

Refereer avond Cardiologie



Endocarditis onderschat en miskend ziektebeeld?



Endocarditis onderschat en miskend ziektebeeld?



Splinter



Janeway



Osler

En als je niet oppast ...



Refereeravond Endocarditis

Ordening in de Wildernis van endocarditis

- Op safari in de Wildernis
- De complexe endocarditis

Pim Horsmans

Ömer Erküner



Pim Horsmans





Preventie

- Predisponerende risicofactoren
- Pathogenen in de bloedbaan
 - Infecties
 - IV drugs
 - Medische handelingen
- Immuuncompetentie
- Antibiotica profylaxe



High risk populatie

- Voorgeschiedenis van infectieuze endocarditis
- Prothetische hartklep / materiaal voor klepreparatie
- Onbehandelde cyanotische congenitale hartziekten / prothetisch materiaal.
- Ventriculair assist device als destination therapy

General prevention measures are recommended in individuals at high and intermediate risk for IE.	I	C	
Antibiotic prophylaxis is recommended in patients with previous IE. ^{47,84,86}	I	B	Gereviseerd
Antibiotic prophylaxis is recommended in patients with surgically implanted prosthetic valves and with any material used for surgical cardiac valve repair. ^{47,87-89}	I	C	Gereviseerd
Antibiotic prophylaxis is recommended in patients with transcatheter implanted aortic and pulmonary valvular prostheses. ⁹¹⁻⁹⁴	I	C	Gereviseerd
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. ^{8,47,97,101}	I	C	Gereviseerd
Antibiotic prophylaxis is recommended in patients with ventricular assist devices. ¹⁰²	I	C	NIEUW

Intermediate risk populatie

- Reumatische hartziekten
- Non-reumatisch degeneratief kleplijden
- Congenitale klep abnormaliteiten
- Cardiovasculair geïmplanteerde elektronische devices (CIED)
- Hypertrofische cardiomyopathie





Table 5 General prevention measures to be followed in patients at high and intermediate risk of infective endocarditis

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.



Bij welke procedures?

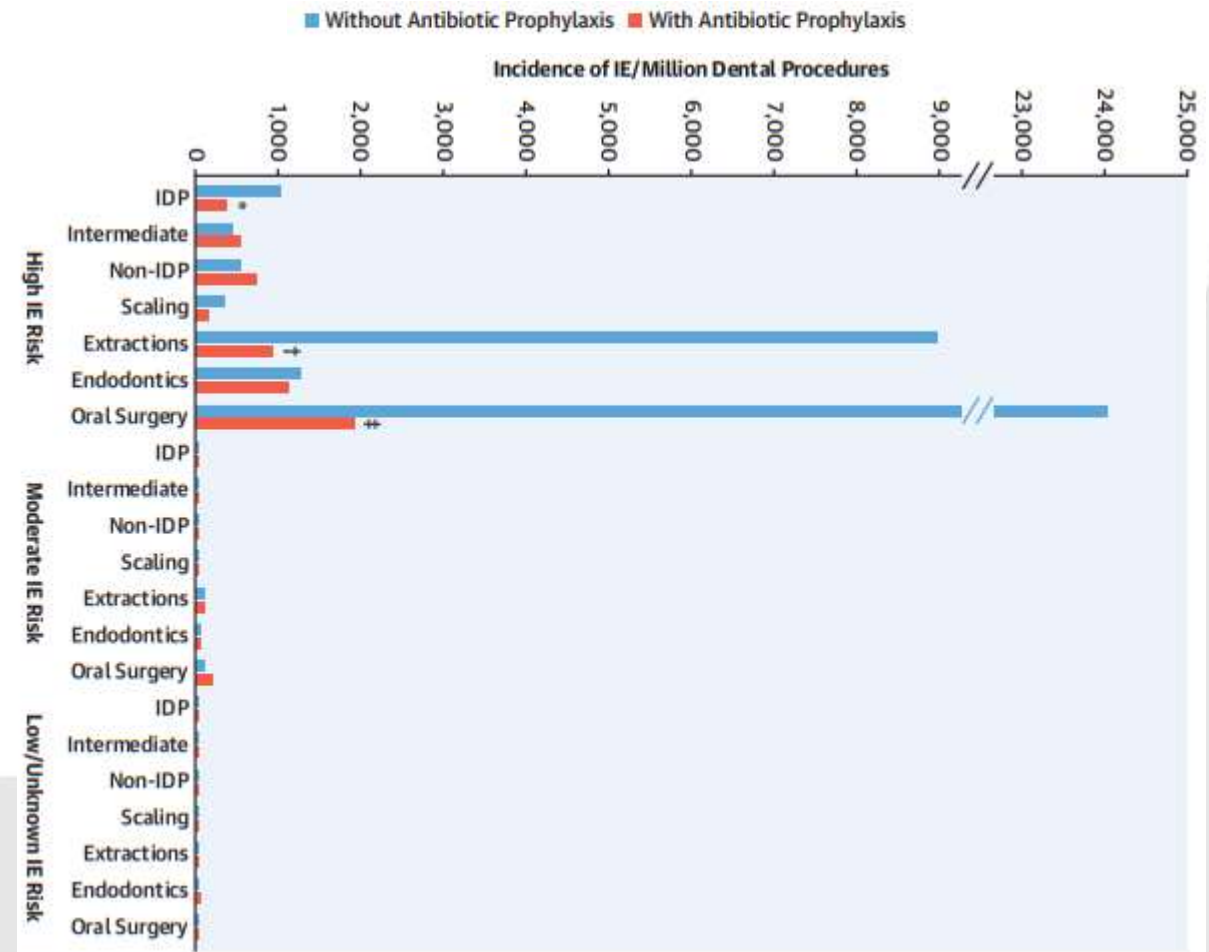
- Risicovolle dentale ingrepen
 - Chirurgische ingrepen
 - Tandvleesmanipulatie
 - Peri-apicale manipulatie
- Non-dentale ingrepen
 - Standaard aseptische procedure
- Cardiale of vasculaire ingrepen
 - Prostetische hartklep, graft, occluder of CIED

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

- 2022, JACC
- Case-crossover
- 8 miljoen patiënten (vs)
- Associatie IDP en IE binnen 4 weken (OR: 2.00; 95% CI: 1.59 – 2.52)
 - Tandextracties OR: 11.08
 - Orale chirurgie OR: 50.77
- Significante reductie na AB profylaxe (OR: 0.49; 95% CI: 0.29–0.85)



■ Without Antibiotic Prophylaxis ■ With Antibiotic Prophylaxis

Incidence of IE/Million Dental Procedures



Table 6 Prophylactic antibiotic regime for high-risk dental procedures

Situation	Antibiotic	Single-dose 30–60 min before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin	2 g orally	50 mg/kg orally
	Ampicillin	2 g i.m. or i.v.	50 mg/kg i.v. or i.m.
	Cefazolin or ceftriaxone	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.
Allergy to penicillin or ampicillin	Cephalexin ^{a,b}	2 g orally	50 mg/kg orally
	Azithromycin or clarithromycin	500 mg orally	15 mg/kg orally
	Doxycycline	100 mg orally	<45 kg, 2.2 mg/kg orally >45 kg, 100 mg orally
	Cefazolin or ceftriaxone ^b	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.

Bij welke procedures?

- Risicovolle dentale ingrepen
 - Chirurgische ingrepen
 - Tandvleesmanipulatie
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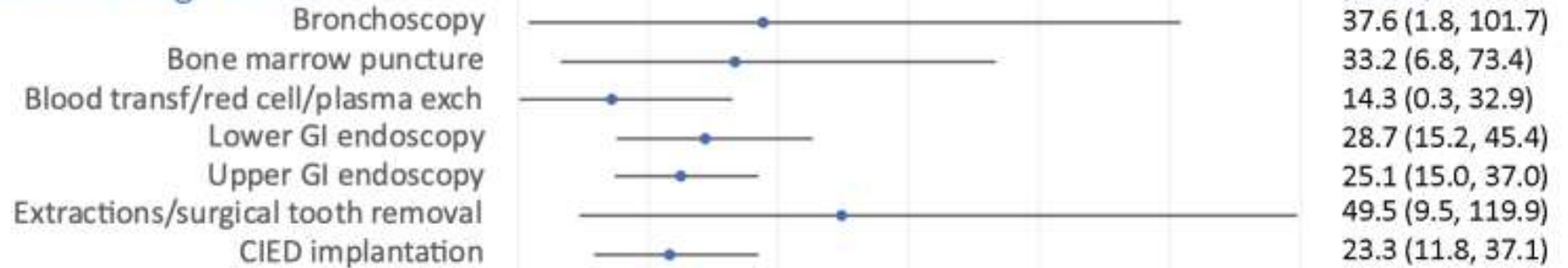


Original research

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 Nicoll³

Patients at High IE-Risk



Systemic antibiotic prophylaxis may be considered for high-risk patients undergoing an invasive diagnostic or therapeutic procedure of the respiratory, gastrointestinal, genitourinary tract, skin, or musculoskeletal systems.

IIb

C

Bij welke procedures?

- Risicovolle dentale ingrepen
 - Chirurgische ingrepen
 - Tandvleesmanipulatie
 - Peri-apicale manipulatie
- Non-dentale ingrepen
 - Standaard aseptische procedure
- Cardiale of vasculaire ingrepen
 - Prothetische hartklep, graft, occluder of CIED

Antibiotic prophylaxis covering for common skin flora including *Enterococcus* spp. and *S. aureus* should be considered before TAVI and other transcatheter valvular procedures.

IIa

C

Education of high-risk patients to prevent infective endocarditis



Figure 2 Education of high-risk patients to prevent infective endocarditis.



Diagnose

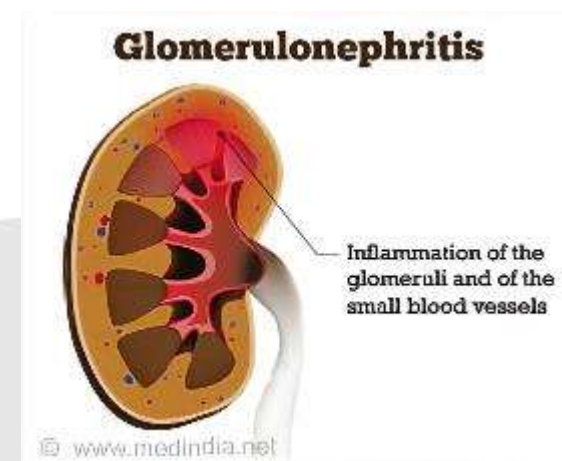
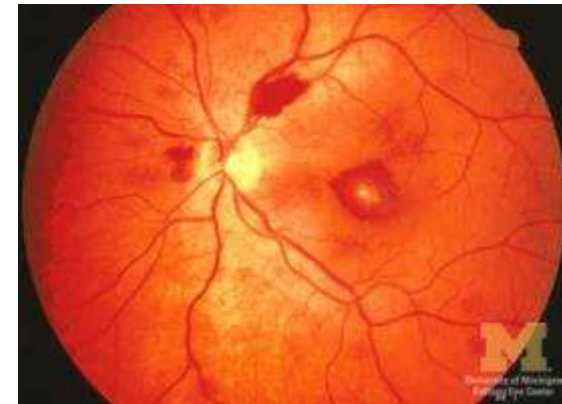
Klinische
verdenking

Consistente
microbiologische
data

IE-gerelateerde
cardiale afwijkingen
op beeldvorming

Diagnose

- Wisselende klinische presentatie
- Lichamelijk onderzoek
 - Koorts (77.7%)
 - Souffle (64.5%)
 - Congestief hartfalen (27.2%)
 - Embolische complicaties (25.3%)
 - Vasculaire en immunologische fenomenen
 - Perifere stigmata niet frequent



Diagnose

- Wisselende klinische presentatie
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 - Embolische complicaties (25.3%)
 - Vasculaire en immunologische fenomenen
 - Perifere stigmata niet frequent



Diagnose

- Bloedkweken
 - *S. aureus* (31%)
 - Orale streptococcen (17%)
 - CoNS (11%)
- Bloedkweek negatieve IE (BKNIE)
 - Onder antibiotica
 - Traag groeiende organismen
- Niet-bacteriële endocarditis
 - ANA, AFS

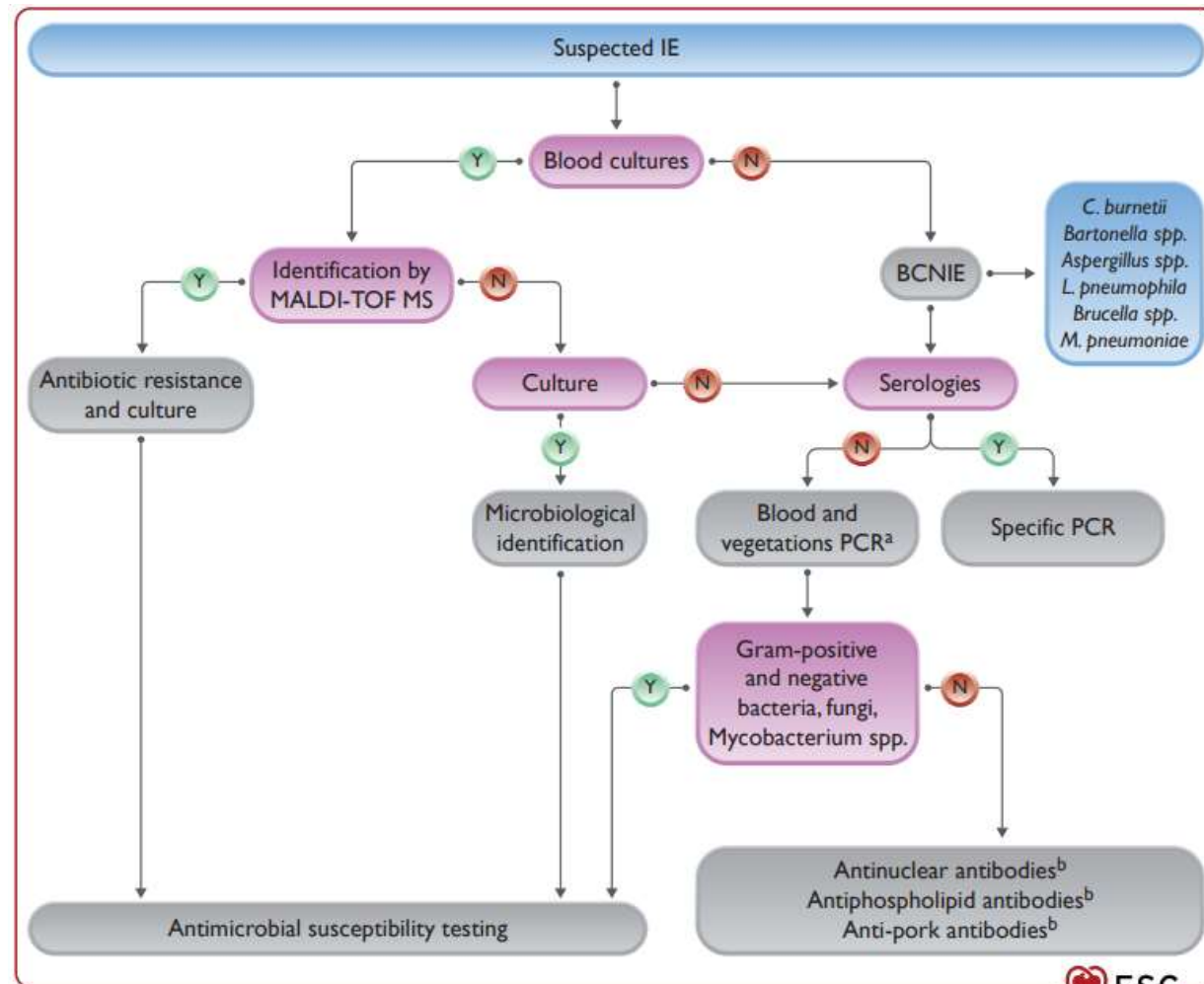


Figure 4 Microbiological diagnostic algorithm in culture-positive and culture-negative infective endocarditis. BCNIE, blood cultures negative endocarditis; IE, infective endocarditis; MALDI-TOF MS, matrix-assisted laser desorption ionization time-of-flight mass spectrometry; PCR, polymerase chain reaction. ^aQualified microbiological laboratory. ^bImmunological laboratory.

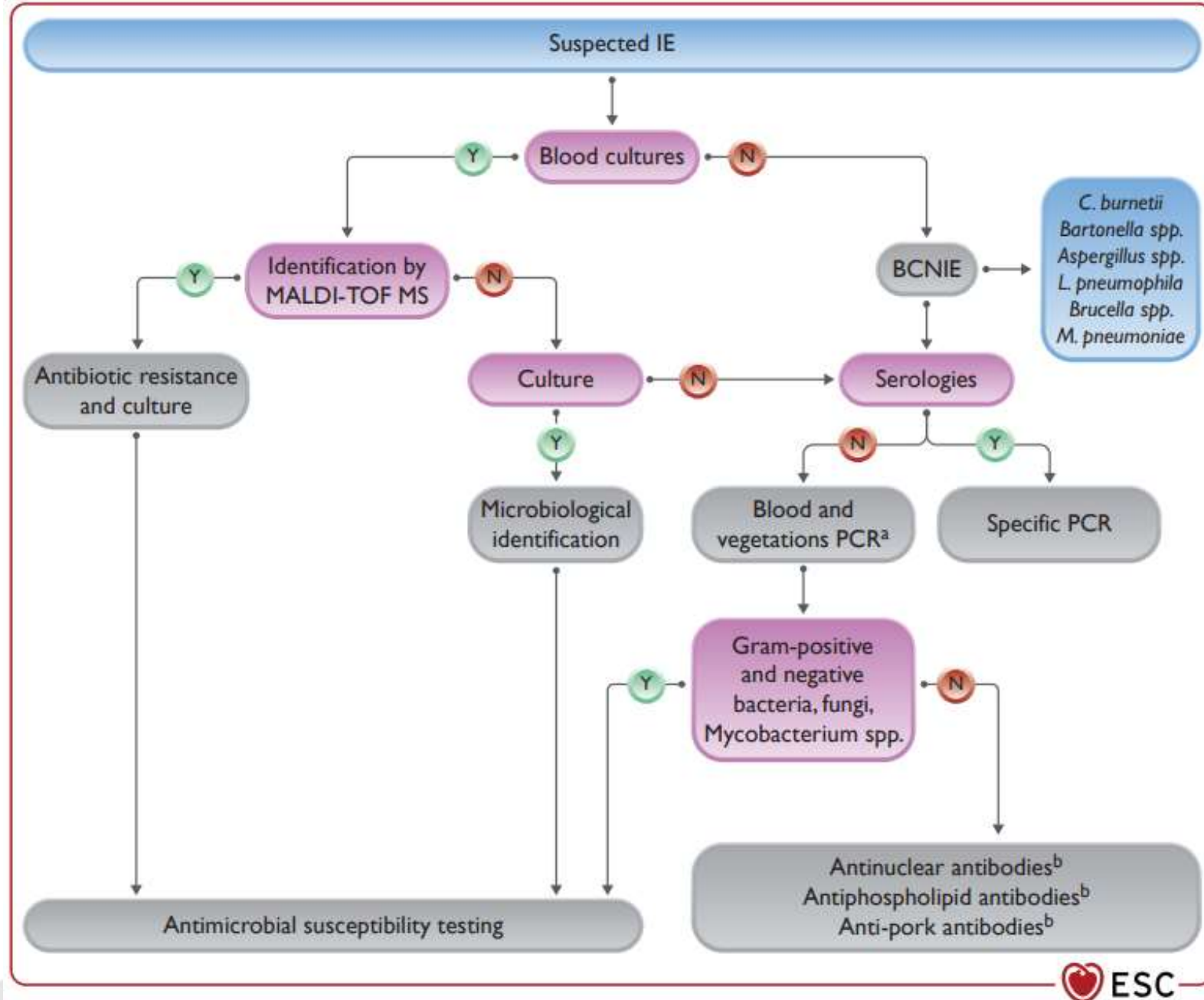


Figure 4 Microbiological diagnostic algorithm in culture-positive and culture-negative infective endocarditis. BCNIE, blood cultures negative endocarditis; IE, infective endocarditis; MALDI-TOF MS, matrix-assisted laser desorption ionization time-of-flight mass spectrometry; PCR, polymerase chain reaction.

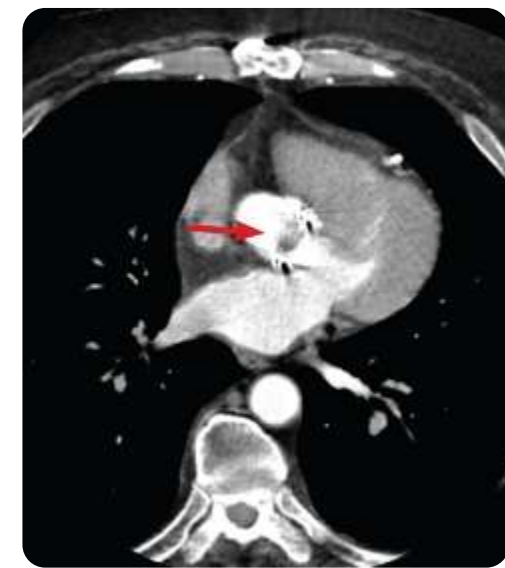
^aQualified microbiological laboratory. ^bImmunological laboratory.

Imaging

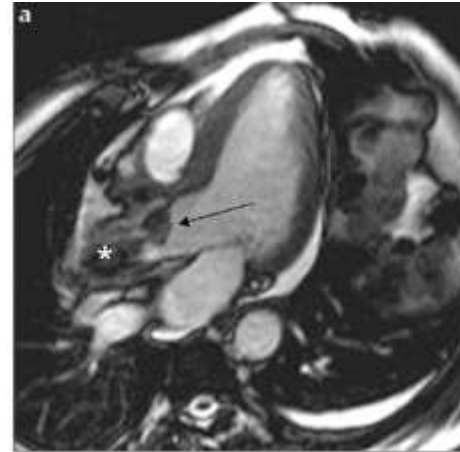
- TTE
- TEE
- CT
- Nucleaire beeldvorming
- MRI



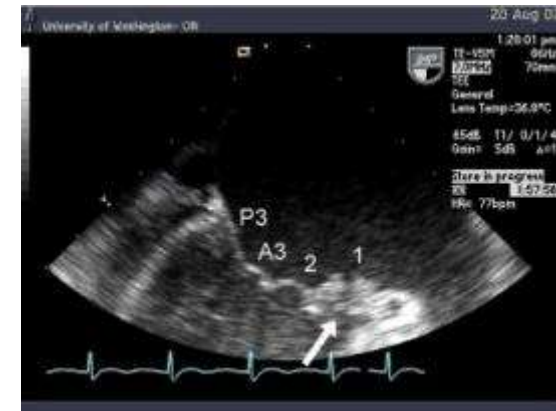
TTE



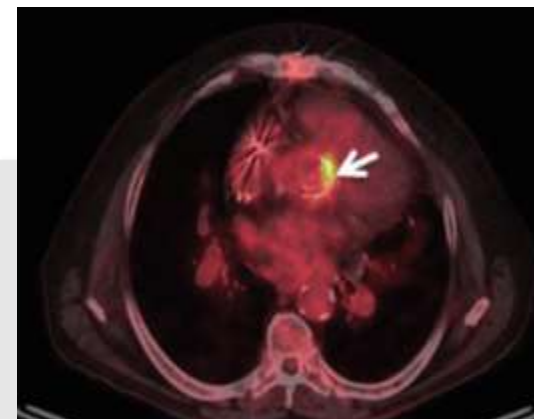
CT



MRI



TEE



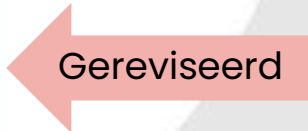
PET CT

Echocardiografie

- TTE
 - Lage sensitiviteit
 - Hoge specificiteit
- TEE
- Herhalen gedurende behandeling

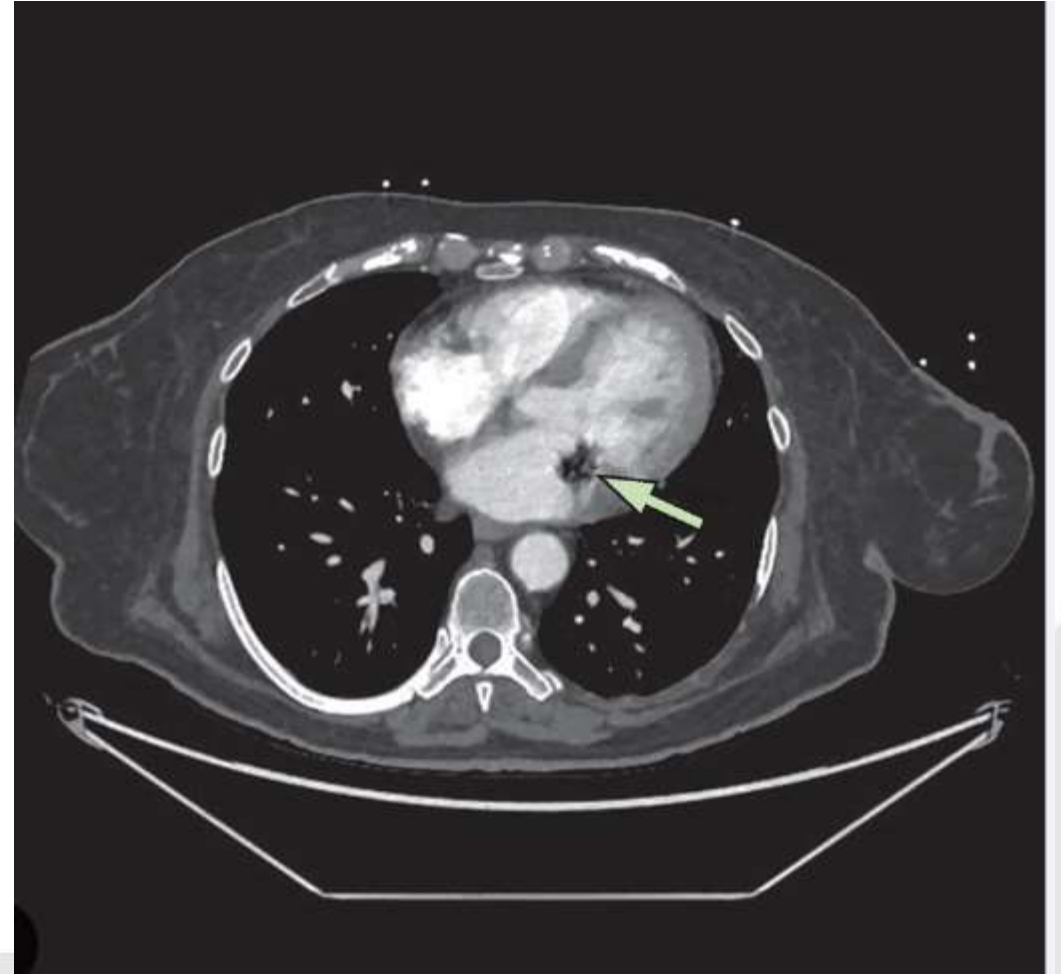
Recommendation Table 5 — Recommendations for the role of echocardiography in infective endocarditis

Recommendations	Class ^a	Level ^b
A. Diagnosis		
TTE is recommended as the first-line imaging modality in suspected IE. ^{166,179}	I	B
TOE is recommended in all patients with clinical suspicion of IE and a negative or non-diagnostic TTE. ^{166,178,179}	I	B
TOE is recommended in patients with clinical suspicion of IE, when a prosthetic heart valve or an intracardiac device is present. ^{166,178,179}	I	B
Repeating TTE and/or TOE within 5–7 days is recommended in cases of initially negative or inconclusive examination when clinical suspicion of IE remains high. ¹⁷⁸	I	C
TOE is recommended 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. ^{165,166,179}	I	C
Performing an echocardiography should be considered in <i>S. aureus</i> , <i>E. faecalis</i> , and some <i>Streptococcus</i> spp. bacteraemia. ^{19,149,174}	IIa	B
B. Follow-up under medical therapy		
Repeating TTE and/or TOE is recommended as soon as a new complication of IE is suspected (new murmur, embolism, persisting fever and bacteraemia, HF, abscess, AVB). ^{165,166,179}	I	B
TOE is recommended when patient is stable before switching from intravenous to oral antibiotic therapy. ^{43,180}	I	B
During follow-up of uncomplicated IE, repeat TTE and/or TOE should be considered to detect new silent complications. The timing of repeat TTE and/or TOE depends on the initial findings, type of microorganism	IIa	B



Cardiale CT

- Diagnose IE
- Beter diagnose perivalvulaire en periprosthetische complicaties
- Onderdiagnose kleine vegetaties
- Systemische complicaties
- Pre-operatieve beoordeling
- Alternatieve diagnoses



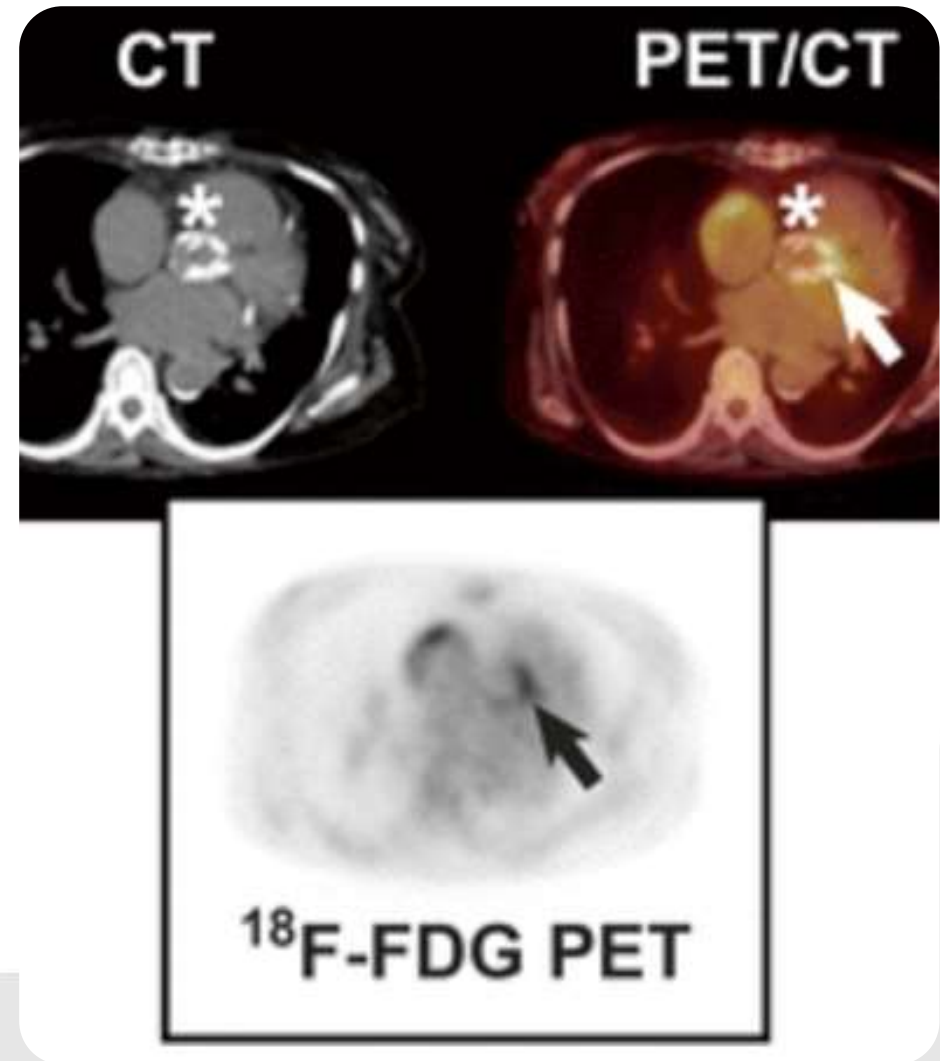
Cardiale MRI

- Diagnose IE
- Complicaties (echter lagere spatiële resolutie)
- Neurologische complicaties
- Diagnose spondylodiscitis en vertebrale osteomyelitis



Nucleaire beeldvorming

- [18F]FDG-PET/CT (en SPECT) aangeraden bij PVE
 - Sensitiviteit 84%
 - Specificiteit 86%
- Lage sensitiviteit bij NVE
- Afwijkingen op afstand, mycotische aneurysma's, port d'entree



Diagnose criteria

- Veranderingen in major en minor criteria van modified Duke's
- Algoritmes voor imaging volgorde
- CIED-gerelateerde IE wordt als rechtzijdige endocarditis beschouwd

Table 10 Definitions of the 2023 European Society of Cardiology modified diagnostic criteria of infective endocarditis**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 $>1:800$.

(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.

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 $>38^{\circ}\text{C}$** **(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.

(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.

IE Classification (at admission and during follow-up)**Definite:**

- 2 major criteria.
- 1 major criterion and at least 3 minor criteria.
- 5 minor criteria.

Possible:

- 1 major criterion and 1 or 2 minor criteria.
- 3–4 minor criteria.

Rejected:

Table 10 Definitions of the 2023 European Society of Cardiology modified diagnostic criteria of infective endocarditis

Major criteria

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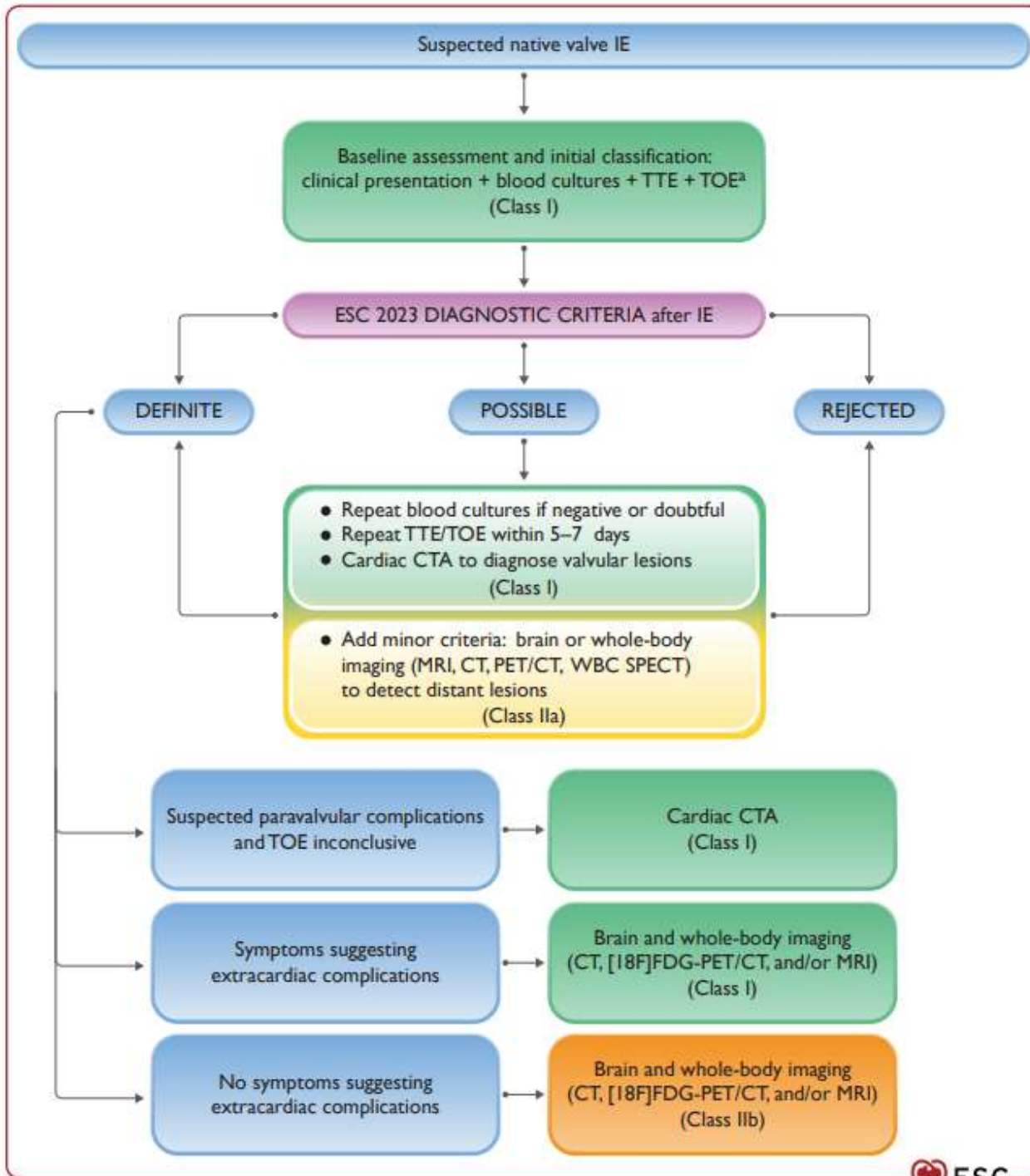
(ii) Imaging positive for IE:

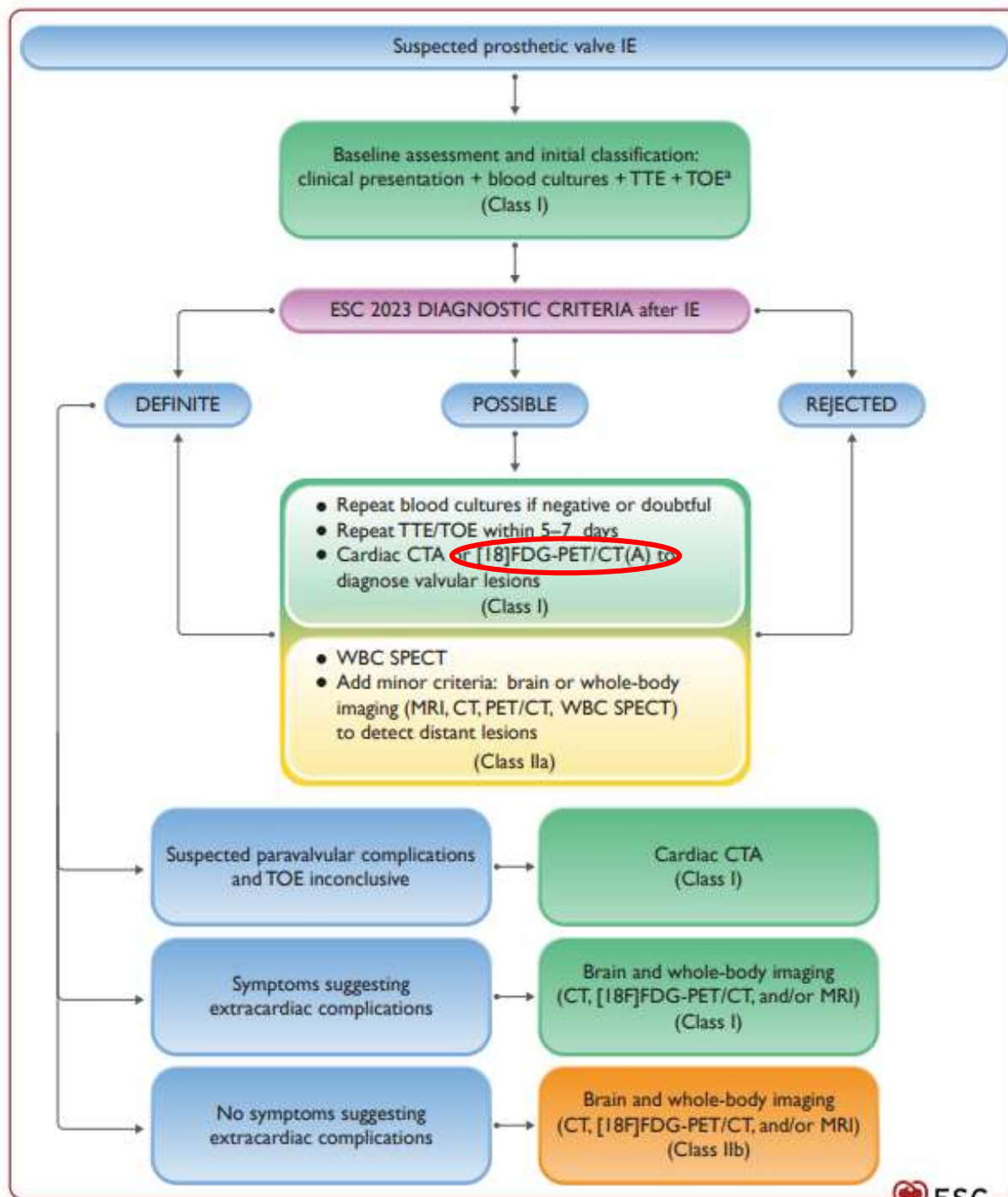
Valvular, perivalvular/periprosthetic and foreign material anatomic and metabolic lesions characteristic of IE detected by any of the following imaging techniques:

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

Minor criteria

- (i) Predisposing conditions (i.e. predisposing heart condition at high or intermediate risk of IE or PWIDs)²**
- (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).
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- (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.





Suspected CIED-associated IE

Baseline assessment and initial classification:
clinical presentation + blood cultures + TTE + TOE
(Class I)

ESC 2023 DIAGNOSTIC CRITERIA after IE

DEFINITE

POSSIBLE

REJECTED

- Repeat blood cultures if negative or doubtful
- Repeat TTE/TOE within 5–7 days
- PET/CT(A) to detect pocket infection +/- pulmonary embolism

(Class I)

- Add minor criteria: thoracic CT to detect septic pulmonary embolism/infarction

(Class IIa)

- PET/CT(A) to detect lead infection

(Class IIb)

Het endocarditis team

- Betere diagnose van ziekte en complicaties
- Uniforme AB behandeling
- Optimale timing voor chirurgische interventie

Recommendations	Class ^a	Level ^b
Diagnosis and management of patients with complicated IE are recommended to be performed at an early stage in a Heart Valve Centre, with immediate surgical facilities and an 'Endocarditis Team' to improve the outcomes. ^{36-41,122,123,125,126}	I	B
For patients with uncomplicated IE managed in a Referring Centre, early and regular communication between the local and the Heart Valve Centre endocarditis teams is recommended to improve the outcomes of the patients. ^{36-41,122,123,125,126}	I	B

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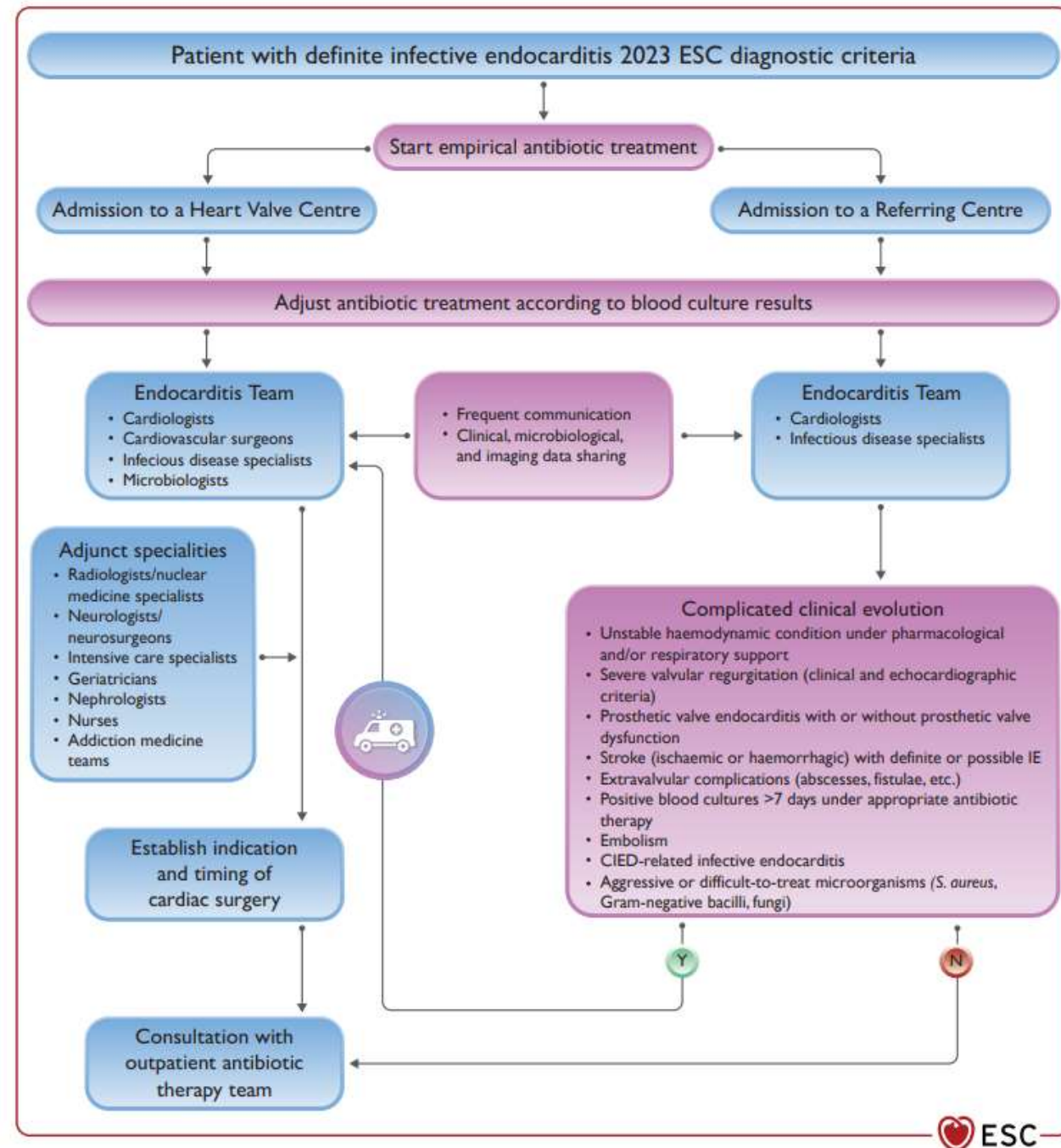
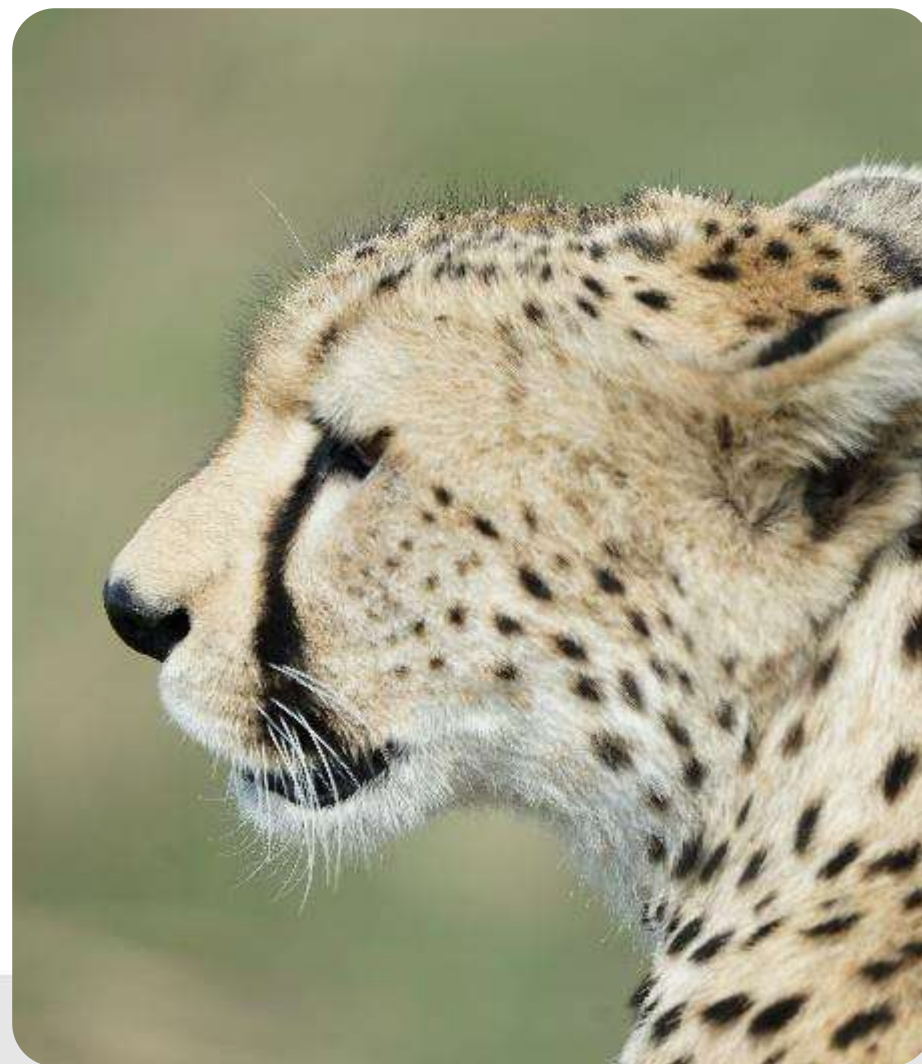


Figure 3 Management of patients with infective endocarditis: positioning of the Endocarditis Team. CIED, cardiovascular implanted electronic device; ESC, European Society of Cardiology.

How to treat the aggressive one



Antimicrobiële therapie

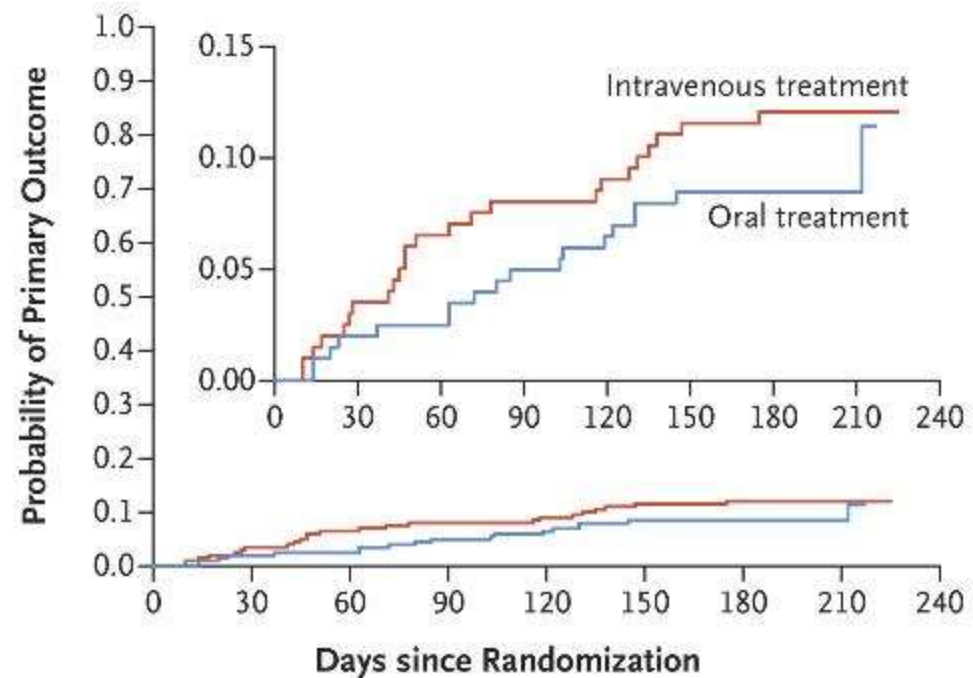
- Bactericide vs bacteriostatisch
- Antibiotische tolerantie
- PVE \geq 6 weken
 - Rifampicine minder tolerantie
- NVE 2-6 weken
- Empirisch ampicilline + ceftriaxon of flucloxacilline + gentamycine
- POET trial



Partial Oral versus Intravenous Antibiotic Treatment of Endocarditis

Kasper Iversen, M.D., D.M.Sc., Nikolaj Ihlemann, M.D., Ph.D., Sabine U. Gill, M.D., Ph.D., Trine Madsen, M.D., Ph.D., et al.

- Gerandomiseerd, non-inferiority, multicenter
- 400 patiënten met linkszijdig IE (NVE & PVE)
- *E. faecalis*, *S. aureus* of CoNS
- Minimaal 10 dagen IV antibiotica
- IV antibiotica continueren (199) vs. switch naar PO (201)
- Primary outcome: all-cause mortality, unplanned cardiac surgery, embolische events, relapse van bacteriëmie
- 6 maanden follow-up



No. at Risk

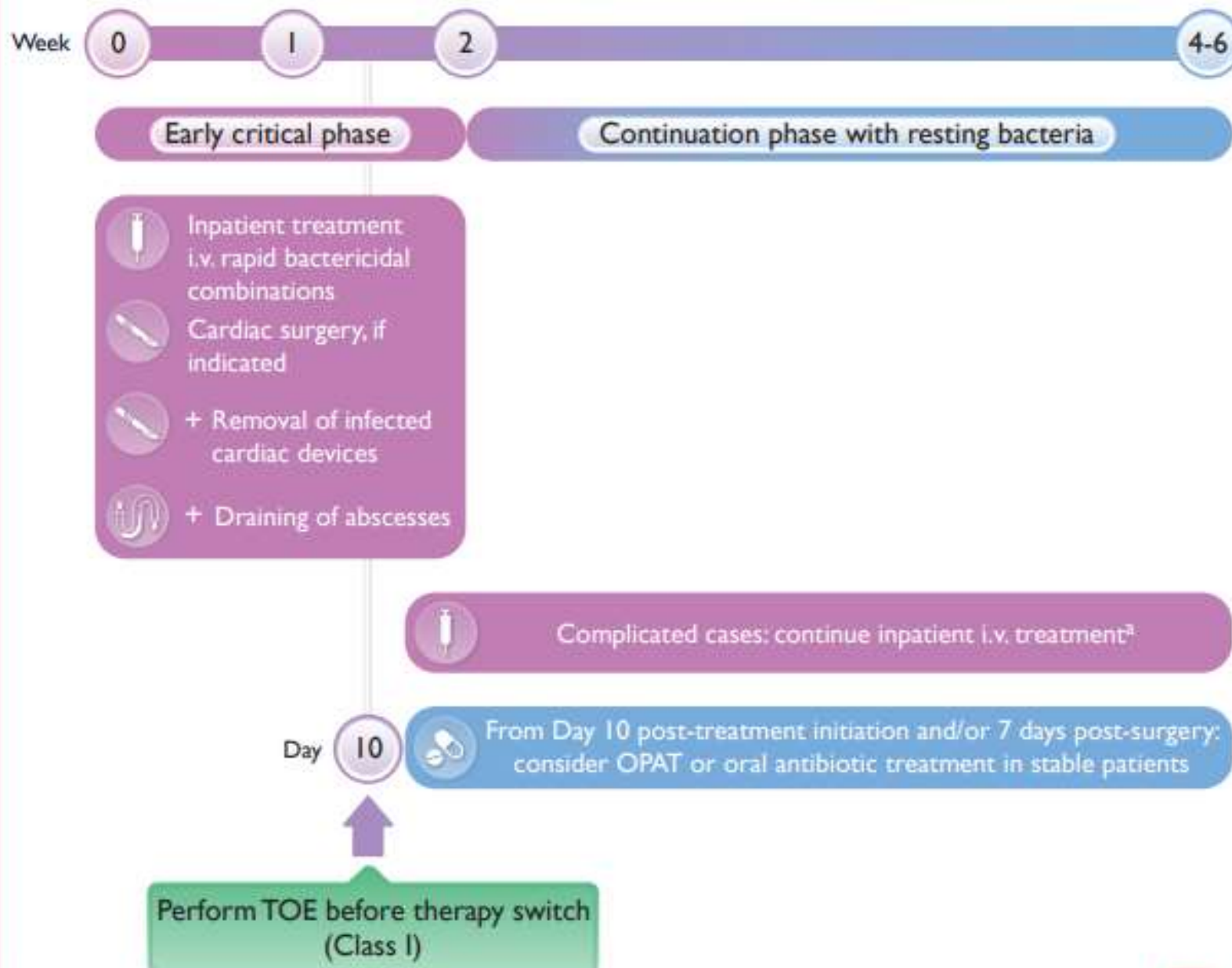
Intravenous treatment	199	192	186	183	181	176	174	28	0
Oral treatment	201	197	196	191	188	184	183	36	0

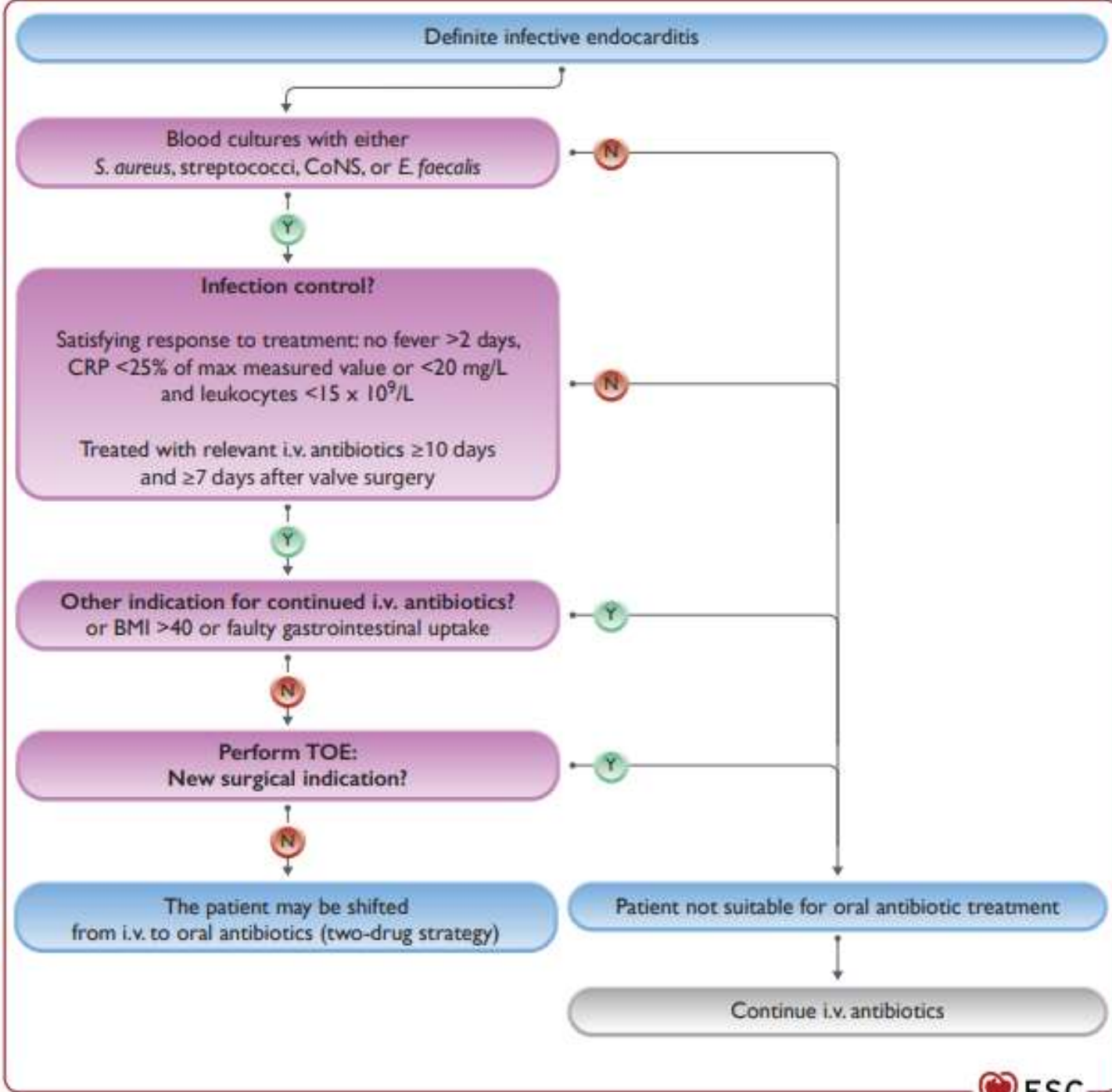
Table 2. Distribution of the Four Components of the Primary Composite Outcome.*

Component	Intravenous Treatment (N=199)	Oral Treatment (N=201)	Difference	Hazard Ratio (95% CI)
			percentage points (95% CI)	
All-cause mortality	13 (6.5)	7 (3.5)	3.0 (-1.4 to 7.7)	0.53 (0.21 to 1.32)
Unplanned cardiac surgery	6 (3.0)	6 (3.0)	0 (-3.3 to 3.4)	0.99 (0.32 to 3.07)
Embolic event	3 (1.5)	3 (1.5)	0 (-2.4 to 2.4)	0.97 (0.20 to 4.82)
Relapse of the positive blood culture†	5 (2.5)	5 (2.5)	0 (-3.1 to 3.1)	0.97 (0.28 to 3.33)

* Six patients, three in each group, had two outcomes.
 † For details about relapse of the positive blood culture, see the Supplementary Appendix.

Phases of antibiotic treatment of infective endocarditis





Take Home Messages

- High risk patiënten die een high risk dentale ingreep ondergaan hebben het grootste voordeel van antibiotica profylaxe
- High risk patiënten hebben wellicht ook bij andere ingrepen al voordeel van antibiotica profylaxe
- Bij TTE bewezen IE, maak een TEE voor het beoordelen van complicaties
- Overweeg orale antibiotica therapie thuis bij ongecompliceerde IE (op TEE) die goed reageren na IV antibiotica



De complexe endocarditis

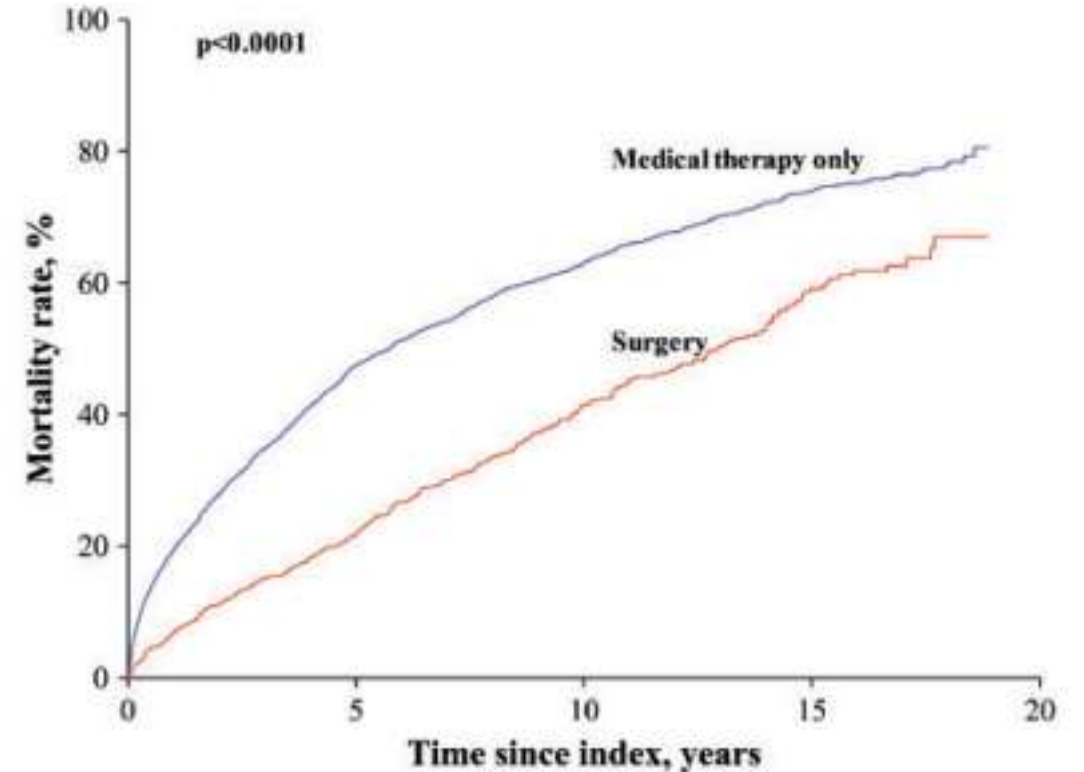


Wanneer chirurgisch in te grijpen?

Ömer Erküner

Chirurgie

- ~50%
- Geen gerandomiseerde data
 - Deens registry
 - 1996-2014
 - 5576 patiënten



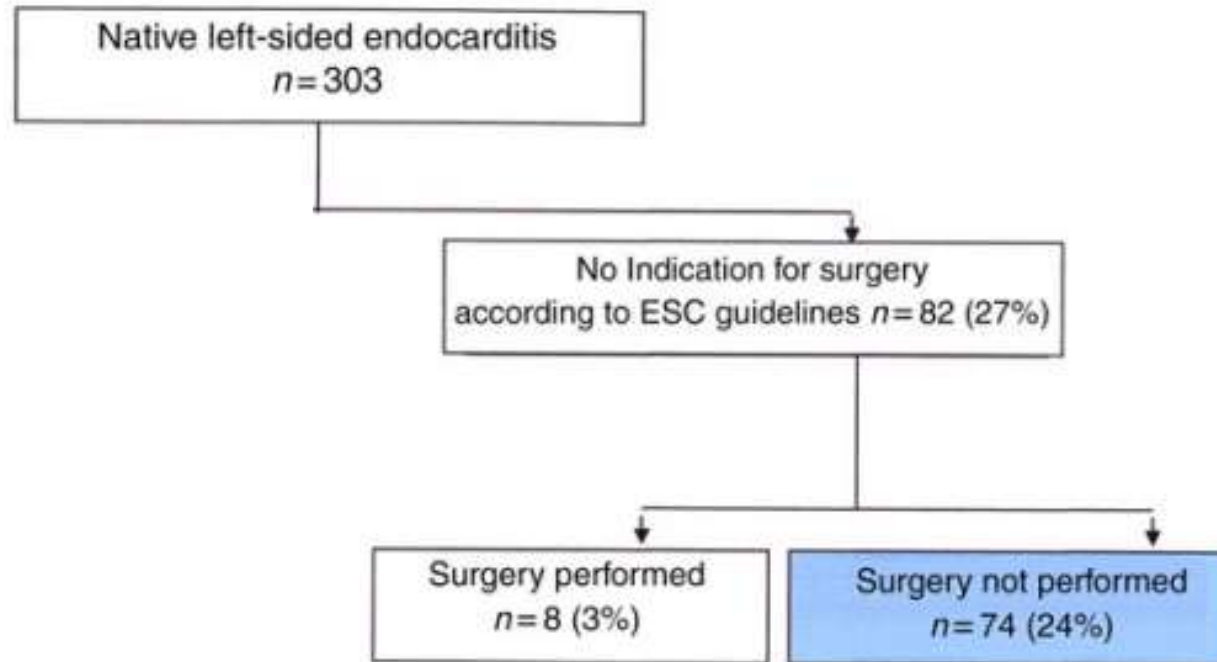
Pre-operatieve risico beoordeling

- In endocarditis team
 - Urgentie
 - Peri-operatief risico
 - Kans op herstel
 - Lange termijn prognose
- Meerdere risico scores ontwikkeld
 - Maar worden niet gebruikt

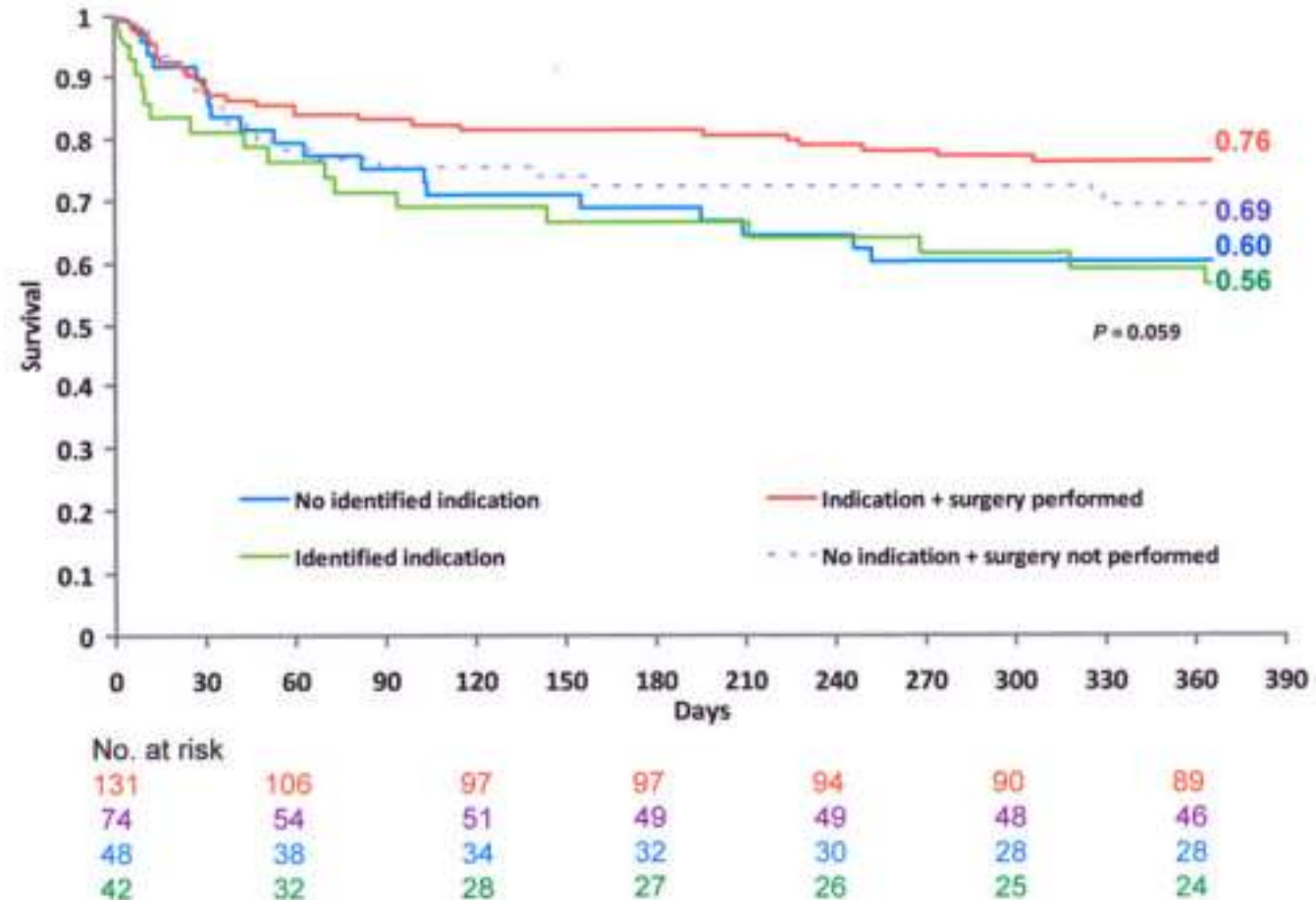
Hoe goed worden de richtlijnen gevolgd?

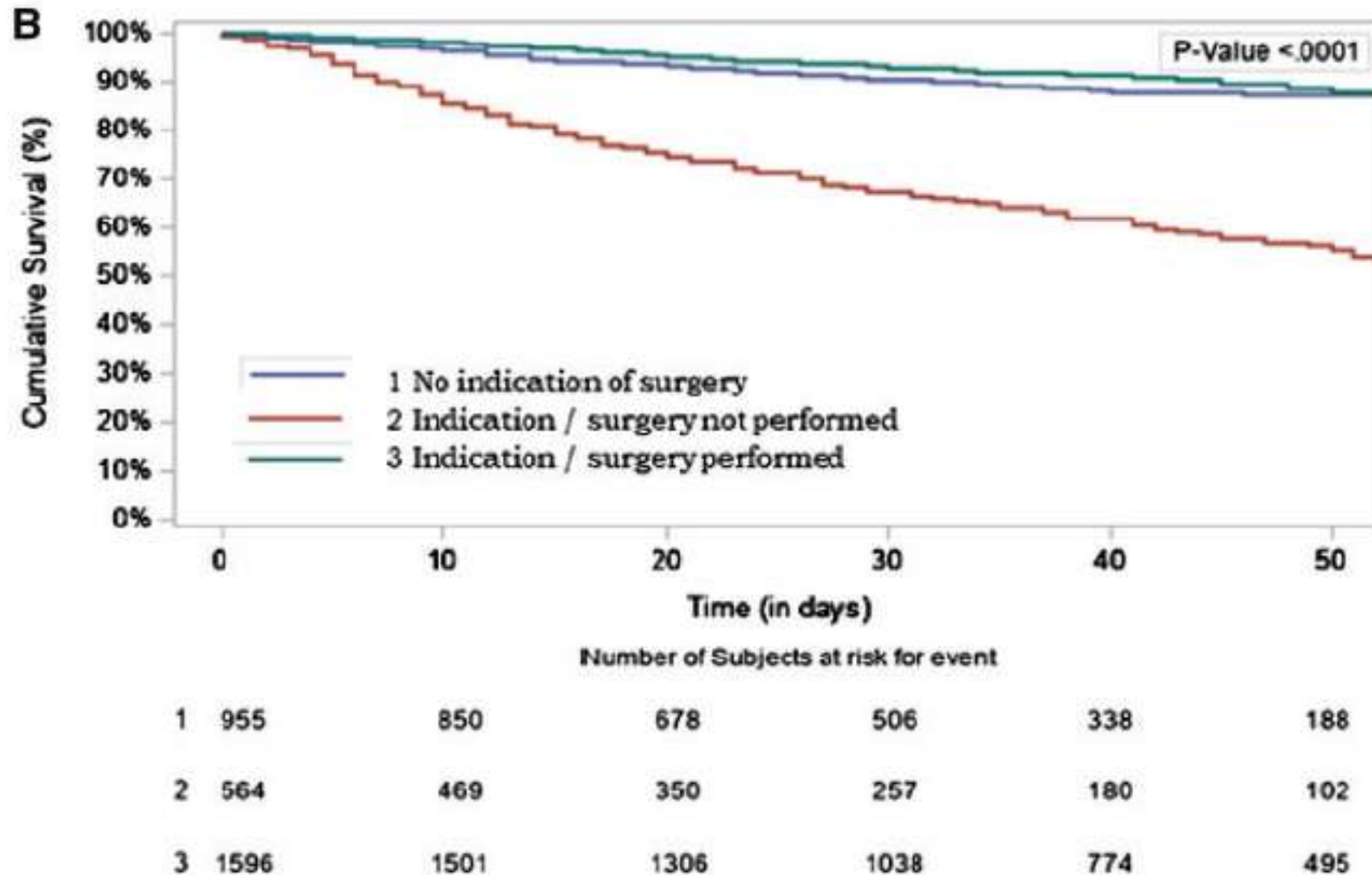
- Frans onderzoek
 - 2008
 - 303 patiënten met linkszijdige endocarditis
 - 2009 ESC guidelines voor endocarditis
 - Zeer vergelijkbaar met 2005 Franse richtlijn

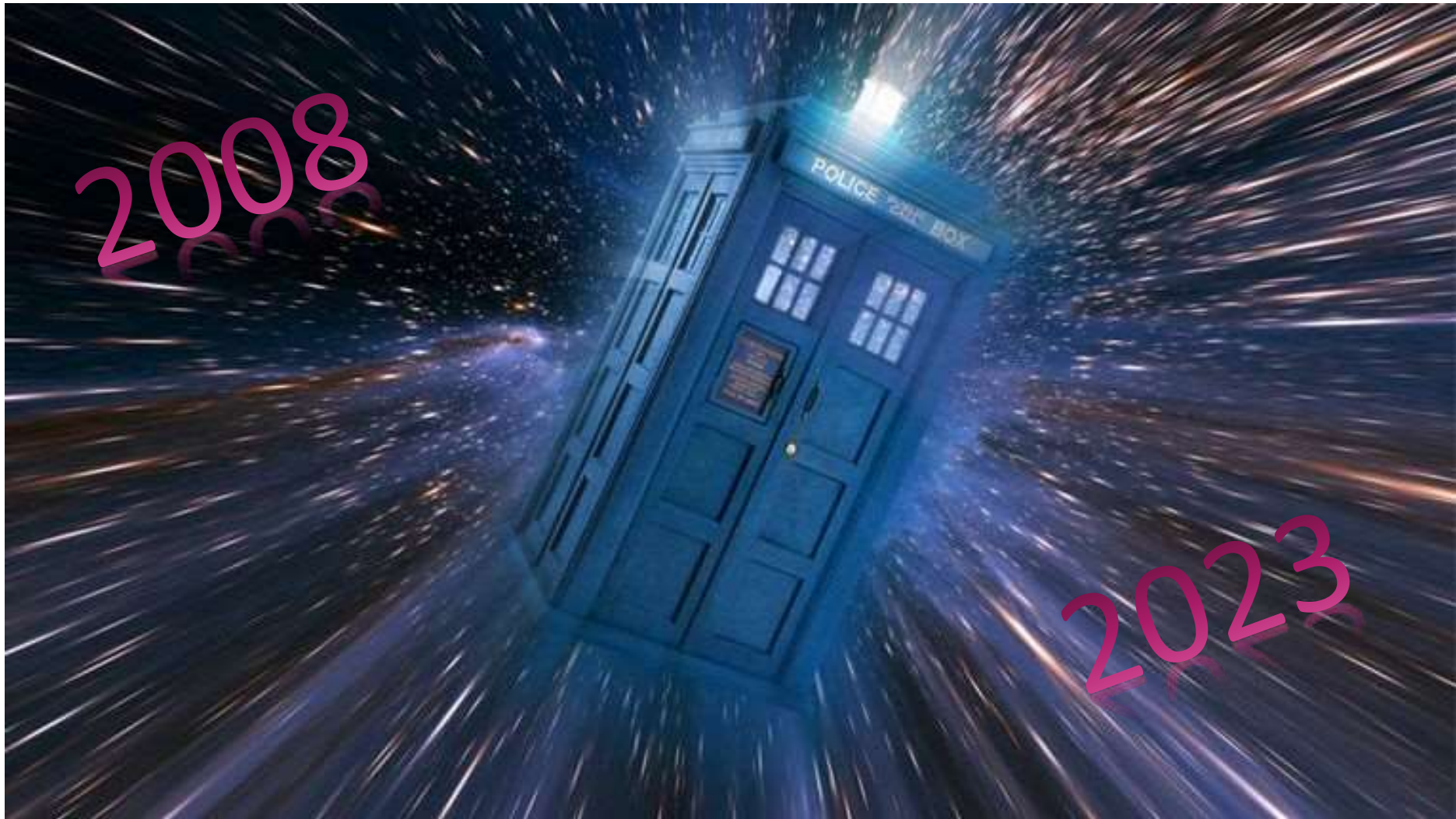
Discrepantie richtlijnen en praktijk



Discrepantie richtlijnen en praktijk





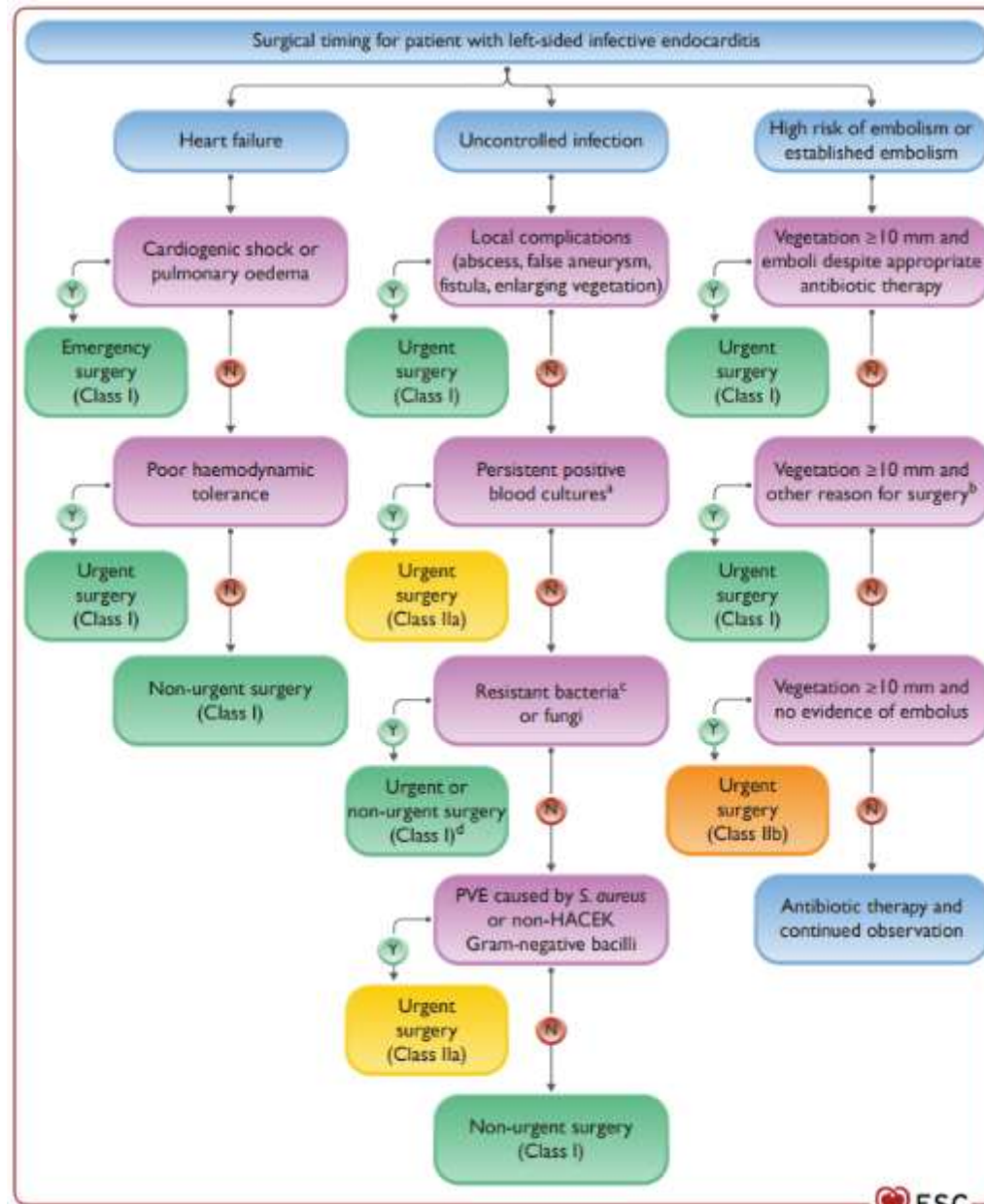


2023 ESC Guidelines for the management of endocarditis

Developed by the task force on the management of endocarditis of the European Society of Cardiology (ESC)

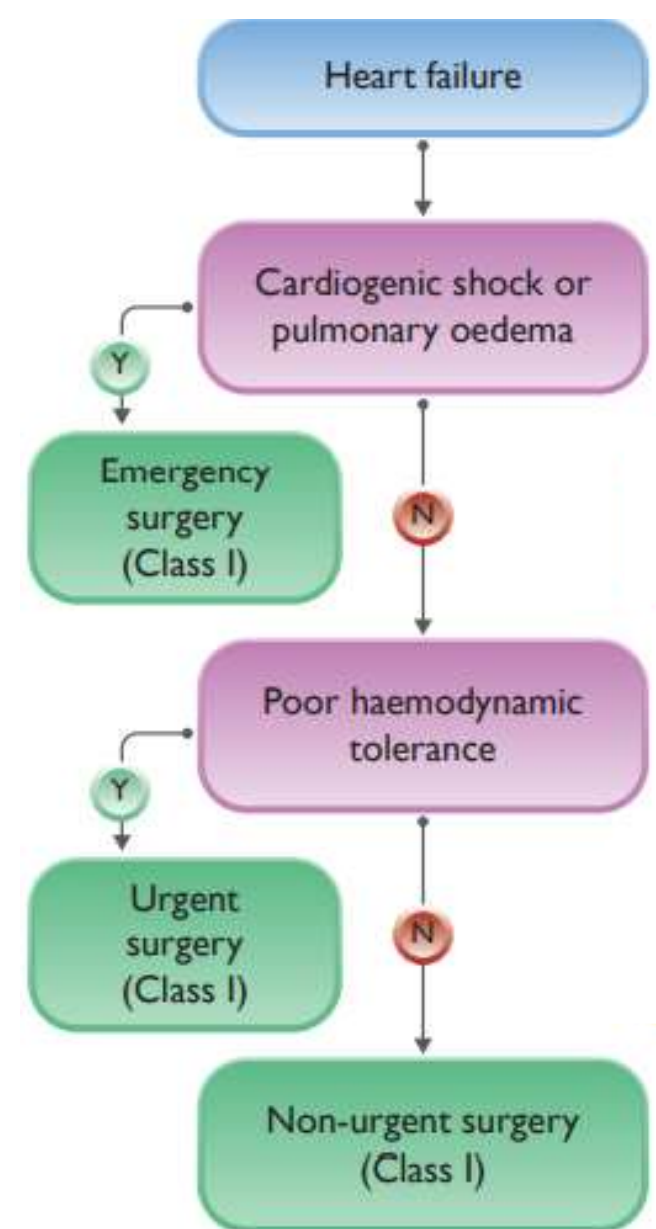
Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS) and the European Association of Nuclear Medicine (EANM)

Authors/Task Force Members: Victoria Delgado ^{*†}, (Chairperson) (Spain), Nina Ajmone Marsan [‡], (Task Force Co-ordinator) (Netherlands), Suzanne de Waha[‡], (Task Force Co-ordinator) (Germany), Nikolaos Bonaros  (Austria), Margarita Brida  (Croatia), Haran Burri  (Switzerland), Stefano Caselli  (Switzerland), Torsten Doent  (Germany), Stephane Ederhy  (France), Paola Anna Erba ¹ (Italy), Dan Foldager (Denmark), Emil L. Fosbøl  (Denmark), Jan Kovac (United Kingdom), Carlos A. Mestres  (South Africa), Owen I. Miller  (United Kingdom), Jose M. Miro ² (Spain), Michal Pazdernik  (Czech Republic), Maria Nazarena Pizzi  (Spain), Eduard Quintana ³ (Spain), Trine Bernholdt Rasmussen  (Denmark), Arsen D. Ristić  (Serbia), Josep Rodés-Cabau (Canada), Alessandro Sionis  (Spain), Liesl Joanna Zühlke  (South Africa), Michael A. Borger ^{*†}, (Chairperson) (Germany), and ESC Scientific Document Group



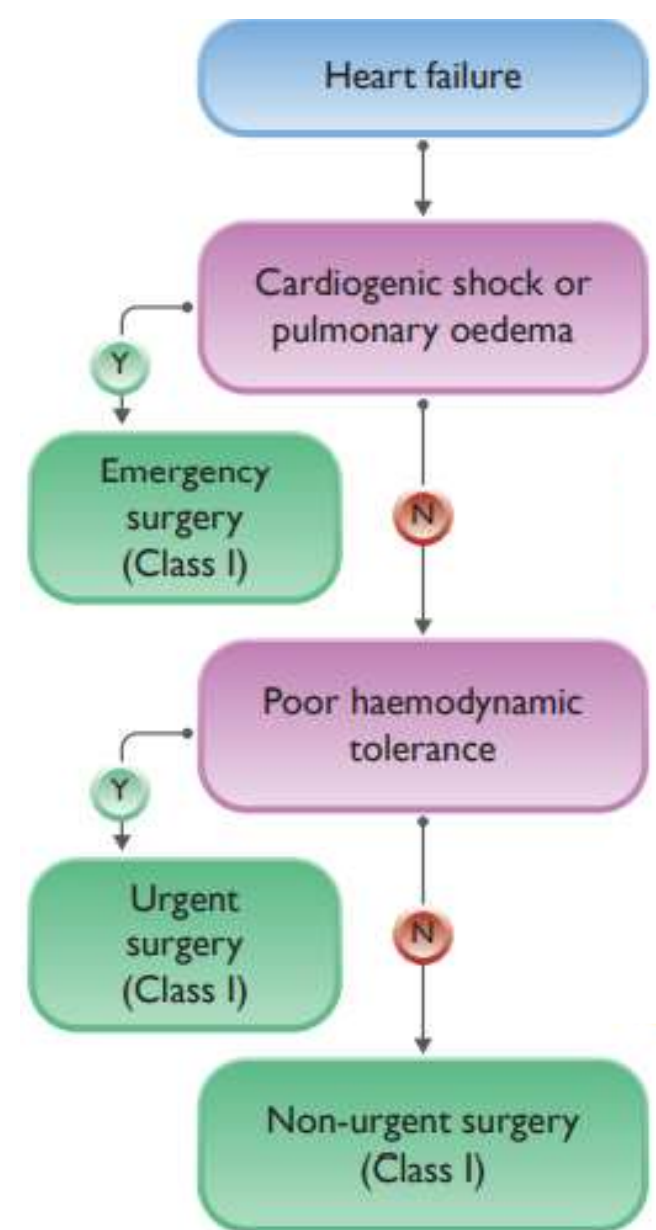
Hartfalen

- Meest voorkomende complicatie
 - 19-73% bij linkszijdige endocarditis
- Meestal door klepperforatie/-ruptuur
 - Chordaruptuur
 - Fistel
 - Interferentie van vegetatie met klepfunctie
 - Myocardinfarct door embolie



Hartfalen

- Geassocieerd met een slechte survival
 - Alleen opereren is effectief
- NYHA IV → Emergency
 - Ongeacht duur van AB behandeling
- NYHA II-III → Urgent



Verandering van termijnen

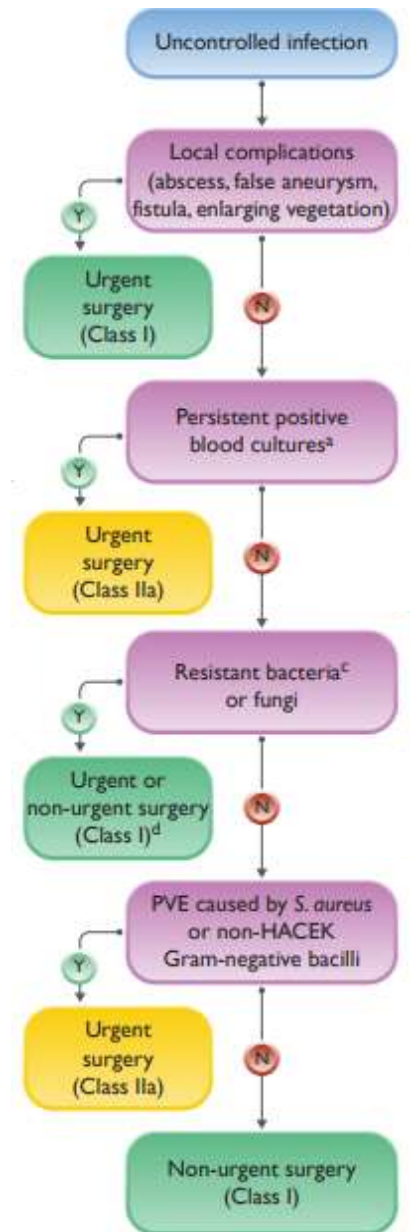
ESG guidelines	2015
Emergency	< 24 uur
Urgent	Binnen aantal dagen < 7 dagen
Elective	Na 1-2 weken AB behandeling

Verandering van termijnen

ESG guidelines	2015	2023
Emergency	< 24 uur	< 24 uur
Urgent	Binnen aantal dagen < 7 dagen	3-5 dagen
Elective/ Non-urgent	Na 1-2 weken AB behandeling	Tijdens opname

Ongecontroleerde infectie

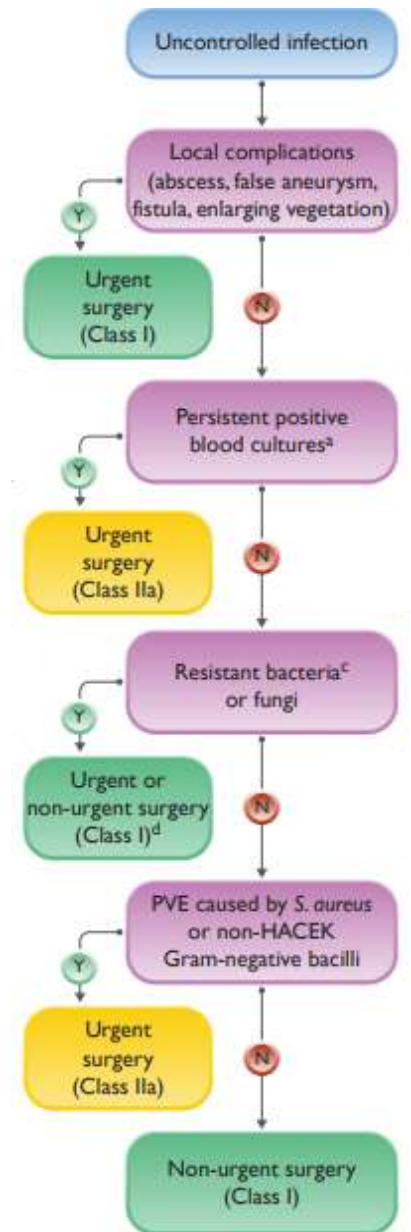
- I. Persistierende infectie/sepsis ondanks antibiotica
 - Arbitraire definitie
- II. Tekenen van lokale infectie niet reagerend op antibiotica
- III. Infectie met resistente of erg virulente organismen



Ongecontroleerde infectie

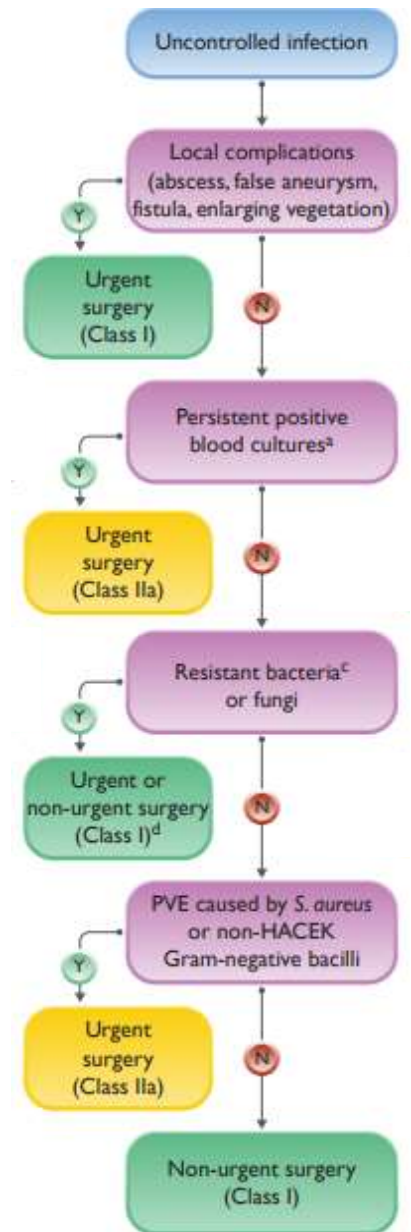
I. Persistierende infectie/sepsis ondanks antibiotica

- Arbitraire definitie
- Aanhoudende koorts en positieve bloedkweken na 7 dagen adequate antibiotica
 - Aanhoudend positieve BK na 48-72 uur → mortaliteit
- Uiteraard na uitsluiten andere oorzaak



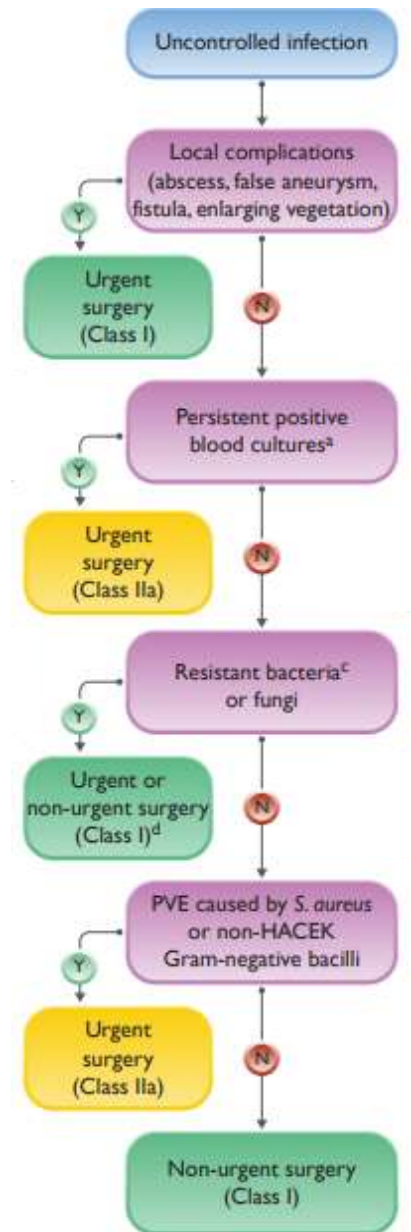
Ongecontroleerde infectie

- I. Persistierende infectie/sepsis ondanks antibiotica
- II. Tekenen van lokale infectie niet reagerend op antibiotica
 - 10-30%
 - Toename vegetatie
 - Abces
 - Pseudoaneurysma
 - Fistel
 - Nieuw AV-blok



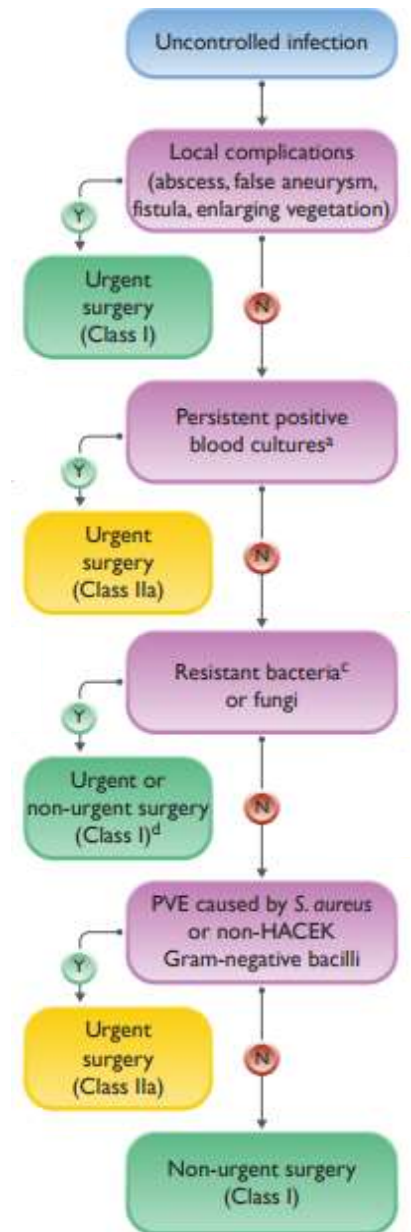
Ongecontroleerde infectie

- I. Persistierende infectie/sepsis ondanks antibiotica
- II. Tekenen van lokale infectie niet reagerend op antibiotica
 - Aortaklep > mitralisklep
 - Bicuspide aortaklep > tricuspide
 - TEE is sensitiever dan TTE
 - CT is goed alternatief
 - PET-CT bij kunstklep



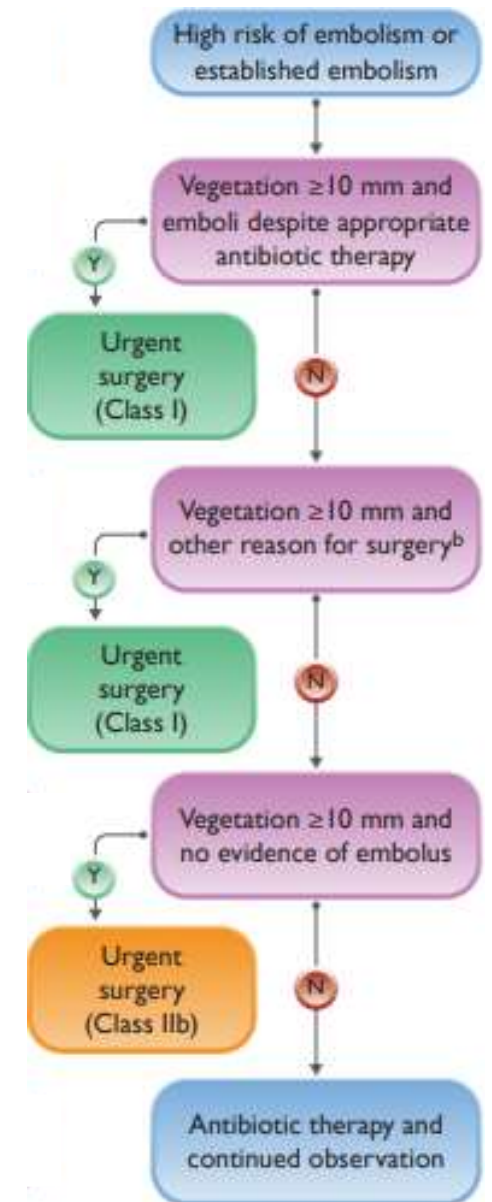
Ongecontroleerde infectie

- I. Persistierende infectie/sepsis ondanks antibiotica
- II. Tekenen van lokale infectie niet reagerend op antibiotica
- III. Infectie met resistente of erg virulente organismen
 - Schimmels
 - MRSA/vanco-resistente enterococcen
 - *S. aureus*
 - Minder vaak: non-Hacek gram -



Embolie

- Linkszijdig: hersenen en milt
 - ~50% asymptomatisch
 - CT-mens wordt vaak verricht, maar weinig invloed op besluitvorming
- Longembolie bij rechtszijdige/pacemaker IE
- Embolisch risico is hoogst dag na start AB
- Voorspellen blijft moeilijk
 - Grootte en mobiliteit vegetatie



(i) Heart failure

Emergency^d surgery is recommended in aortic or mitral NVE or PVE with severe acute regurgitation, obstruction, or fistula causing refractory pulmonary oedema or cardiogenic shock.^{420,423,424,429,476,477}

I

B

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

(iii) Prevention of embolism

Urgent^d surgery is recommended in aortic or mitral NVE or PVE with persistent vegetations ≥ 10 mm after one or more embolic episodes despite appropriate antibiotic therapy.^{451,455,457,471,478}

I

B

Urgent^d surgery is recommended in IE with vegetation ≥ 10 mm and other indications for surgery.^{5,460,465,466,471,478}

I

C

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

(ii) Uncontrolled infection

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 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 IE with persistently positive blood cultures >1 week or persistent sepsis despite appropriate antibiotic therapy and adequate control of metastatic foci.^{436,437}

IIa

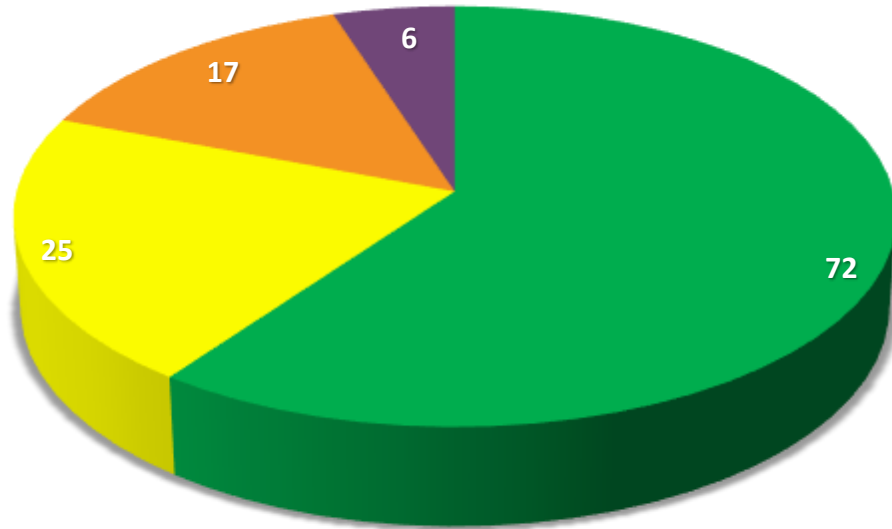
B

Urgent^d surgery should be considered in PVE caused by *S. aureus* or non-HACEK Gram-negative bacteria.^{5,385,449}

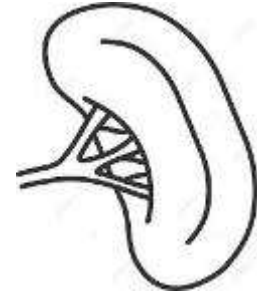
IIa

C

Class of recommendation



■ I ■ IIA ■ IIB ■ III



Complicaties van endocarditis

First degree AV block



Second degree AV block (Mobitz I or Wenckebach)



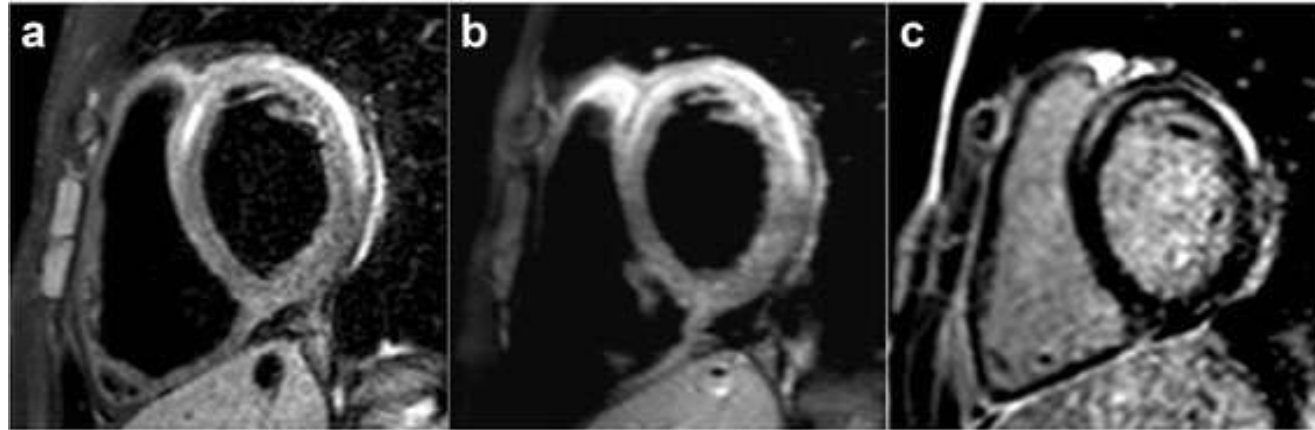
Second degree AV block (Mobitz II)



Second degree AV block (2:1 block)



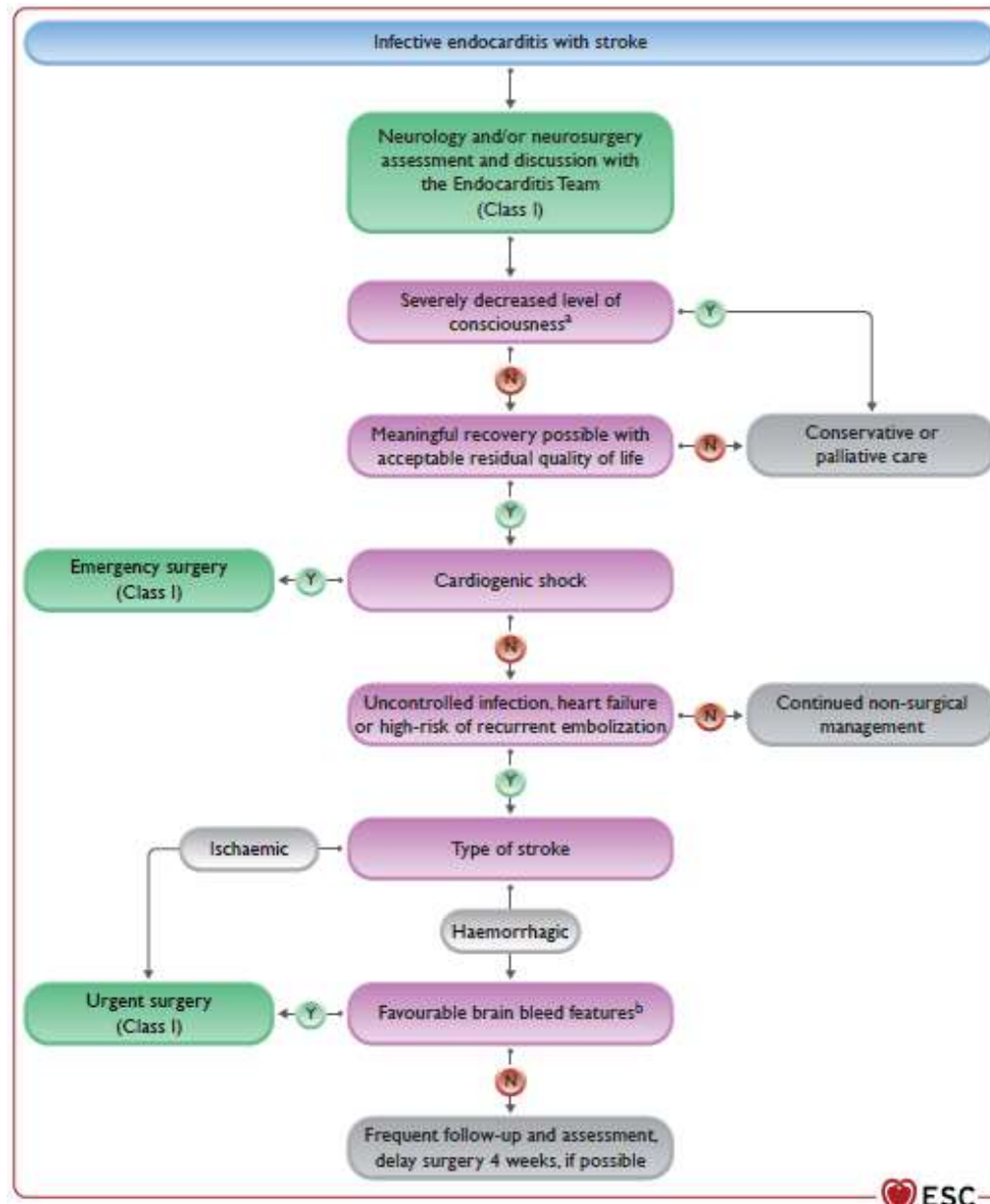
Third degree AV block with junctional escape



Neurologisch



- Ischemisch meest voorkomend
 - Bloeding, meningitis, abces, encephalopathie
- Vaker bij *s. aureus*
 - En dus bij grotere/mobielere vegetatie
- Gepaard met hogere mortaliteit
- MRI cerebrum met gadolinium verrichten
 - Indien niet mogelijk CT met contrast
- Vroeg chirurgisch ingrijpen
 - Geen bewijs voor antistolling

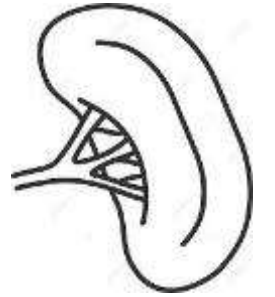


Post-operatieve hemorragische transformatie

- Laag risico: 2-7%
- Kan ook optreden bij asymptomatische patiënten
- Hoge mortaliteit: 40%

- Dus in geval van neurologisch event: geen reden tot uitstellen operatie, urgente ingreep
 - Als primair een bloeding: timing controversieel

Milt



- Miltinfarct ~20% van patiënten
 - Vaak asymptomatisch
 - 5% hiervan wordt abces
- Behandeling middels antibiotica
 - Indien abces of niet reagerend: splenectomie of draineren
 - Timing maakt niet veel uit

Minder vaak voorkomende complicaties

- Myocarditis/pericarditis
- AV-geleidingsstoornissen

Recommendations	Class ^a	Level ^b
Immediate epicardial pacemaker implantation should be considered in patients undergoing surgery for valvular IE and complete AVB if one of the following predictors of persistent AVB is present: pre-operative conduction abnormality, <i>S. aureus</i> infection, aortic root abscess, tricuspid valve involvement, or previous valvular surgery. ⁵¹⁵	IIa	C

	Total (n = 3116)	Prosthesis+Repair (n = 939)	Native (n = 1764)	PM/ICD (n = 308)	p
No conduction abnormality	2547 / 2878 (88.5%)	721 / 874 (82.5%)	1505 / 1628 (92.4%)	242 / 285 (84.9%)	<0.0001
AV block I	232 / 2878 (8.1%)	117 / 874 (13.4%)	92 / 1628 (5.7%)	15 / 285 (5.3%)	
AV block II	17 / 2878 (0.6%)	6 / 874 (0.7%)	10 / 1628 (0.6%)	1 / 285 (0.4%)	
AV block III	82 / 2878 (2.8%)	30 / 874 (3.4%)	21 / 1628 (1.3%)	27 / 285 (9.5%)	

Minder vaak voorkomende complicaties

- Myocarditis/pericarditis
- AV-geleidingsstoornissen
- Spondylodiscitis
 - Vaakst s. aureus
 - Rugpijn → MRI rug
 - Goede uitkomsten na 4-6 weken AB behandeling

Minder vaak voorkomende complicaties

- Myocarditis/pericarditis
- AV-geleidingsstoornissen
- Spondylodiscitis
- Mycotische aneurysmata

Coronaire diagnostiek pre-operatief

- Mannen > 40 jaar
- Postmenopauzale vrouwen
- ≥ 1 CV risicofactoren of bekend coronairlijden

Recommendations	Class ^a	Level ^b
In haemodynamically stable patients with aortic valve vegetations who require cardiac surgery and are high risk for CAD, a high-resolution multislice coronary CTA is recommended. ^{185,546}	I	B
Invasive coronary angiography is recommended in patients requiring heart surgery who are high risk for CAD, in the absence of aortic valve vegetations.	I	C
In emergency situations, valvular surgery without pre-operative coronary anatomy assessment regardless of CAD risk should be considered. ^{543,545}	IIa	C
Invasive coronary angiography may be considered despite the presence of aortic valve vegetations in selected patients with known CAD or at high risk of significant obstructive CAD. ^{193,543,544}	IIb	C

Extracardiale infectie: wanneer behandelen?

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.

Post-operatieve mortaliteit

- 10-20%
 - Coagulopathie
 - Tamponade
 - Dialyse
 - CVA

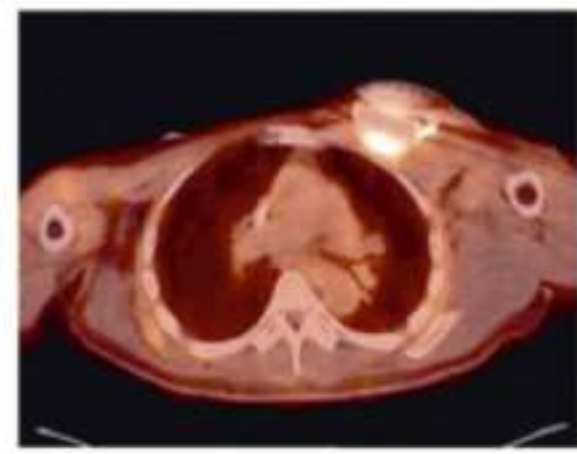
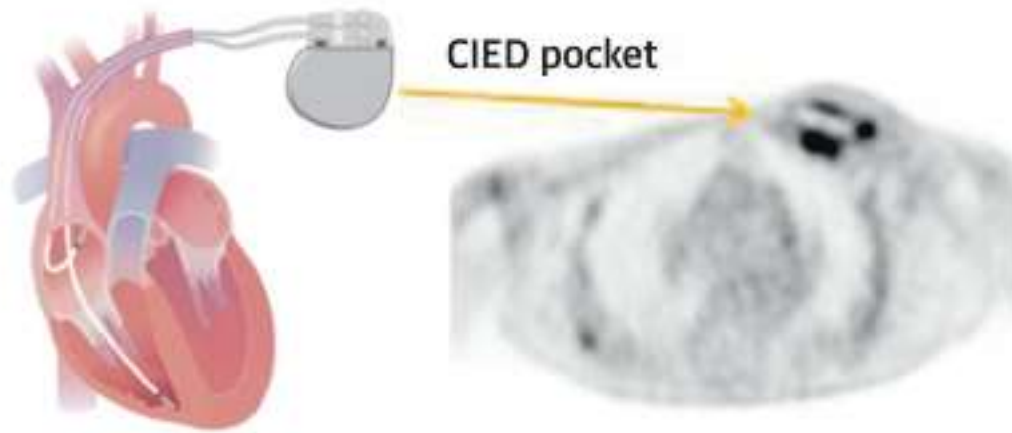
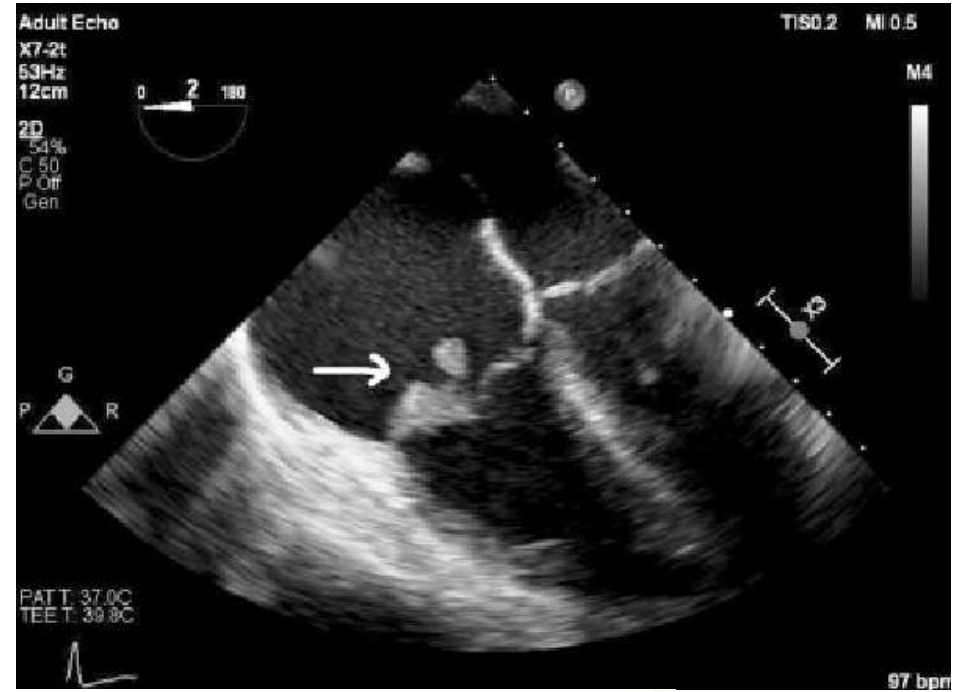


Prognose

- Recidief risico 2-9%
 - Patient educatie: AB profylaxe en gebit
- Hartrevalidatie aanbieden

- Overleving na 1 jaar: 85-90%
- Overleving na 5 jaar: 70-80%
- Cave: referral bias

Specifieke situaties



Kunstklependocarditis



- Meest ernstige vorm van endocarditis
- 1-6% van de patiënten met kunstklep
 - Biologisch > kunstklep
- 20-30% van alle endocarditiden
- TEE noodzakelijk, maar diagnostiek moeizamer
 - Atypische presentatie: aanhoudende koorts maar (nog) geen afwijkingen op beeldvorming
 - Combineren van meerdere beeldvormende technieken

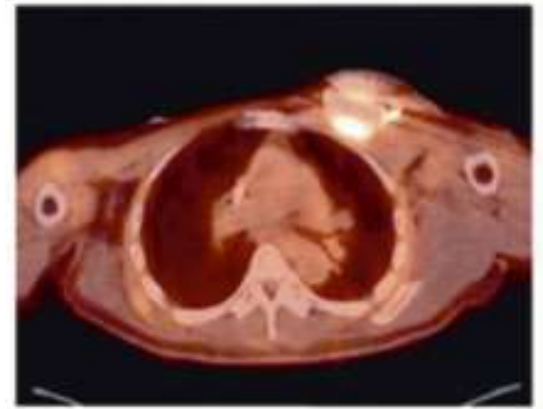
Kunstklependocarditis



- Hoge in-hospital mortaliteit 20-40%
- Indicatie voor chirurgie zelfde als natief
- Verschil vroege vs. late

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

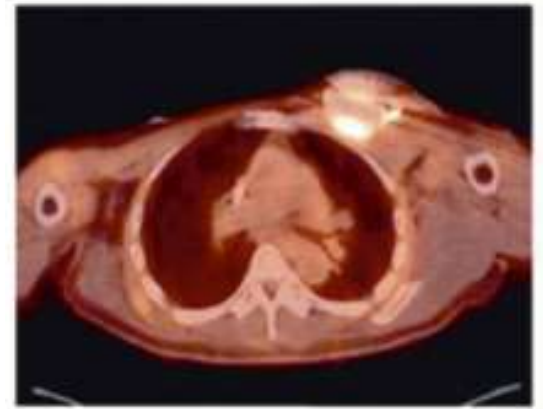
Pacemaker/ICD endocarditis

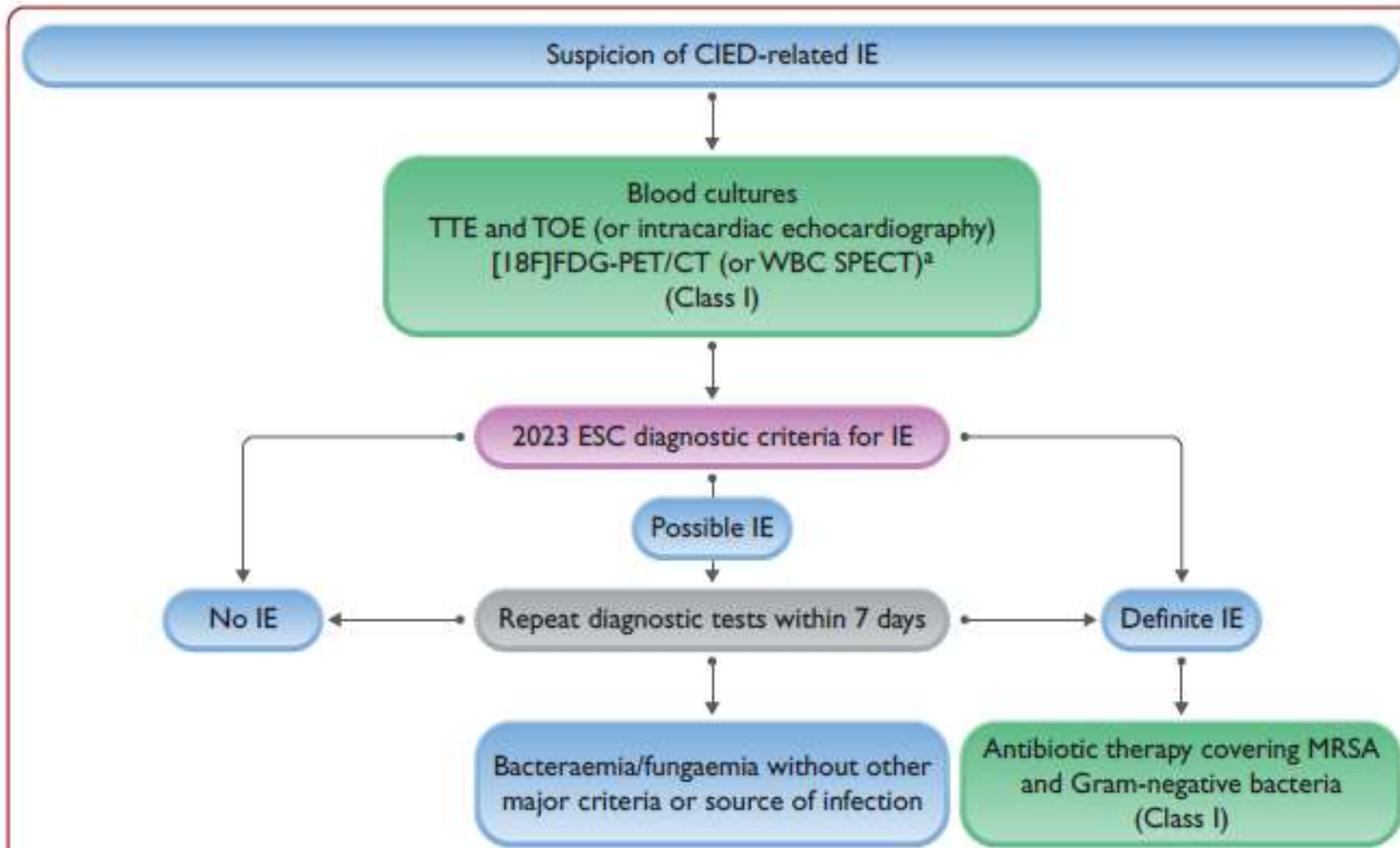


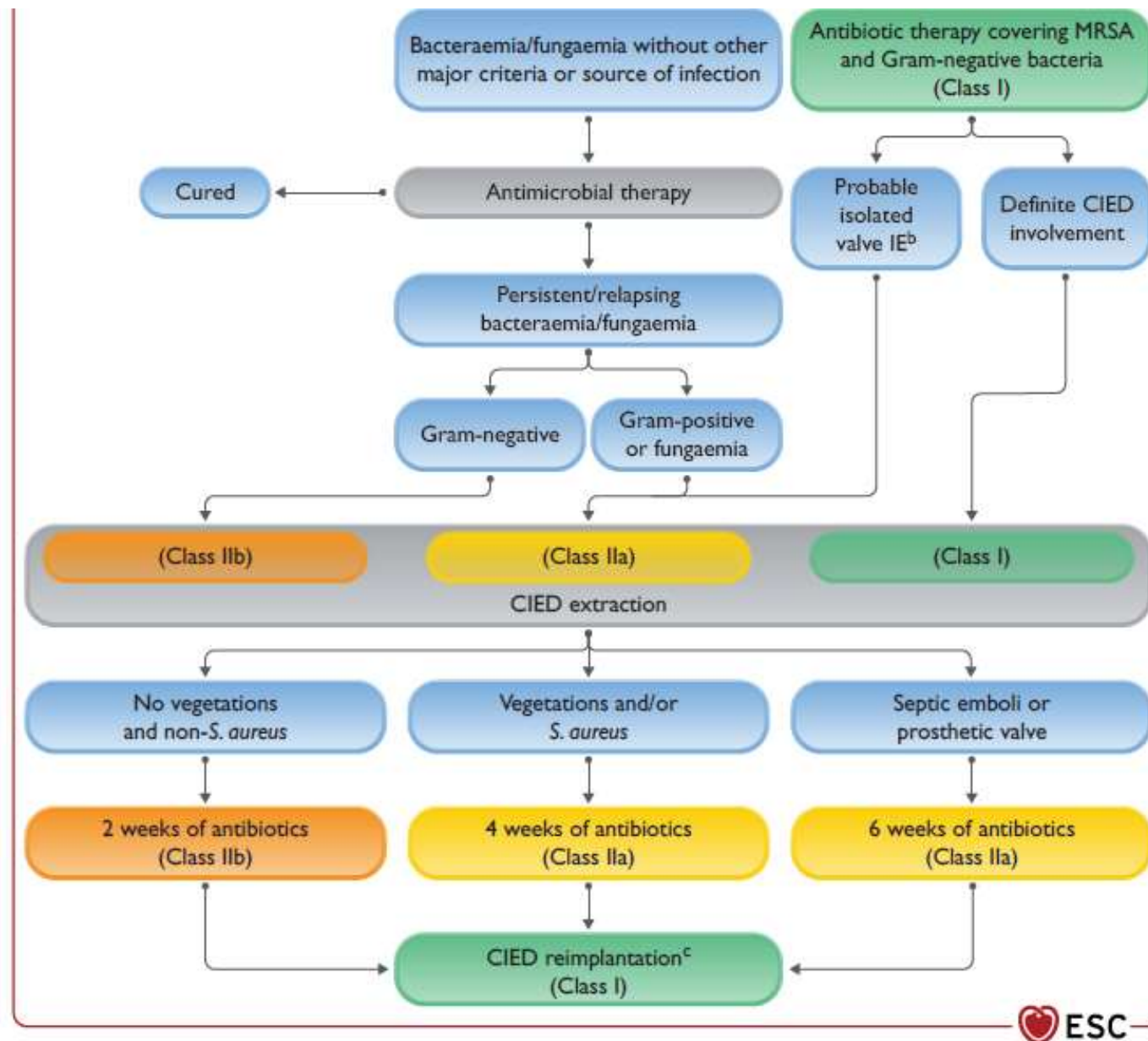
- Definitie: klinische tekenen pocket infectie en/of beeldvorming voldoen aan diagnostische criteria
- Twee mechanismen:
 - Infectie door lokale huidflora patiënt
 - Via bacteriëmie door distale focus
- Vaak CoNS of *s. aureus*

Pacemaker/ICD endocarditis

- Geen bewijs voor AB in pocket achterlaten
- Flucloxacilline of cefazoline 1-2 g i.v. voor ingreep
- AB envelop alleen in hoog risico ingrepen
 - NNT ~200 en duur
- Antibiotica profylaxe niet aangeraden

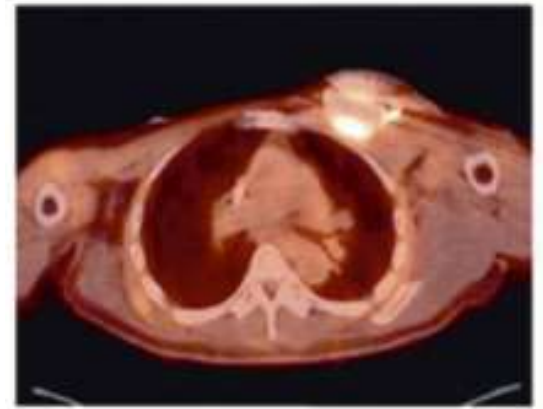




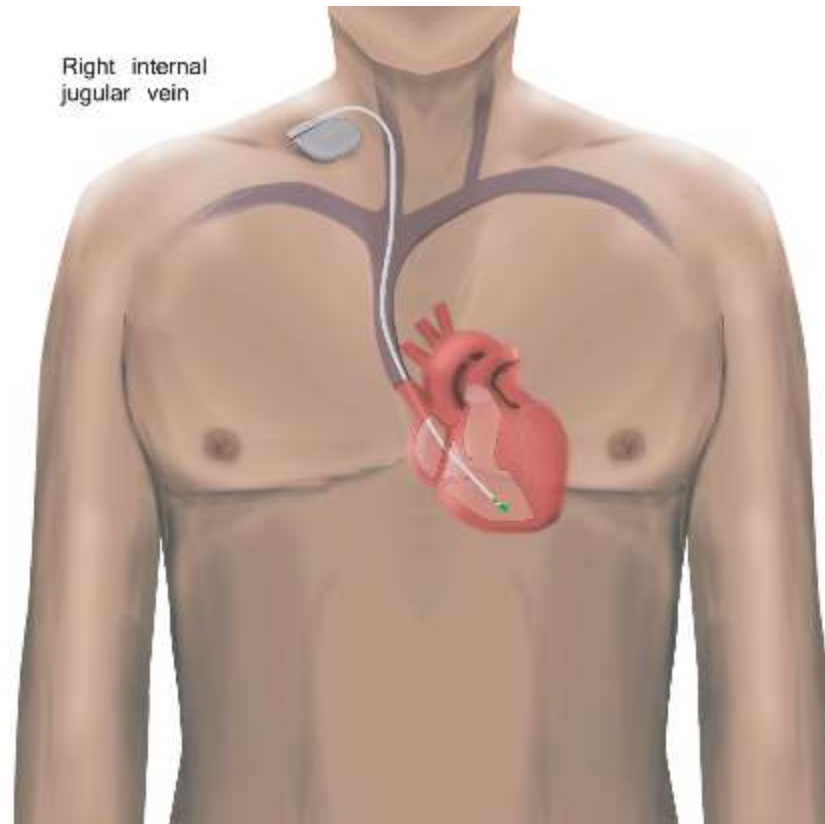


Pacemaker/ICD endocarditis

- Lead en device extractie in expertise centra
 - Niet uitstellen, hoe sneller hoe beter
- Percutaan > chirurgisch
 - Tenzij ook kleppen verwijderd moeten worden
- Hardware op kweek zetten, vooral lead tip
- Reimplantatie afhankelijk van afhankelijkheid van device



Pacemaker/ICD endocarditis

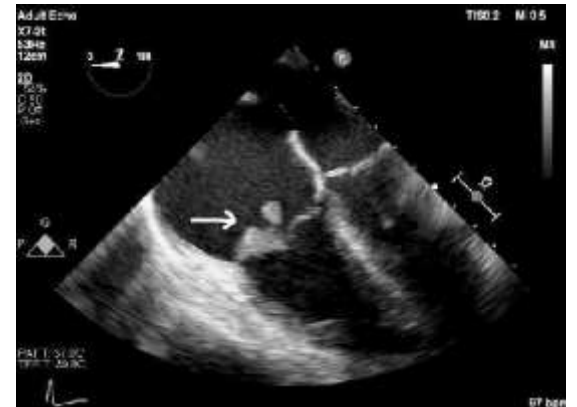


**ESC**European Society
of CardiologyEuropace (2020) 22, 515–516
doi:10.1093/europace/euz246**EHRA CONSENSUS PAPER**

European Heart Rhythm Association (EHRA) international consensus document on how to prevent, diagnose, and treat cardiac implantable electronic device infections—endorsed by the Heart Rhythm Society (HRS), the Asia Pacific Heart Rhythm Society (APHRS), the Latin American Heart Rhythm Society (LAHRS), International Society for Cardiovascular Infectious Diseases (ISCVID) and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS)

Rechtszijdige endocarditis

- ~ 5-10% van alle endocarditis
- Vaak bij congenitale aandoeningen of veneuze katheters
- Naast koorts/bacteriemie vaak pulmonale klachten
 - Hoesten, thoracale pijn, hemoptoe
- Relatief goede prognose
- Reageert goed op antibiotische behandeling
 - 90%
 - Operatie indien AB faalt



Take home messages



- Operatie als er sprake is van hartfalen, ongecontroleerde infectie, voorkomen septische embolie
- Ingreep vaak binnen 3-5 dagen, maar <24 uur als cardiogene shock
- Operatie niet uitstellen bij patiënten met ischemisch CVA

Lokale praktijken?

- VieCuri Venlo
- Maastricht UMC+
- Zuyderland Heerlen/Sittard



Samenvatting