2023 ESC Infective Endocarditis

Key points

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2023 Guidelines vs. 2015 Guidelines

- Prevention of IE
  - New recommendations
  - Definitions of risk categories
  - Prevention measures
  - Patient education
- Diagnosis
- Antibiotic therapy
  - Oral / OPAT
  - Same antibiotic regimen
- Surgical intervention in IE

2023 Guidelines vs. 2015 Guidelines

- Prevention of IE
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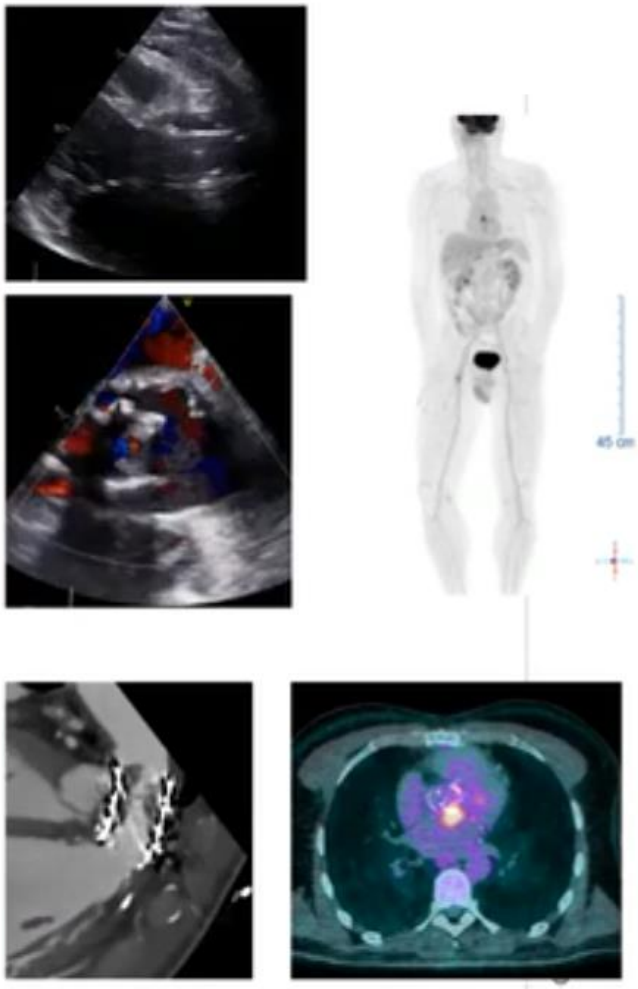
Advanced imaging in IE

- CT
- FDG-PET/CT
- WBC-SPECT/CT
- MRI



2023 ESC modified diagnostic criteria of IE

Major criteria (continued)

(ii) Imaging positive for IE

Valvular, perivalvular/periprosthetic and foreign material anatomic and metabolic lesions characteristic of IE detected by any of the following imaging techniques:

- Echocardiography (TTE and TOE)
- Cardiac CT
- [18F]-FDG-PET/CT(A)
- WBC SPECT/CT

NEW

Minor criteria

(i) Predisposing conditions (i.e. predisposing heart condition at high or intermediate risk of IE or PWIDs)[a]

(ii) Fever defined as temperature >38°C

(iii) Embolic vascular dissemination (including those asymptomatic detected by imaging only):

- Major systemic and pulmonary emboli/infarcts and abscesses.
- Haematogenous osteoarticular septic complications (i.e. spondylodiscitis).
- Mycotic aneurysms.
- Intracranial ischaemic/haemorrhagic lesions.
- Conjunctival haemorrhages.
- Janeway's lesions.

- CT
- MRI
- PET/CT

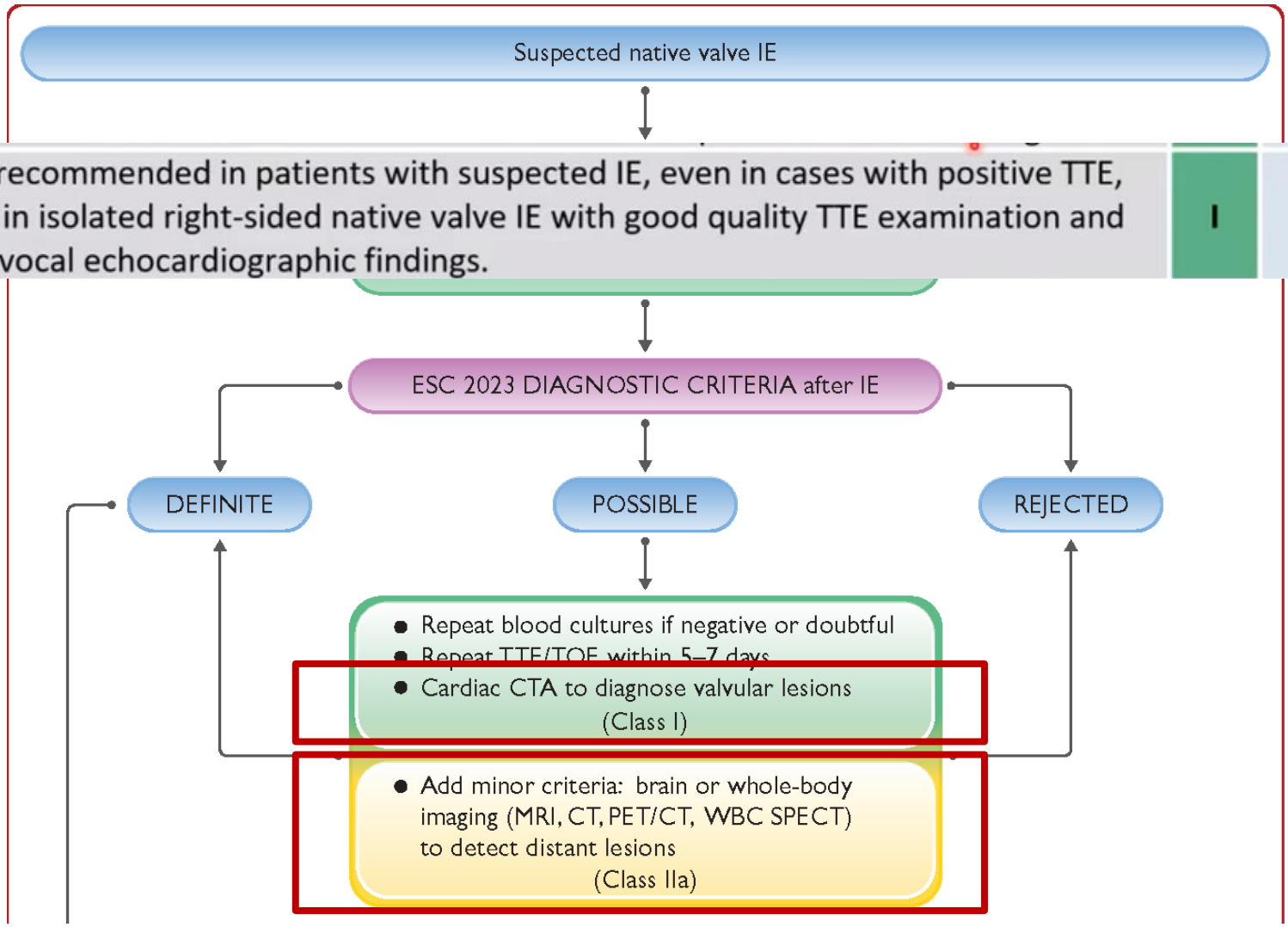
(IV) Immunological phenomena:

- Glomerulonephritis.
- Osler nodes and Roth spots.
- Rheumatoid factor.

(V) Microbiological evidence:

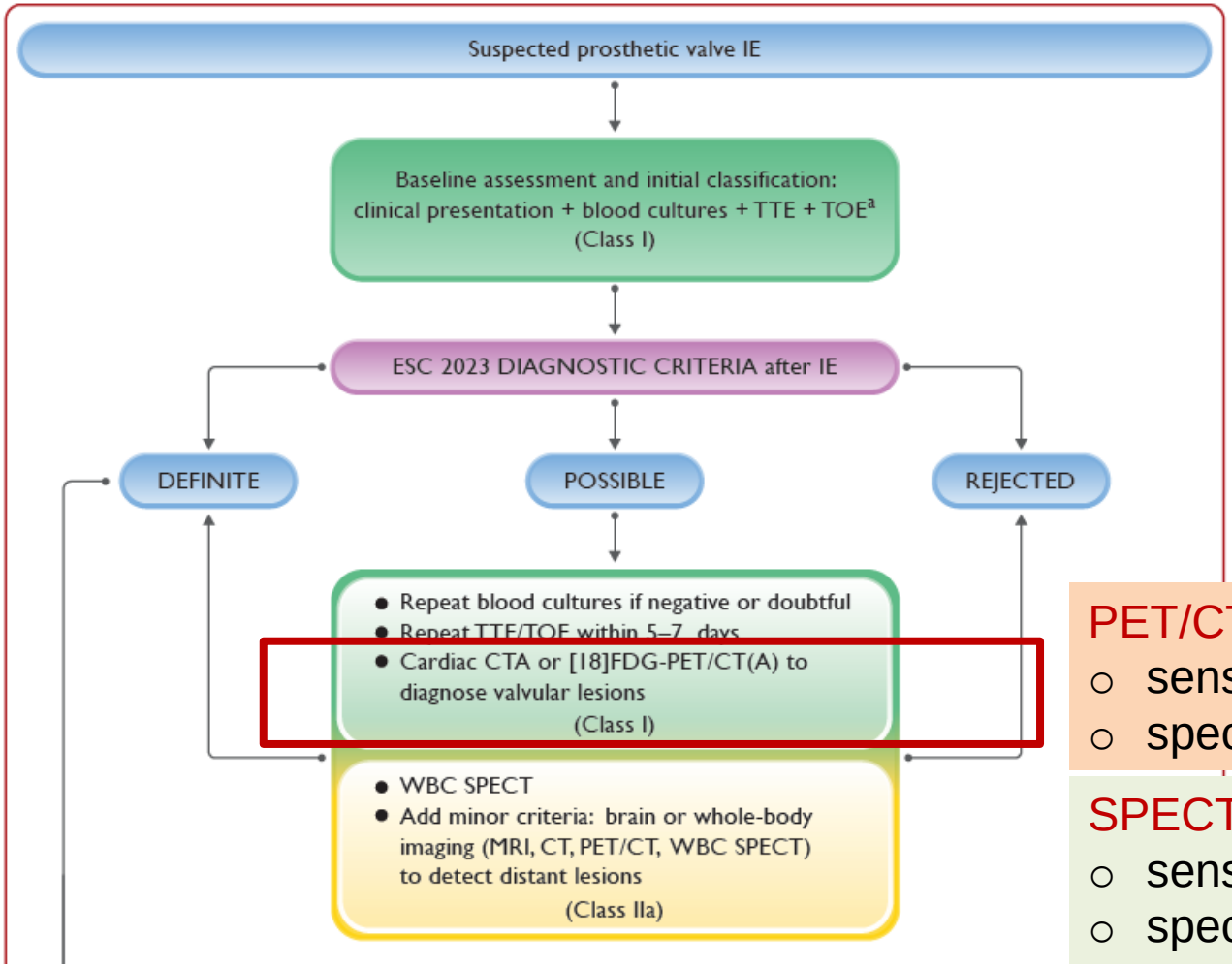
NEW

ESC 2023 diagnostic algorithm : NVE



NEW

ESC 2023 diagnostic algorithm : PVE



PET/CT
- sensitivity: 86%
- specificity: 84%

SPECT/CT
- sensitivity: 64-90%
- specificity: 36-100%

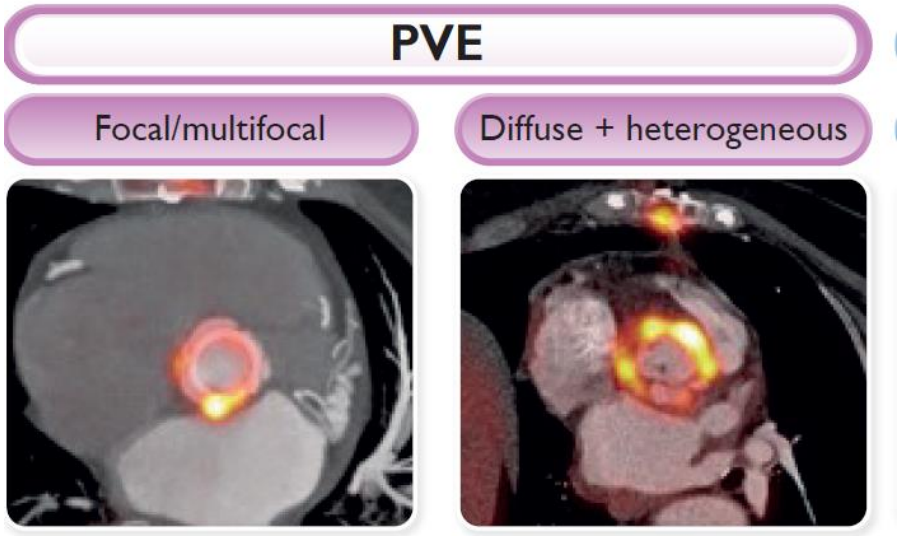


Table S5 **^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography cardiac imaging findings in prosthetic valve endocarditis**

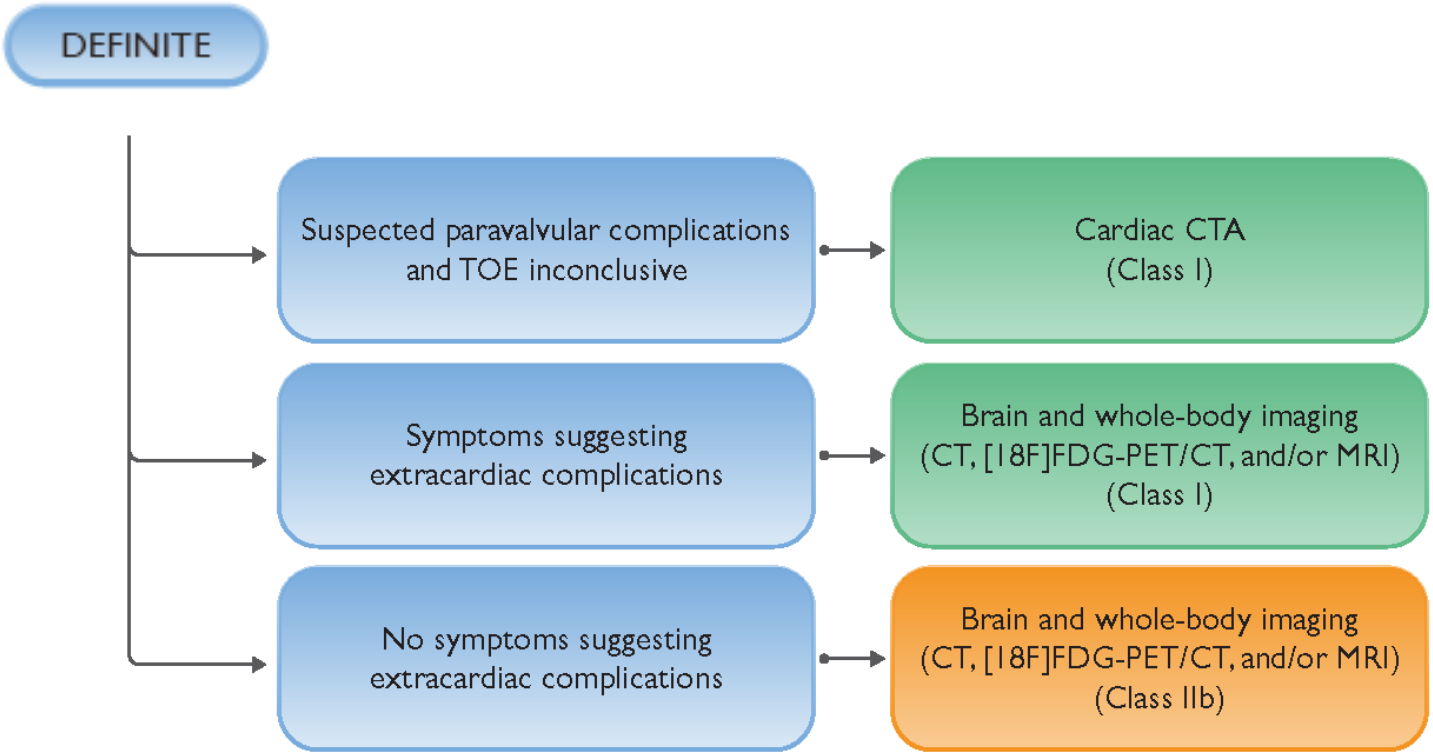
	Qualitative (visual) analysis	Semi-quantitative analysis
Metabolic findings	• [^{18}F]FDG uptake distribution pattern: focal/multifocal or diffuse-heterogeneous distribution. • Location of [^{18}F]FDG uptake: at the valve (intravalvular in the leaflets), valvular/prosthetic (following the supporting structure of the valve), or perivalvular/periprosthetic (next to the valve/prosthesis). • Moderate-intense [^{18}F]FDG visual intensity as compared with other organs considered a normal reference (considering ongoing antimicrobial therapy). • Uptake associated with anatomic lesions. • Hypermetabolism of spleen and/or bone marrow as indirect sign of IE.	Commonly used parameters for quantification: • SUVmax: maximum standardized uptake value. • SUVmean: mean standardized uptake value. • SUVratio: prosthesis-to-background (hepatic or blood pool) SUV. • The probability of infection increases as the SUVmax and/or SUVratio values are higher (considering ongoing antimicrobial therapy) There are no standardized threshold or cut-off values Reported reference values can be taken into account: • SUVmax >5 (95% CI, 4–15) • SUVratio >2.5 (95% CI, 2–6).
Anatomic findings	Visualization of lesions characteristic of IE: • Valvular: severe leaflet thickening,[a] vegetation,[a] leaflet perforation[a]. • Perivalvular or periprosthetic complications: abscess, pseudoaneurysm, infected collection, fistula,[a] prosthetic valve dehiscence[a].	

Table S3 **Definition of cardiac lesions characteristic of infective endocarditis as detected by imaging techniques and surgery**

	Echocardiography	ECG-gated cardiac CT	[18F]FDG-PET/CT(A) and WBC SPECT/CT	Surgery
Valvular lesions				
Leaflet thickening	Diffuse increase in thickness, more or less regular, of one or more leaflets, without vegetations	Diffuse increase in thickness, more or less regular, of one or more leaflets, without vegetations	No visually detectable uptake or mild uptake at the valve leaflets	Diffuse or nodular increase in leaflet thickness
Vegetation	Oscillating or non-oscillating intracardiac echogenic mass attached to a valve or other endocardial structures (chordae, chamber walls), or attached to implanted intracardiac material	Low/intermediate-attenuation mobile soft tissue lesions of variable size attached to valves, endocardium, or prosthetic material	Usually not detectable or sometimes seen as focal uptake at the valve (intravalvular in the leaflets) or at the valvular/prosthetic ring (following the supporting structure of the valve)	Infected mass attached to an endocardial structure or on implanted intracardiac material
Leaflet perforation	Leaflet tissue defect through which flow is observed with colour Doppler images	Leaflet tissue defect observed in more than one-dimensional view	Usually not detectable	Leaflet tissue defect
Perivalvular or periprosthetic complications				
Abscess	Non-homogeneous echogenic or echolucent perivalvular thickening	Soft tissue thickening around a valve/prosthesis or a graft	Increased perivalvular uptake (focal or heterogeneous pattern) at the valvular/prosthetic ring (following the supporting structure of the valve)	Perivalvular cavity with necrosis and purulent material (or without purulent material if direct contact with the cardiovascular lumen)
Pseudoaneurysm	Pulsatile perivalvular echo-free space, with colour Doppler flow detected	Contrast-filled sacculation arising from a cardiac/vascular structure (valve/prosthesis, aortic root, graft sutures, etc.) Pulsatility may be seen in multiphasic cardiac CT (cine images)	Increased perivalvular/periprosthetic uptake (focal or heterogeneous pattern) at the pseudoaneurysm	Perivalvular cavity communicating with the cardiovascular lumen
Infected collection	Well-defined accumulation of liquid, with an echolucent appearance and an organized wall (often around aortic grafts)	Well-defined lesion with hypodense content (liquid and corpuscular material) surrounded by an iso/hyperdense wall (frequently visualized around aortic grafts)	Increased perivalvular/periprosthetic uptake (focal or multifocal pattern) at an anatomical lesion with hypodense content, normally at the wall	Peritubular accumulation of liquid
Fistula	Colour Doppler communication between two neighbouring cavities through a perforation	Abnormal contrast-filled tract or focal communication between vascular structures/cardiac chambers	No visually detectable uptake or increased perivalvular/periprosthetic uptake (linear pattern, following the supporting structure of the valve)	Communication between two neighbouring cavities through a perforation and/or tract
Prosthetic valve dehiscence	Paravalvular regurgitation identified in colour Doppler, with or without rocking motion of the prosthesis	Extensive periprosthetic tissue defect or extensive continuity solution in the sewing ring suture causing misalignment of the prosthesis. Rocking motion of the prosthesis may be seen in multiphasic cardiac CT (cine images)	Increased periprosthetic uptake (focal, multifocal, heterogeneous pattern)	Separation of sewing ring from the surrounding annular tissue

NEW

ESC 2023 diagnostic algorithm : NVE / PVE



ESC 2023 diagnostic algorithm
Role of advanced Imaging

- Diagnosis
  - major criteria - minor criterion
- Complications
  - Perivalvular
  - Extracardiac : abscess ; MSK
  - Neurologic : mycotic aneurysm , stroke, abscess
- Source of bacteremia
- Alternative diagnosis

2023 ESC modified diagnostic criteria of IE

Minor criteria

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NEW

(IV) Immunological phenomena:

- Glomerulonephritis.
- Osler nodes and Roth spots.
- Rheumatoid factor.

(V) Microbiological evidence:

- Positive blood culture but does not meet a major criterion as noted above.
- Serological evidence of active infection with organism consistent with IE.

- 6-8%
- ASX
- Backpain
- Neuro deficits
- Persistent fever
- 1ry focus of IE

NEW

Osteoarticular IE -related infections

Recommendations	Class[a]	Level[b]
MRI or PET/CT is recommended in patients with suspected spondylodiscitis and vertebral osteomyelitis complicating IE.[30,32,206,524]	I	C
TTE/TOE is recommended to rule out IE in patients with spondylodiscitis and/or septic arthritis with positive blood cultures for typical IE microorganisms.[247,248,517–521,523]	I	C
More than 6-week antibiotic therapy should be considered in patients with osteoarticular IE-related lesions caused by difficult-to-treat microorganisms, such as *S. aureus* or *Candida* spp., and/or complicated with severe vertebral destruction or abscesses.[523,525,530]	IIa	C

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2023 ESC modified diagnostic criteria of IE

Major criteria

(i) Blood cultures positive for IE

(a) Typical microorganisms consistent with IE from two separate blood cultures:
Oral streptococci, *Streptococcus gallolyticus* (formerly *S. bovis*), HACEK group, *S. aureus*, *E. faecalis*

(b) Microorganisms consistent with IE from continuously positive blood cultures:

- ≥2 positive blood cultures of blood samples drawn >12 h apart.
- All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 h apart).

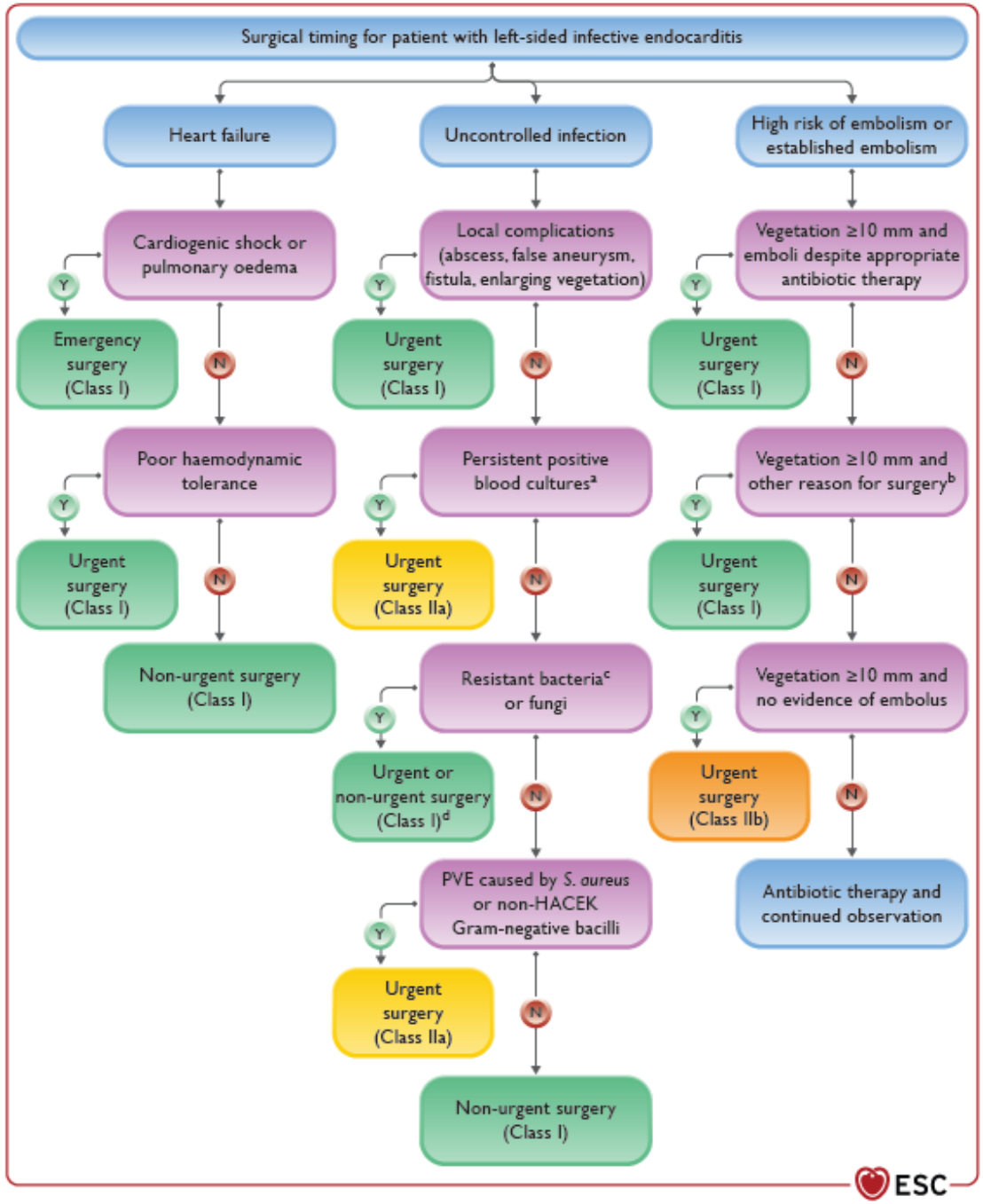
(c) Single positive blood culture for *C. burnetii* or phase I IgG antibody titre >1:800.

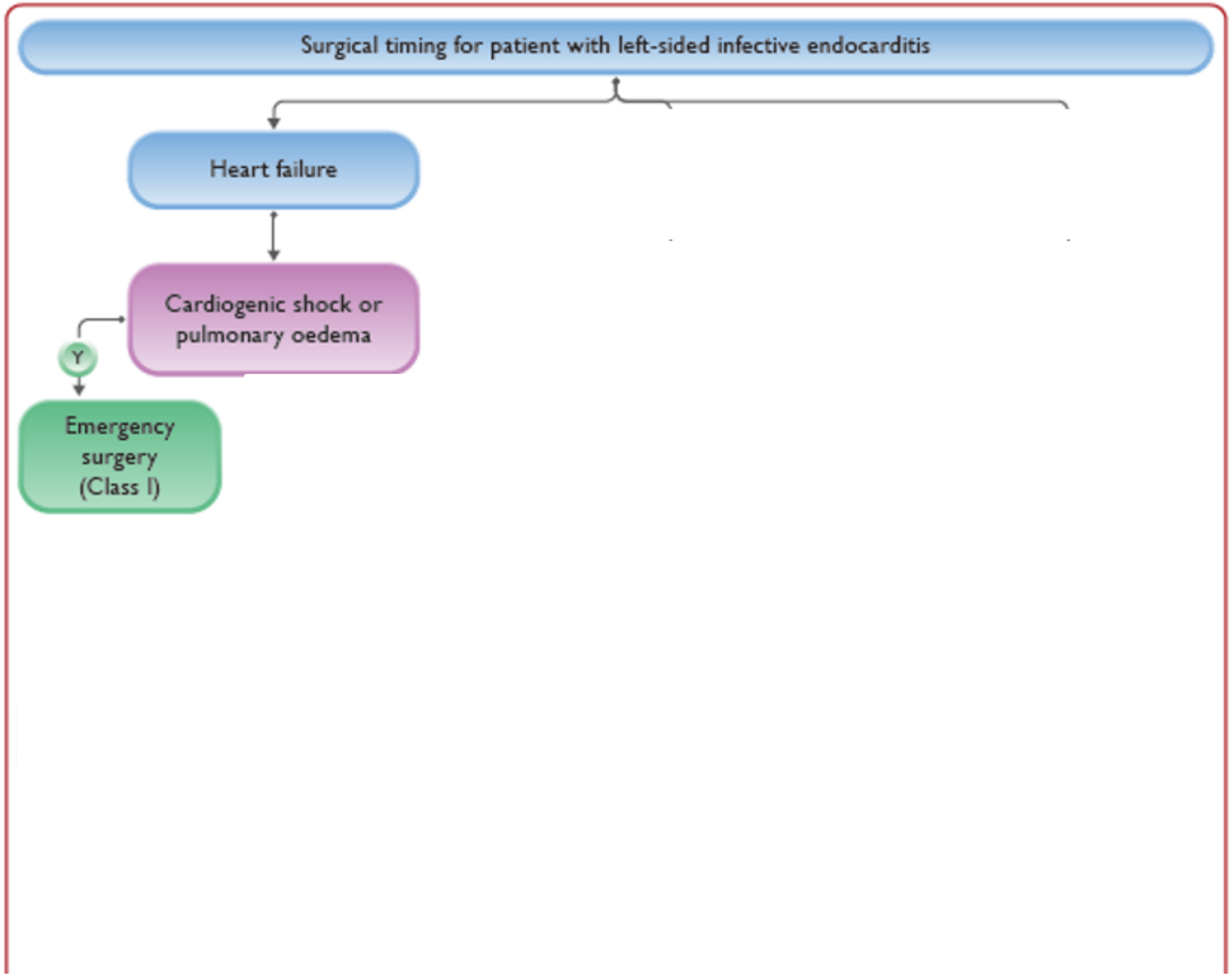
2023 Guidelines vs. 2015 Guidelines

- Prevention of IE
  - New recommendations
  - Definitions of risk categories
- Diagnosis
- Antibiotic therapy
  - Oral / OPAT
  - Same antibiotic regimen
- Surgical intervention in IE

Expanded Indications

Early Surgery


Surgical timing for patient with left-sided infective endocarditis
Heart failure
Cardiogenic shock or pulmonary oedema
Y
Emergency surgery (Class I)
N
Poor haemodynamic tolerance
Y
Urgent surgery (Class I)
N
Non-urgent surgery (Class I)
Uncontrolled infection
Local complications (abscess, false aneurysm, fistula, enlarging vegetation)
Y
Urgent surgery (Class I)
N
Persistent positive blood cultures[a]
Y
Urgent surgery (Class IIa)
N
Resistant bacteria[c] or fungi
Y
Urgent or non-urgent surgery (Class I)[d]
N
PVE caused by S. aureus or non-HACEK Gram-negative bacilli
Y
Urgent surgery (Class IIa)
N
Non-urgent surgery (Class I)
High risk of embolism or established embolism
Vegetation ≥10 mm and emboli despite appropriate antibiotic therapy
Y
Urgent surgery (Class I)
N
Vegetation ≥10 mm and other reason for surgery[b]
Y
Urgent surgery (Class I)
N
Vegetation ≥10 mm and no evidence of embolus
Y
Urgent surgery (Class IIb)
N
Antibiotic therapy and continued observation
ESC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Y
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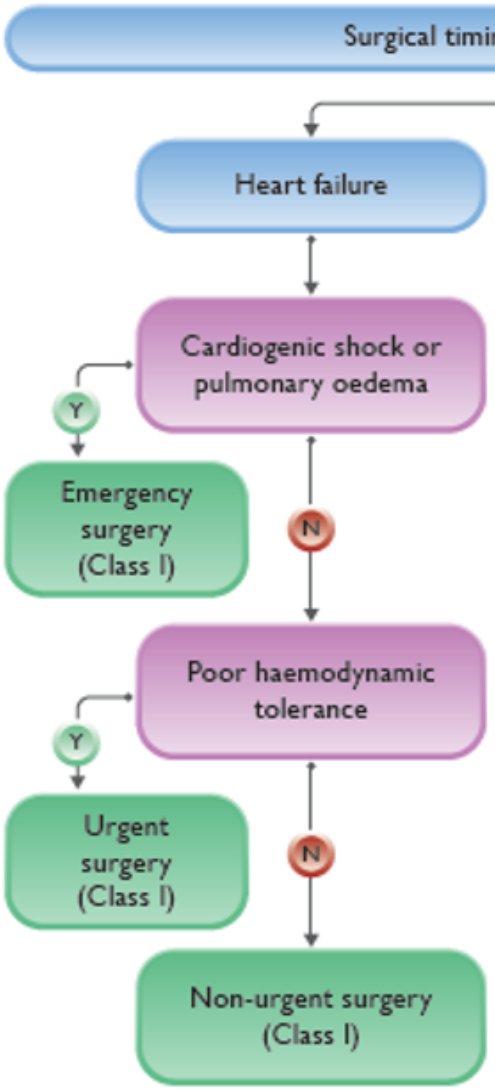


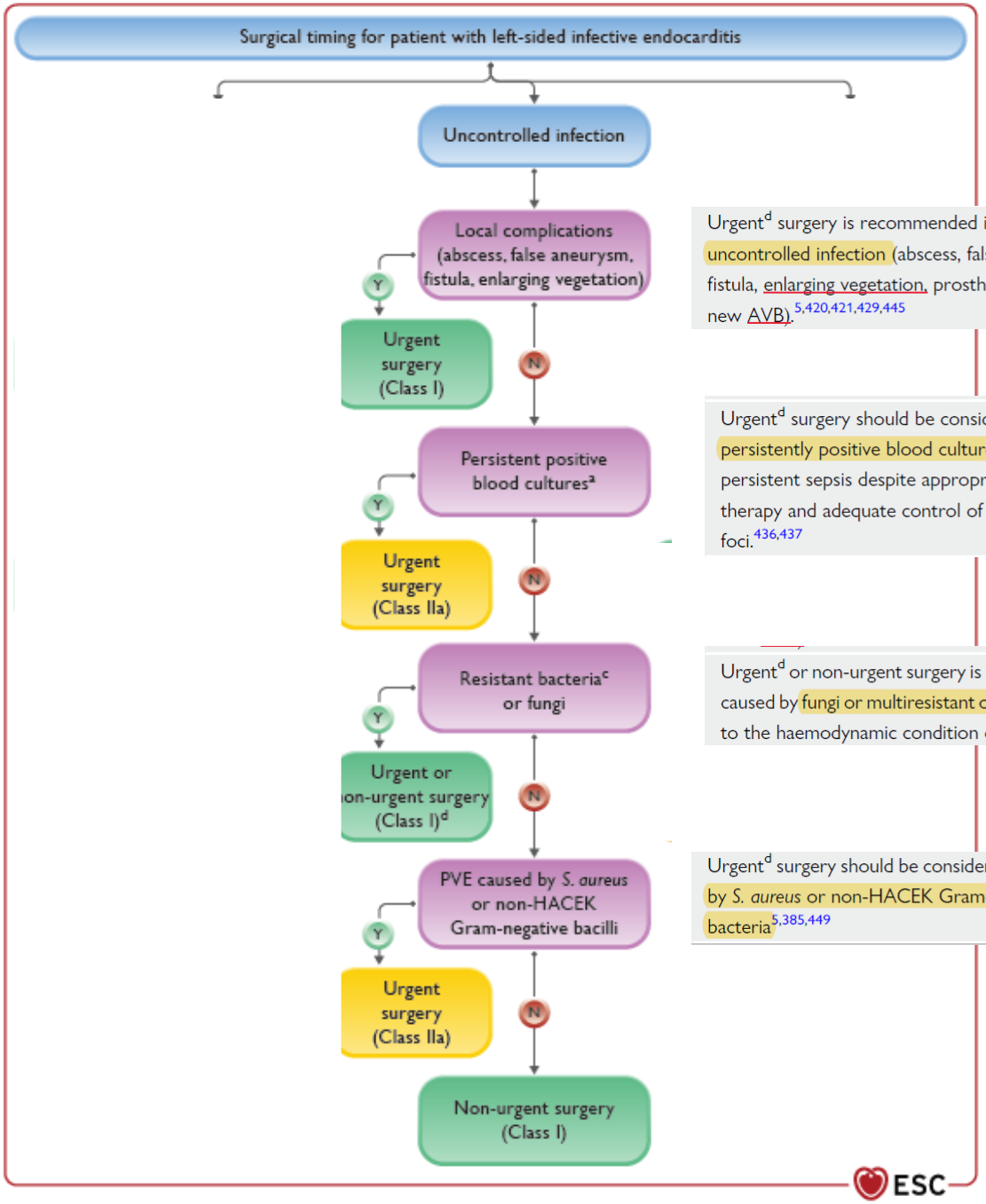
Urgent[d] surgery is recommended in aortic or mitral NVE or PVE with severe acute regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance.[5,420–422,429]	I	B

2023 NEW TIMING DEFINITIONS

EMERGENCY: within 24h

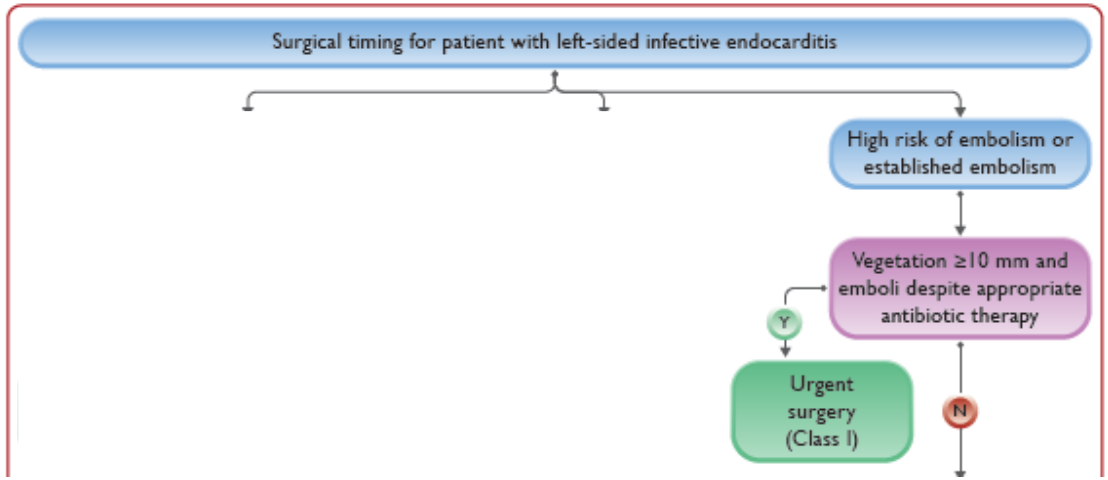
URGENT: within 3–5 days

NON-URGENT: within same admission

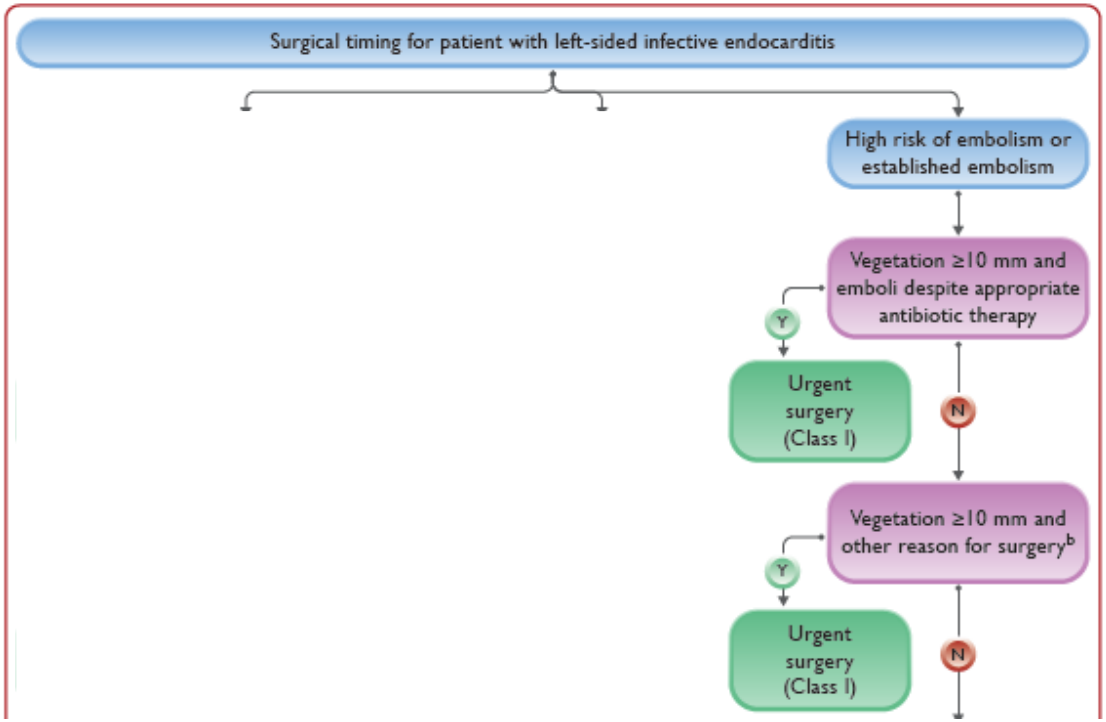


Urgent[d] surgery is recommended in locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation, prosthetic dehiscence, new AVB).[5,420,421,429,445]	I	B
Urgent[d] surgery should be considered in IE with persistently positive blood cultures >1 week or persistent sepsis despite appropriate antibiotic therapy and adequate control of metastatic foci.[436,437]	IIa	B
Urgent[d] or non-urgent surgery is recommended in IE caused by fungi or multiresistant organisms according to the haemodynamic condition of the patient.[420]	I	C
Urgent[d] surgery should be considered in PVE caused by *S. aureus* or non-HACEK Gram-negative bacteria[5,385,449]	IIa	C

ESC


Surgical timing for patient with left-sided infective endocarditis
High risk of embolism or established embolism
Vegetation ≥10 mm and emboli despite appropriate antibiotic therapy
Y
Urgent surgery (Class I)
N

Revised

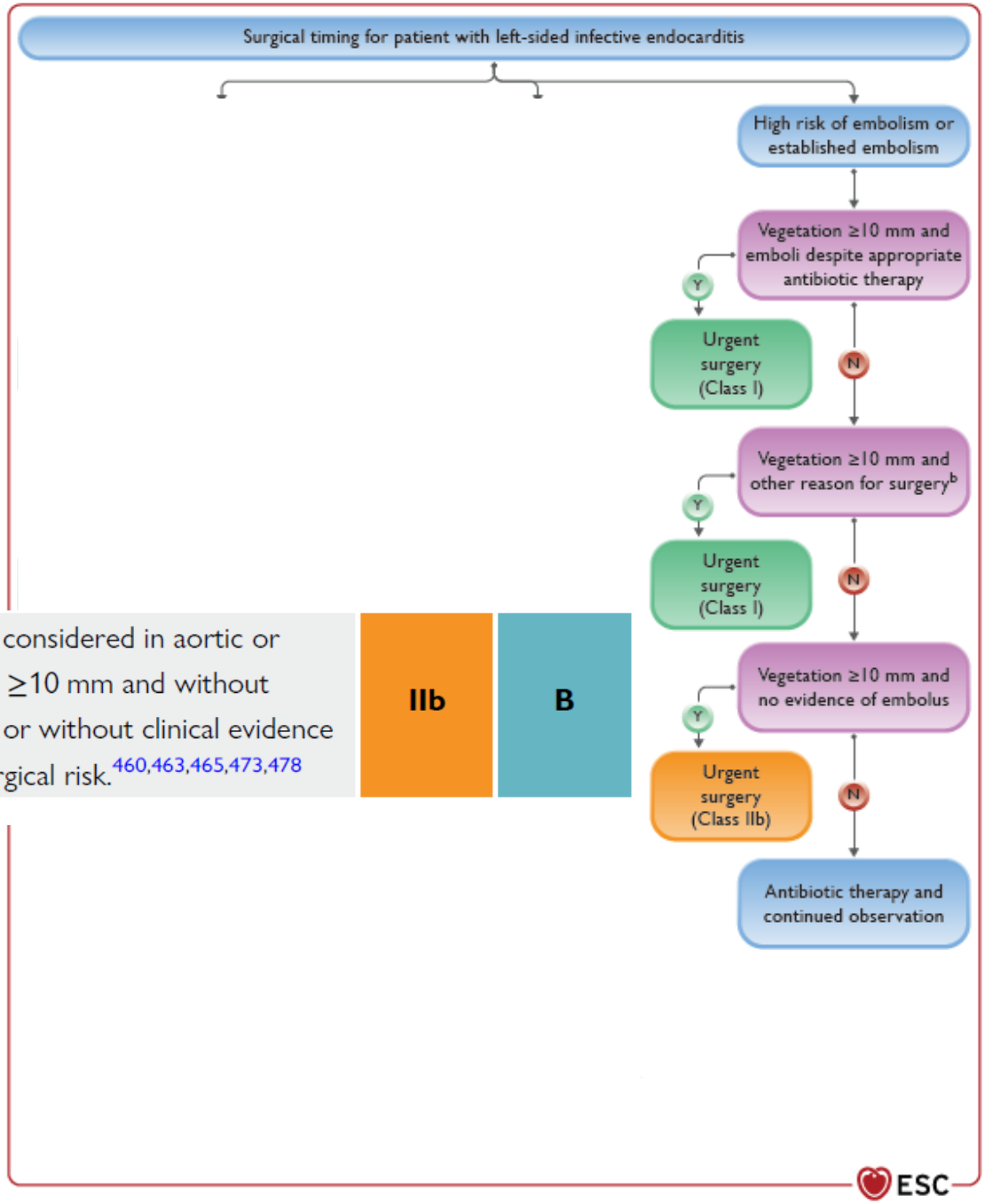

Surgical timing for patient with left-sided infective endocarditis
High risk of embolism or established embolism
Vegetation ≥10 mm and emboli despite appropriate antibiotic therapy
Y
Urgent surgery (Class I)
N
Vegetation ≥10 mm and other reason for surgery[b]
Y
Urgent surgery (Class I)
N

Revised

NEW

Urgent[d] surgery may be considered in aortic or mitral IE with vegetation ≥10 mm and without severe valve dysfunction or without clinical evidence of embolism and low surgical risk.[460,463,465,473,478]

IIb	B



Revised

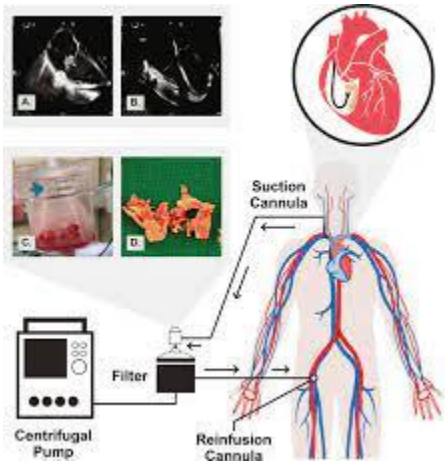
Rt-sided IE

Recommendations	Class[a]	Level[b]	
Surgery is recommended in patients with right-sided IE who are receiving appropriate antibiotic therapy for the following scenarios:			
Right ventricular dysfunction secondary to acute severe tricuspid regurgitation non-responsive to diuretics.[479]	I	B	Revised
Persistent vegetation with respiratory insufficiency requiring ventilatory support after recurrent pulmonary emboli.[479,755]	I	B	Revised
Large residual tricuspid vegetations (>20 mm) after recurrent septic pulmonary emboli.[145,471]	I	C	Revised
Patients with simultaneous involvement of left-heart structures.[749]	I	C	Revised
Surgery should be considered in patients with right-sided IE who are receiving appropriate antibiotic therapy and present persistent bacteraemia/sepsis after at least 1 week of appropriate antibiotic therapy.[436,755]	IIa	C	

NEW

Rt-sided IE

NEW



Recommendations	Class[a]	Level[b]
Tricuspid valve repair should be considered instead of valve replacement, when possible.[479]	IIa	B
Debulking of right intra-atrial septic masses by aspiration may be considered in selected patients who are high risk for surgery.[753]	IIb	C

Surgery for Early PVE

New

Recommendation Table 19 — Recommendations for prosthetic valve endocarditis

Recommendations	Class[a]	Level[b]
Surgery is recommended for early PVE (within 6 months of valve surgery) with new valve replacement and complete debridement. [621,635]	I	C

Surgery for Late PVE

a surgical strategy is recommended for PVE in high-risk subgroups identified by prognostic assessment, i.e. PVE complicated with HF, severe prosthetic dysfunction, abscess, or persistent fever

patients with uncomplicated non-staphylococcal late PVE can be managed conservatively.[632–634] However, patients who are initially treated medically require close follow-up because of the risk of late events and the higher risk of relapse or valvular dysfunction.

Preoperative CA in patients with Ao valve -IE

- Ao valve + vegetation → C-CTA (Class : I)

- Ao valve + no vegetation → Coronary cath (Class : I)

Preoperative CA in patients with Ao valve -IE

- Ao valve + vegetation → C-CTA (Class : I)

New

- Ao valve + no vegetation → Coronary cath (Class : I)
- Ao valve + vegetation in selected patients → Coronary cath (Class IIb)
- Emergency surgery → no assessment (Class IIa)

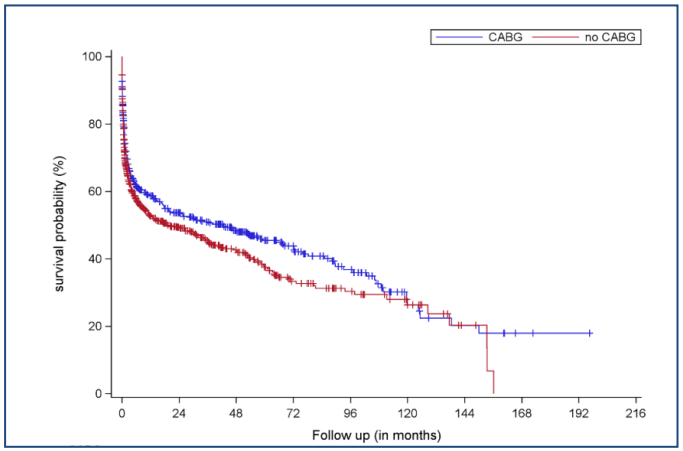
Article

Role of Concomitant Coronary Artery Bypass Grafting in Valve Surgery for Infective Endocarditis

Mahmoud Diab [1], Thomas Lehmann [2], Carolyn Weber [3], Georgi Petrov [4], Maximilian Luehr [3], Payam Akhyari [4], Sems-Malte Tugtekin [5], P. Christian Schulze [6], Marcus Franz [6], Martin Misfeld [7,8], Michael A. Borger [8], Klaus Matschke [5], Thorsten Wahlers [3], Artur Lichtenberg [4], Christian Hagl [9] and Torsten Doenst [1,*]

Table 4. Operative procedures in patients with coronary artery disease after adjustment using inverse probability weighting.

Variables	CABG (n = 527)	No-CABG (n = 715)	p
Postop. Hemodialysis	29%	25%	0.052
Postoperative stroke	26%	21%	0.003
Re-exploration	17%	15%	0.228
30-d mortality	24%	23%	0.370



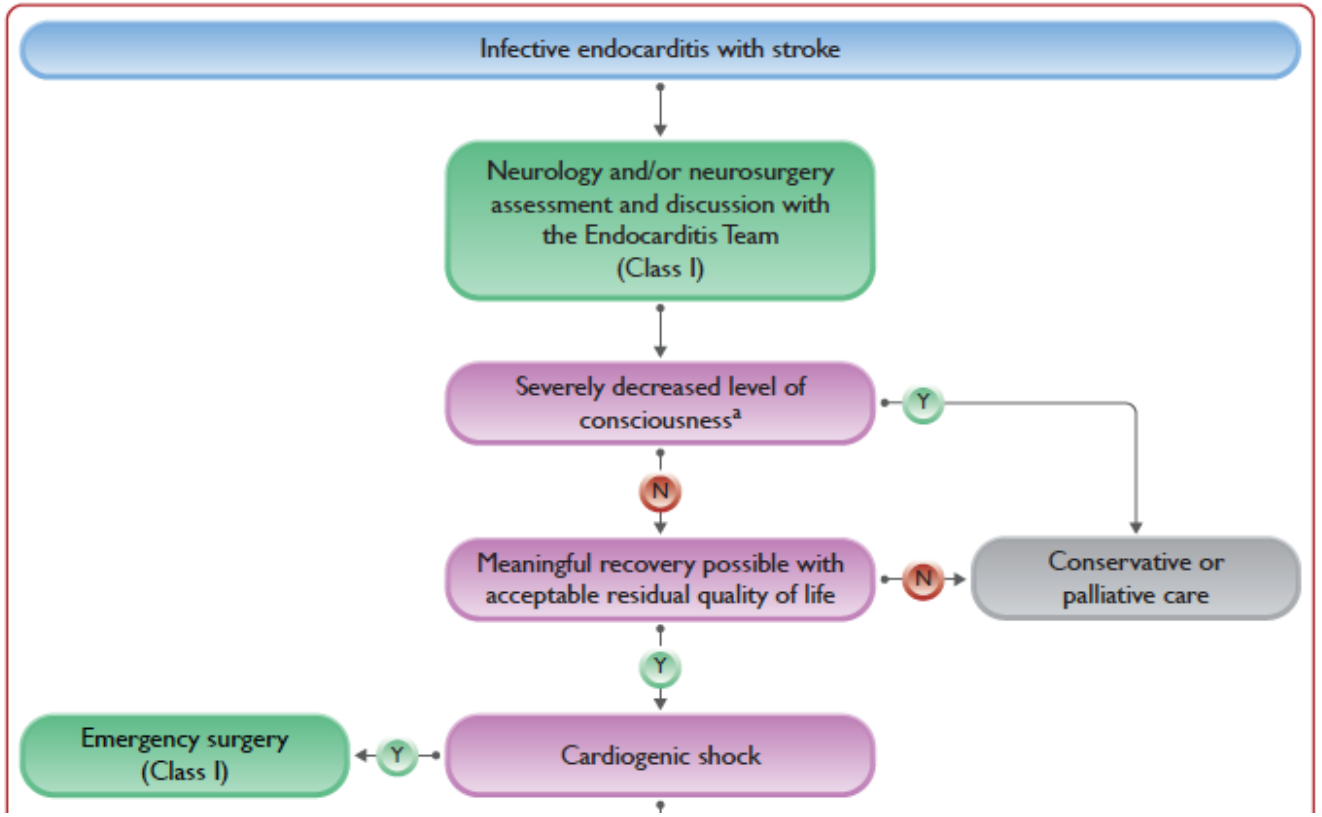
J Clin Med 2021;10:2867.

Choice of valve prosthesis

Table 12 Features favouring a non-mechanical valve substitute in the setting of surgery for acute infective endocarditis

Early surgery after a recent ischaemic stroke
Evidence of intracranial bleeding
Woman of childbearing age
High likelihood of prolonged mechanical circulatory support
Advanced age or frailty
Poor or unknown medical compliance
Expected complicated and prolonged post-operative course
Patient preference

Surgery for IE following stroke.



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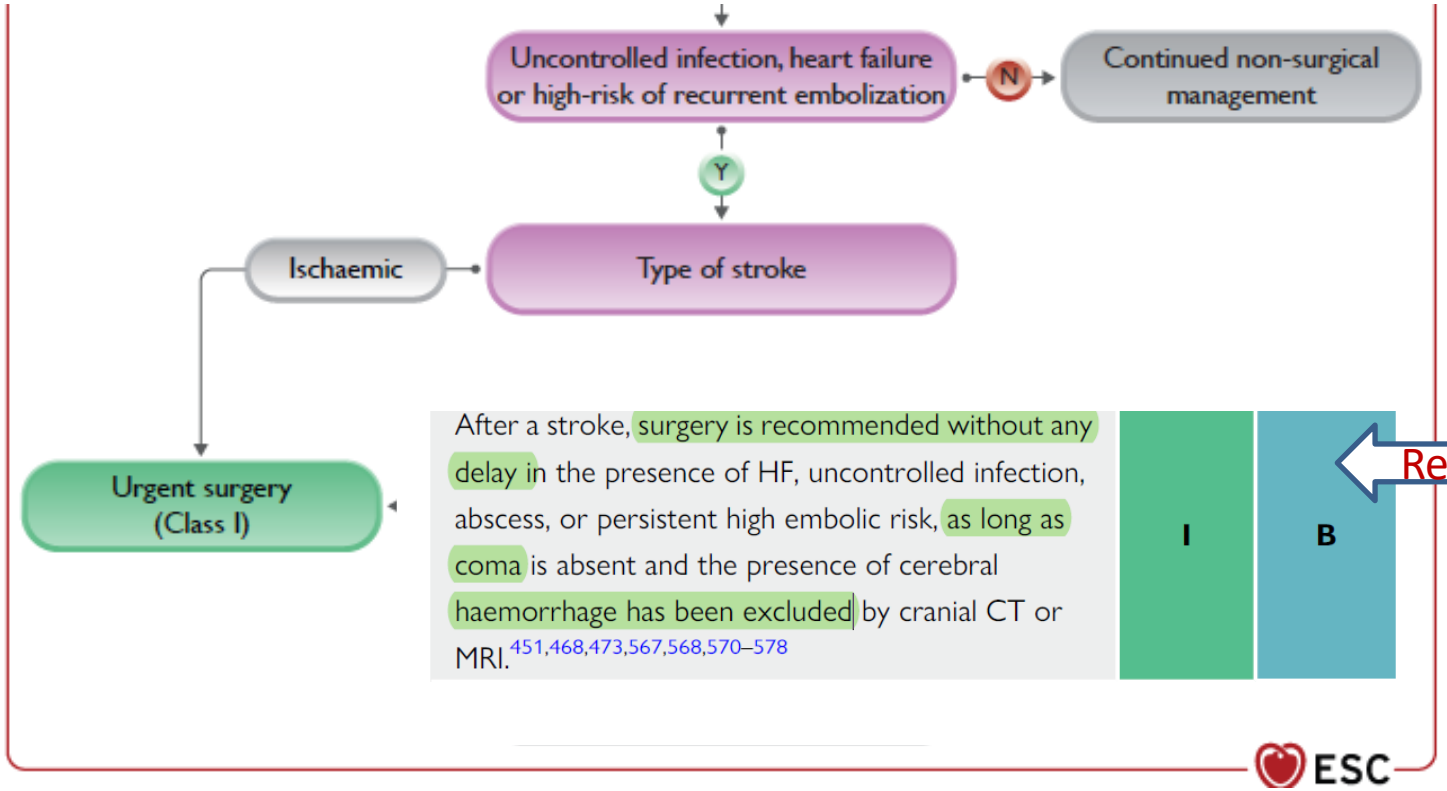
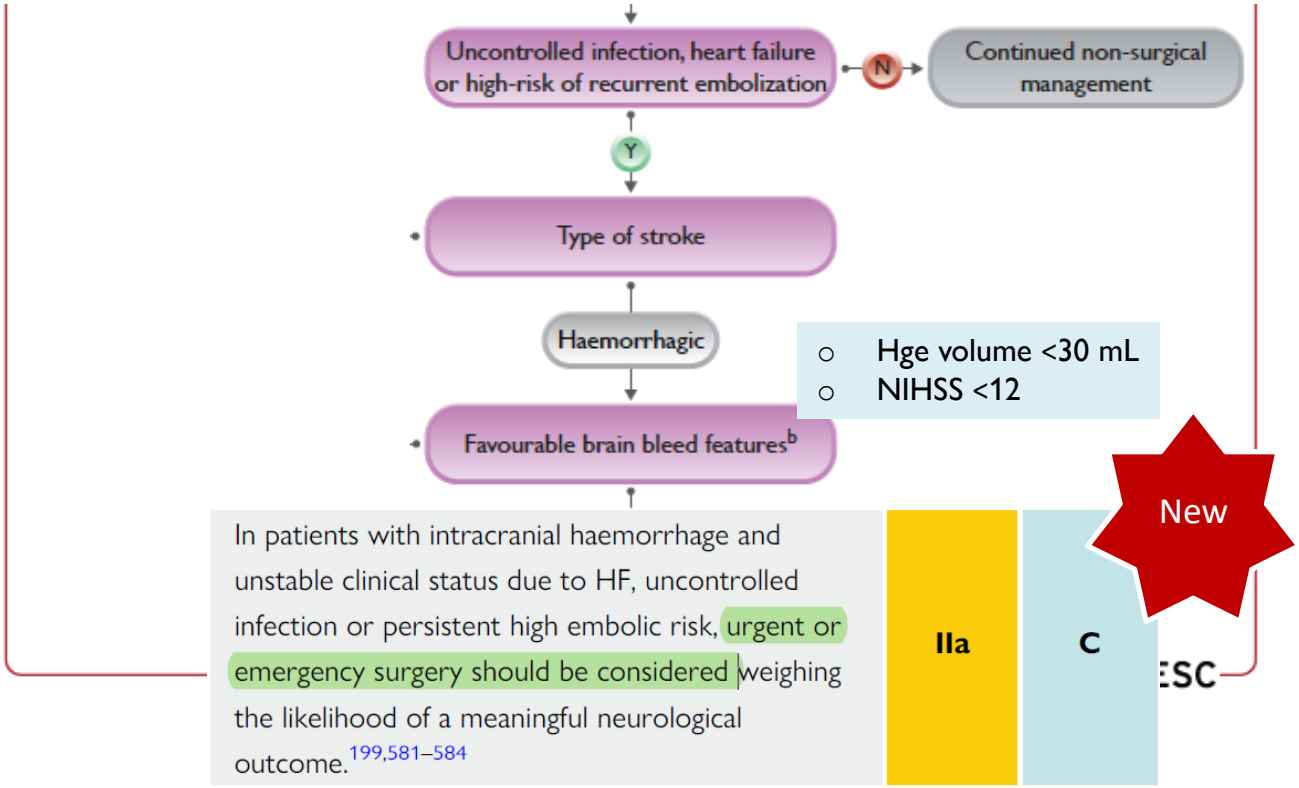


Surgery for IE following stroke.



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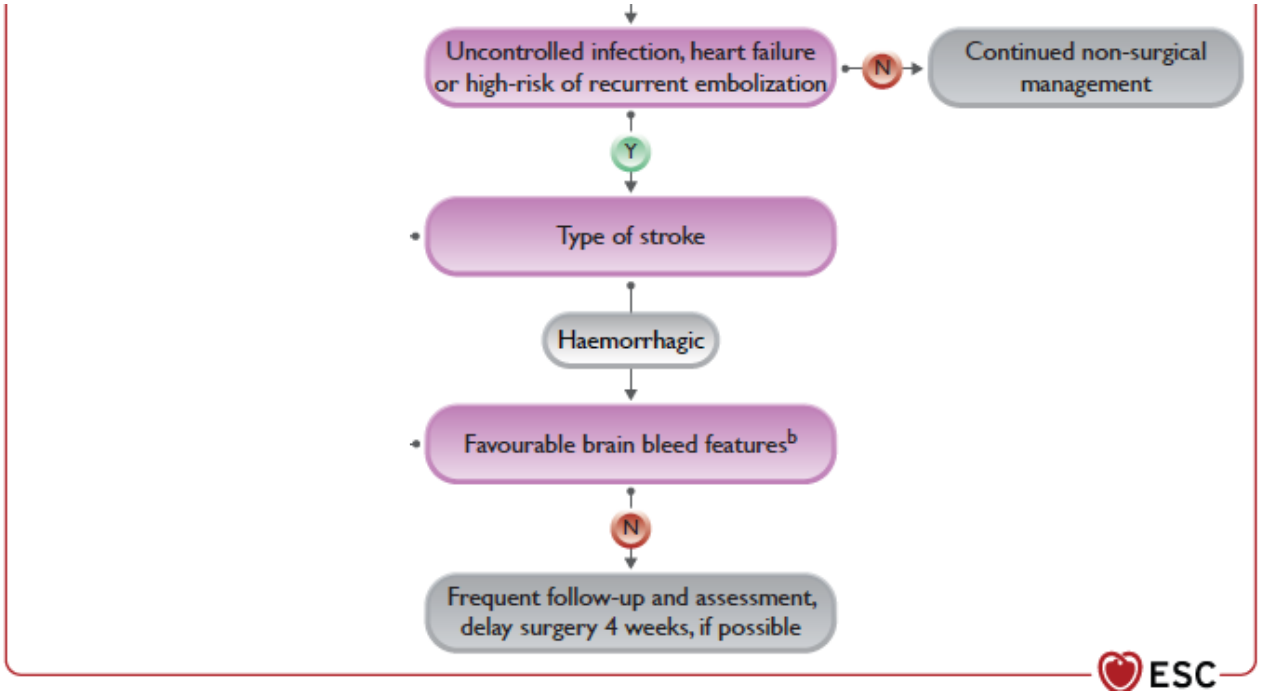


Surgery in presence of extracardiac infection

2023 ESC

10.1.2. Extracardiac infection

Extracardiac foci may be treated prior to valve surgery, during the valve operation, or post-operatively, dependent on the urgency of cardiac surgery. Regardless of the timing of intervention, infective foci need to be eradicated before completion of antibiotic therapy in order to avoid cardiac valve reinfection.

2015 ESC

10.2.2 Extracardiac infection

If a primary focus of infection likely to be responsible for IE has been identified, it must be eradicated before cardiac surgical intervention unless valve surgery is urgent. In any case, it should be eradicated before the end of antibiotic therapy.

Thank You…

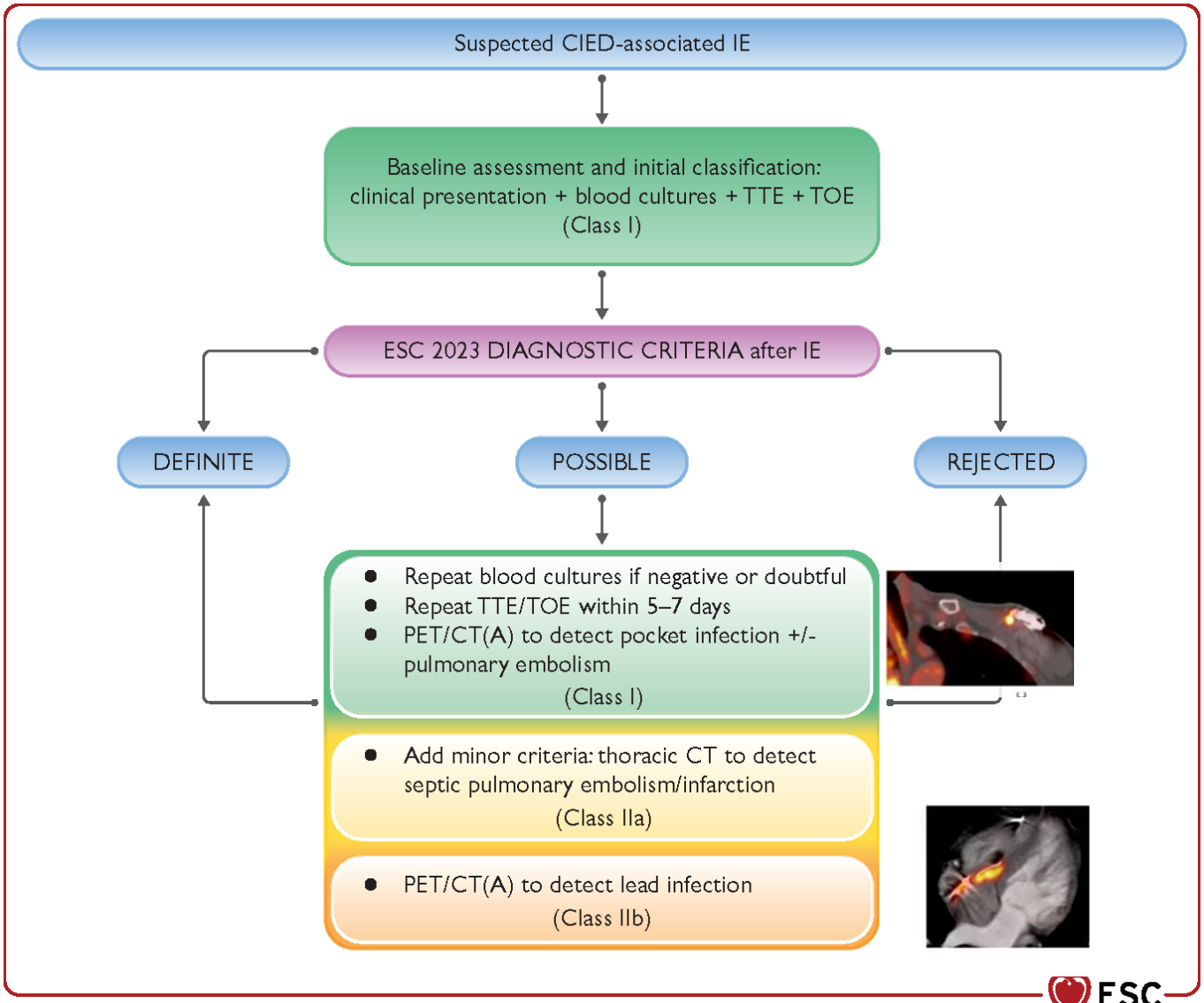
TAVI

- Rt-side IE

CEID

- CEID

ESC 2023 diagnostic algorithm : CIED-IE



Neurological Complications

- CNS

Surgical intervention

- Ou

PW

- Ad

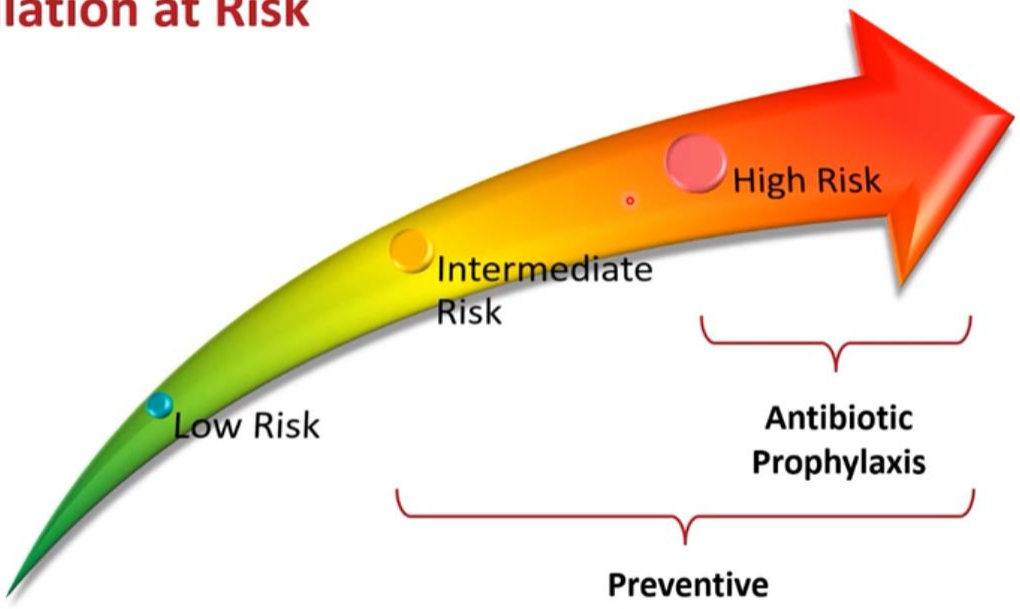
Prophylaxis against IE

- AB prophylaxis
- Preventive measures
- Patient education

Prevention of infective endocarditis

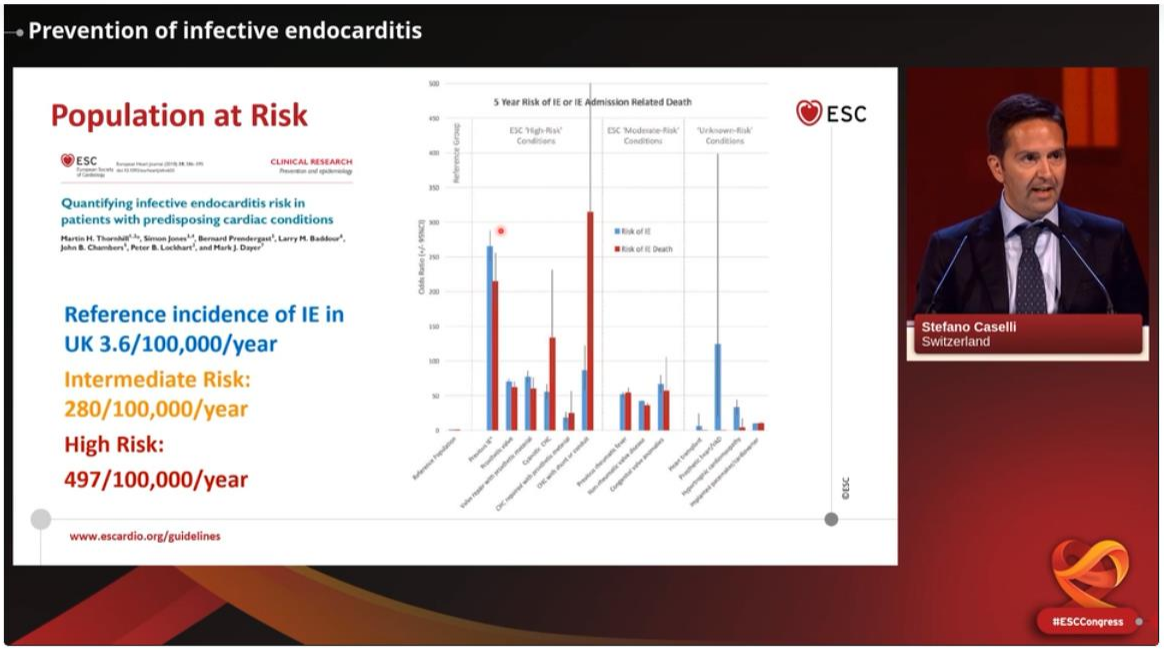
Population at Risk

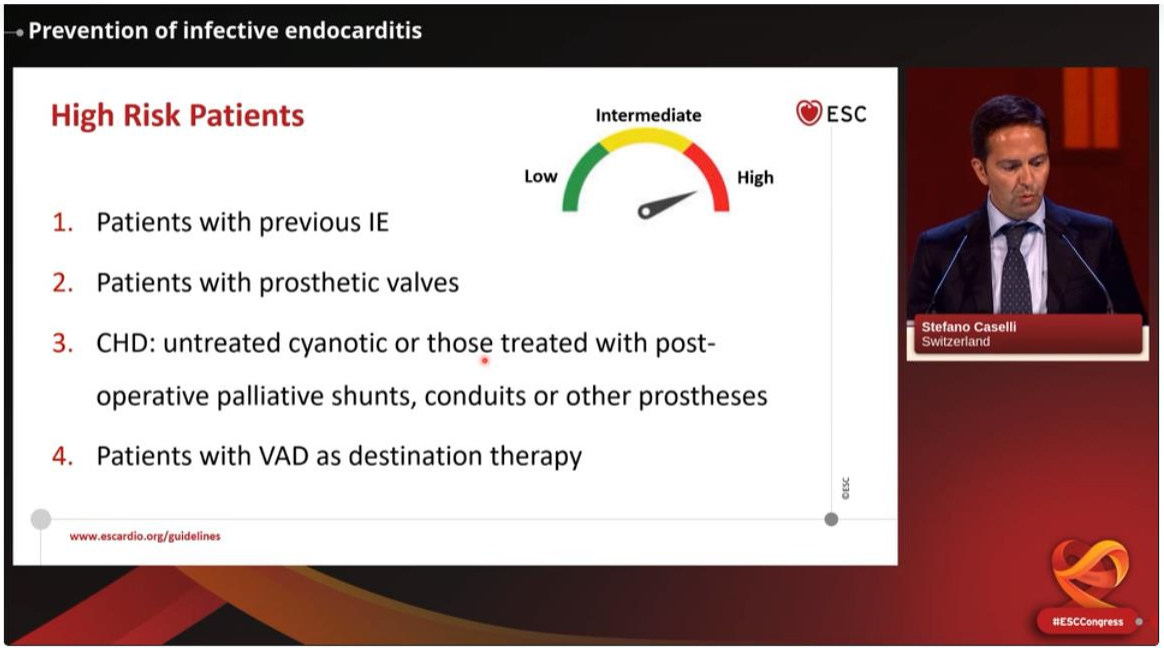
ESC



www.escardio.org/guidelines

Stefano Caselli
Switzerland





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Prevention measures

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- Patients should be encouraged to maintain twice daily tooth cleaning and to seek professional dental cleaning and follow-up at least twice yearly for high-risk patients and yearly for others
- Strict cutaneous hygiene, including optimized treatment of chronic skin conditions
- Disinfection of wounds
- Curative antibiotics for any focus of bacterial infection
- No self-medication with antibiotics
- Strict infection control measures for any at-risk procedure
- Discouragement of piercing and tattooing
- Limitation of infusion catheters and invasive procedures when possible. Strict adherence to care bundles for central and peripheral cannulae should be performed

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2023 ESC Guidelines for the management of endocarditis
(European Heart Journal; 2023 – doi: 10.1093/eurheartj/ehad193)

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Procedures at Risk

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1. Dental procedures

2. Non-dental procedures

3. Cardiac procedures

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Prevention of infective endocarditis

Dental Procedures

- Case-crossover Study in almost 8million US subjects.
- Invasive dental procedures significantly associated with the incidence of endocarditis.
- Antibiotic-prophylaxis before invasive dental procedures was associated with reduced incidence of Endocardits.

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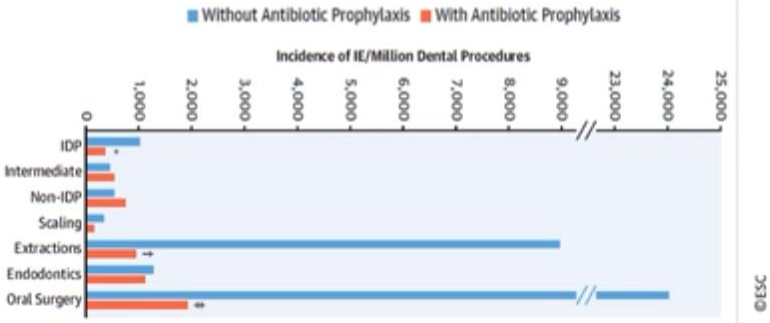
ORIGINAL INVESTIGATIONS

Antibiotic Prophylaxis Against Infective Endocarditis Before Invasive Dental Procedures

Martin H. Thornhill, MBBS, BDS, PhD,[a,b] Teresa B. Gibson, PhD,[c] Frank Yoon, PhD,[c] Mark J. Dayer, MBBS, PhD,[d] Bernard D. Prendergast, BM, BS, DM,[e] Peter B. Lockhart, DDS,[b] Patrick T. O'Gara, MD,[f] Larry M. Baddour, MD[g]



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Non-Dental Procedures

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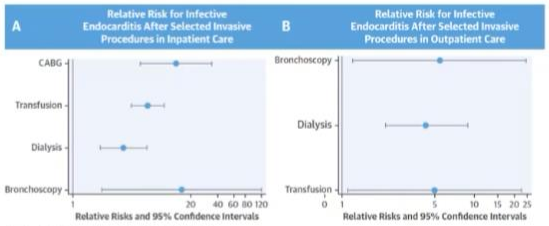
Invasive Procedures Associated With the Development of Infective Endocarditis

Imre Janszky, MD, PhD,[a,b] Katalin Gémes, PhD,[c] Staffan Ahnve, MD, PhD,[c] Hilmir Asgeirsson, MD, PhD,[d,e] Jette Möller, PhD[c]

CENTRAL ILLUSTRATION Relative Risks for Infective Endocarditis After Selected Procedures: Logarithmic Scale

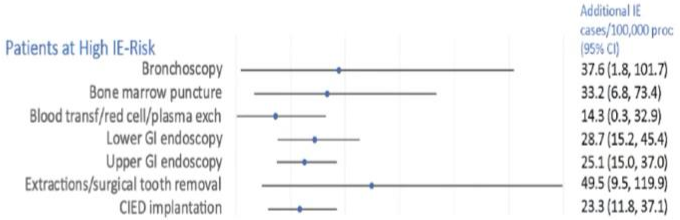


Janszky, I. et al. J Am Coll Cardiol. 2018;71(24):2744-52.

Original research

Temporal association between invasive procedures and infective endocarditis

Martin H Thornhill [1,2] Annabel Crum,[3] Richard Campbell,[3] Tony Stone,[3] Ellen C Lee,[3] Mike Bradburn,[4] Veronica Fibisan,[3] Mark Dayer [5] Bernard D Prendergast [6] Peter Lockhart,[2] Larry Baddour [7] Jon Nicoll[3]



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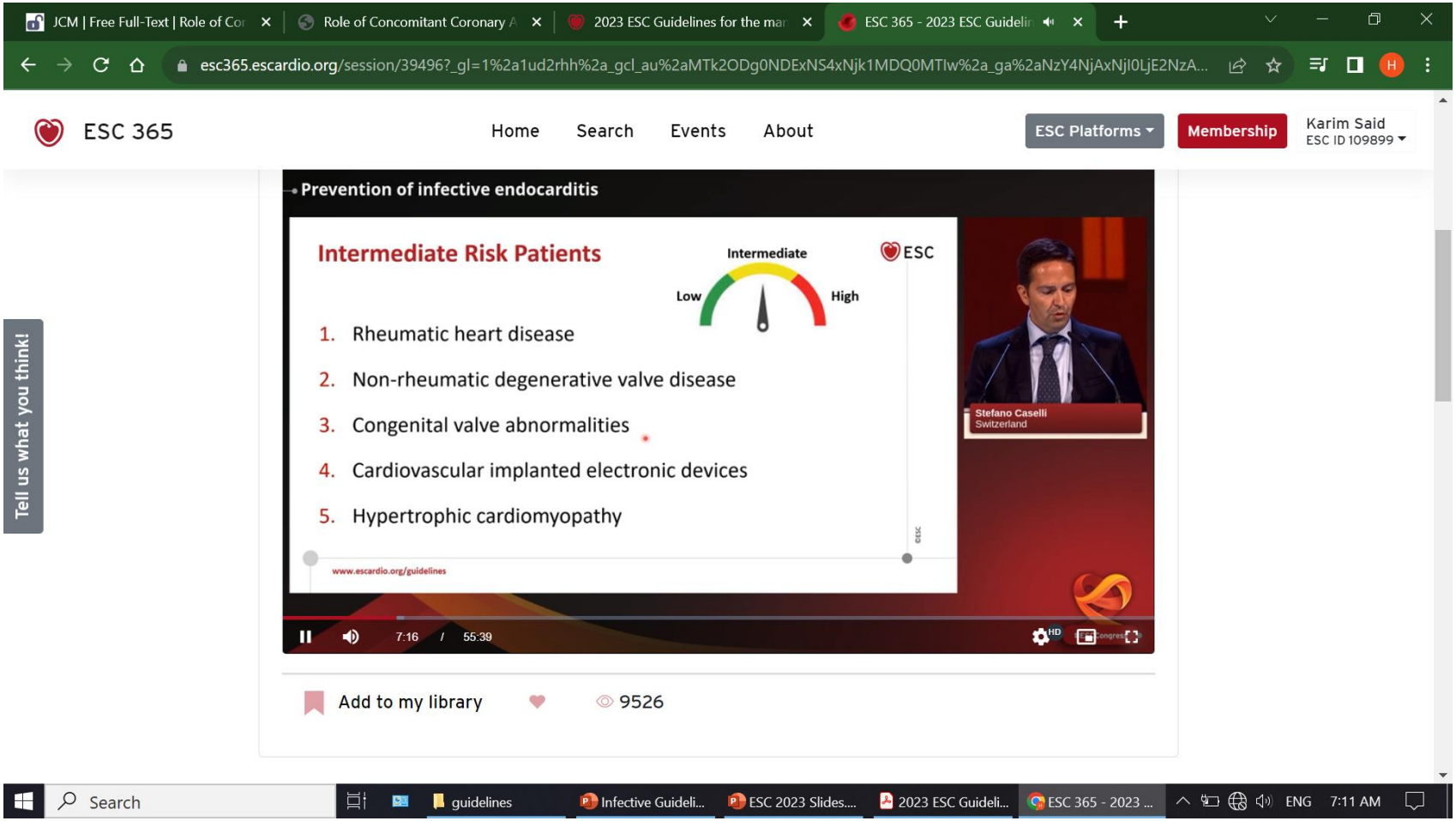
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Karim Said
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Intermediate Risk Patients
Intermediate
Low
High
ESC
1. Rheumatic heart disease
2. Non-rheumatic degenerative valve disease
3. Congenital valve abnormalities
4. Cardiovascular implanted electronic devices
5. Hypertrophic cardiomyopathy
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Prevention of infective endocarditis

Recommendations for antibiotic prophylaxis in patients with cardiovascular diseases undergoing oro-dental procedures at increased risk for IE (1)

Recommendations	Class	Level	
General prevention measures are recommended in individuals at high and intermediate risk for IE.	I	C	New
Antibiotic prophylaxis is recommended in patients with **previous IE**.	I	B	Revised
Antibiotic prophylaxis is recommended in patients with surgically implanted **prosthetic valves and with any material used for surgical cardiac valve repair**.	I	C	Revised
Antibiotic prophylaxis is recommended in patients with **transcatheter implanted** aortic and pulmonary valvular prostheses.	I	C	Revised
Antibiotic prophylaxis is recommended in patients with **untreated cyanotic CHD**, and **patients treated with surgery or transcatheter procedures with post-operative palliative shunts, conduits, or other prostheses**. After surgical repair, in the absence of residual defects or valve prostheses, antibiotic prophylaxis is recommended only for the first 6 months after the procedure.	I	C	Revised

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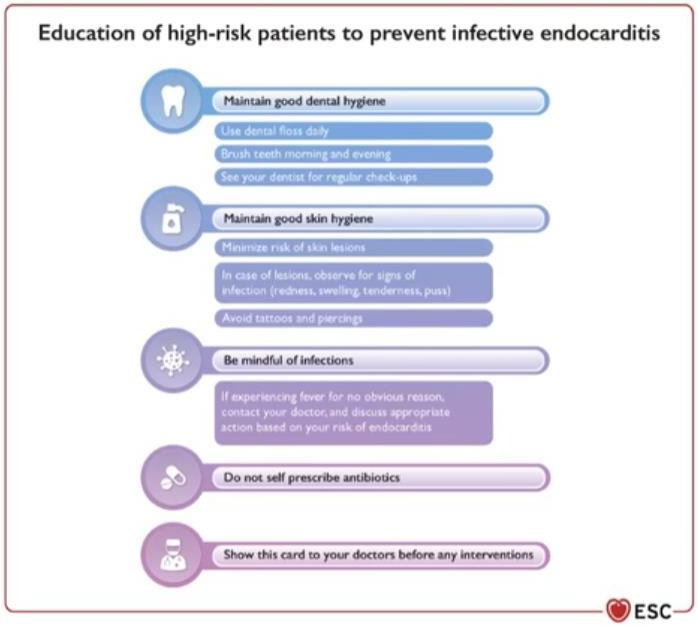
3.4 Patient's Education

Patients should be educated on the risks of endocarditis and on its prevention

National cardiac societies are invited to develop specific Patient's cards.



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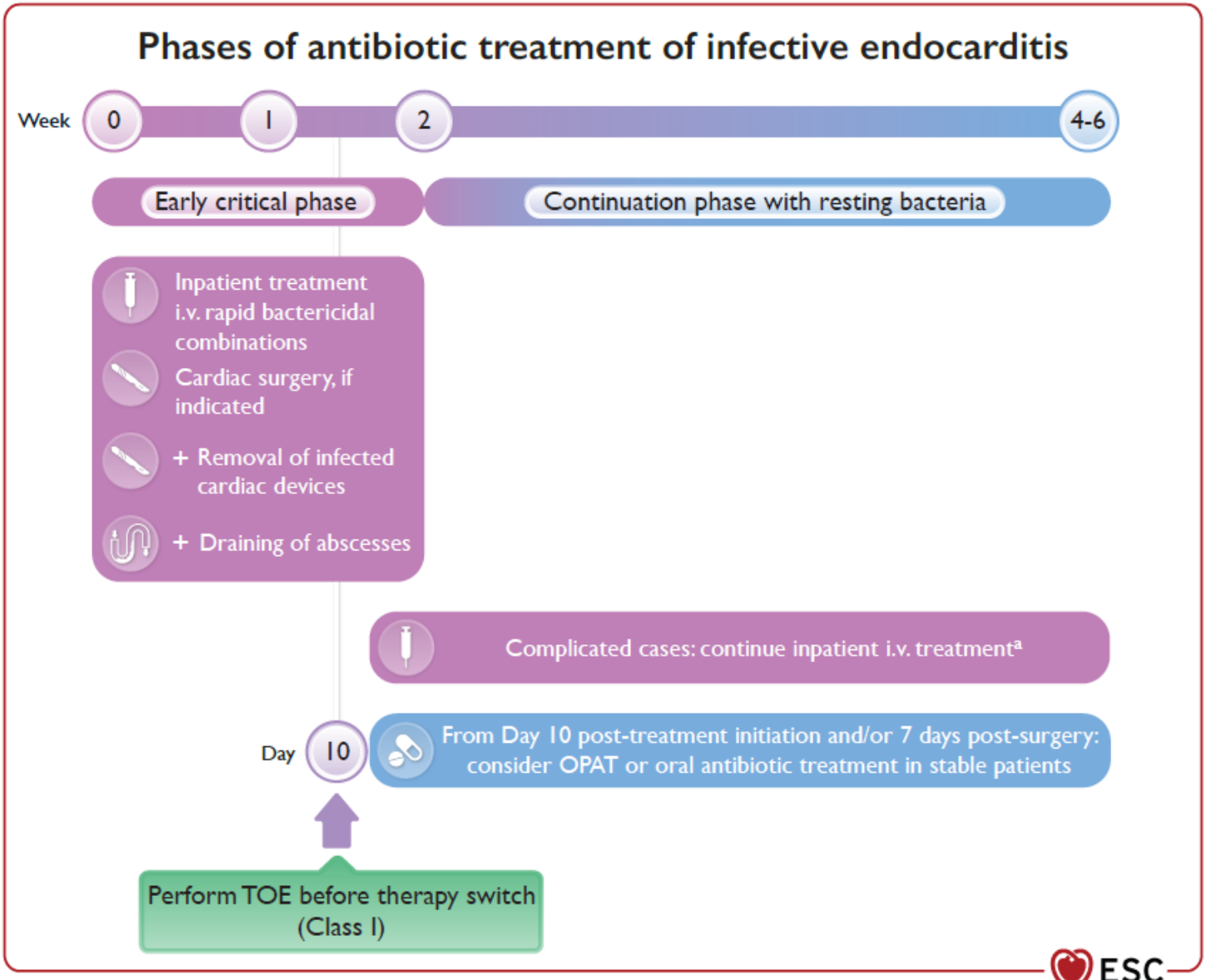
Outpatient

- Advan

Table 7 Members of the Endocarditis Team

	Heart Valve Centre
Core members	• Cardiologists. • Cardiac imaging experts. • Cardiovascular surgeons. • Infectious disease specialist (or internal medicine specialist with expertise in infectious diseases). • Microbiologist. • Specialist in outpatient parenteral antibiotic treatment.
Adjunct specialities	• Radiologist and nuclear medicine specialist. • Pharmacologist. • Neurologist and neurosurgeon. • Nephrologist. • Anaesthesiologists. • Critical care. • Multidisciplinary addiction medicine teams. • Geriatricians. • Social worker. • Nurses. • Pathologist.


Phases of antibiotic treatment of infective endocarditis
Week
0
1
2
4-6
Early critical phase
Continuation phase with resting bacteria
Inpatient treatment i.v. rapid bactericidal combinations
Cardiac surgery, if indicated
+ Removal of infected cardiac devices
+ Draining of abscesses
Complicated cases: continue inpatient i.v. treatment[a]
Day
10
From Day 10 post-treatment initiation and/or 7 days post-surgery: consider OPAT or oral antibiotic treatment in stable patients
Perform TOE before therapy switch (Class I)
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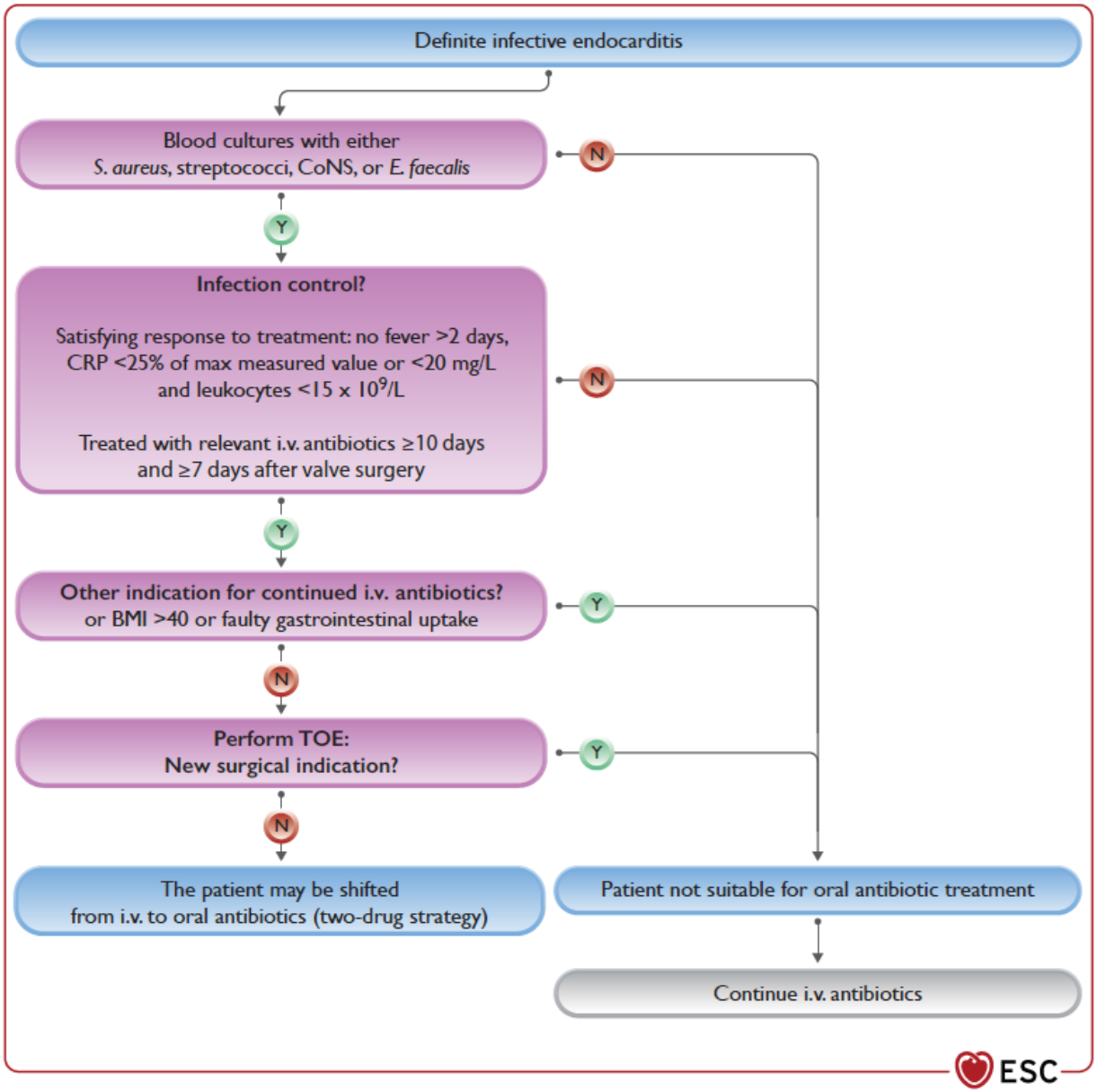
Definite infective endocarditis
Blood cultures with either
S. aureus, streptococci, CoNS, or E. faecalis
N
Y
Infection control?
Satisfying response to treatment: no fever >2 days,
CRP <25% of max measured value or <20 mg/L
and leukocytes <15 x 10^9/L
Treated with relevant i.v. antibiotics ≥10 days
and ≥7 days after valve surgery
N
Y
Other indication for continued i.v. antibiotics?
or BMI >40 or faulty gastrointestinal uptake
Y
N
Perform TOE:
New surgical indication?
Y
N
The patient may be shifted
from i.v. to oral antibiotics (two-drug strategy)
Patient not suitable for oral antibiotic treatment
Continue i.v. antibiotics
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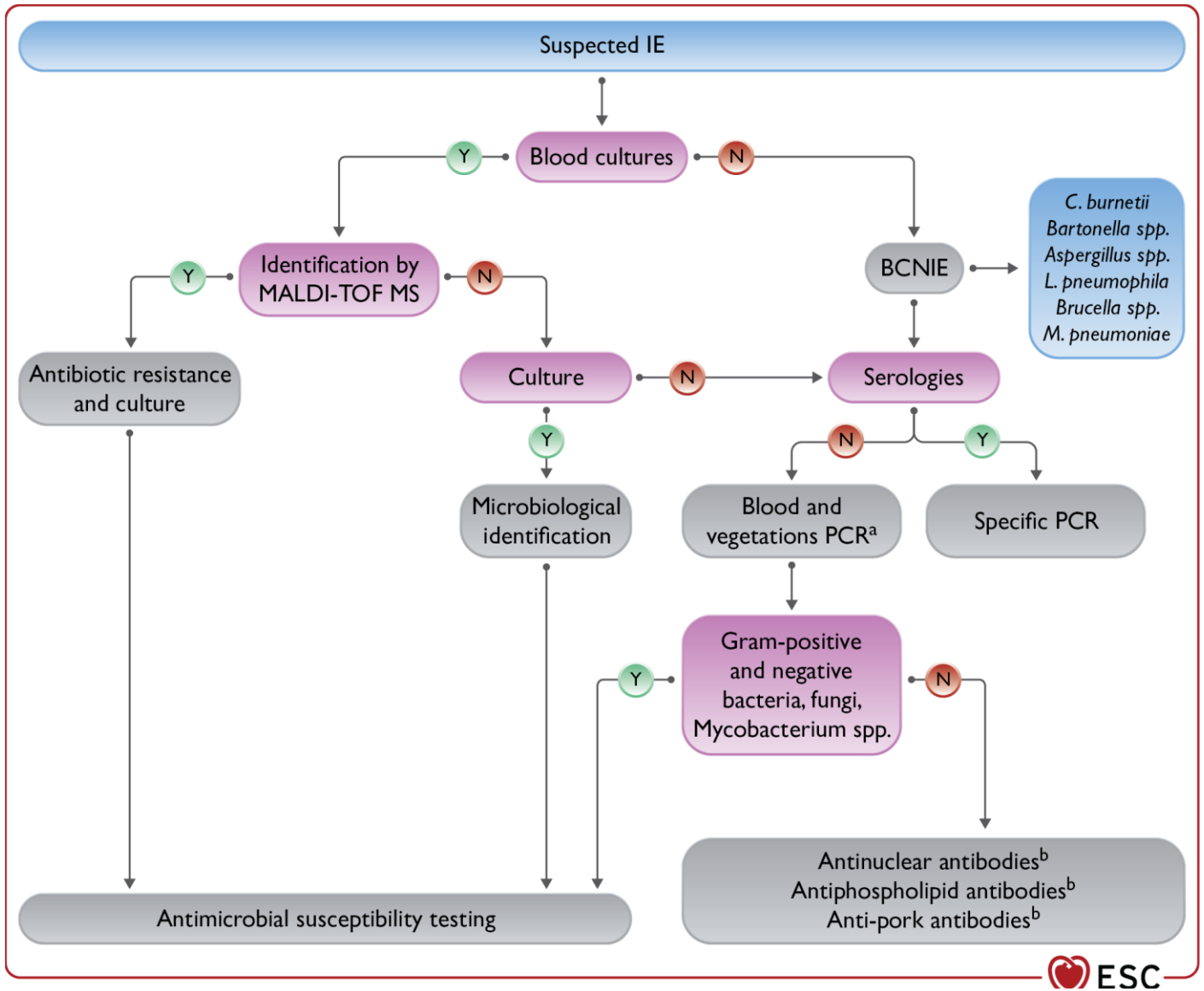
Microbiological Diagnostic Algorithm


Suspected IE
Blood cultures
Y
N
Identification by MALDI-TOF MS
Y
N
Antibiotic resistance and culture
Culture
N
Y
Microbiological identification
BCNIE
C. burnetii
Bartonella spp.
Aspergillus spp.
L. pneumophila
Brucella spp.
M. pneumoniae
Serologies
N
Y
Blood and vegetations PCR[a]
Specific PCR
Gram-positive and negative bacteria, fungi, Mycobacterium spp.
Y
N
Antimicrobial susceptibility testing
Antinuclear antibodies[b]
Antiphospholipid antibodies[b]
Anti-pork antibodies[b]
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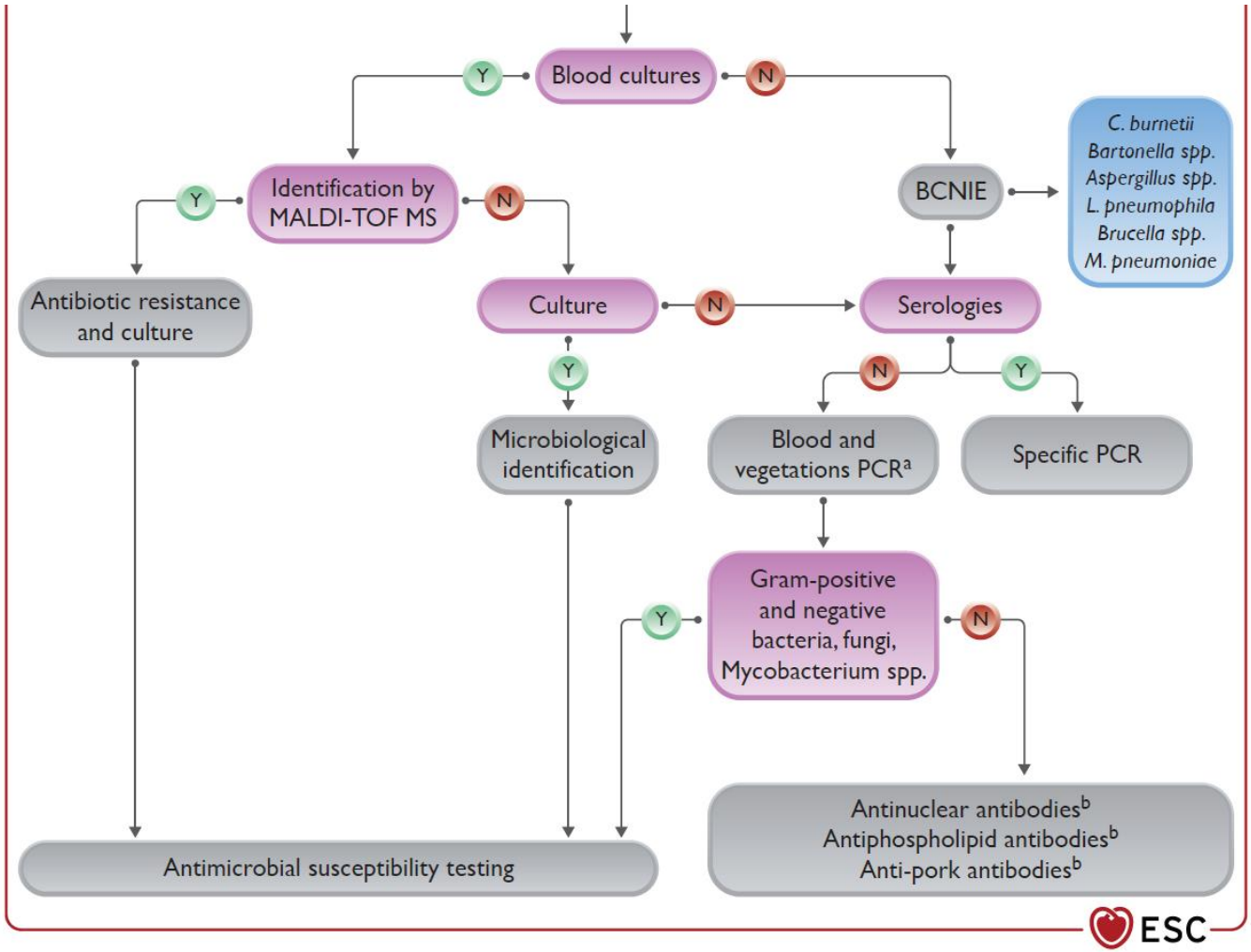
Blood cultures
Y
N
Identification by MALDI-TOF MS
Y
N
Antibiotic resistance and culture
Culture
N
Y
Microbiological identification
BCNIE
C. burnetii
Bartonella spp.
Aspergillus spp.
L. pneumophila
Brucella spp.
M. pneumoniae
Serologies
N
Y
Blood and vegetations PCR[a]
Specific PCR
Gram-positive and negative bacteria, fungi, Mycobacterium spp.
Y
N
Antimicrobial susceptibility testing
Antinuclear antibodies[b]
Antiphospholipid antibodies[b]
Anti-pork antibodies[b]
ESC