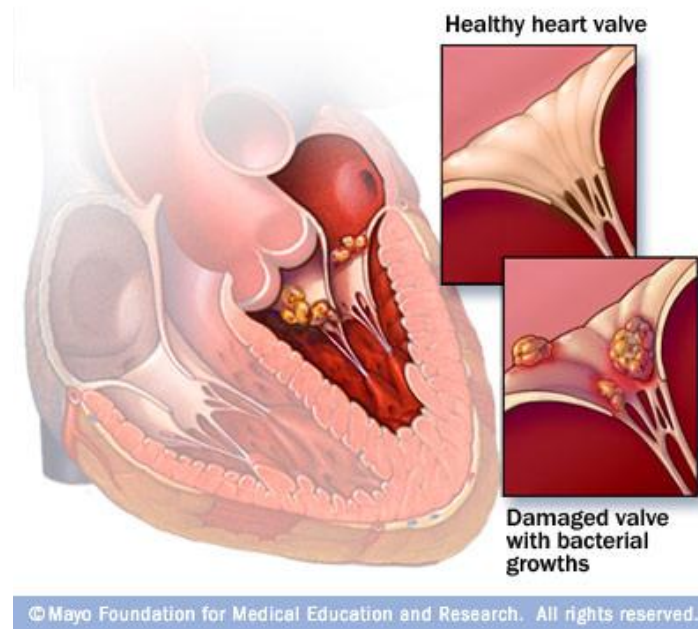


Infekční endokarditida

R.Rokyta,
Kardiologické odd. FN Plzeň, LFUK Plzeň



Předatestační kurs kardiologie
Olomouc 18.10.2017



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ESC GUIDELINES

2015 ESC Guidelines for the management of infective endocarditis

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

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

Authors/Task Force Members: Gilbert Habib* (Chairperson) (France), Patrizio Lancellotti* (co-Chairperson) (Belgium), Manuel J. Antunes (Portugal),

Infekční endokarditida

- Definice a klasifikace, etiologie, patogeneze
- Profylaxe
- Diagnostika
- Prognostická stratifikace
- Terapie
- Specifické situace

Infekční endokarditida

- **Definice** = přítomnost infikovaného trombu (vegetace) na srdeční chlopni nebo endokardu

Epidemiologie

- Incidence 30-100 případů/1000 000 obyvatel ročně,
- M/Ž 2:1
- starší populace, polymorbidita (DM, CHRI) „iatrogenní“, PVE
- device-related
- 50 % u pacientů bez předchozí anamnézy chlopenní vady

Classification and definitions

According to location of infection and absence or presence of intracardiac material

Left-sided native valve IE

Left sided prosthetic valve IE (PVE)

- Early PVE (< 1 year)
- Late PVE (>1 year)

Right-sided IE

Device-related IE

- Permanent pacemaker
- Permanent cardioverter-defibrillator

According to the mode of acquisition

Health care associated IE

- Nosocomial (Hospitalisation >48 h before IE)
- Non nosocomial: IE starting <48 h after admission
 - Home based nursing, IV treatment, Haemodialysis, or IV chemotherapy (<30 days before)
 - Hospitalisation in acute care <90 days before IE
 - Resident in a nursing home or long-term facility

Community-acquired IE

Intravenous drug-abuse IE

Infekční endokarditida - etiologie

- Streptokoky – viridující (dutina ústní, GIT), A,B,C,D,G
- Stafylokoky – S. aureus, KNS (umělé chlopně, pacemaker)
80 % - streptokoky + stafylokoky
- Enterokoky – faecalis n. faecium
- G- bakterie – enterobakterie (E.coli, salmonely, klebsiely)
Pseudomonas aeruginosa
- Candida albicans, Aspergillus
- HACEK – Haemophilus, Actinobacillus, Cardiobacterium,
Eikenella, Kingella
- Coxiella burnetii, Bartonella, Chlamydia, Tropheryma whipplei
(konstantně neg. HK)

Infekční endokarditida - patogeneze

endoteliální léze

obnažená subendokardiální tkáň

trombogeneze

infekce

šíření - lokální

- embolizace

Bakteriémie – invazivní procedury,

- žvýkání, čištění zubů

Infekční endokarditida

Postižení aortální chlopně – subvalvulární absces, píštěl

AV blokáda, kissing vegetace
na mitrální chlopni

**Postižení mitrální chlopně – časté embolizace (CNS,
ledviny, slezina, kůže)**

Pravostranná IE – embolizace – dolní laloky plic



Infekční endokarditida

- Definice a klasifikace, etiologie, patogeneze
- **Profylaxe**
- Diagnostika
- Prognostická stratifikace
- Terapie
- Specifické situace

Risk-benefit analysis

Intermediate risk of IE

- **Risk of IE**

- Occurrence of IE after unprotected dental procedure 1/50,000
- In-hospital death due to IE (20% mortality) 1/250,000

- **Risk of antibiotic prophylaxis**

- Death/anaphylaxis due to amoxicillin 1/75,000

1 death / 250,000

1 death / 75,000

No AB prophylaxis

AB prophylaxis

Risk-benefit analysis

High risk of IE

- **Risk of IE**

- Occurrence of IE after unprotected dental procedure $1/10,000$
- In-hospital death due to IE (20% mortality) $1/50,000$

- **Risk of antibiotic prophylaxis**

- Death/anaphylaxis due to amoxicillin $1/75,000$

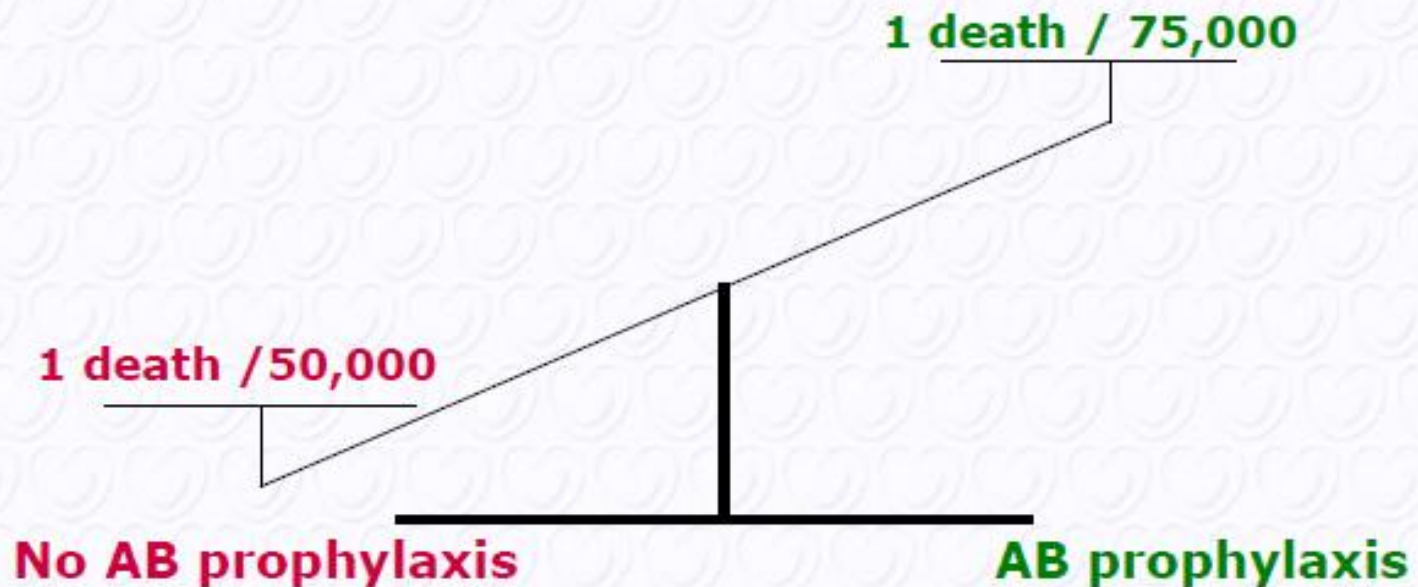


Table 3 Cardiac conditions at highest risk of infective endocarditis for which prophylaxis should be considered when a high-risk procedure is performed

Recommendations	Class ^a	Level ^b
<p>Antibiotic prophylaxis should be considered for patients at highest risk for IE:</p> <p>(1) Patients with any prosthetic valve, including a transcatheter valve, or those in whom any prosthetic material was used for cardiac valve repair.</p> <p>(2) Patients with a previous episode of IE.</p> <p>(3) Patients with CHD:</p> <p>(a) Any type of cyanotic CHD.</p> <p>(b) Any type of CHD repaired with a prosthetic material, whether placed surgically or by percutaneous techniques, up to 6 months after the procedure or lifelong if residual shunt or valvular regurgitation remains.</p>	IIa	C
Antibiotic prophylaxis is not recommended in other forms of valvular or CHD.	III	C

ČKS 2007: bikusp. aortální chlopeč, aortální stenóza, významná MR, AoR

Table 5 Recommendations for prophylaxis of infective endocarditis in the highest-risk patients according to the type of at-risk procedure

Recommendations	Class ^a	Level ^b
A. Dental procedures		
<ul style="list-style-type: none"> Antibiotic prophylaxis should only be considered for dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa <p style="text-align: center;">Scaling, roots</p>	IIa	C
<ul style="list-style-type: none"> Antibiotic prophylaxis is not recommended for local anaesthetic injections in non-infected tissues, treatment of superficial caries, removal of sutures, dental X-rays, placement or adjustment of removable prosthodontic or orthodontic appliances or braces or following the shedding of deciduous teeth or trauma to the lips and oral mucosa 	III	C

Table 6 Recommended prophylaxis for high-risk dental procedures in high-risk patients

Situation	Antibiotic	Single-dose 30–60 minutes before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin or ampicillin ²	2 g orally or i.v.	50 mg/kg orally or i.v.
Allergy to penicillin or ampicillin	Clindamycin	600 mg orally or i.v.	20 mg/kg orally or i.v.

²Alternatively, cephalexin 2 g i.v. for adults or 50 mg/kg i.v. for children, cefazolin or ceftriaxone 1 g i.v. for adults or 50 mg/kg i.v. for children.

Cephalosporins should not be used in patients with anaphylaxis, angio-oedema, or urticaria after intake of penicillin or ampicillin due to cross-sensitivity.

Table 4 Non-specific prevention measures to be followed in high-risk and intermediate-risk patients

These measures should ideally be applied to the general population and particularly reinforced in high-risk patients:

- Strict dental and cutaneous hygiene. Dental follow-up should be performed twice a year in high-risk patients and yearly in the others.
- Disinfection of wounds.
- Eradication or decrease of chronic bacterial carriage: skin, urine.
- Curative antibiotics for any focus of bacterial infection.
- No self-medication with antibiotics.
- Strict infection control measures for any at-risk procedure.
- Discourage piercing and tattooing.
- Limit the use of infusion catheters and invasive procedure when possible. Favour peripheral over central catheters, and systematic replacement of the peripheral catheter every 3–4 days. Strict adherence to care bundles for central and peripheral cannulae should be performed.

The « Endocarditis team »

• Characteristics of the reference centre

1. Immediate access to diagnostic procedures should be possible, including TTE, TOE, multislice CT, MRI, and nuclear imaging.
2. Immediate access to cardiac surgery should be possible during the early stage of the disease, particularly in case of complicated IE
3. Several specialists should be present on site (the “Endocarditis Team”), including at least cardiac surgeons, cardiologists, anaesthesiologists, ID specialists.

Recommendations	Class	Level
Patients with complicated IE should be evaluated and managed at an early stage in a reference centre, with immediate surgical facilities and the presence of a multidisciplinary “Endocarditis Team”, including an ID specialist, a microbiologist, a cardiologist, imaging specialists, a cardiac surgeon, and if needed a specialist in CHD.	IIa	B
For patients with non-complicated IE managed in a non-reference centre, early and regular communication with the reference centre and, when needed, with visit to the reference centre, should be made.	IIa	B

Infekční endokarditida

- Definice a klasifikace, etiologie, patogeneze
- Profylaxe
- Diagnostika
 - 1) Klinika
 - 2) Mikrobiologie
 - 3) Echokardiografie a další zobrazovací metody
- Prognostická stratifikace
- Terapie
- Specifické situace

IE – klinický obraz

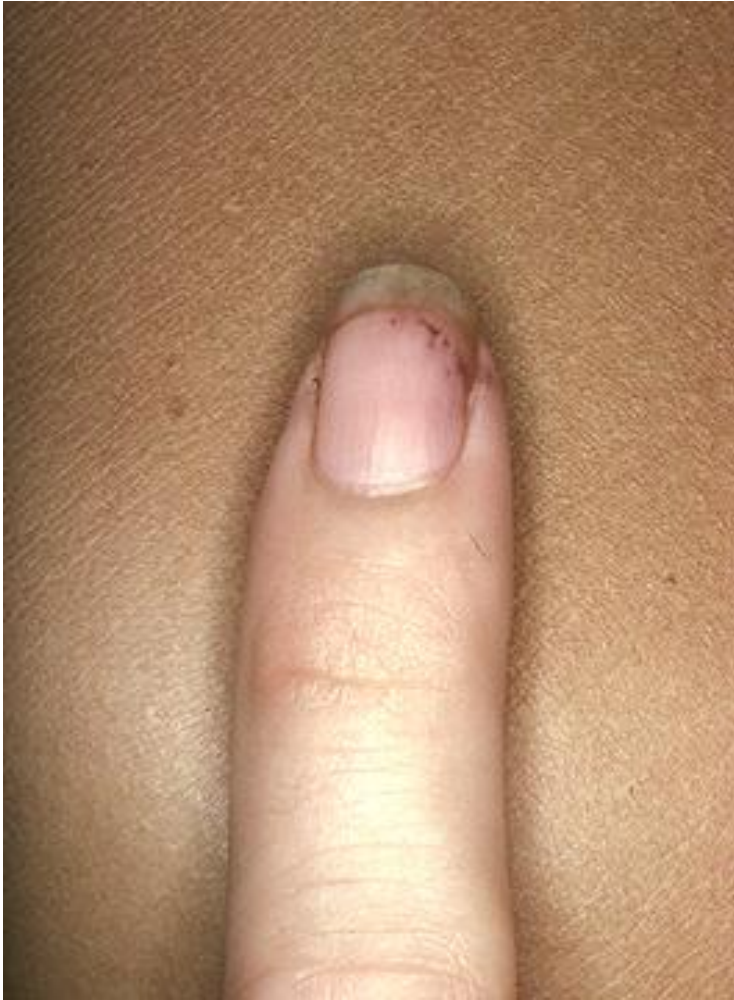
1) Subakutní a chronická

- chřipkové příznaky, subfebrilie, noční pocení
- šelest na srdci, elevace zánětlivých markerů,
- splenomegalie, anémie
- třískové hemorhagie pod nehty
- Oslerovy nodozity, Rothovy skvrny, Janawayovy skvrny

2) Akutní IE

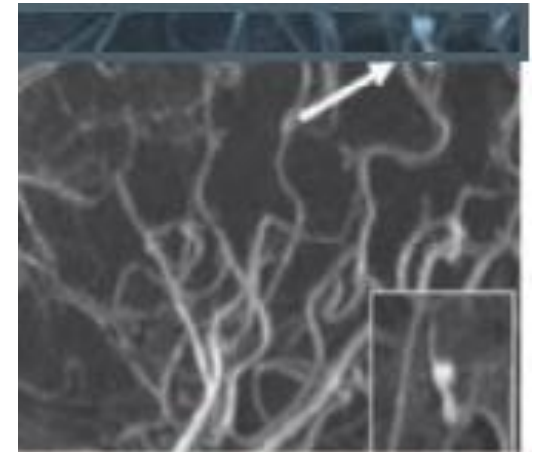
- sepse
- šelest zpočátku chybí
- sklon k embolizacím a septickým metastázám

cca 50 % nový šelest, 20 % zvýrazněný známý šelest



CNS komplikace

- nejčastější extrakardiální komplikace
 - ischemická a hemoragická CMP, TIA
 - nemá embolizace
 - mykotické aneurysma
 - absces mozku, meningitida
-
- velké, mobilní vegetace v mitrální pozici
 - infekce Staph.aureus



IE – mikrobiologická diagnostika

Hemokultivace – 3 x po 30-60 min á 20 ml krve
alespoň 1 anaerobní
před ATB
nezávisle na vzestupu teploty
z periferní žíly

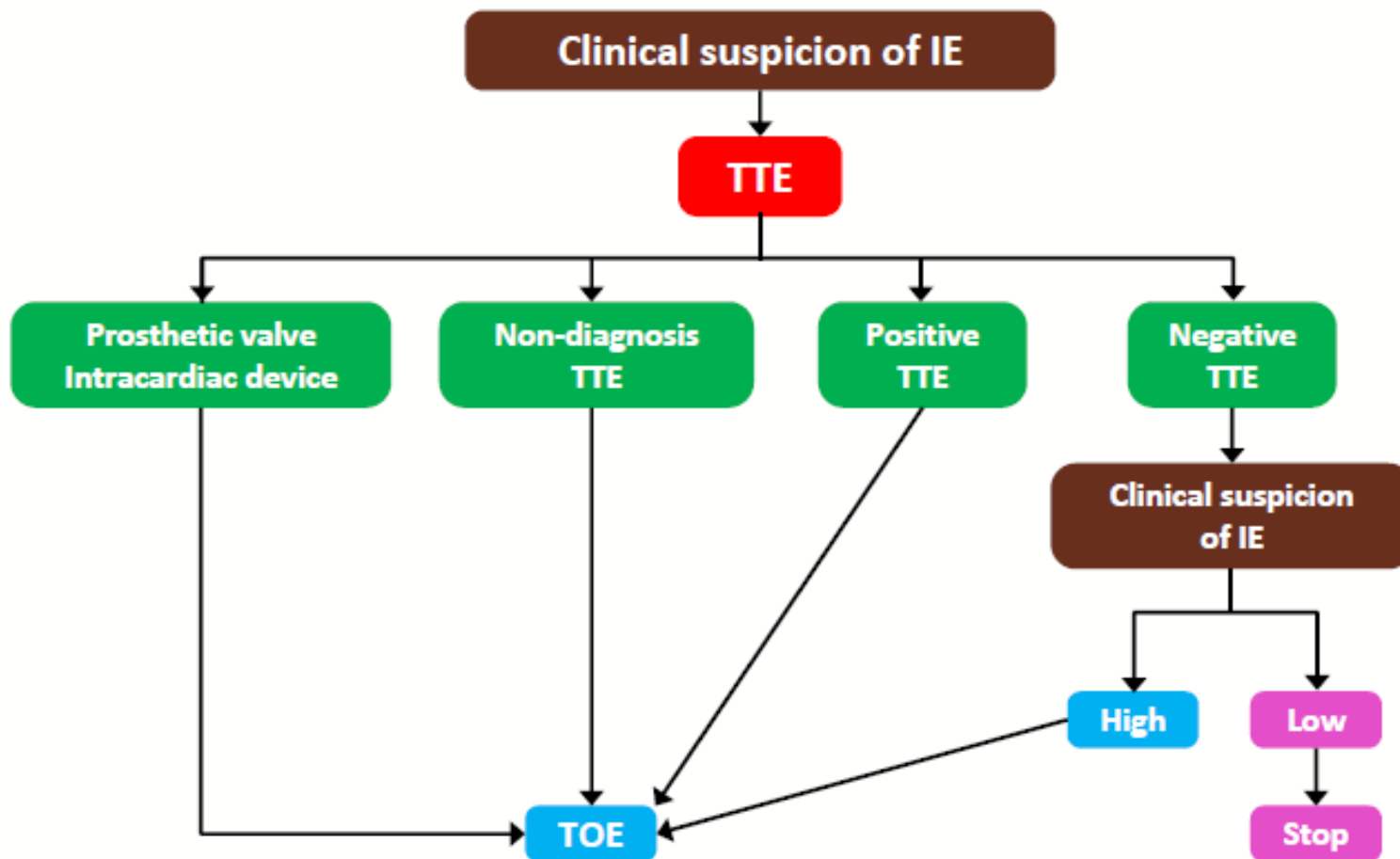
Bakteriální DNA – PCR techniky (operační mat.)

IE s negativní hemokulturoou

Table 12 Investigation of rare causes of blood culture negative infective endocarditis

Pathogen	Diagnostic procedures
<i>Brucella spp.</i>	Blood cultures, serology, culture, immunohistology, and PCR of surgical material.
<i>Coxiella burnetii</i>	Serology (IgG phase I >1:800), tissue culture, immunohistology, and PCR of surgical material.
<i>Bartonella spp.</i>	Blood cultures, serology, culture, immunohistology, and PCR of surgical material.
<i>Tropheryma whipplei</i>	Histology and PCR of surgical material.
<i>Mycoplasma spp.</i>	Serology, culture, immunohistology, and PCR of surgical material.
<i>Legionella spp.</i>	Blood cultures, serology, culture, immunohistology, and PCR of surgical material.
Fungi	Blood cultures, serology, PCR of surgical material.

Varianta: kromě HK ihned náběr serologie



If initial TOE is negative but high suspicion for IE remains, repeat TTE and/or TOE within 5-7 days

Echocardiography should be considered in <i>Staphylococcus aureus</i> bacteraemia.	IIa	B
TOE should be considered in the majority of adult patients with suspected IE, even in cases with positive TTE.	IIa	C

IE – diagnostika

TEE (TTE)

Hlavní: vegetace, perivalvulární absces, dehiscence protězy,

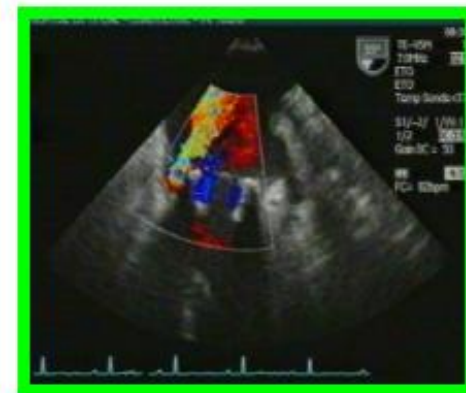
Nepřímé: nově vzniklá regurgitace



vegetation



abscess



*new dehiscence
of prosthetic valve*

FR 47Hz
17cm

2D
54%
C 50
P Low
HGen

G
P R
1.7 3.4



FR 16Hz
17cm

2D
52%
C 50
P Low
HGen
CF
67%
2.5MHz
WF High
Med

G
P R
1.7 3.4

JPEG

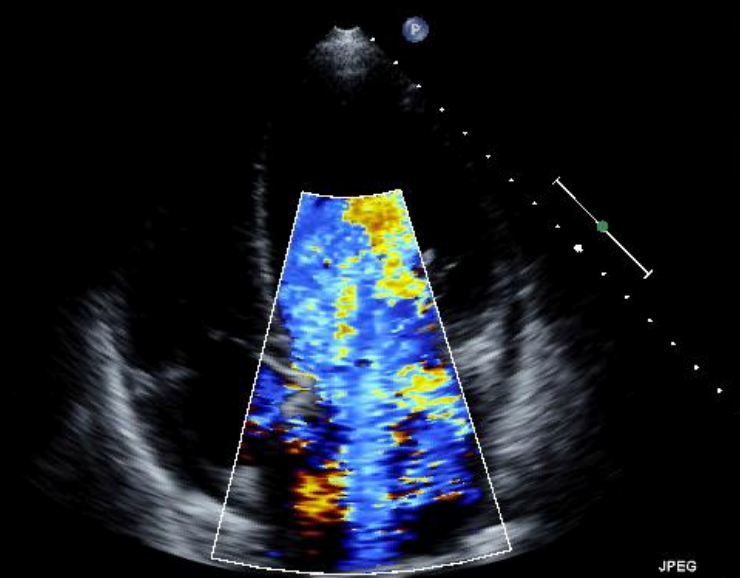


M3 M1

+56.2



-56.2
cm/s



JPEG

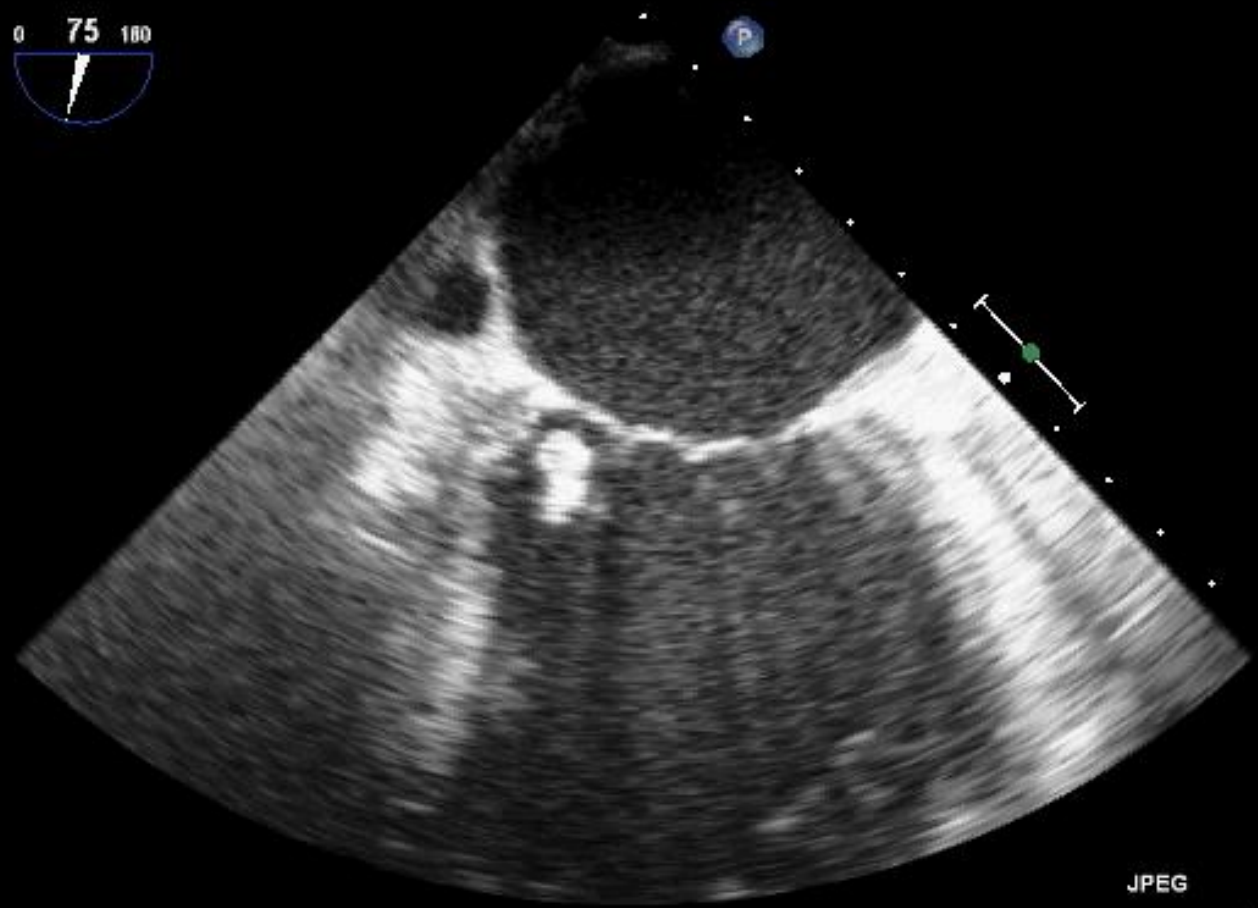
122 bpm

FR 52Hz
12cm

2D
80%
C 50
P Off
Gen



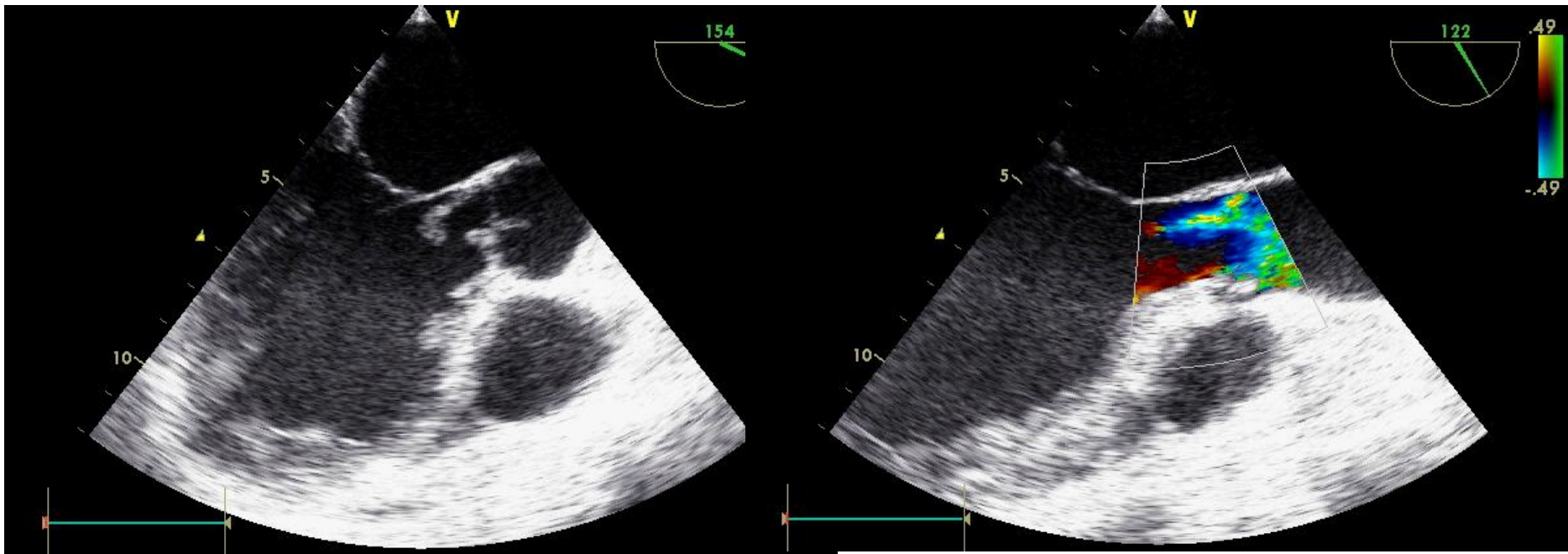
M4



JPEG

PAT T: 42.0C
TEE T: 39.1C

51 bpm



B. Follow-up under medical therapy

- Repeat TTE and/or TOE are recommended as soon as a new complication of IE is suspected (new murmur, embolism, persisting fever, HF, abscess, atrioventricular block).

I	B
---	---

Recommendations	Class ^a	Level ^b
<ul style="list-style-type: none"> Repeat TTE and/or TOE should be considered during follow-up of uncomplicated IE, in order to detect new silent complications and monitor vegetation size. The timing and mode (TTE or TOE) of repeat examination depend on the initial findings, type of microorganism, and initial response to therapy. 	IIa	B

D. Following completion of therapy

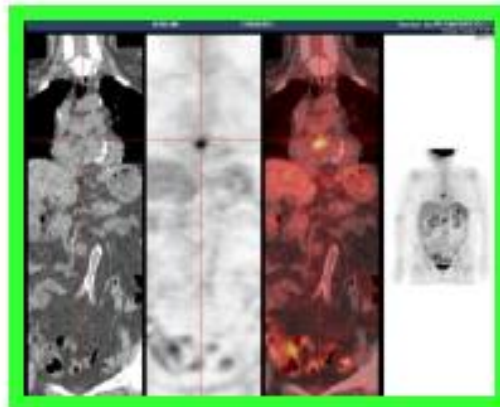
- TTE is recommended at completion of antibiotic therapy for evaluation of cardiac and valve morphology and function.

I	C
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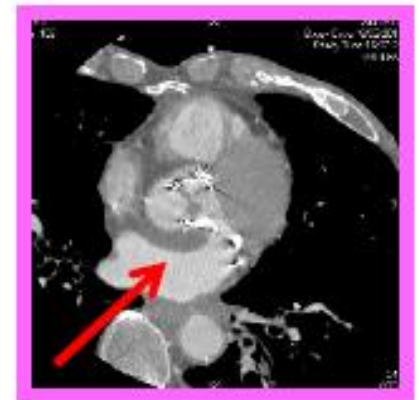
Multimodality imaging in IE



TOE
Morphology



PET CT
Inflammation /
infection



Cardiac CT
Perivalvular lesions

Table 13 Definition of infective endocarditis according to the modified Duke criteria (adapted from Li et al.⁸⁷)

Definite IE
Pathological criteria <ul style="list-style-type: none">• Microorganisms demonstrated by culture or on histological examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or• Pathological lesions; vegetation or intracardiac abscess confirmed by histological examination showing active endocarditis
Clinical criteria <ul style="list-style-type: none">• 2 major criteria; or• 1 major criterion and 3 minor criteria; or• 5 minor criteria
Possible IE
<ul style="list-style-type: none">• 1 major criterion and 1 minor criterion; or• 3 minor criteria
Rejected IE
<ul style="list-style-type: none">• Firm alternate diagnosis; or• Resolution of symptoms suggesting IE with antibiotic therapy for ≤ 4 days; or• No pathological evidence of IE at surgery or autopsy, with antibiotic therapy for ≤ 4 days; or• Does not meet criteria for possible IE, as above

ESC 2015 modified criteria for diagnosis of IE

Major criteria

1. Blood cultures positive for IE

- a. Typical microorganisms consistent with IE from 2 separate blood cultures:
- b. Microorganisms consistent with IE from persistently positive blood cultures:
- c. Single positive blood culture for *Coxiella burnetii* or phase I IgG antibody titre >1:800

2. Imaging positive for IE

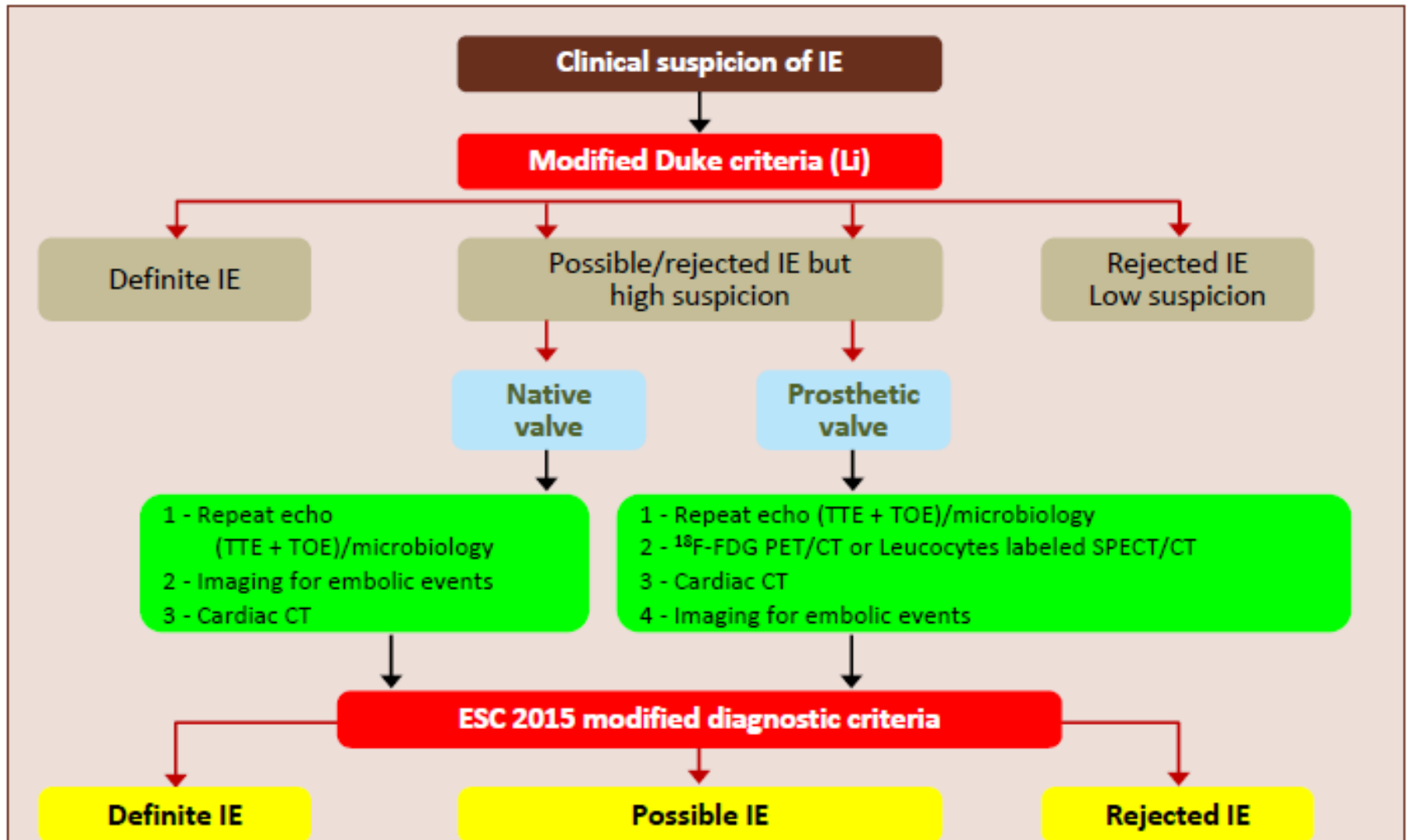
- a. Echocardiogram positive for IE:
 - Vegetation
 - Abscess, pseudoaneurysm, intracardiac fistula
 - Valvular perforation or aneurysm
 - New partial dehiscence of prosthetic valve
- b. Abnormal activity around the site of prosthetic valve implantation detected by ¹⁸F-FDG PET/CT (only if the prosthesis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

ESC 2015 modified criteria for diagnosis of IE

Minor criteria

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

ESC 2015 algorithm for diagnosis of IE



Infekční endokarditida

- Definice a klasifikace, etiologie, patogeneze
- Profylaxe
- Diagnostika
- Prognostická stratifikace
- Terapie
- Specifické situace

Mortalita - dobře citlivé streptokoky 3 %

- stafylokokové 25-40 %

- mykotické nad 80 %

Prediktory špatné prognózy

Patient Characteristics

- Elderly
- Prosthetic valve IE
- Insulin dep. diabetes
- Co-morbidity

Microorganisms

- S. Aureus
- Fungi
- Gram-negative bacilli

Complicated IE

- Heart failure
- Renal failure
- Stroke
- Septic shock
- Periannular complications

Echocardiographic findings

- Periannular complications
- Severe left-sided valve regurgitation
- Low LVEF
- Pulmonary hypertension
- Large vegetations
- Severe prosthetic dysfunction
- Premature valve closure/signs of \uparrow diastolic Pr.

Infekční endokarditida

- Definice a klasifikace, etiologie, patogeneze
- Profylaxe
- Diagnostika
- Prognostická stratifikace
- **Terapie**
- Specifické situace

IE – terapie

1) Antibiotika

- primárně baktericidní
- vysoké dávky
- nitrožilně
- doba (2-8 týdnů)

Table 20 Proposed antibiotic regimens for initial empirical treatment of infective endocarditis in acute severely ill patients (before pathogen identification)^a

Antibiotic	Dosage and route	Class ^b	Level ^c	Comments
Community-acquired native valves or late prosthetic valves (≥ 12 months post surgery) endocarditis				
Ampicillin with (Flu)cloxacillin or oxacillin with Gentamicin ^d	12 g/day i.v. in 4–6 doses 12 g/day i.v. in 4–6 doses 3 mg/kg/day i.v. or i.m. in 1 dose	IIa	C	Patients with BCNIE should be treated in consultation with an ID specialist.
Vancomycin ^d with Gentamicin ^d	30–60 mg/kg/day i.v. in 2–3 doses 3 mg/kg/day i.v. or i.m. in 1 dose			
Early PVE (<12 months post surgery) or nosocomial and non-nosocomial healthcare associated endocarditis				
Vancomycin ^d with Gentamicin ^d with Rifampin	30 mg/kg/day i.v. in 2 doses 3 mg/kg/day i.v. or i.m. in 1 dose 900–1200 mg i.v. or orally in 2 or 3 divided doses	IIb	C	Rifampin is only recommended for PVE and it should be started 3–5 days later than vancomycin and gentamicin has been suggested by some experts. In healthcare associated native valve endocarditis, some experts recommend in settings with a prevalence of MRSA infections >5% the combination of cloxacillin plus vancomycin until they have the final <i>S. aureus</i> identification

Table 16 Antibiotic treatment of infective endocarditis due to oral streptococci and *Streptococcus bovis* group^a

Antibiotic	Dosage and route	Duration (weeks)	Class ^b	Level ^c	Ref. ^d	Comments
Strains penicillin-susceptible (MIC ≤ 0.125 mg/L) oral and digestive streptococci						
Standard treatment: 4-week duration						
Penicillin G or Amoxicillin ^e or Ceftriaxone ^f	12–18 million U/day i.v. either in 4–6 doses or continuously 100–200 mg/kg/day i.v. in 4–6 doses 2 g/day i.v. or i.m. in 1 dose	4 4 4	I I I	B B B	6,8, 135– 139	Preferred in patients > 65 years or with impaired renal or VIII (vestibulo-cochlear) cranial nerve functions. 6-week therapy recommended for patients with PVE
Paediatric doses^g Penicillin G 200,000 U/kg/day i.v. in 4–6 divided doses Amoxicillin 300 mg/kg/day i.v. in 4–6 equally divided doses Ceftriaxone 100 mg/kg/day i.v. or i.m. in 1 dose						
Standard treatment: 2-week duration						
Penicillin G or Amoxicillin ^e or Ceftriaxone ^f combined with Gentamicin ^h or Netilmicin	12–18 million U/day i.v. either in 4–6 doses or continuously 100–200 mg/kg/day i.v. in 4–6 doses 2 g/day i.v. or i.m. in 1 dose 3 mg/kg/day i.v. or i.m. in 1 dose 4–5 mg/kg/day i.v. in 1 dose	2 2 2 2	I I I I	B B B B	6,8, 127, 135– 138	Only recommended in patients with non-complicated NVE with normal renal function. Netilmicin is not available in all European countries.
Paediatric doses^g Penicillin G, amoxicillin, and ceftriaxone as above Gentamicin 3 mg/kg/day i.v. or i.m. in 1 dose or 3 equally divided doses						
In beta-lactam allergic patientsⁱ						
Vancomycin ⁱ	30 mg/kg/day i.v. in 2 doses	4	I	C		6-week therapy recommended for patients with PVE
Paediatric doses^g Vancomycin 40 mg/kg/day i.v. in 2 or 3 equally divided doses						

ATB léčba – nové směry

- OPAT – outpatient parenteral ATB therapy
(obvykle po 2 týdnech)
- POET – partial oral treatment of endocarditis
- Daptomycin – (lipopeptide) – pravostranná IE
(VRSA)

IE – chirurgická léčba

- rozvoj srdečního selhání s anatomickou příčinou – nejčastější indikace k operaci
- nekontrolovaná infekce
- nepříznivý vývoj – narůstající vegetace, embolizace

asi polovina pacientů s IE je operována

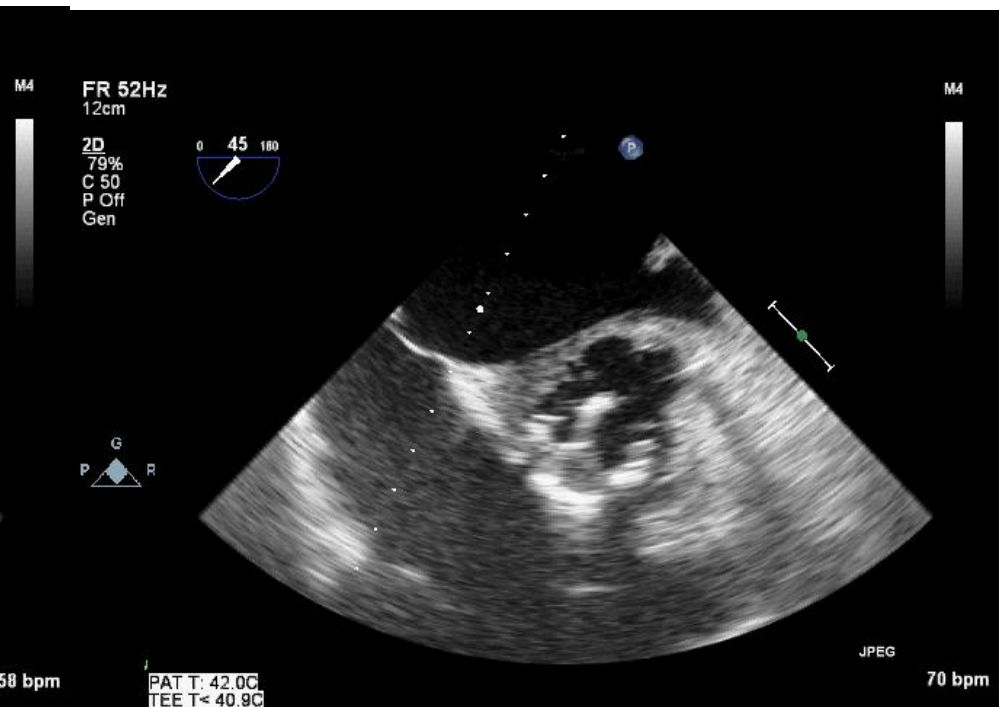
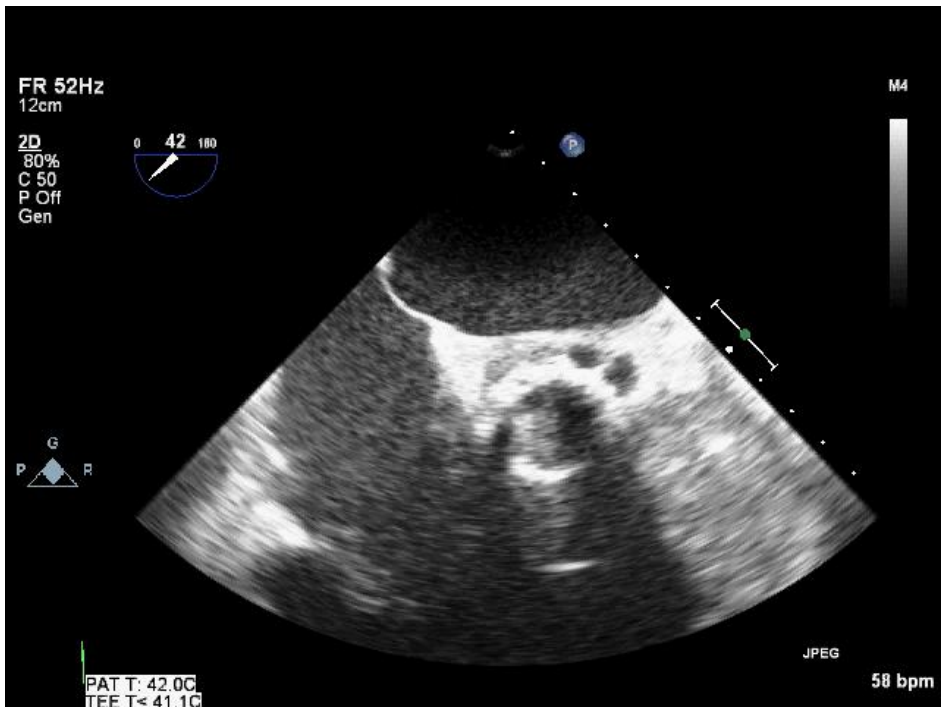
emergentní operace – do 24 hodin

urgentní operace – do 7 dnů

elektivní – po 1-2 týdnech léčby

Table 22 Indications and timing of surgery in left-sided valve infective endocarditis (native valve endocarditis and prosthetic valve endocarditis)

Indications for surgery	Timing ^a	Class ^b	Level ^c
1. Heart failure			
Aortic or mitral NVE or PVE with severe acute regurgitation, obstruction or fistula causing refractory pulmonary oedema or cardiogenic shock	Emergency	I	B
Aortic or mitral NVE or PVE with severe regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance	Urgent	I	B
2. Uncontrolled infection			
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation)	Urgent	I	B
Infection caused by fungi or multiresistant organisms	Urgent/ elective	I	C
Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci	Urgent	IIa	B
PVE caused by staphylococci or non-HACEK gram-negative bacteria	Urgent/ elective	IIa	C



Embolizace

- 20-50 %, výskyt klesá po zahájení ATB léčby
- nejčastěji v prvních 2 týdnech
- souvisí s velikostí a mobilitou vegetací
- nejčastěji mozek, slezina
- nemá ve 20-50 %

Early Surgery versus Conventional Treatment for Infective Endocarditis

Duk-Hyun Kang, M.D., Ph.D., Yong-Jin Kim, M.D., Ph.D.,

Vegetation diameter	14.1±3.5	13.5±3.2
>10–15 mm — no. (%)	26 (67)	26 (70)
>15 mm — no. (%)	13 (33)	11 (30)

Table 3. Clinical End Points.

Outcome	Conventional Treatment (N=39)	Early Surgery (N=37)	P Value
Primary end point — no. (%)			
In-hospital death or embolic event at 6 wk	9 (23)	1 (3)	0.01
In-hospital death	1 (3)	1 (3)	1.00
Embolic event at 6 wk			
Any	8 (21)	0	0.005
Cerebral	5 (13)	0	
Coronary	1 (3)	0	
Popliteal	1 (3)	0	
Splenic	1 (3)	0	
Secondary end points at 6 mo — no. (%)			
Any	11 (28)	1 (3)	0.003
Death	2 (5)	1 (3)	1.00

Table 22 Indications and timing of surgery in left-sided valve infective endocarditis (native valve endocarditis and prosthetic valve endocarditis)

3. Prevention of embolism			
Aortic or mitral NVE or PVE with persistent vegetations > 10 mm after one or more embolic episode despite appropriate antibiotic therapy	Urgent	I	B
Aortic or mitral NVE with vegetations > 10 mm, associated with severe valve stenosis or regurgitation, and low operative risk	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated very large vegetations (> 30 mm)	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated large vegetations (> 15 mm) and no other indication for surgery ^e	Urgent	IIb	C

Anti-thrombotic therapy in infective endocarditis

- Indications for anticoagulant and antiplatelet therapy the same as in other patients
- Initiation of anti-thrombotic therapy is not indicated as adjunctive therapy in IE
 - Anticoagulant and antiplatelet therapy
- Thrombolytic therapy contraindicated
 - (thrombectomy could be considered in ischaemic stroke)

Endocarditis with Stroke

- Clinical assessment
- Immediate Cerebral CT scan / MRI
- TTE / TEE

- Refer the patient to a reference center

**Immediate discussion
within the endocarditis team***

No theoretical indication for surgery**

Theoretical indication for surgery**

Yes

- Intracranial haemorrhage
- Coma
- Severe comorbidities
- Stroke with severe damage

No

Conservative treatment and monitoring
Delayed (> 4 weeks) surgery when indicated

Urgent surgery

♥ Ischaemic stroke: **SURGERY**

- Small stroke/TIA: < 3 days
- Large stroke: surgery after 2-4 weeks

♥ Hemorrhagic stroke: **surgery** after 4 weeks

Infekční endokarditida

- Definice a klasifikace, etiologie, patogeneze
- Profylaxe
- Diagnostika
- Prognostická stratifikace
- Terapie
- Specifické situace

Prostetická IE (PVE)

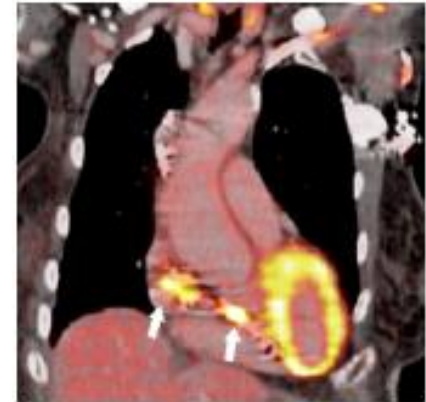
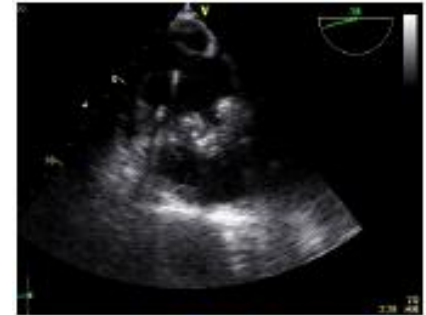
- stejně častá u bioprotéz a mechanických protéz
- časná vs. pozdní (>1 rok po operaci)
Časná PVE – stafylokoky (MRSA), G-, mykotické
Pozdní PVE – stafylokoky, streptokoky, enterokoky,
- důsledek – většinou nová prostetická regurgitace, méně často obstrukce vegetací (skiaskopie nebo TEE)
- oproti NVE – častěji neg. echokardiografie a HK
- Duke kritérie – méně senzitivní než pro NVE
- nemocniční mortalita 20-40 %

TAVI PVE endocarditis



Cardiac device related endocarditis (CDRIE, pacemakery a ICD)

- incidence 1,9 /1000 přístrojů/rok (častěji ICD)
- lokalizovaná infekce (kapsa) x CDRIE
- nejčastěji kontaminace lokální flórou při implantaci
- rizika: horečka 24 hod před implantací, dočasná KS před implantací, časná reimplantace
- často septické plicní emboly
- obtížná dg., nejč. stafylokoky (KNS, St.aureus)



Cardiac device-related infective endocarditis (CDRIE)

- Medical therapy alone → high mortality and risk of recurrence
- Often due to staphylococcal species (≈50% MRSA)
- Duration of therapy ? 4–6 weeks (no data)

Recommendations	Class	Level
B. Principles of treatment		
1. Prolonged (i.e. before and after extraction) antibiotic therapy and complete hardware (device and leads) removal are recommended in definite CDRIE, as well as in presumably isolated pocket infection.	I	C
2. Complete hardware removal should be considered on the basis of occult infection without other apparent source of infection.	IIa	C
3. In patients with NVE or PVE and an intracardiac device with no evidence of associated device infection, complete hardware extraction may be considered.	IIb	C

Cardiac device-related infective endocarditis (CDRIE)

- Transvenous lead extraction is the preferred method
- In experienced centres, procedural mortality rates have been shown to be between very low

Recommendations	Class	Level
C. Mode of device removal		
1. Percutaneous extraction is recommended in most patients with CDRIE, even those with vegetations >10 mm.	I	B
2. Surgical extraction should be considered if percutaneous extraction is incomplete or impossible or when there is associated severe destructive tricuspid IE.	IIa	C
3. Surgical extraction may be considered in patients with large vegetations (>20 mm).	IIb	C

Cardiac device-related infective endocarditis (CDRIE)

Recommendations	Class	Level
D. Reimplantation		
1. After device extraction, reassessment of the need for reimplantation is recommended.	I	C
2. When indicated, definite reimplantation should be postponed if possible to allow a few days or weeks of antibiotic therapy.	IIa	C
3. A “temporary” ipsilateral active fixation strategy may be considered in PM-dependent patients requiring appropriate antibiotic treatment before reimplantation.	IIb	C
4. Temporary pacing is not routinely recommended.	III	C

- Reimplantation on the contralateral side
- Optimal timing of reimplantation ?
- Negative blood cultures for 72 h
- Delayed if valve infection (14 days)



New guidelines ESC 2015: summary

1. Changing disease, but persistent high mortality
2. Reduce prophylaxis, increase prevention
3. Multimodality imaging for diagnosis
4. New diagnostic criteria/ESC diagnostic algorithm
5. Early surgery
6. Multidisciplinary “endocarditis team”

On-going anticoagulant therapy

- Increased risk of intracranial haemorrhage?
- Especially in *S. aureus* PVE
- May decrease early embolic risk

- Individual decisions
- Bridging with heparin/LMWH?

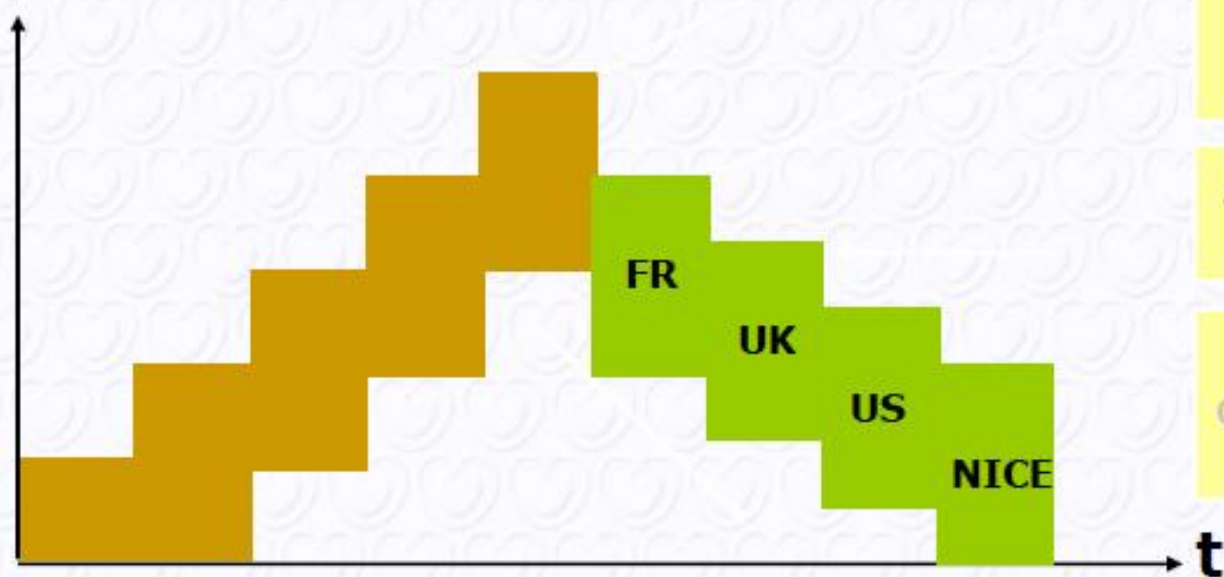
On-going antiplatelet therapy

- Possible reduction of embolic complications or IE development. Data contradictory

Antibiotic Prophylaxis in IE: NICE Guidelines

■ Expert guidelines & consensus conferences

- USA (AHA): 1954, 1965, 1977, 1984, 1990, 1999, **2007**
- UK (BSAC): 1982, 1986, 1990, 1992, **2006, 2008 (NICE)**
- Switzerland : 1984, 2000
- ESC : 2004
- France : 1992, **2002**



All types of procedure in any patient at risk

All types of procedure, optional in intermediate-risk patients

All types of dental care in any patient at high risk

Only certain dental care procedures in any patient at high risk

Recommendations	Class ^a	Level ^b
B. Respiratory tract procedures^c		
<ul style="list-style-type: none"> Antibiotic prophylaxis is not recommended for respiratory tract procedures, including bronchoscopy or laryngoscopy, or transnasal or endotracheal intubation 	III	C
C. Gastrointestinal or urogenital procedures or TOE^c		
<ul style="list-style-type: none"> Antibiotic prophylaxis is not recommended for gastroscopy, colonoscopy, cystoscopy, vaginal or caesarean delivery or TOE 	III	C
D. Skin and soft tissue procedures^c		
<ul style="list-style-type: none"> Antibiotic prophylaxis is not recommended for any procedure 	III	C

- high risk patients (CHD)- avoid piercing (tongue!) and tattooing. If yes: asepsis
- health care assoc IE (CVC insertion etc.) – asepsis

Cardiac device-related infective endocarditis (CDRIE)

Recommendations	Class	Level
A. Diagnosis		
1. Three or more sets of blood cultures are recommended before prompt initiation of antimicrobial therapy for CIED infection.	I	C
2. Lead-tip culture is indicated when the CIED is explanted.	I	C
3. TOE is recommended in patients with suspected CDRIE with positive or negative blood cultures, independent of the results of TTE , to evaluate lead-related endocarditis and heart valve infection	I	C
4. Intracardiac echocardiography may be considered in patients with suspected CDRIE, positive blood cultures and negative TTE and TOE.	IIb	C
5. Radiolabelled leukocyte scintigraphy and ¹⁸F-FDG PET/CT scanning may be considered additive tools in patients with suspected CDRIE, positive blood cultures, and negative echocardiography.	IIb	C

- The sensitivity of Duke criteria is increased by including local signs of infection and pulmonary embolism as major criteria