

Challenging the experts

***A patient with a prosthetic heart
valve and positive PET.***

Gilbert Habib
La Timone Hospital
Marseille - France

EuroValve

October 28th, 2021

Case: Aortic bioprosthetic endocarditis

History of the disease

- ✦ 83 year-old woman
- ✦ aortic bioprosthesis 2014 for aortic stenosis
- ✦ past breast cancer
- ✦ unexplained fever August 2021

Clinical examination on admission : 14 sept 2021

- ✦ fever = 39°
- ✦ aortic systolic murmur 2/6
- ✦ normal neurological examination
- ✦ no heart failure

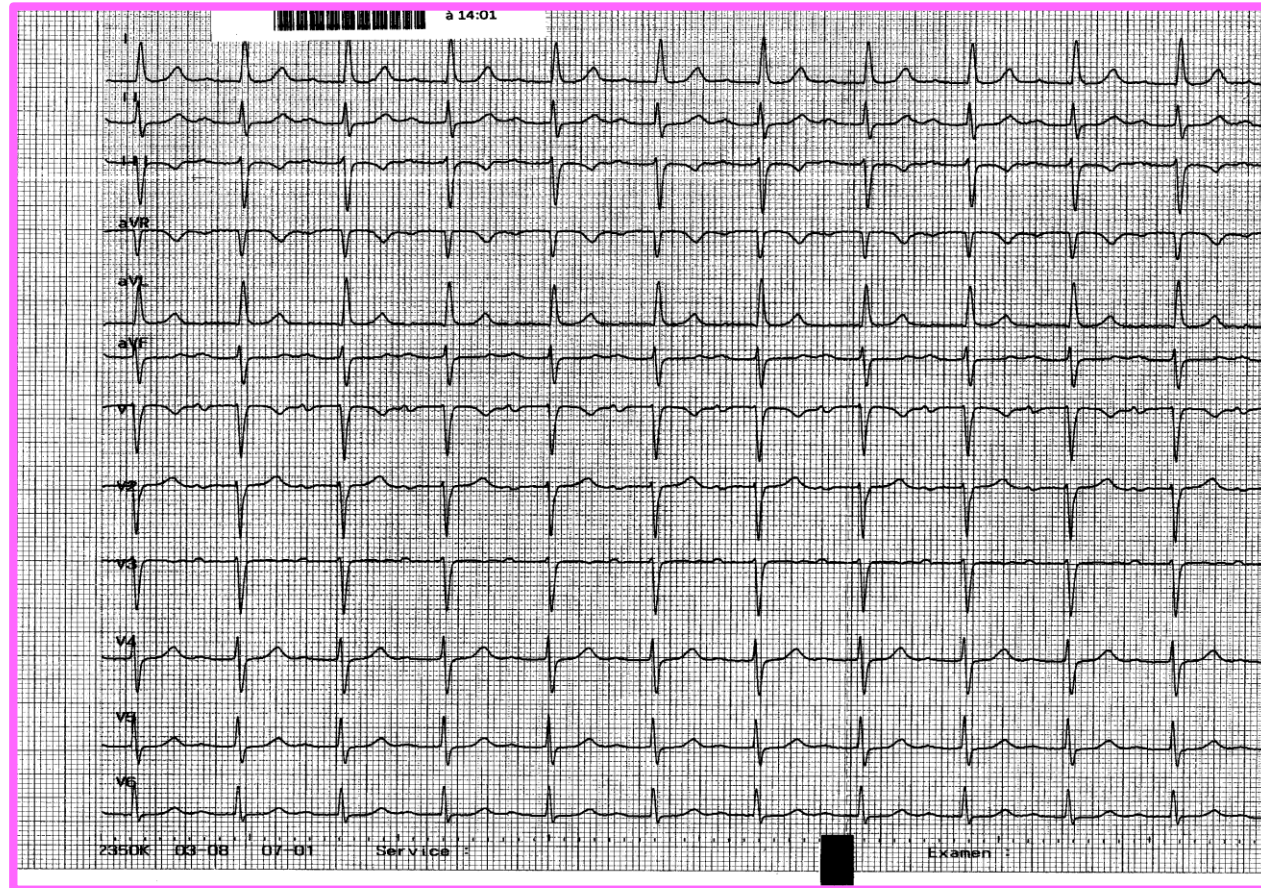
Aortic bioprosthetic endocarditis

Laboratory data

- ✦ white blood cell count : 12,700/mm³
- ✦ CRP : 110 mg/l
- ✦ serum creatinin : 100 µmol/l
- ✦ haemoglobin : 9 g/dl

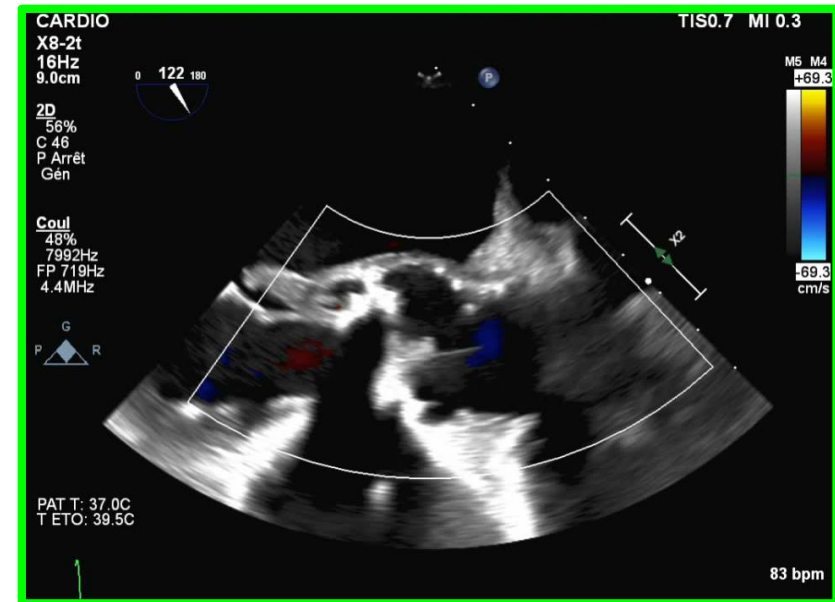
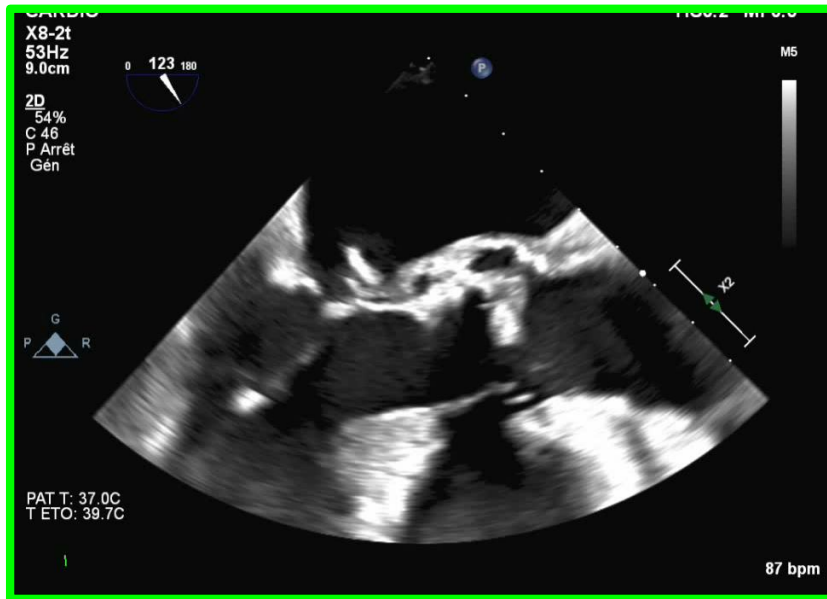
Blood cultures: Enterococcus Faecalis

Electrocardiogram on admission



1st degree AV block

First TEE on admission

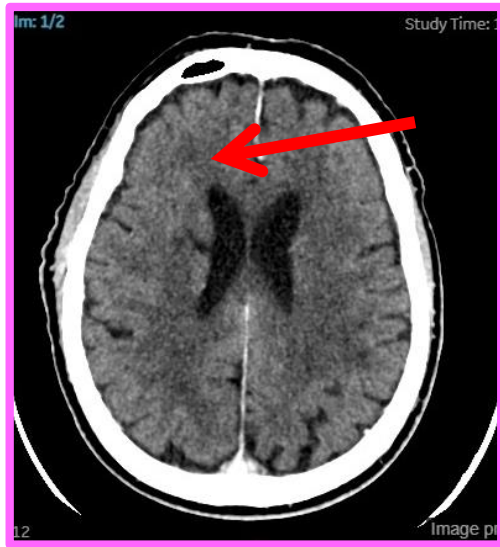


September, 14th 2021

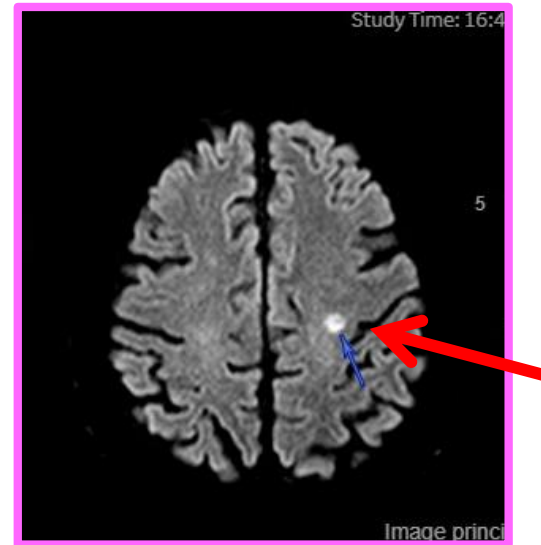
**Do we need any additional
imaging investigation
before going to surgery?**



Cerebral imaging on admission



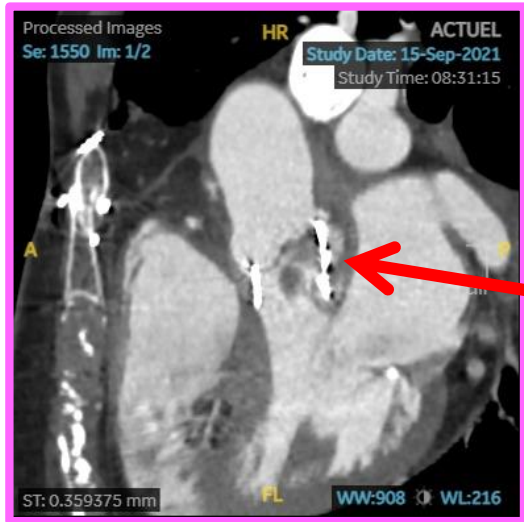
Cerebral CT scan



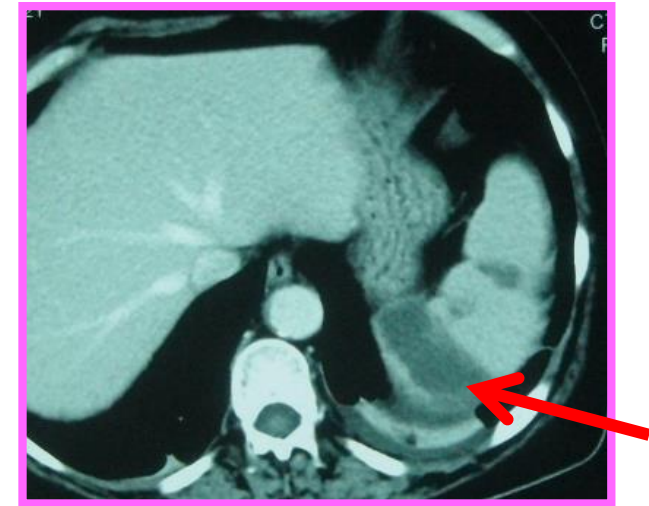
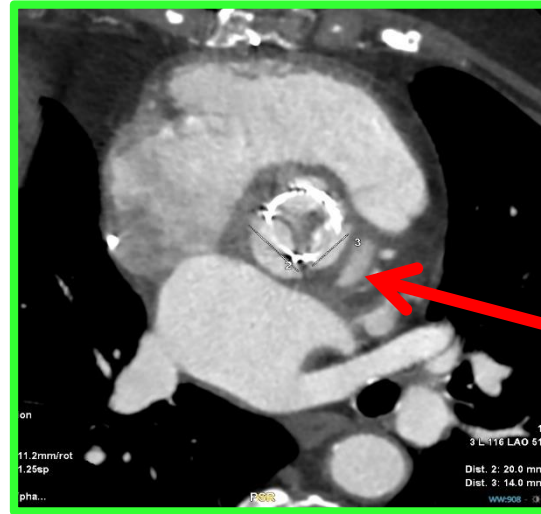
Cerebral MRI

September, 14th 2021

Endocarditis CT-scan on admission



Periprosthetic abscess



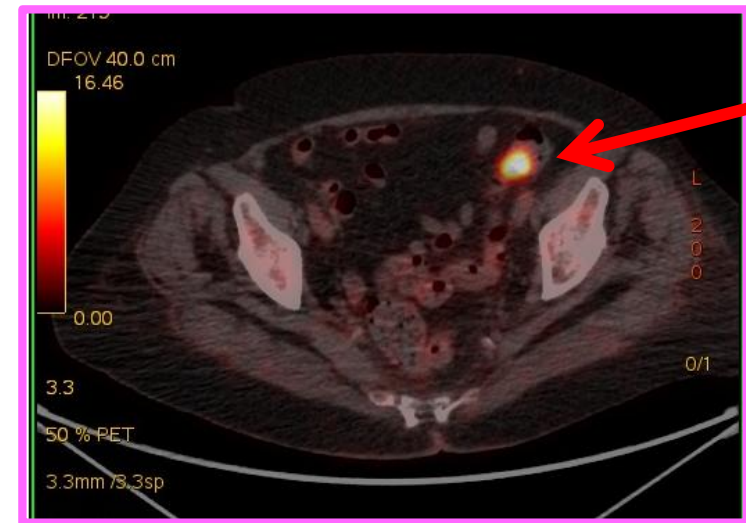
Splenic embolism

September, 14th 2021

^{18}F FDG-PET-CT



Prosthetic uptake



Colic uptake

September, 16th 2021

Surgery 17 September 2021



✦ urgent surgery performed on day 3

- ✦ aortic abscess, mitral valve vegetations
- ✦ aortic valve replacement by an Edwards Lifesciences Perimount Magna Ease
- ✦ mitral valve repair



Aortic bioprosthetic endocarditis

1. *Diagnosis*

2. **Treatment**



Echocardiography

Nuclear Imaging



***Cerebral
imaging***

Cardiovascular CT



Multimodality Imaging in Infective Endocarditis

An Imaging Team Within the Endocarditis Team

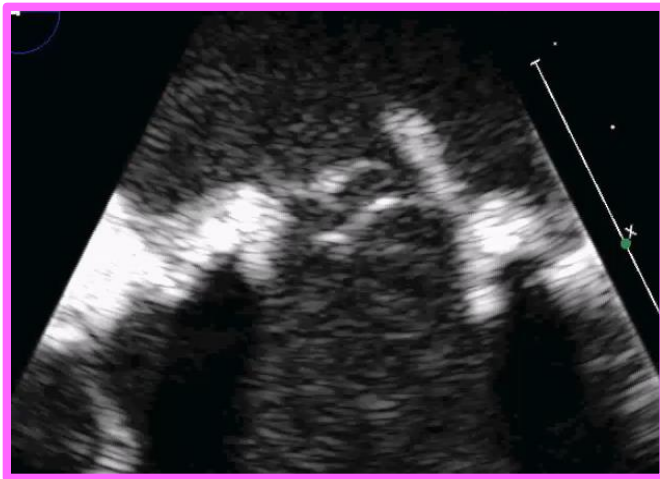
ABSTRACT: Infective endocarditis (IE) is a complex disease with cardiac involvement and multiorgan complications. Its prognosis depends on prompt diagnosis that leads to an aggressive therapeutic management combining antibiotic therapy and early cardiac surgery when indicated. However, IE diagnosis always poses a challenge, and echocardiography remains diagnostically imperfect in cases of prosthetic valve IE or cardiac implantable electronic device infection. In recent years, other imaging modalities (computed tomography, magnetic resonance imaging, nuclear imaging) have experienced significant technical improvements, and their application to the detection of

Paola A. Erba, MD, PhD*
Maria N. Pizzi, MD, PhD*
Albert Roque, MD, PhD
Erwan Salaun, MD
Patrizio Lancellotti, MD,
PhD
Pilar Tornos, MD
Gilbert Habib, MD, PhD



The Duke echographic criteria

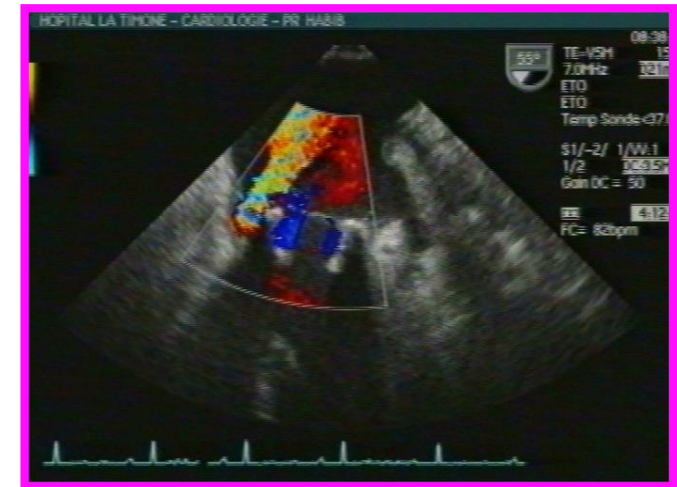
Durack DT Am J Med 1994 ; 96 : 200-9



vegetation



abscess



*new dehiscence
of prosthetic valve*



European Heart Journal (2015) 36, 3075–3123
doi:10.1093/eurheartj/ehv319

ESC GUIDELINES

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)

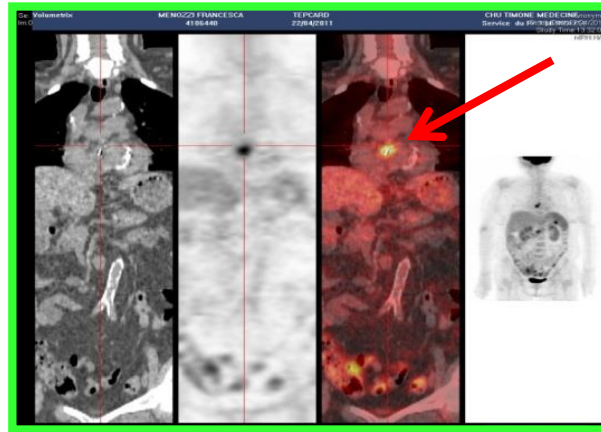


The ESC 2015 imaging criteria

Habib G et al - ESC guidelines Europ Heart J 2015



TOE
Morphology



PET CT
Inflammation /
infection

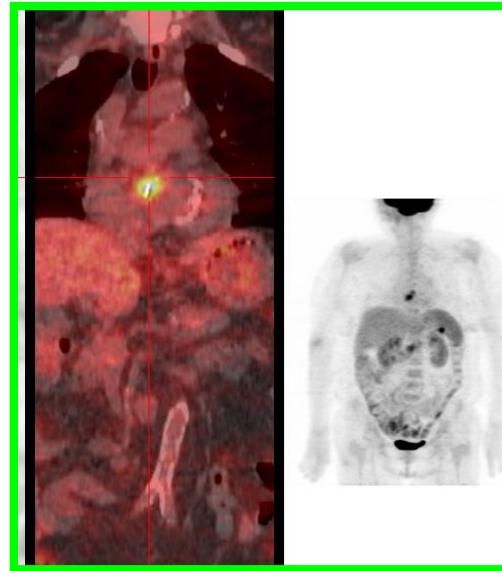


Cardiac CT
Perivalvular lesions

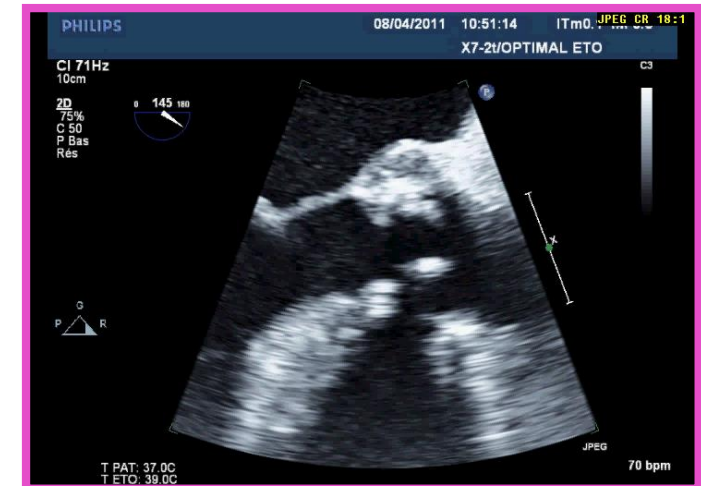
^{18}F FDG-PET-CT in endocarditis



First TOE



^{18}F FDG-PET-CT



Follow-up TOE

ESC 2015 modified criteria for diagnosis of IE

Major criteria

1. Blood cultures positive for IE

- a. Typical microorganisms consistent with IE from 2 separate blood cultures:
- b. Microorganisms consistent with IE from persistently positive blood cultures:
- 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:

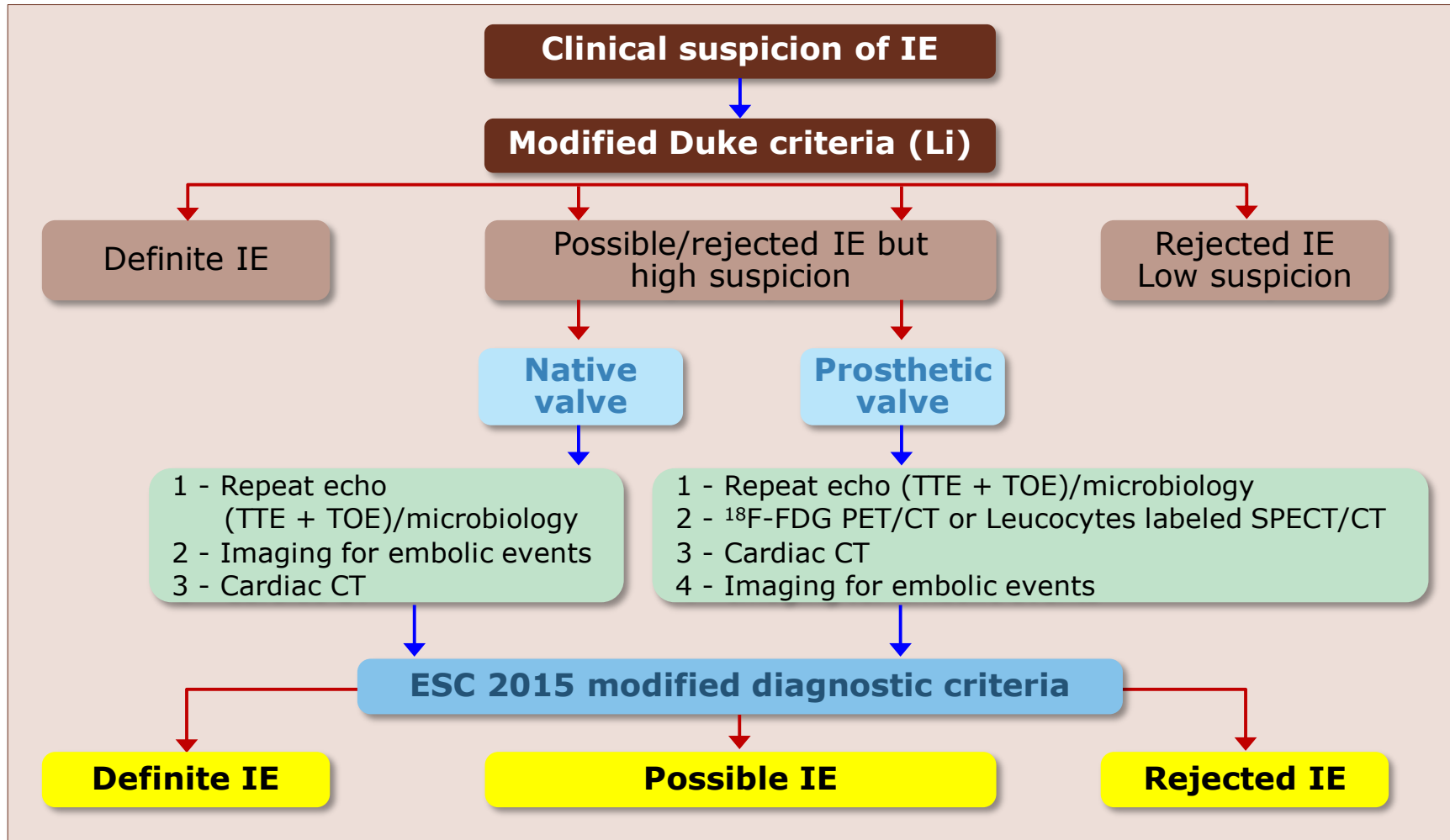
- Vegetation
- Abscess, pseudoaneurysm, intracardiac fistula
- Valvular perforation or aneurysm
- New partial dehiscence of prosthetic valve

b. Abnormal activity around the site of prosthetic valve implantation detected by ^{18}F -FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.

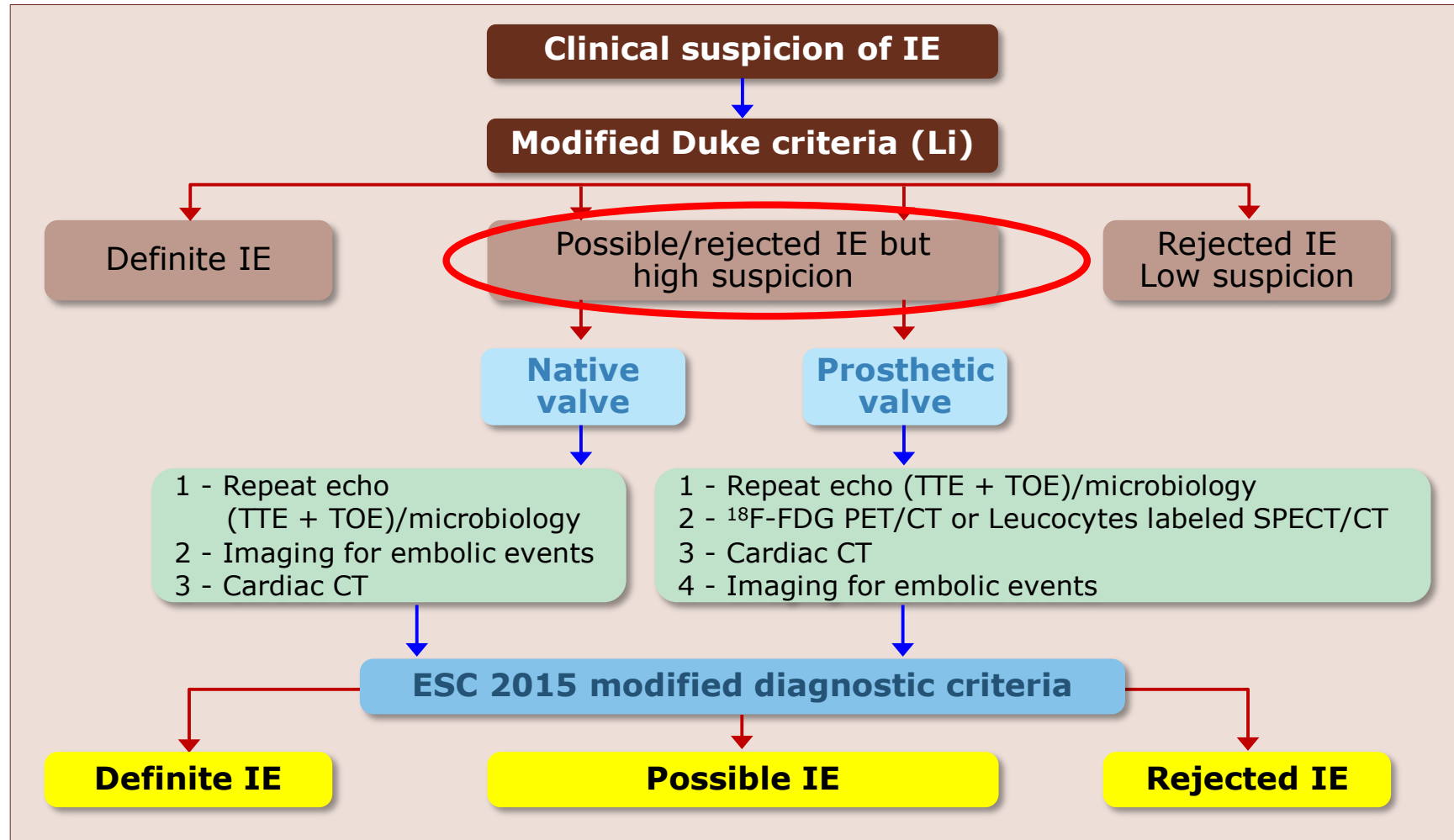
c. Definite paravalvular lesions by cardiac CT.



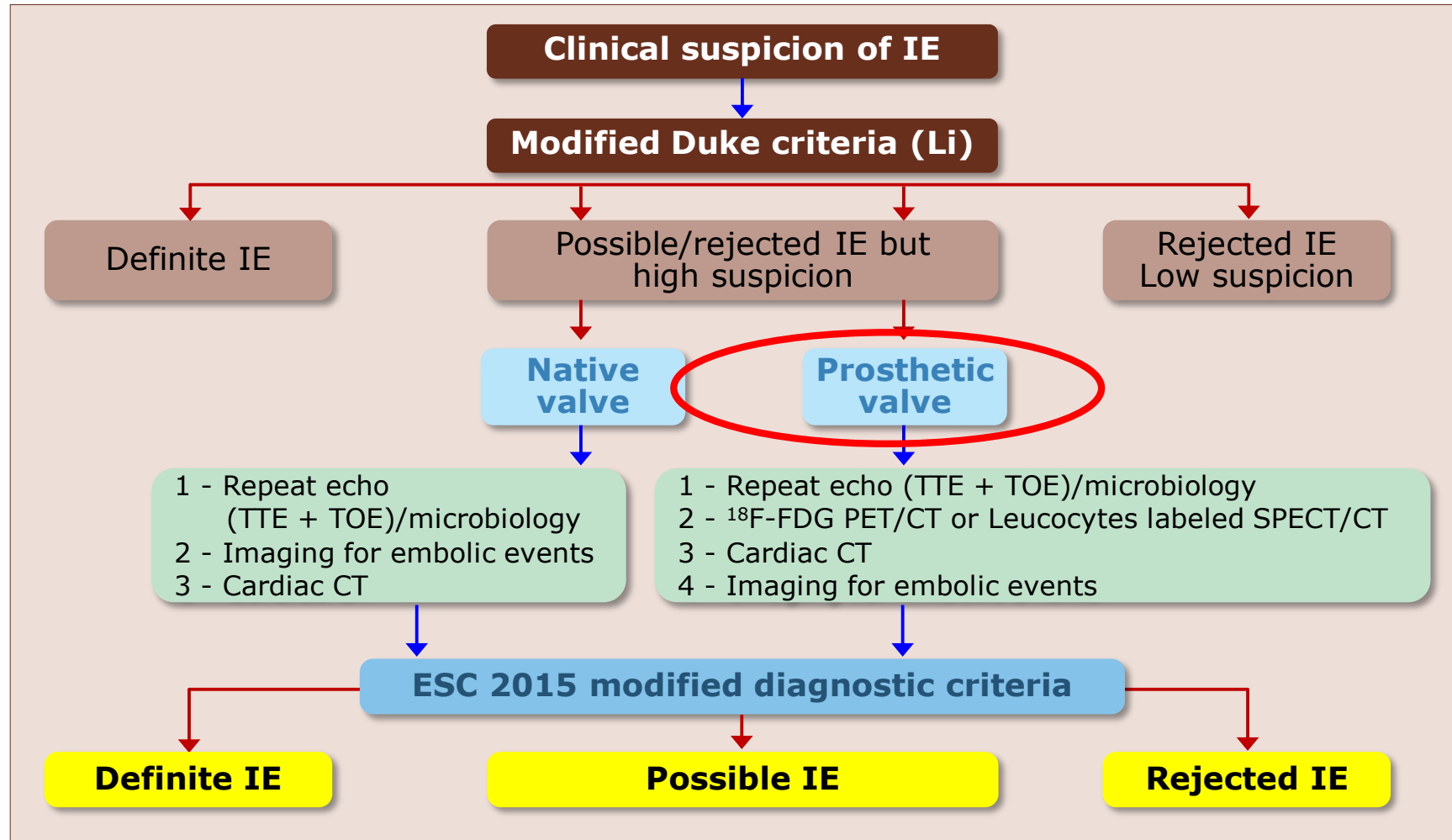
ESC 2015 algorithm for diagnosis of IE



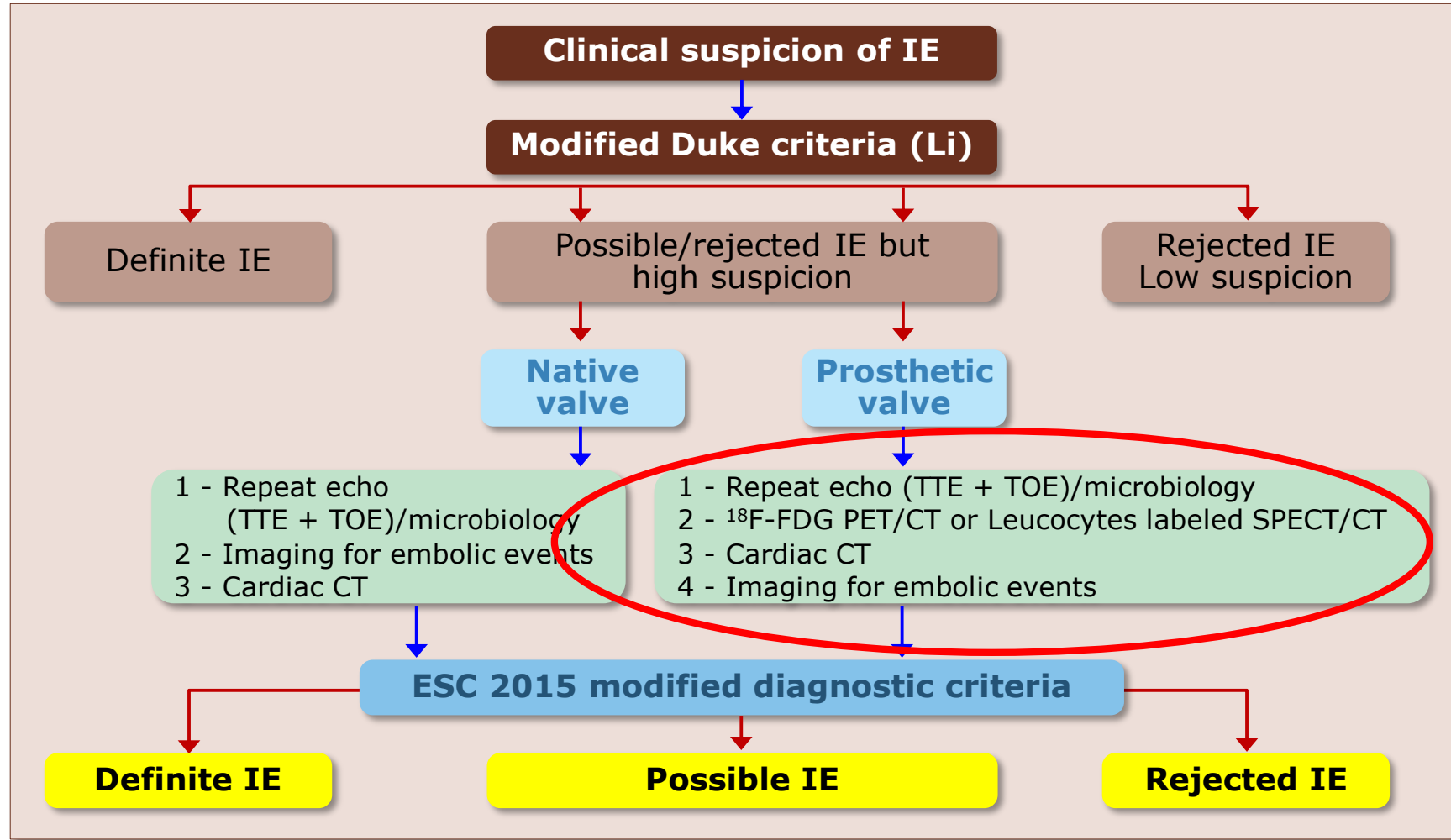
ESC 2015 algorithm for diagnosis of IE



ESC 2015 algorithm for diagnosis of IE



ESC 2015 algorithm for diagnosis of IE



Multimodality imaging in IE

CLINICAL PRACTICE GUIDELINE: FULL TEXT

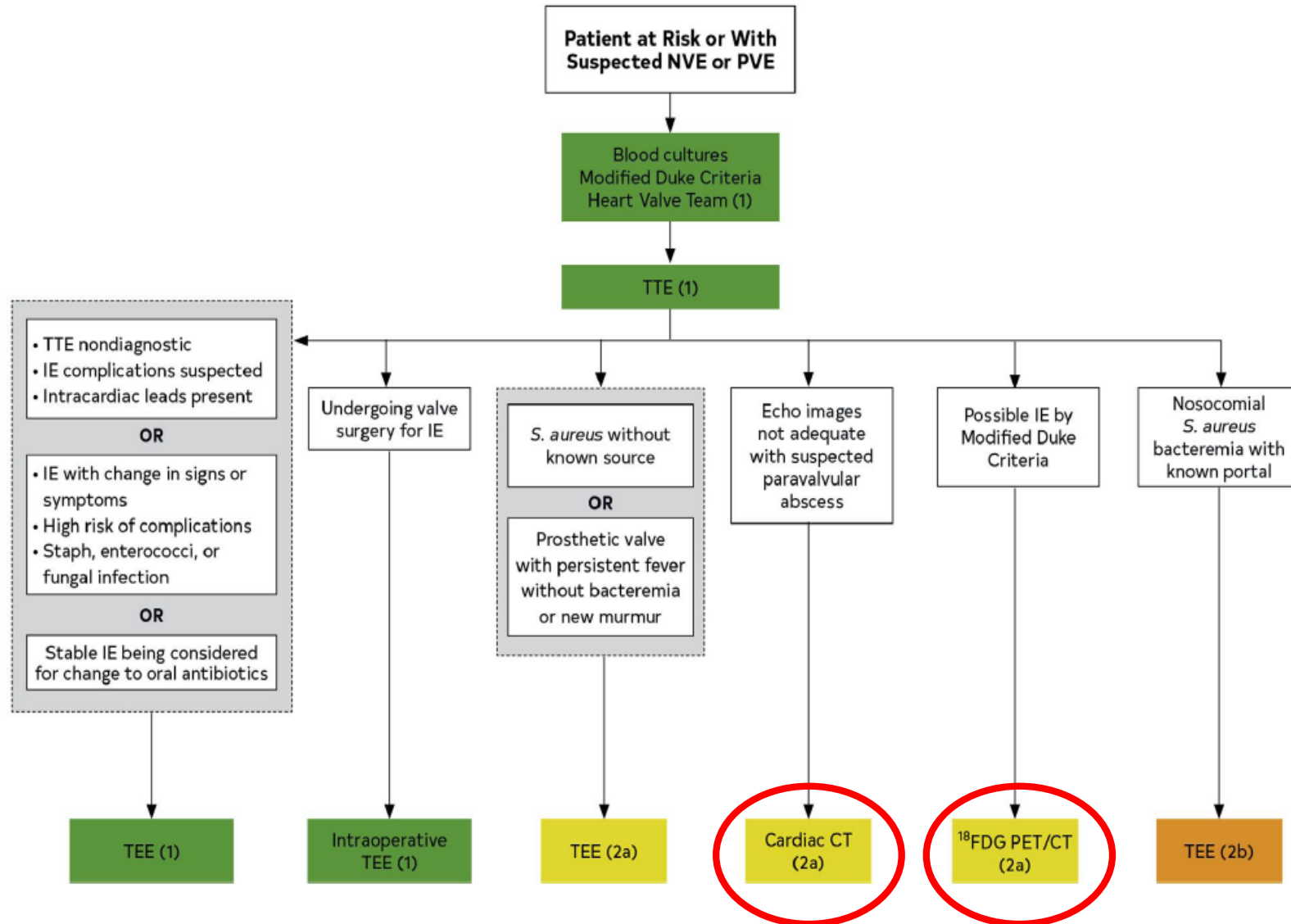
2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Developed in collaboration with and endorsed by the American Association for Thoracic Surgery, American Society of Echocardiography, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists, and Society of Thoracic Surgeons

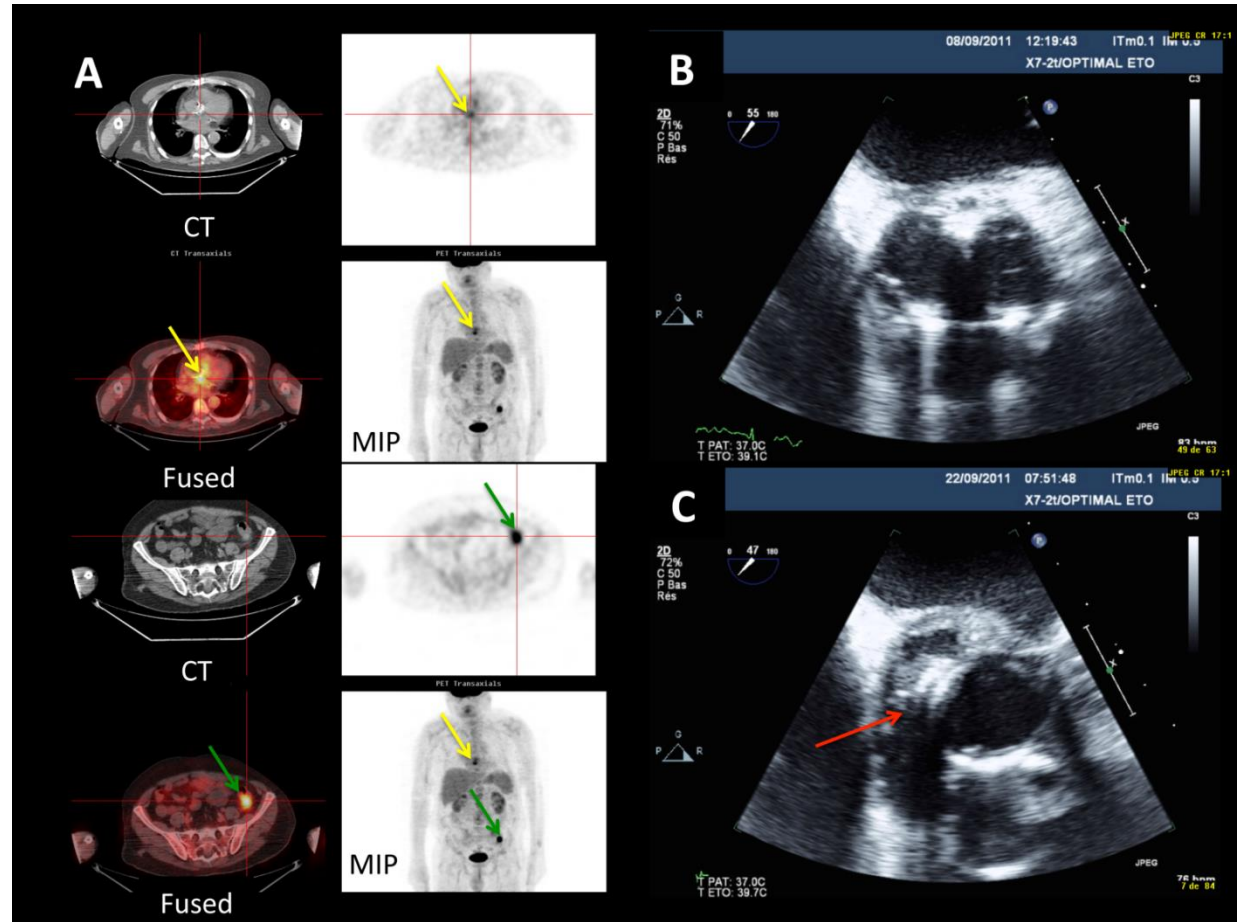


Multimodality imaging in IE



^{18}F FDG-PET-CT in endocarditis

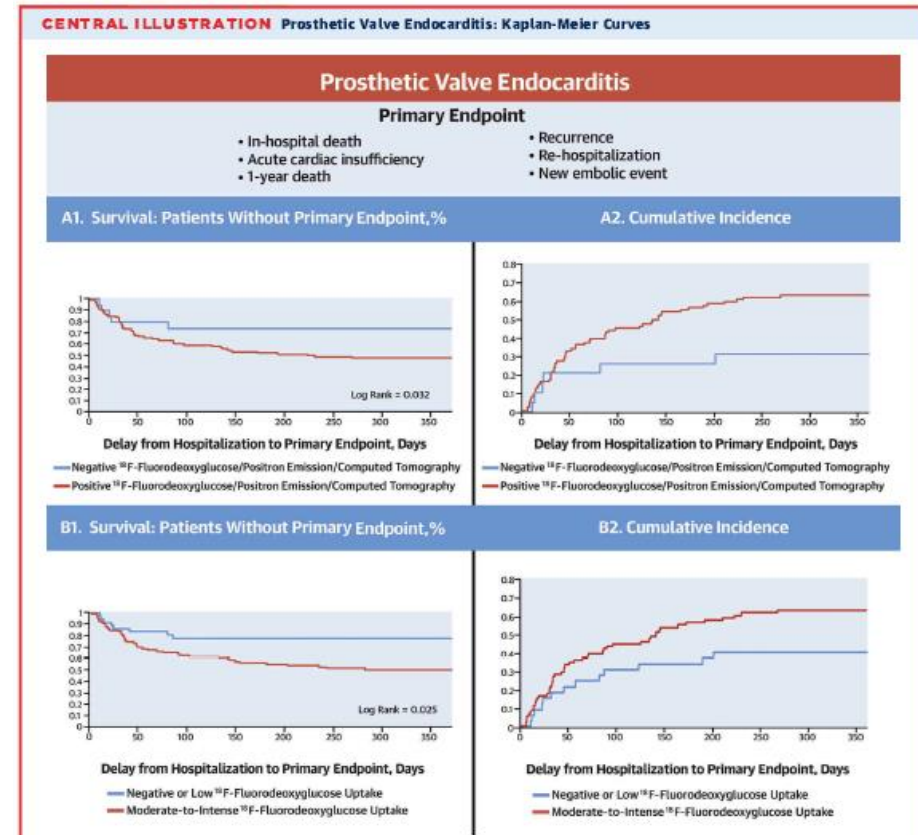
1. Early diagnosis of perivalvular lesions
2. Detection of secondary lesions



Prognostic value of ^{18}F -FDG-PET-CT

San R- JACC 2019; 174: 1031-40

1. 173 patients with IE (109 PVE – 64 NVE)
2. follow-up : 1 year
3. moderate-to-severe ^{18}F -FDG-PET-CT uptake was associated with more events



Embolic risk: value of ^{18}F -FDG-PET-CT

San R- JACC 2019; 174: 1031-40

TABLE 5 Major Cardiac Events in the PVE and NVE Groups According to ^{18}F -FDG PET/CT Results

	PVE Group (n = 109)				NVE Group (n = 64)			
	Positive ^{18}F -FDG		Moderate to Intense ^{18}F -FDG Uptake		Positive ^{18}F -FDG		Moderate to Intense ^{18}F -FDG Uptake	
	HR (95% CI)	p Value	HR (95% CI)	p Value	HR (95% CI)	p Value	HR (95% CI)	p Value
In-hospital death	0.49 (0.2-2.60)	0.36	0.43 (0.10-1.80)	0.25	2.78 (0.44-17.50)	0.25	1.53 (0.16-16.10)	0.69
1-yr death	1.43 (0.41-6.00)	0.50	1.40 (0.51-3.97)	0.50	1.35 (0.26-8.06)	0.68	1.77 (0.64-4.93)	0.27
Recurrence	1.24 (0.14-10.98)	0.84	3.10 (0.37-26.28)	0.28	2.45 (0.40-14.85)	0.67	3.00 (0.35-26.00)	0.30
New embolic event	3.1 (0.37-26.00)	0.82	7.50 (1.24-45.20)	0.03	3.13 (0.50-20.0)	0.21	8.80 (1.10-69.50)	0.02
Acute cardiac failure	1.97 (0.60-6.45)	0.25	1.00 (0.44-2.57)	0.89	1.87 (0.56-6.24)	0.31	1.30 (0.54-3.13)	0.55
Rehospitalization	3.27 (0.70-15.20)	0.11	3.00 (0.94-9.47)	0.05	2.50 (0.53-11.90)	0.24	3.57 (1.10-11.3)	0.03



Aortic bioprosthetic endocarditis

1. Diagnosis

2. *Treatment*



Indications and timing of surgery

Indications for surgery	Timing	Class	Level
1. Heart Failure			
Aortic or mitral NVE or PVE with severe acute regurgitation, obstruction or fistula causing refractory pulmonary oedema or cardiogenic shock.	Emergency	I	B
Aortic or mitral NVE or PVE with severe regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance.	Urgent	I	B
2. Uncontrolled infection			
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation).	Urgent	I	B
Infection caused by fungi or multiresistant organisms.	Urgent/elective	I	C
Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci.	Urgent	IIa	B
PVE caused by staphylococci or non-HACEK Gram negative bacteria.	Urgent/elective	IIa	C
3. Prevention of embolism			
Aortic or mitral NVE or PVE with persistent vegetations >10 mm after one or more embolic episode despite appropriate antibiotic therapy.	Urgent	I	B
Aortic or mitral NVE with vegetations >10 mm, associated with severe valve stenosis or regurgitation, and low operative risk.	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated very large vegetations (>30 mm).	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated large vegetations (>15 mm) and no other indication for surgery.	Urgent	IIb	C



Indications and timing of surgery

Indications for surgery	Timing	Class	Level
1. Heart Failure			
Aortic or mitral NVE or PVE with severe acute regurgitation, obstruction or fistula causing refractory pulmonary oedema or cardiogenic shock.	Emergency	I	B
Aortic or mitral NVE or PVE with severe regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance.	Urgent	I	B
2. Uncontrolled infection			
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation).	Urgent	I	B
Infection caused by fungi or multiresistant organisms.	Urgent/elective	I	C
Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci.	Urgent	IIa	B
PVE caused by staphylococci or non-HACEK Gram negative bacteria.	Urgent/elective	IIa	C
3. Prevention of embolism			
Aortic or mitral NVE or PVE with persistent vegetations >10 mm after one or more embolic episode despite appropriate antibiotic therapy.	Urgent	I	B
Aortic or mitral NVE with vegetations >10 mm, associated with severe valve stenosis or regurgitation, and low operative risk.	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated very large vegetations (>30 mm).	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated large vegetations (>15 mm) and no other indication for surgery.	Urgent	IIb	C



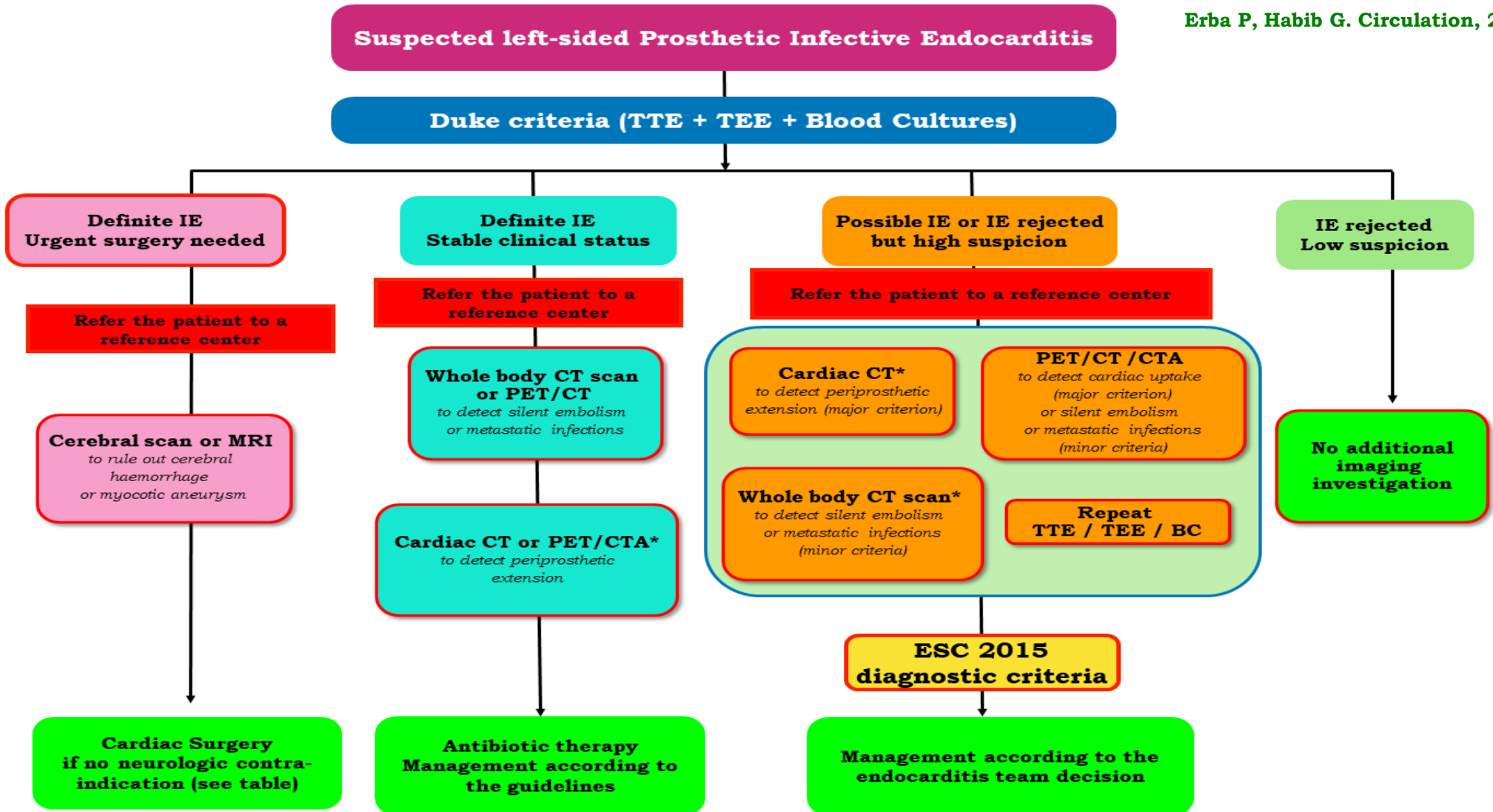
Indication 2: uncontrolled infection

Indications for surgery	Timing	Class	Level
2. Uncontrolled infection			
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation).	Urgent	I	B
Infection caused by fungi or multiresistant organisms.	Urgent/elective	I	C
Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci.	Urgent	Ila	B



Algorithm for diagnosis and treatment of Prosthetic IE

Erba P, Habib G. Circulation, 2019



Take-home messages: PVE

- 1. Frequently difficult diagnosis**
- 2. Echocardiography first, but multimodality imaging mandatory**
- 3. New ESC diagnostic criteria and algorithm**
- 4. Early surgery, if not contraindicated**
- 5. Multidisciplinary “Imaging Endocarditis Team”**





2015



2019



European Heart Journal (2015) 36, 3075–3123
doi:10.1093/eurheartj/ehv319

ESC GUIDELINES

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)



ESC

European Society of Cardiology

European Heart Journal (2019) 0, 1–11
doi:10.1093/eurheartj/ehz620

FASTTRACK CLINICAL RESEARCH

Valvular heart disease

Clinical presentation, aetiology and outcome of infective endocarditis. Results of the ESC-EORP EURO-ENDO (European infective endocarditis) registry: a prospective cohort study

Gilbert Habib ^{1,2*}, Paola Anna Erba ^{3,4}, Bernard Iung ⁵, Erwan Donal⁶, Bernard Cosyns ⁷, Cécile Laroche⁸, Bogdan A. Popescu⁹, Bernard Prendergast¹⁰, Pilar Tornos¹¹, Anita Sadeghpour¹², Leopold Oliver¹³, Jolanta-Justina Vaskelyte¹⁴, Rouguiatou Sow ¹⁵, Olivier Axler¹⁶, Aldo P. Maggioni¹⁷, and Patrizio Lancellotti^{18,19,20}; on behalf of the EURO-ENDO Investigators[†]



31 March 2018 - 3116 patients



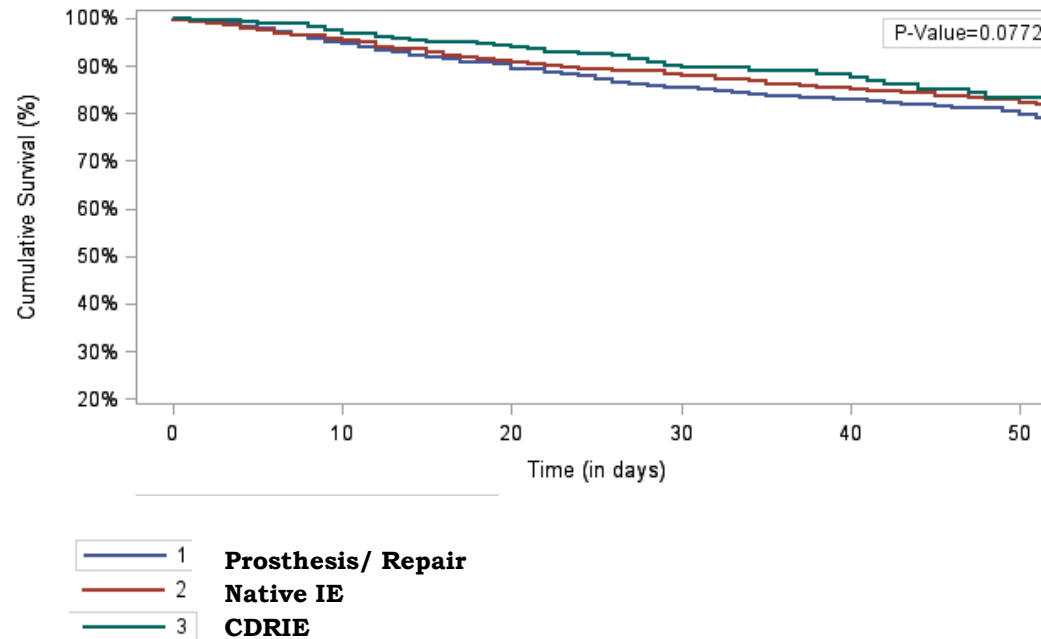
Surgical therapy

1. Surgery was performed during hospitalization in 1596 (51.2%) patients.
2. Following ESC guidelines, theoretical indication for cardiac surgery was present in 2160 (69.3%) patients.

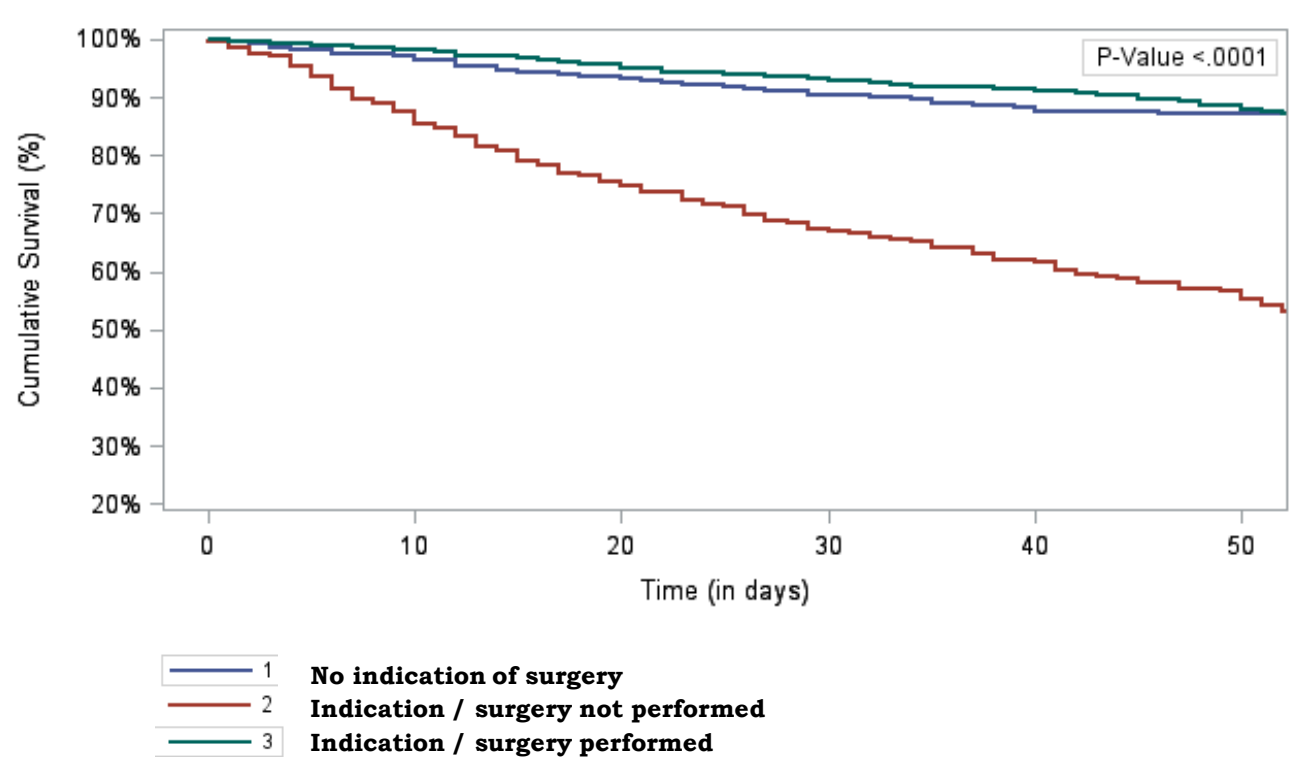
	Total (n =3116)	ESC (n =2470)	Non-ESC (n = 646)	P-value
Theoretical Indication of cardiac surgery	2160 / 3115 (69.3%)	1747 / 2470 (70.7%)	413 / 645 (64.0%)	0.0010
Indication				
Haemodynamic	999 / 2160 (46.3%)	788 / 1747 (45.1%)	211 / 413 (51.1%)	0.0283
Embolic	693 / 2160 (32.1%)	590 / 1747 (33.8%)	103 / 413 (24.9%)	0.0005
Infectious	1387 / 2160 (64.2%)	1077 / 1747 (61.6%)	310 / 413 (75.1%)	<0.0001
Other	207 / 2160 (9.6%)	159 / 1747 (9.1%)	48 / 413 (11.6%)	0.1175
Cardiac surgery performed	1596 / 2160 (73.9%)	1275 / 1747 (73.0%)	321 / 413 (77.7%)	0.0485

1-month mortality in EURO-ENDO

1. 532 In-hospital deaths = 17.1%
2. Similar in ESC vs non-ESC countries



1-month mortality in EURO-ENDO



Multivariate predictors of in-hospital death

	Hazard Ratio	95% CI	p Wald
Charlson index	1.08	[1.05-1.11]	<.0001
Creatinine >2mg/dl	2.00	[1.60-2.49]	<.0001
CHF	2.38	[1.89-2.99]	<.0001
Vegetation length > 10mm	1.64	[1.33-2.01]	<.0001
Cerebral complication	1.91	[1.46-2.49]	<.0001
Abscess	1.58	[1.20-2.06]	0.0010
Indication - not performed	2.73	[2.06-3.62]	<.0001
Indication - performed	0.72	[0.53-0.96]	0.0240



Take-Home messages : IE

1. Difficult diagnosis is still frequent
2. A multidisciplinary approach is mandatory, including cardiologists, cardiac surgeons, and specialists of infectious diseases.
3. New imaging tools exist, including nuclear imaging and cardiac CT, but experience is needed and knowledge of the indications and limitations of each technique is mandatory
4. Patients with difficult diagnosis should be sent to reference centres and managed by a specialized endocarditis team
5. Any complicated endocarditis should theoretically be treated by early surgery after discussion within the endocarditis team



3 key-points: TAVI endocarditis

- 1. Diagnosis more difficult, role of multimodality imaging**
- 2. Frail patients, difficult to treat, few patients operated**
- 3. The most severe form of infective endocarditis**

The most frequent form of endocarditis in the future?

