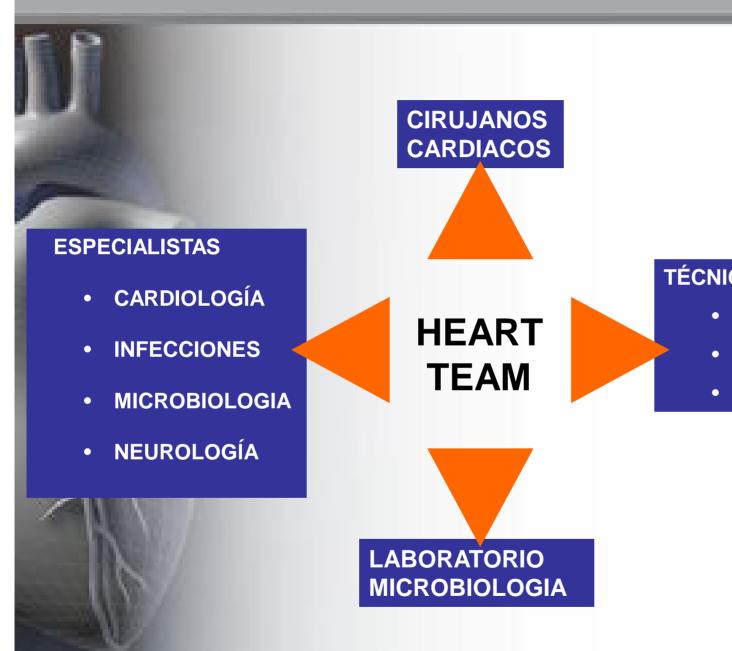














TÉCNICAS DE IMAGEN

- ECOCARDIOGRAFÍA
- TAC, RNM
- PET

4. The 'Endocarditis Team'

IE is a disease that needs a collaborative approach for the following

- First, IE is not a single disease, but rather may present with very different aspects depending on the first organ involved, the underlying cardiac disease (if any), the microorganism involved. the presence or absence of complications and the patient's characteristics. No single practitioner will be able to manage and treat a patient in whom the main clinical symptoms might be cardiac, rheumatological, infectious, neurological or other.
- Second, a very high level of expertise is needed from practitioners from several specialties, including cardiologists, cardiac surgeons, ID specialists, microbiologists, neurologists, neurosurgeons, experts in CHD and others. Echocardiography is known to have a major importance in the diagnosis and management of IE. How ever, other imaging techniques, including magnetic resonance imaging (MRI), multislice computed tomography (MSCT), and nuclear imaging, have also been shown to be useful for diagnosis, follow-up and decision making in patients with IE. 10 Incl
- Finally, about half of the patients with IE undergo surg important and is considered mandatory in all cases cated IE [i.e. endocarditis with heart failure (HF), abscess or embolic or neurological complications].





these specialists in the team is becoming increasingly in partients with IE. Includes the perts in CHD and others. Echocardiography is known to have a

the hospital course. 54 Early discussion with the surgir major importance in the diagnosis and management of IE. How-

5.3.1 Echocardiography

Echocardiography, either transthoracic echocardiography (TTE) or TOE, is the technique of choice for the diagnosis of IE, and plays a key role in the management and monitoring of these patients. 64,65 Echocardiography must be performed as soon as IE is suspected.



Table 8 Characteristics of the 'Endocarditis Team'

When to refer a patient with IE to an 'Endocarditis Team'

- Patients with complicated IE (i.e. endocarditis with HF, abscess, or embolic or neurological complication or CHD), should be referred early and managed in a reference centre with immediate surgical facilities.
- Patients with non-complicated IE can be initially managed in a non-reference centre, but with regular communication with the reference centre, consultations with the multidisciplinary 'Endocarditis Team', and, when needed, with external visit to the reference centre.

Characteristics of the reference centre

in a reference centre

- Immediate access to diagnostic procedures should be possible, including TTE, TOE, multislice CT, MRI, and nuclear imaging.
- Immediate access to cardiac surgery should be possible during the early stage of the disease, particularly in case of complicated IE (HI; abscess, large vegetation, neurological, and embolic complications).
- 3. Several specialists should be present on site (the 'Endocarditis Team'), including at least cardiac surgeons, cardiologists, anaesthesiologists, ID specialists, microbiologists and, when available, specialists in valve diseases, CHD, pacemaker extraction, echocardiography and other cardiac imaging techniques, neurologists, and facilities for neurosurgery and interventional neuroradiology.

Role of the 'Endocarditis Team'

- The 'Endocarditis Team' should have meetings on a regular basis in order to discuss cases, take surgical decisions, and define the type of follow-up.
- The 'Endocarditis Team' chooses the type, duration, and mode of follow up of antibiotic therapy, according to a standardized protocol, following the current guidelines.
- 3. The 'Endocarditis Team' should participate in national or international registries, publicly report the mortality and morbidity of their centre, and be involved in a quality improvement programme, as well as in a patient education programme.
- 4. The follow-up should be organized on an outpatient visit basis at a frequency depending on the patient's clinical status (ideally at 1, 3, 6, and 12 months after hospital discharge, since the majority of events occur during this period⁵⁷).





Acceso inmediato

- Eco TT
- Eco TE



Characteristics of the reference centre



 Immediate access to diagnostic procedures should be possible, including TTE, TOE, multislice CT, MRI, and nuclear imaging.



ECO EN EL DIAGNÓSTICO DE ENDOCARDITIS INFECCIOSA

TTE should be performed in all cases of suspected IE (Class I; Level of Evidence B).

ÚNICA RECOMENDACIÓN A EN TODAS LAS GUÍAS



Echocardiography should be performed expeditiously in patients suspected of having IE ($Class\ I$; $Level\ of\ Evidence\ A$). Clase I, Nivel de evidencia A

*Done in a quick and efficient way (Merriam-Webster)

Expeditivo. Adj: que tiene facilidad en dar expediente o salida en un negocio, sin muchos miramientos, evitando trámites (RAE)