

Kommentarer til DCS endorsement af "2023 ESC Guidelines for the management of endocarditis ESC Clinical Practice Guidelines"

Der har været nedsat en gruppe på 20 personer med bred geografisk repræsentation fra arbejdsgrupperne for henholdsvis DCS imaging, arytmie og medfødte hjertesygdomme og fra infektionsmedicinsk, mikrobiologisk og thoraxkirurgisk selskaber. Efter grundig intern diskussion og efterfølgende fremlæggelse for DCS's medlemmer endorses denne nye ESC guidelines med følgende generelle og specifikke kommentarer.

Egenskab	Navn	Arbejdssted
Formand	Emil Fosbøl	RH
Imaging	Jonas A Povlsen	AUH
	Marlene Tofterup	OUH
	Niels Eske Bruun	Roskilde
	Henning Bundgaard	RH
	Kristina Procida	Roskilde
	Vibeke Guldbrand Rasmussen	Vejle
	Ulrik Christensen	Ålborg
	Kasper Iversen	Herlev
Arytmi	Jens Brock Johansen	Odense
Medfødte hjertesygdomme	Annette Schophuus Jensen	RH
	Mathis Gröning	RH
Infektionsmedicin	Jannik Helweg-Larsen	RH
	Daniel Faurholdt	RH
	Hanne Arildsen	AUH
Mikrobiologi	Claus Moser	RH
	Flemming Rosenvinge	OUH
	Lars Erik Lemming	AUH
Thoraxkirurgi	Morten Smerup	RH
	Ivy Susanne Modrau	AUH

Generelle kommentarer

- 2023 guidelines følger i bred forstand formatet fra de sidste 2015 guidelines. Der er tilkommet en del nye flow charts og især rekommandationer for per oral behandling og CIED-endokarditis er tilføjet/udbygget.
- Evidensen er sparsom for en del af rekommandationerne og der er afvigelser fra Europæiske forhold til danske forhold hvorfor vi flere gange henviser til den danske behandlingsvejledning for endokarditis. Dette er især gældende for valg og brug af antibiotika.

Kapitel 3: Prevention

Risiko grupper:

Høj risiko: Tidligere IE, klap protese, kongenit hjertesygdom, LVAD (destination terapi)

General prevention measures to be followed in patients at high and intermediate risk for 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

DCS kommentar:

Endorses af DCS

Recommendations for antibiotic prophylaxis in patients with cardiovascular diseases undergoing oral procedures at increased risk for IE

Recommendations	Class	Level
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.	I	B
Antibiotic prophylaxis is recommended in patients with surgically implanted prosthetic valves and with any material used for surgical cardiac valve repair.	I	C
Antibiotic prophylaxis is recommended in patients with transcatheter implanted aortic and pulmonary valvular prostheses.	I	C
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
Antibiotic prophylaxis is recommended in patients with ventricular assist devices.	I	C
Antibiotic prophylaxis should be considered in patients with transcatheter mitral and tricuspid valve repair.	IIa	C
Antibiotic prophylaxis may be considered in recipients of heart transplant.	IIb	C
Antibiotic prophylaxis is not recommended in other patients at low risk for IE.	III	C

DCS kommentar:

Endorses af DCS

Det bemærkes, at vi i Danmark vil holde os til at anbefale antibiotika profylakse 6 måneder efter intrakardiel device behandling (PFO, ASD, LAA lukning, MitraClip etc). Der henvises til den nationale behandlings vejledning for endokarditis

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	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	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.	

DCS kommentar:

Endorses af DCS

Det understreges at børn her betragtes som 12 år og under.

Det foreslås at dosis for Doxycyclin er 200 mg og ikke 100 mg

En del af de nævnte præparater bruges ikke i Danmark og derfor henvises til den danske behandlingsvejledning for endokarditis

Recommendations for infective endocarditis prevention in high-risk patients



Recommendations	Class	Level
Antibiotic prophylaxis is recommended in dental extractions, oral surgery procedures, and procedures requiring manipulation of the gingival or periapical region of the teeth.	I	B
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

DCS kommentar:

Endorses af DCS

Vi understreger, at lokal bedøvelse i tandkødet—i et ikke inficeret område—ikke anses som gingival manipulation og derfor ikke skal give anledning AB profylakse.

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

Education of high-risk patients to prevent infective endocarditis

- Maintain good dental hygiene**
 - Use dental floss daily
 - Brush teeth morning and evening
 - See your dentist for regular check-ups
- Maintain good skin hygiene**
 - Minimize risk of skin lesions
 - In case of lesions, observe for signs of infection (redness, swelling, tenderness, puss)
 - Avoid tattoos and piercings
- Be mindful of infections**
 - If experiencing fever for no obvious reason, contact your doctor, and discuss appropriate action based on your risk of endocarditis
- Do not self prescribe antibiotics**
- Show this card to your doctors before any interventions**

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DCS kommentar:
Endorses af DCS

Recommendations for infective endocarditis prevention in cardiac procedures



Recommendations	Class	Level
Pre-operative screening for nasal carriage of <i>S. aureus</i> is recommended before elective cardiac surgery or transcatheter valve implantation to treat carriers.	I	A
Peri-operative antibiotic prophylaxis is recommended before placement of a CIED.	I	A
Optimal pre-procedural aseptic measures of the site of implantation is recommended to prevent CIED infections.	I	B
Periprocedural antibiotic prophylaxis is recommended in patients undergoing surgical or transcatheter implantation of a prosthetic valve, intravascular prosthetic, or other foreign material.	I	B
Surgical standard aseptic measures are recommended during the insertion and manipulation of catheters in the catheterization laboratory environment.	I	C
Elimination of potential sources of sepsis (including of dental origin) should be considered ≥ 2 weeks before implantation of a prosthetic valve or other intracardiac or intravascular foreign material, except in urgent procedures.	IIa	C
Antibiotic prophylaxis covering for common skin flora including <i>Enterococcus</i> spp. and <i>S. aureus</i> should be considered before TAVI and other transcatheter valvular procedures.	IIa	C
Systematic skin or nasal decolonization without screening for <i>S. aureus</i> is not recommended.	III	C

DCS kommentar:

Endorses af DCS, dog ikke anbefaling nr 1 i tabellen.

Det bemærkes at der ikke screenes for *S. aureus* bærertilstand i Danmark og at vi ikke ser evidensen stærk nok til at ændre praksis. Især fordi der gives profylakse ved operation.

Kapitel 4: Endokarditis team

Members of the Endocarditis Team



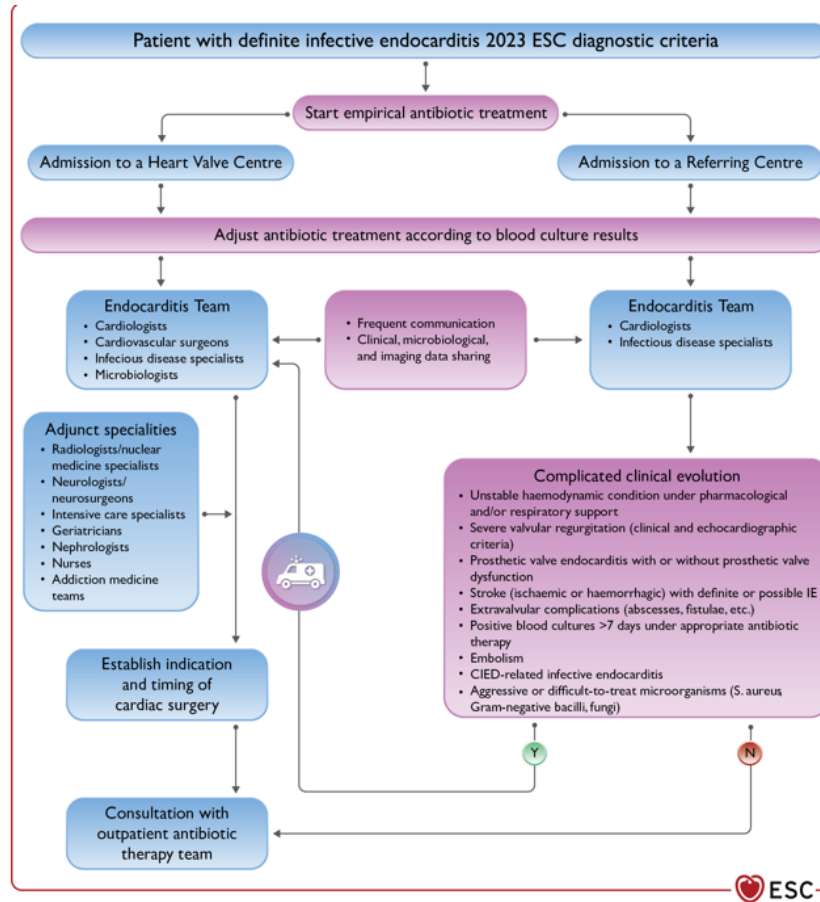
	Heart valve centre
Core members	<ul style="list-style-type: none">• Cardiologists• <u>Cardiac imaging experts</u>• <u>Cardiovascular surgeons</u>• <u>Infectious disease specialist</u> (or <u>internal medicine specialist with expertise in infectious diseases</u>)• <u>Microbiologist</u>• <u>Specialist in outpatient parenteral antibiotic treatment</u>
Adjunct specialities	<ul style="list-style-type: none">• <u>Radiologist and nuclear medicine specialist</u>• <u>Pharmacologist</u>• <u>Neurologist and neurosurgeon</u>• <u>Nephrologist</u>• <u>Anaesthesiologists</u>• <u>Critical care</u>• <u>Multidisciplinary addiction medicine teams</u>• <u>Geriatricians</u>• <u>Social worker</u>• <u>Nurses</u>• <u>Pathologist</u>

DCS kommentar:

Endorses af DCS

Det bemærkes at en OPAT ekspert ikke er relevant i Danmark.

Figure 3
Management of patients with infective endocarditis: positioning of the Endocarditis Team



DCS kommentar:

Endorses af DCS

Vi vil gerne understrege, at der i Danmark ikke er tilstande hvor der er tvunget overflytning af patient til HSE. Dette vil altid foregå i tæt samarbejde og konference mellem IE-satellit og HSE.

Recommendations for the Endocarditis Team



Recommendations	Class	Level
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.	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.	I	B

DCS kommentar:

Endorses af DCS

Vi vil gerne understrege, at der i Danmark ikke er tilstande hvor der er tvunget overflytning af patient til HSE. Dette vil altid foregå i tæt samarbejde og konference mellem IE-satellit og HSE.

Kapitel 5: diagnose

Investigation of rare causes of blood culture-negative infective endocarditis



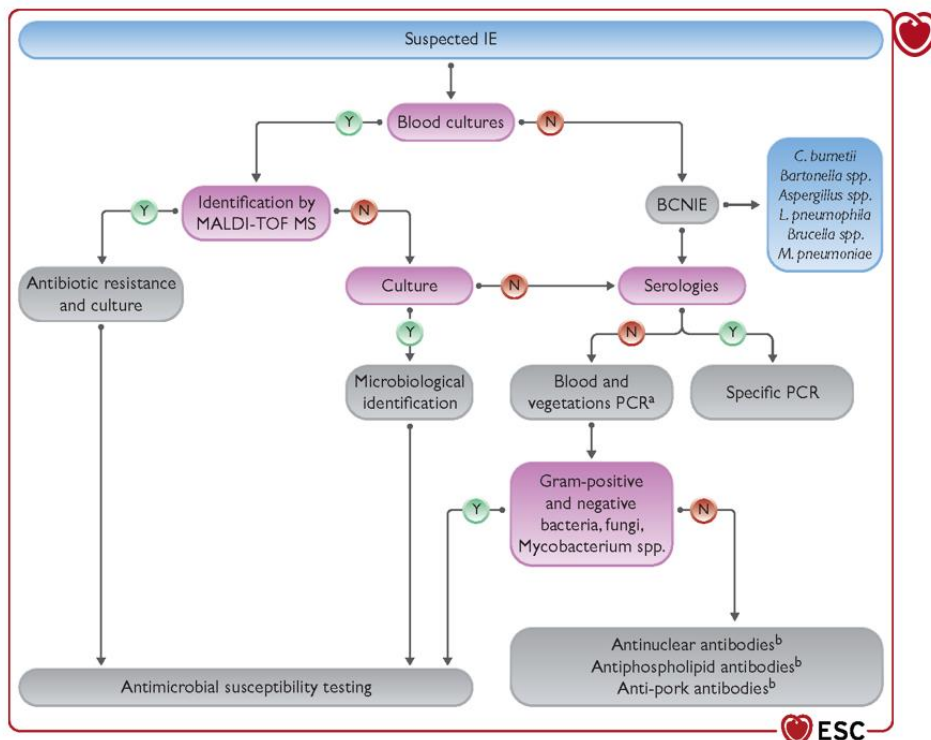
<u>Pathogen</u>	<u>Diagnostic procedures</u>
<i>Brucella</i> spp.	Serology, blood cultures, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>C. burnetii</i>	Serology (IgG phase I >1:800), tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>Bartonella</i> spp.	Serology (IgG phase I >1:800), blood cultures, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>T. whipplei</i>	Histology and 16S rRNA sequencing of tissue
<i>Mycoplasma</i> spp.	Serology, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>Legionella</i> spp.	Serology, blood cultures, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
Fungi	Serology, blood cultures, 18S rRNA sequencing of tissue
Mycobacteria (including <i>Mycobacterium chimaera</i>)	Specific blood cultures, 16S rRNA sequencing of tissue

DCS kommentar:

Endorses IKKE af DCS

Det bemærkes at tabellen er overfladisk i detaljegraden og enkelte steder faktisk forkert. Dyrknings negativ endokarditis skal i Danmark udredes i tæt samarbejde med endokarditis team. Se i stedet den danske nationale behandlingsvejledning.

Figure 4
Microbiological diagnostic algorithm in culture-positive and culture-negative infective endocarditis



DCS kommentar:

Endorses af DCS

Det bemærkes, at ikke alle elementer af figuren er mulig/logisk at følge i en dansk kontekst. Udredning af dyrknings negativ IE skal foregå struktureret i endokarditis team sammenhæng. Der henvises til den danske behandlingsvejledning for endokarditis

Recommendations	Class	Level
A. Diagnosis		
TTE is recommended as the first-line imaging modality in suspected IE.	I	B
TOE is recommended in all patients with clinical suspicion of IE and a negative or non-diagnostic TTE.	I	B
TOE is recommended in patients with clinical suspicion of IE, when a prosthetic heart valve or an intracardiac device is present.	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.	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.	I	C
Performing an echocardiography should be considered in <i>S. aureus</i> , <i>E. faecalis</i> , and some <i>Streptococcus</i> spp. bacteraemia.	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).	I	B
TOE is recommended when patient is stable before switching from intravenous to oral antibiotic therapy.	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, and initial response to therapy.	IIa	B
C. Intra-operative echocardiography		
Intra-operative echocardiography is recommended in all cases of IE requiring surgery.	I	C
D. Following completion of therapy		
TTE and/or TOE are recommended at completion of antibiotic therapy for evaluation of cardiac and valve morphology and function in patients with IE who did not undergo heart valve surgery.	I	C

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DCS kommentar:

Endorses af DCS

Vi mener, at man i særlige tilfælde kan udføre TTE fremfor TEE ved skift til per oral behandling, men TEE er udgangspunktet

Recommendations for the role of computed tomography, nuclear imaging, and magnetic resonance in infective endocarditis (1)



Recommendations	Class	Level
Cardiac CTA is recommended in patients with possible NVE to detect valvular lesions and confirm the diagnosis of IE.	I	B
[18F]FDG-PET/CT(A) and cardiac CTA are recommended in possible PVE to detect valvular lesions and confirm the diagnosis of IE.	I	B
Cardiac CTA is recommended in NVE and PVE to diagnose paravalvular or periprosthetic complications if echocardiography is inconclusive.	I	B
Brain and whole-body imaging (CT, [18F]FDG-PET/CT, and/or MRI) are recommended in symptomatic patients with NVE and PVE to detect peripheral lesions or add minor diagnostic criteria.	I	B
WBC SPECT/CT should be considered in patients with high clinical suspicion of PVE when echocardiography is negative or inconclusive and when PET/CT is unavailable.	IIa	C
[18F]FDG-PET/CT(A) may be considered in possible CIED-related IE to confirm the diagnosis of IE.	IIb	B
Brain and whole-body imaging (CT, [18F]FDG-PET/CT, and MRI) in NVE and PVE may be considered for screening of peripheral lesions in asymptomatic patients.	IIb	B

DCS kommentar:

Endorses af DCS

Det bemærkes, at vi ikke foreslår at hjerte CT skal benyttes ved "possible nativ klap IE" for at afklare diagnosen; men det kan overvejes.

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)

(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

DCS kommentar:

Endorses af DCS

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



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:

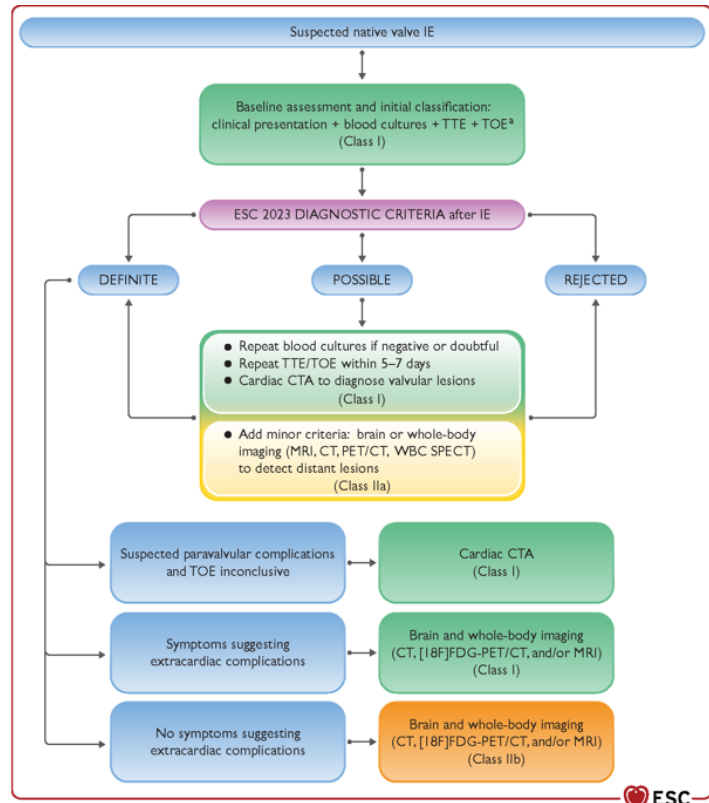
- Does not meet criteria for definite or possible at admission with or without a firm alternative diagnosis

DCS kommentar:

Endorses af DCS

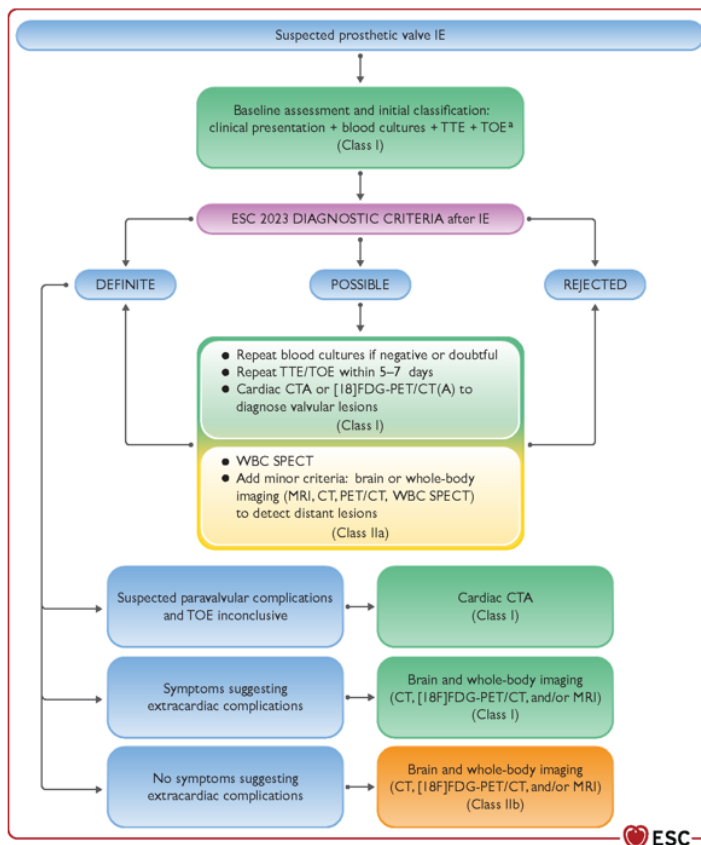
Det bemærkes at der kun kan tælle 1 point for hvert minor kriterium. Validerings artikler ventes.

Figure 5
European Society of
Cardiology 2023
algorithm for
diagnosis of native
valve infective
endocarditis



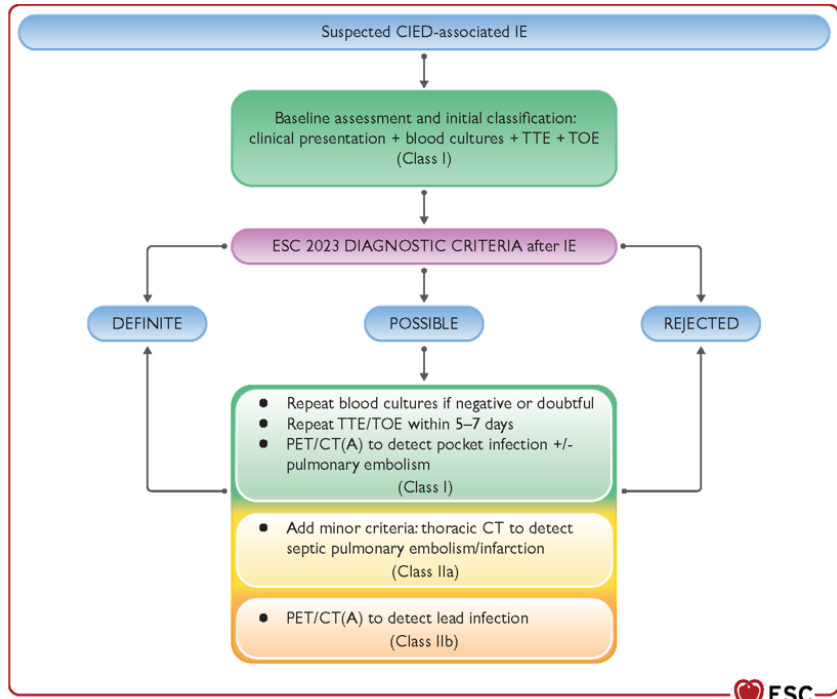
DCS kommentar:
 Endorses af DCS

Figure 6
European Society of
Cardiology 2023
algorithm for
diagnosis of
prosthetic valve
infective endocarditis



DCS kommentar:
 Endorses af DCS

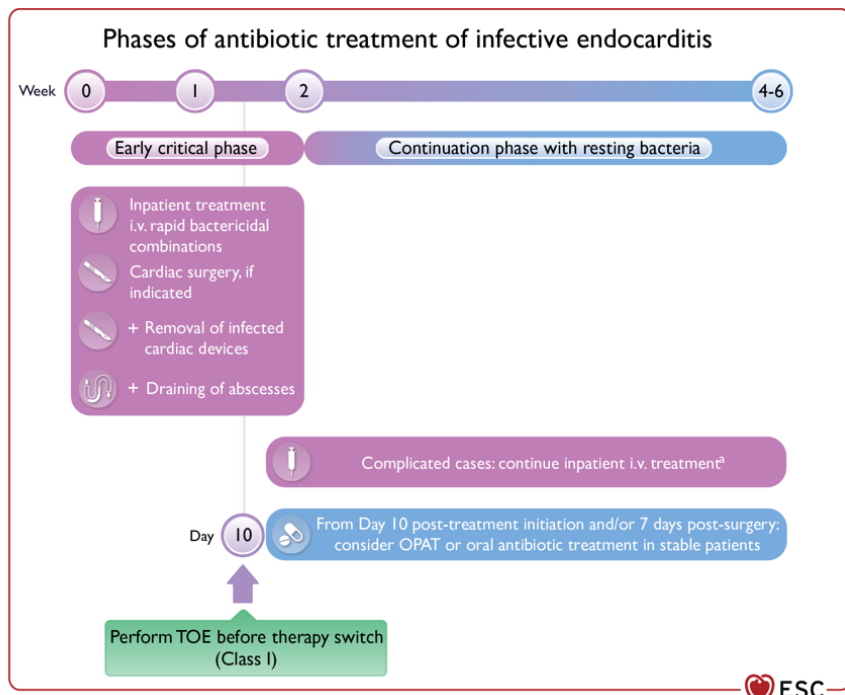
Figure 7
European Society of
Cardiology 2023
algorithm for
diagnosis of cardiac
device-related
infective endocarditis



DCS kommentar:
 Endorses af DCS

Figure 8

Phases of antibiotic treatment for infective endocarditis in relation to outpatient parenteral antibiotic therapy and partial oral endocarditis treatment



DCS kommentar:

Endorses af DCS

Det understreges at "combinations" i iv fasen ikke er ment som kombination af flere iv AB

Tabel 7, 8, 9 omhandler specifik antibiotisk behandling af streptokok, stafylokok og enterokok endokarditis og er lange tabeller. Tabel 11 omhandler antibiotika behandling af sjældne agens. Se venligst ESC dokumentet

DCS kommentar:

Endorses af DCS

Det bemærkes at evidensen for de forskellige regimer er sparsom. Behandlingen beror på vurdering af den individuelle patient i endokarditis teamet. Vi gør opmærksom på, at balancen mellem effekt og bivirkninger skal holdes for øje, herunder særligt nefrotoksicitet. Der henvises til den danske nationale behandlingsvejledning tilpasset danske forhold.

Recommendations for antibiotic regimens for initial empirical treatment of infective endocarditis (before pathogen identification)



Recommendations	Class	Level
In patients with community-acquired NVE or late PVE (≥ 12 months post-surgery), ampicillin in combination with ceftriaxone or with (flu)cloxacillin and gentamicin should be considered using the following doses: <i>Adult antibiotic dosage and route</i>	IIa	C
Ampicillin 12 g/day i.v. in 4–6 doses		
Ceftriaxone 4 g/day i.v. or i.m. in 2 doses		
(Flu)cloxacillin 12 g/day i.v. in 4–6 doses		
Gentamicin 3 mg/kg/day i.v. or i.m. in 1 dose		
<i>Paediatric antibiotic dosage and route</i>		
Ampicillin 300 mg/kg/day i.v. in 4–6 equally divided doses		
Ceftriaxone 100 mg/kg i.v. or i.m. in 1 dose		
(Flu)cloxacillin 200–300 mg/kg/day i.v. in 4–6 equally divided doses		
Gentamicin 3 mg/kg/day i.v. or i.m. in 3 equally divided doses		
In patients with early PVE (< 12 months post-surgery) or nosocomial and non-nosocomial healthcare-associated IE, vancomycin or daptomycin combined with gentamicin and rifampin may be considered using the following doses: <i>Adult antibiotic dosage and route</i>	IIb	C
Vancomycin 30 mg/kg/day i.v. in 2 doses		
Daptomycin 10 mg/kg/day i.v. in 1 dose		
Gentamicin 3 mg/kg/day i.v. or i.m. in 1 dose		
Rifampin 900–1200 mg i.v. or orally in 2 or 3 doses		
<i>Paediatric antibiotic dosage and route</i>		
Vancomycin 40 mg/kg/day i.v. in 2–3 equally divided doses		
Gentamicin 3 mg/kg/day i.v. or i.m. in 3 equally divided doses		
Rifampin 20 mg/kg/day i.v. or orally in 3 equally divided doses		
Allergy to beta-lactams		
In patients with community-acquired NVE or late PVE (≥ 12 months post-surgery) who are allergic to penicillin, cefazolin, or vancomycin in combination with gentamicin may be considered using the following doses: <i>Adult antibiotic dosage and route</i>		
Cefazolin 6 g/day i.v. in 3 doses		
Vancomycin 30 mg/kg/day i.v. in 2 doses		
Gentamicin 3 mg/kg/day i.v. or i.m. in 1 dose		
<i>Paediatric antibiotic dosage and route</i>		
Cefazolin 6 g/day i.v. in 3 doses		
Vancomycin 40 mg/kg/day i.v. in 2–3 equally divided doses		
Gentamicin 3 mg/kg/day i.v. or i.m. in 3 equally divided doses		

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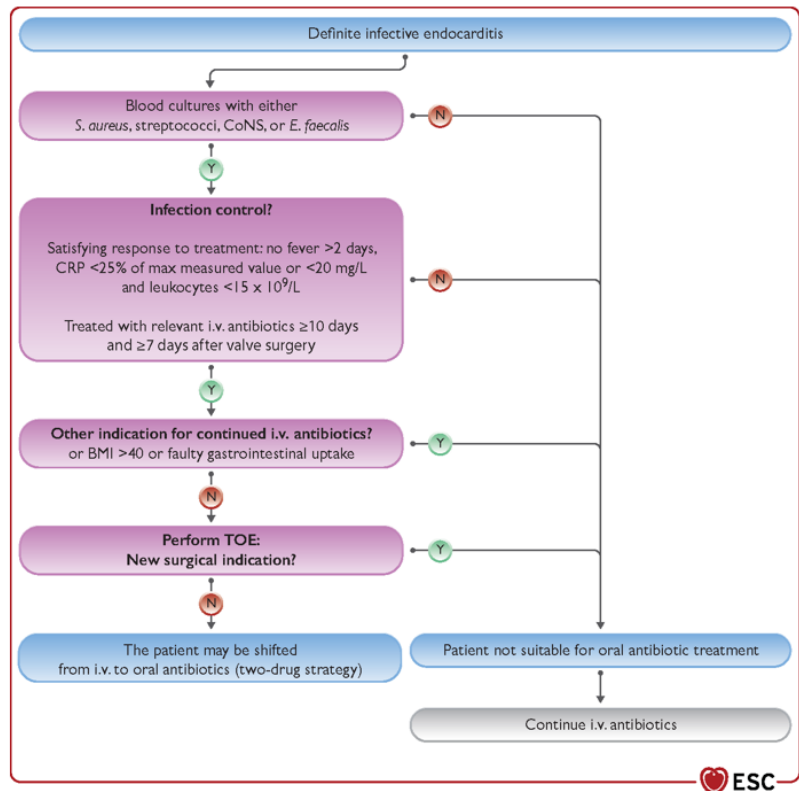
DCS kommentar:

Endorses af DCS

Det bemærkes at evidensen for de forskellige regimer er sparsom. Behandlingen beror på vurdering af den individuelle patient i endokarditis teamet. Vi gør opmærksom på, at balancen mellem effekt og

bivirkninger skal holdes for øje, herunder særligt nefrotoksicitet. Der henvises til den danske nationale behandlingsvejledning tilpasset danske forhold.

Figure 9
Flowchart to assess clinical stability based on the Partial Oral Treatment of Endocarditis trial



DCS kommentar:
 Endorses af DCS

Recommendations for outpatient antibiotic treatment of infective endocarditis



Recommendations	Class	Level
Outpatient parenteral or oral antibiotic treatment should be considered in patients with left-sided IE caused by <i>Streptococcus</i> spp., <i>E. faecalis</i> , <i>S. aureus</i> , or CoNS who were receiving appropriate i.v. antibiotic treatment for at least 10 days (or at least 7 days after cardiac surgery), are clinically stable, and who do not show signs of abscess formation or valve abnormalities requiring surgery on TOE.	IIa	A
Outpatient parenteral antibiotic treatment is not recommended in patients with IE caused by highly difficult-to-treat microorganisms, liver cirrhosis (Child-Pugh B or C), severe cerebral nervous system emboli, untreated large extracardiac abscesses, heart valve complications, or other severe conditions requiring surgery, severe post-surgical complications, and PWID-related IE.	III	C

DCS kommentar:

Endorses af DCS

Vi understreger, at per oral behandling er underbygget i et randomiseret studie (POET), men ikke OPAT.

Med afsæt i resultaterne fra POET studiet, mener vi, at per oral behandling ikke kun skal overvejes, men i stedet skal gøres, hvis muligt. Altså svarende til Klasse I indikation.

Kapitel 8: Indications for surgery and management of main infective endocarditis complications

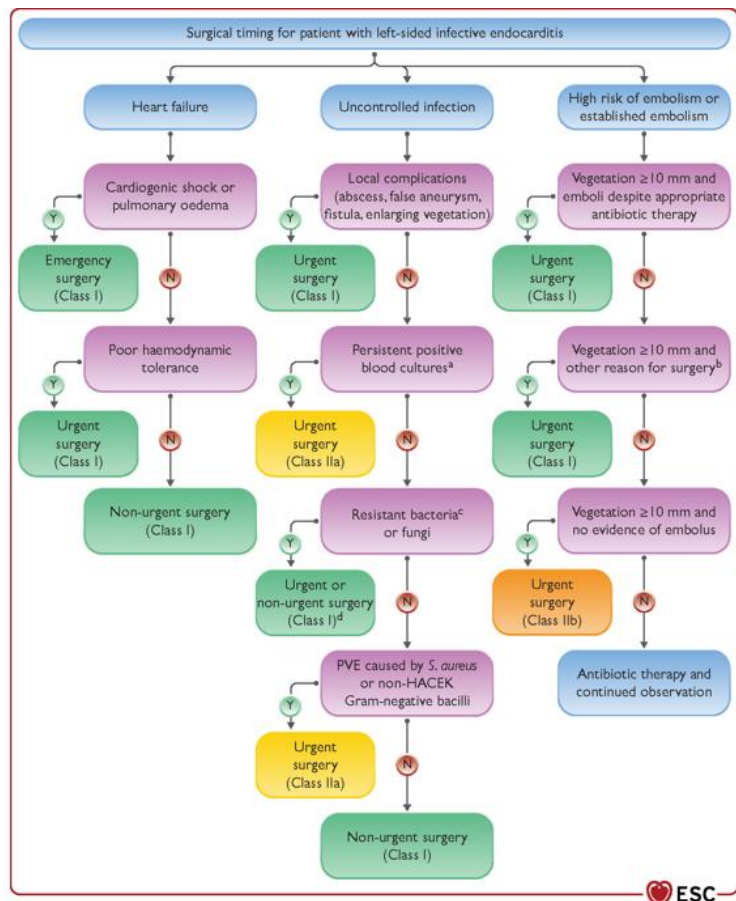
Surgery timing:

Emergency: within 24 hours

Urgent: Within 3–5 days

Non-urgent: Within same hospital admission

Figure 10
Proposed surgical timing for infective endocarditis



DCS kommentar:

Endorses IKKE i den fulde form af DCS:

Vi vil gerne understrege at *S. aureus* ikke anses som en resistent bakterie som afstedkommer operation ved en klasse I indikation. Det samme gælder VRE.

Fodnote C: *S. aureus* (methicillin resistant and non-methicillin resistant), vancomycin-resistant enterococci, non-HACEK Gram-negative bacteria and fungi.

Recommendations for the main indications of surgery in infective endocarditis (native valve endocarditis and prosthetic valve endocarditis)



Recommendations	Class	Level
(i) Heart failure		
Emergency surgery is recommended in aortic or mitral NVE or PVE with severe acute regurgitation, obstruction, or fistula causing refractory pulmonary oedema or cardiogenic shock.	I	B
Urgent 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.	I	B
(ii) Uncontrolled infection		
Urgent surgery is recommended in locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation, prosthetic dehiscence, new AVB).	I	B
Urgent or non-urgent surgery is recommended in IE caused by fungi or multiresistant organisms according to the haemodynamic condition of the patient.	I	C
Urgent 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.	IIa	B
Urgent surgery should be considered in PVE caused by <i>S. aureus</i> or non-HACEK Gram-negative bacteria.	IIa	C
(iii) Prevention of embolism		
Urgent 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.	I	B
Urgent surgery is recommended in IE with vegetation ≥ 10 mm and other indications for surgery.	I	C
Urgent 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.	IIb	B

DCS kommentar:

Endorses af DCS

Her bemærkes det, at ved *S. aureus* PVE anbefales kirurgi som en IIa/LOE C rekommandation. Dette er forskelligt fra Figure 10. Vi vil gerne understrege at *S. aureus* ikke anses som en resistent bakterie, som afstedkommer operation ved en klasse I indikation.

Kapitel 9: Other complications of infective endocarditis

Recommendations for the treatment of neurological complications of infective endocarditis



Recommendations	Class	Level
Brain CT or MRA is recommended in patients with IE and suspected infective cerebral aneurysms.	I	B
Neurosurgery or endovascular therapy is recommended for large aneurysms, those with continuous growth despite optimal antibiotic therapy, and ruptured intracranial infective cerebral aneurysms.	I	C
If non-invasive techniques are negative and the suspicion of infective aneurysm remains, invasive angiography should be considered.	IIa	B
In embolic stroke, mechanical thrombectomy may be considered if the expertise is available in a timely manner.	IIb	C
Thrombolytic therapy is not recommended in embolic stroke due to IE.	III	C

DCS kommentar:

Endorses af DCS.

Vi anbefaler kun brug af CT/MR af hjernen hvis der forekommer symptomer. Det er ikke helt klart for den første anbefaling i tabellen.

Recommendations for pacemaker implantation in patients with complete atrioventricular block and infective endocarditis



Recommendation	Class	Level
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.	IIa	C

<p>DCS kommentar: Endorses af DCS</p>
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Recommendations for patients with musculoskeletal manifestations of infective endocarditis



Recommendations	Class	Level
MRI or PET/CT is recommended in patients with suspected spondylodiscitis and vertebral osteomyelitis complicating IE.	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.	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 <i>S. aureus</i> or <i>Candida</i> spp., and/or complicated with severe vertebral destruction or abscesses.	IIa	C

DCS kommentar:

Endorses af DCS

Recommendations for pre-operative coronary anatomy assessment in patients requiring surgery for infective endocarditis



Recommendations	Class	Level
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.	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.	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.	IIb	C

DCS kommentar:

Endorses af DCS, dog ikke anbefaling nr 2

Vi mener ikke, at det er tvunget at lave invasiv KAG forud for kirurgi og vi endorser IKKE anbefaling nr 2 i denne tabel.

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

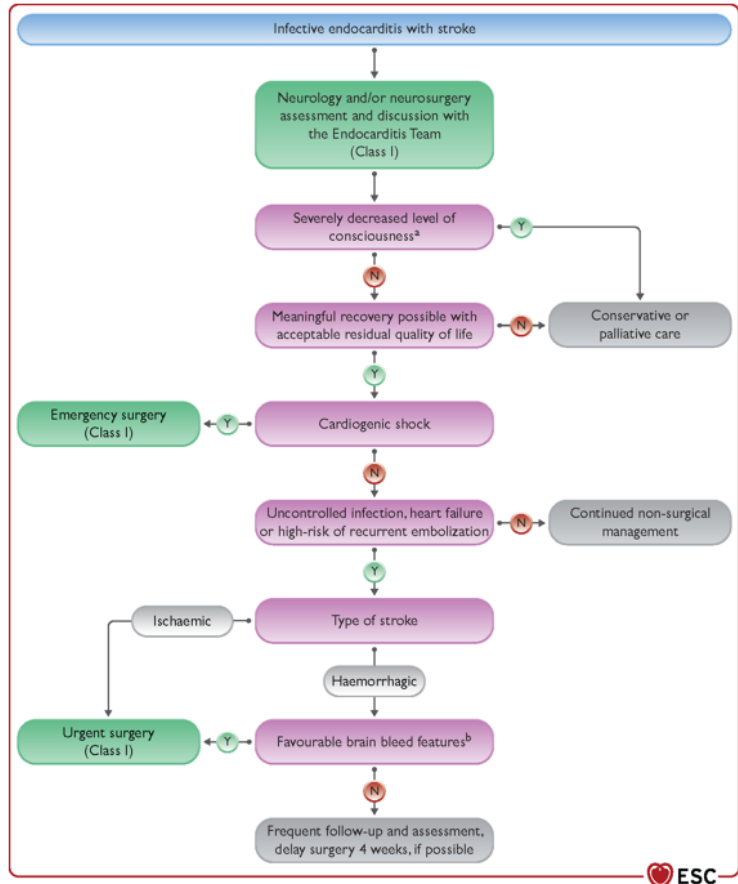


- Early surgery after a recent ischaemic stroke
- Evidence of intracranial bleeding
- Woman of childbearing age
- High likelihood of prolonged mechanical circulatory support
- Advanced age or frailty
- Poor or unknown medical compliance
- Expected complicated and prolonged post-operative course
- Patient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

DCS kommentar:

Endorses af DCS

Figure 11
Surgery for infective endocarditis following stroke



DCS kommentar:
 Endorses af DCS

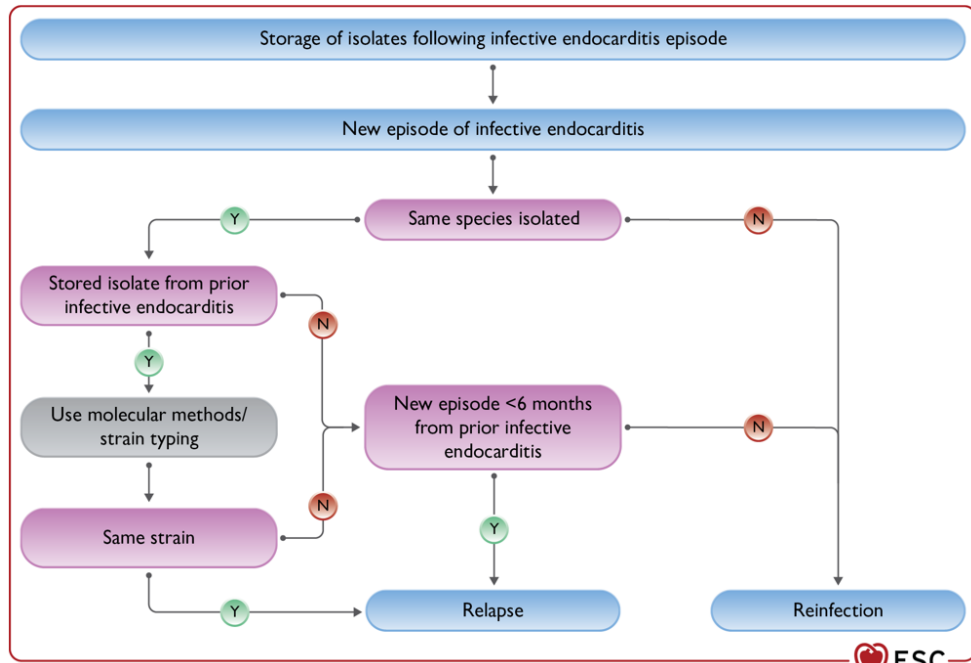
Indications and timing of cardiac surgery after neurological complications in active infective endocarditis



Recommendations	Class	Level
After a transient ischaemic attack, cardiac surgery, if indicated, is recommended without delay.	I	B
After a stroke, surgery is recommended without any delay in the presence of HF, uncontrolled infection, abscess, or persistent high embolic risk, <u>as long as coma is absent</u> and the presence of cerebral haemorrhage has been excluded by cranial CT or MRI.	I	B
Following intracranial haemorrhage, delaying cardiac surgery >1 month, if possible, with frequent reassessment of the patient's clinical condition and imaging should be considered.	IIa	C
In patients with intracranial haemorrhage and unstable clinical status due to HF, uncontrolled infection or persistent high embolic risk, urgent or emergency surgery should be considered weighing the likelihood of a meaningful neurological outcome.	IIa	C

DCS kommentar:
Endorses af DCS

Figure 12
Algorithm
differentiating
relapse from
reinfection



DCS kommentar:

Endorses af DCS

Det bemærkes at typebestemmelse meget sjældent er nødvendig og anbefales derfor ikke som rutine

Recommendations for post-discharge follow-up



Recommendations	Class	Level
Patient education on the risk of recurrence and preventive measures, with emphasis on dental health, and based on the individual risk profile, is recommended during follow-up.	I	C
Addiction treatment for patients following PWID-related IE is recommended.	I	C
Cardiac rehabilitation including physical exercise training should be considered in clinically stable patients based on an individual assessment.	IIa	C
Psychosocial support may be considered to be integrated in follow-up care, including screening for anxiety and depression, and referral to relevant psychological treatment.	IIb	C

DCS kommentar:

Endorses af DCS

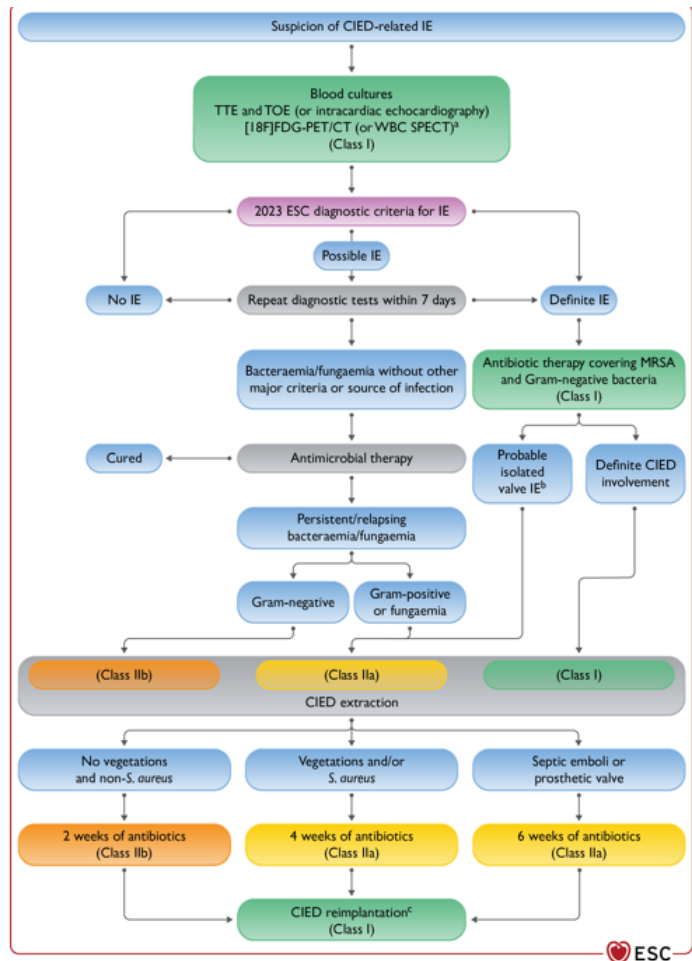
Recommendations for prosthetic valve endocarditis



Recommendation	Class	Level
Surgery is recommended for early PVE (within 6 months of valve surgery) with new valve replacement and complete debridement.	I	C

<p>DCS kommentar: Endorses af DCS</p>
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Figure 13
Management of cardiovascular implanted electronic device-related infective endocarditis



DCS kommentar:
 Endorses til dels af DCS
 Det bemærkes, at der ikke er evidens for at non-S. aureus CIED infektion kræver 4 ugers behandling. Dette endorses ikke og det holdes til 2 ugers behandling, som anført i den danske nationale behandlingsvejledning.

Recommendations for cardiovascular implanted electronic device-related infective endocarditis



Recommendations	Class	Level
Antibiotic prophylaxis covering <i>S. aureus</i> is recommended for CIED implantation.	I	A
TTE and TOE are both recommended in case of suspected CIED-related IE to identify vegetations.	I	B
Complete system extraction without delay is recommended in patients with definite CIED-related IE under initial empirical antibiotic therapy.	I	B
Obtaining at least three sets of blood cultures is recommended before prompt initiation of empirical antibiotic therapy for CIED infection, covering methicillin-resistant staphylococci and Gram-negative bacteria.	I	C
If CIED reimplantation is indicated after extraction for CIED-related IE, it is recommended to be performed at a site distant from the previous generator, as late as possible, once signs and symptoms of infection have abated and until blood cultures are negative for at least 72 h in the absence of vegetations, and negative for at least 2 weeks if vegetations were visualized.	I	C
Complete CIED extraction should be considered in case of valvular IE, even without definite lead involvement, taking into account the identified pathogen and requirement for valve surgery.	IIa	C
In cases of possible CIED-related IE with occult Gram-positive bacteraemia or fungaemia, complete system removal should be considered in case bacteraemia/fungaemia persists after a course of antimicrobial therapy.	IIa	C
Extension of antibiotic treatment of CIED-related endocarditis to (4–6) weeks following device extraction should be considered in the presence of septic emboli or prosthetic valves.	IIa	C
Use of an antibiotic envelope may be considered in select high-risk patients undergoing CIED reimplantation to reduce risk of infection.	IIb	B
In cases of possible CIED-related IE with occult Gram-negative bacteraemia, complete system removal may be considered in case of persistent/relapsing bacteraemia after a course of antimicrobial therapy.	IIb	C
In non- <i>S. aureus</i> CIED-related endocarditis without valve involvement or lead vegetations, and if follow-up blood cultures are negative without septic emboli, 2 weeks of antibiotic treatment may be considered following device extraction.	IIb	C
Removal of CIED after a single positive blood culture, with no other clinical evidence of infection, is not recommended.	III	C

© ESC

DCS kommentar:

Endorses af DCS

Kommentar til rekommandation nr 5: I Danmark er søsat et studie der undersøger tidlig vs sen reimplantation efter CIED infektion. Dette vurderes at være acceptabelt ud fra samlet litteratur og undersøgelsen er godkendt af VEK.

Recommendations for the surgical treatment of right-sided infective endocarditis

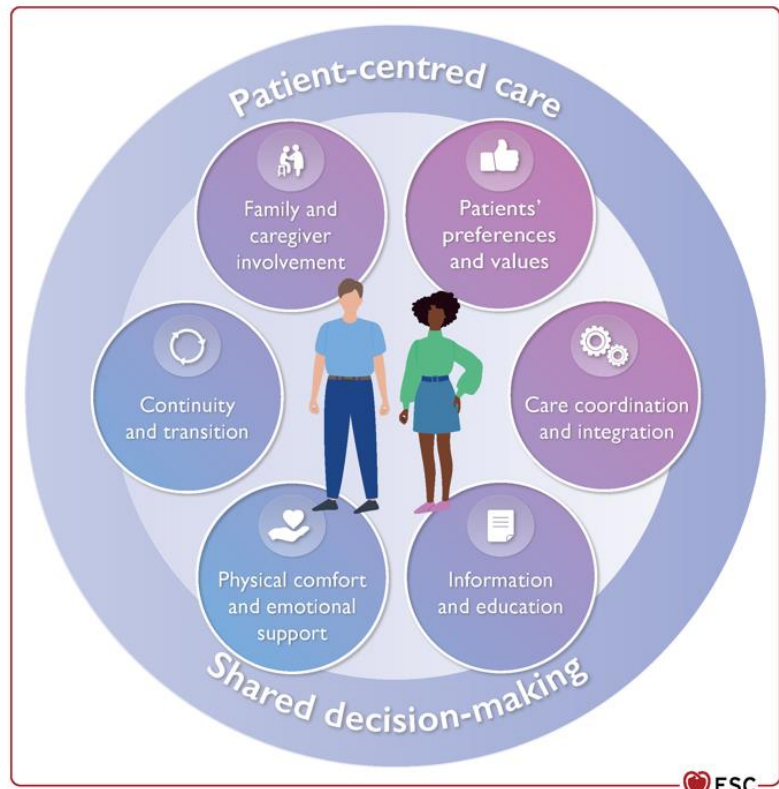


Recommendations	Class	Level
Surgery is recommended in patients with right-sided IE who are receiving appropriate antibiotic therapy for the following scenarios:		
Right ventricular dysfunction secondary to acute severe tricuspid regurgitation non-responsive to diuretics.	I	B
Persistent vegetation with respiratory insufficiency requiring ventilatory support after recurrent pulmonary emboli.	I	B
Large residual tricuspid vegetations (>20 mm) after recurrent septic pulmonary emboli.	I	C
Patients with simultaneous involvement of left-heart structures.	I	C
Surgery is recommended in patients with right-sided IE who are receiving appropriate antibiotic therapy for the following scenarios: (continued)		
Tricuspid valve repair should be considered instead of valve replacement, when possible.	IIa	B
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.	IIa	C
Prophylactic placement of an epicardial pacing lead should be considered at the time of tricuspid valve surgical procedures.	IIa	C
Debulking of right intra-atrial septic masses by aspiration may be considered in selected patients who are high risk for surgery.	IIb	C
Interruption of antiplatelet or anticoagulant therapy is recommended in the presence of major bleeding (including intracranial haemorrhage).	I	C
In patients with intracranial haemorrhage and a mechanical valve, reinitiating unfractionated heparin should be considered as soon as possible following multidisciplinary discussion.	IIa	C
In the absence of stroke, replacement of oral anticoagulant therapy by unfractionated heparin under close monitoring should be considered in cases where indication for surgery is likely (eg. <i>S. aureus</i> IE).	IIa	C
Thrombolytic therapy is not recommended in patients with IE.	III	C

DCS kommentar:

Endorses af DCS

Figure 14
Concept of patient-centred care in infective endocarditis



DCS kommentar:
Endorses af DCS