



# (infective) endocarditis

OLVG 2019

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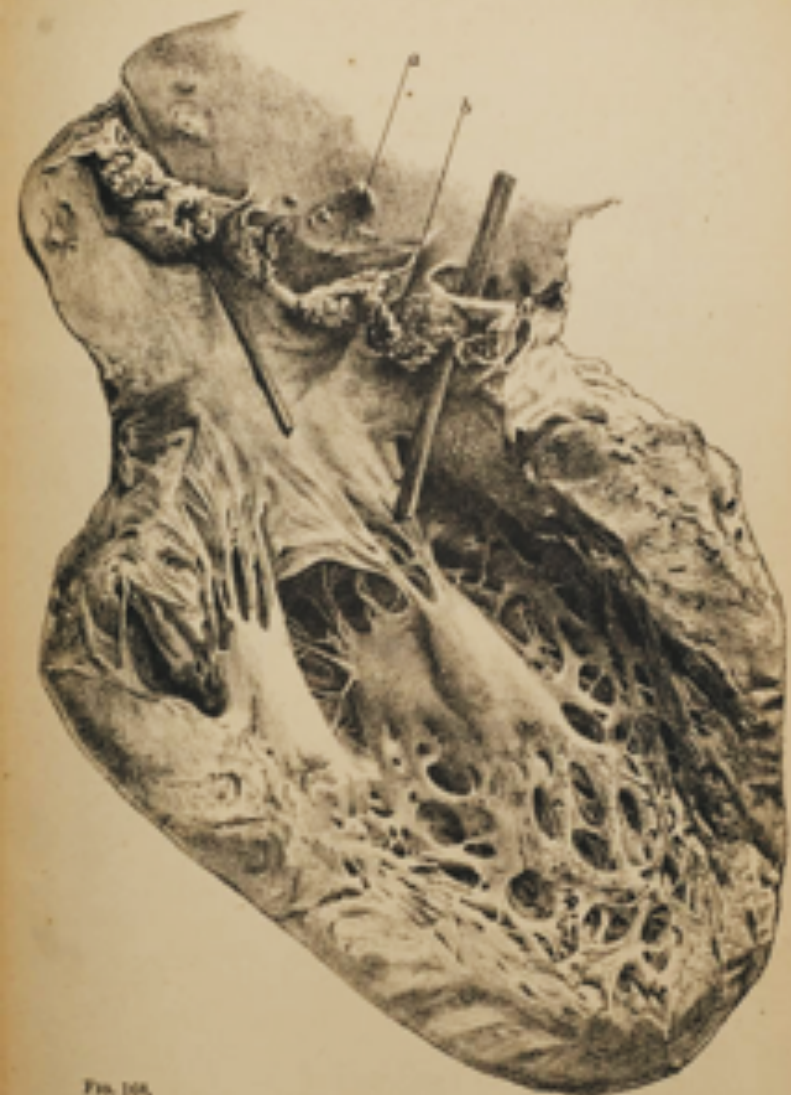


FIG. 166.

*Aortic Valve in a case of Ulceration Endocarditis. (Natural size.)*

The Aortic Cusps are thickly coated with vegetations; two of the segments are ulcerated through (pieces of whalebone being placed in the apertures); the letter, a, points to a small depression (consisting aneurysm), surrounded by minute vegetations, at the base of the Aorta; it has evidently been produced by the vegetation, b, which at every systole would be forcibly pushed against the base of the Aorta at this spot.

# LAZARI RIVERII,

CONSILIARII, MEDICI

AC PROFESSORIS REGII,

Necnon Regiorum in Univerſitate Monſpelienſi  
Medicinæ Profeſſorum Decani,

OPERA MEDICA UNIVERSA;

QUIBUS CONTINENTUR,

- I. Inſtitutionum Medicarum, Libri quinque.
- II. Praeſes Medicæ, Libri ſeptemdecim.
- III. Obſervationum Medicarum, Centuriæ quatuor.

QUIBUS ACCEDUNT OBSERVATIONES VARIE  
ab aliis communicatæ:

ſcilicet OBSERVATIONES Inſpirationum morboſarum. Et deſcriptio ſyſtema  
ARCANA Rivieri præſentata.

Omnia non tantum ab ipſo Authore ſed et ab aliis, amantibus, acceptis; ſed etiam à  
JOHANNI MARCELLO HUGUETAN, ſculptore, et JOHANNI DORVILLE, præſentatis.

NUNC TERIO SINGULA PÆCILLIARIBUS SEU INDICIBUS ILLUSTRATA.



LUGDUNI,  
Sumpt. JOANNIS-ANTONII HUGUETAN, & SOC.

M. DC. LXXIX.  
CUM PRIVILEGIO REGIS.



FIG. 167.—Ulceration endocarditis; Rupture of the chordæ tendineæ; Aneurysm in the mitral valve. (Natural size.)

The specimen came under my notice in the post-mortem theatre of the Royal Infirmary of Edinburgh, during the winter of 1863-64. The patient was under the care of Professor Greenfield, with whose kind permission the specimen is reproduced here.

A piece of cane has been passed through an ulcer in one of the aortic cusps; a, a, point to two ulcers in the anterior flap of the mitral valve, which communicate with the aneurysm seen in Fig. 170; b, b, ruptured chordæ tendineæ. The mitral and aortic valve segments are covered with enormous vegetations.

## Blog 26/06/2012

Vorige week maandag voelde Roel zich opeens heel slecht, **hoofdpijn, hoge koorts** Na een week flink hoge koorts en af en aan naar het ziekenhuis gaan, testen doen, is Roel afgelopen maandag opgenomen in het ziekenhuis. .... De zaterdag ervoor kreeg hij nog een slokdarmecho om te zien of er geen bacteriën op de **kunstklep** zouden zitten. Maar dat konden ze toen niet zien. Daarna zijn we dan ook gewoon naar huis gegaan.

Maandag jl. zijn er nog wat andere testen gedaan om te bekijken waar die hoge koorts toch vandaan zou komen. 's Ochtends om 10u, na het bloedprikken, is hij onwel geworden. Ik was er toen nog bij toen hij wegviel maar pas later werd duidelijk dat dit een **herseninfectie** was. Roel belde me nota bene zelf met '**dubbele tong**' op uit het ziekenhuis, dat dit gebeurd was. Ik was echt als verdoofd, kon het niet geloven



# Endocarditis is van een andere orde...



Links versus rechtszijdig

Natief (eigen klep) versus prothese

Device gerelateerd

**Diagnose volgens de *Duke criteria*:**

Combinatie van bloedkweek uitslagen, imaging en klinische symptomen

# Classificatie en terminologie endocarditis

## Activiteit:

actief vs genezen

## Recurrence:

Recurrent: < 1jaar recidief

Persisterend

## Waarschijnlijkheid vd diagnose:

Definitief

Suspect/verdacht

Mogelijk

## Speciale omstandigheden:

Prothese endocarditis

Vroeg < 1jaar naar vervanging

PM endocarditis

iv drugs gebruik

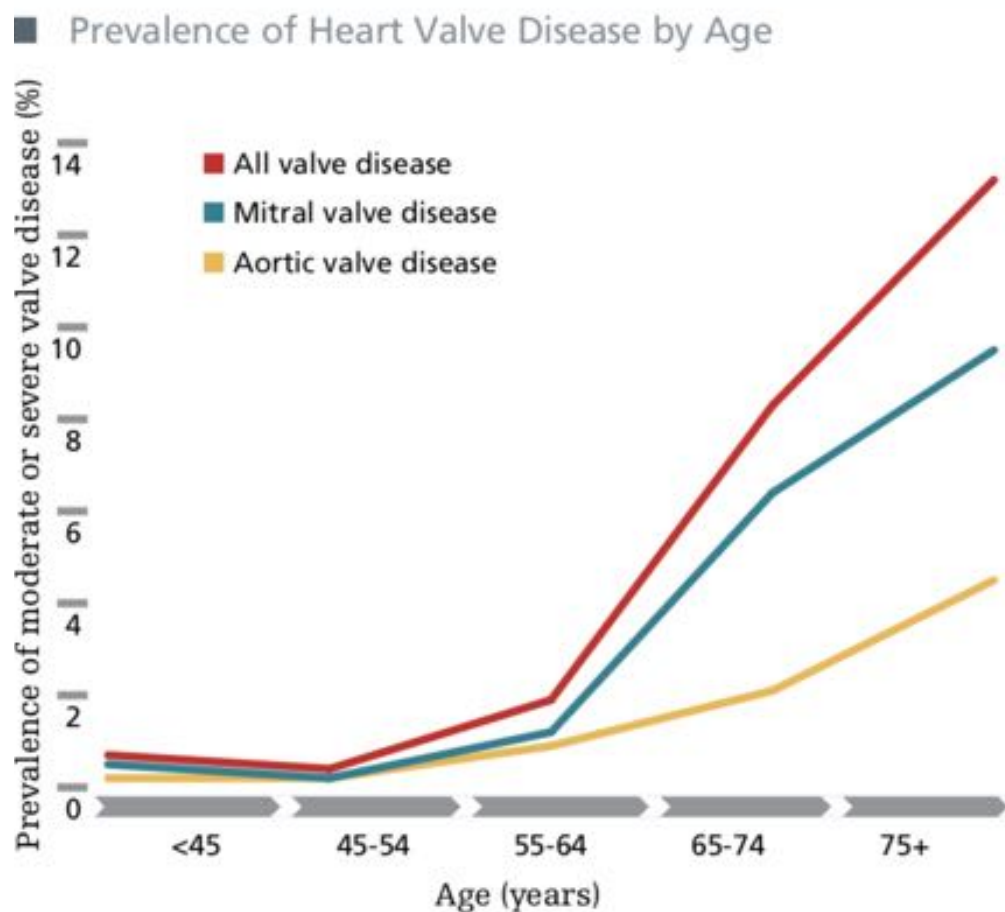
## Anatomische lokalisatie

Aorta, TV, MV, PV: links vs rechts

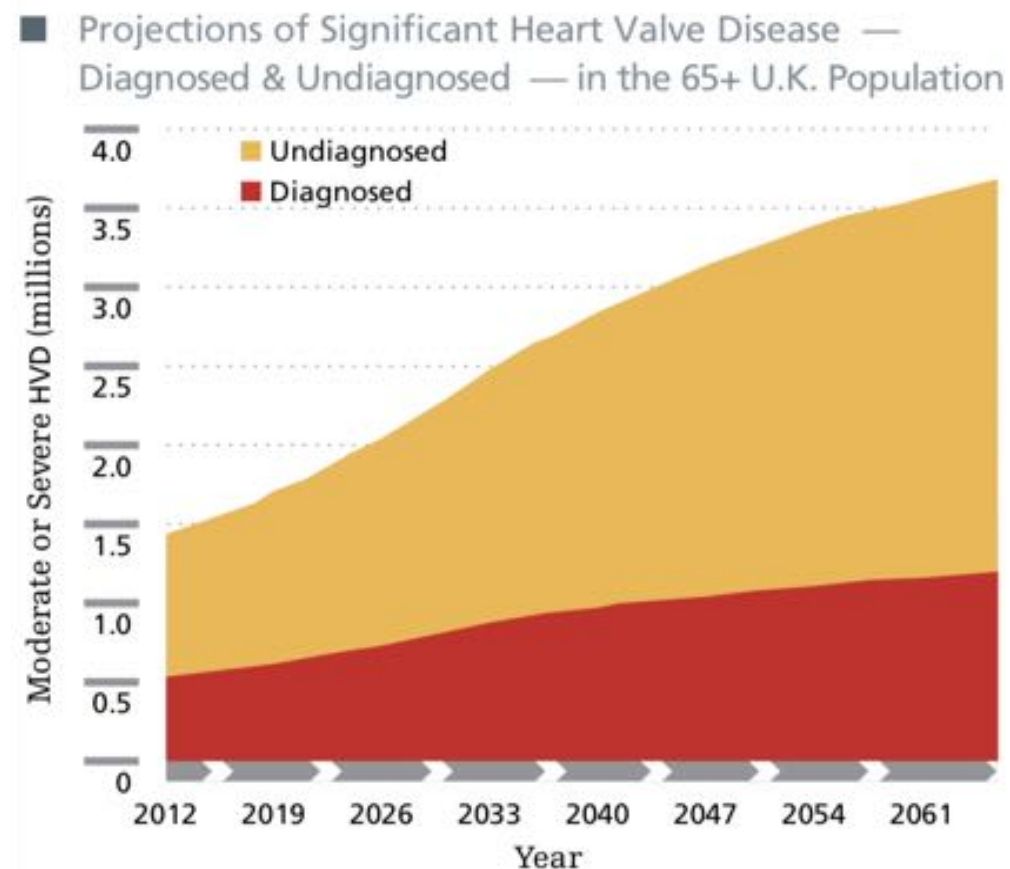
## Causatieve micro-organismen

St Aureus/HACEK

# Burden: Valvular Heart Disease (UK)

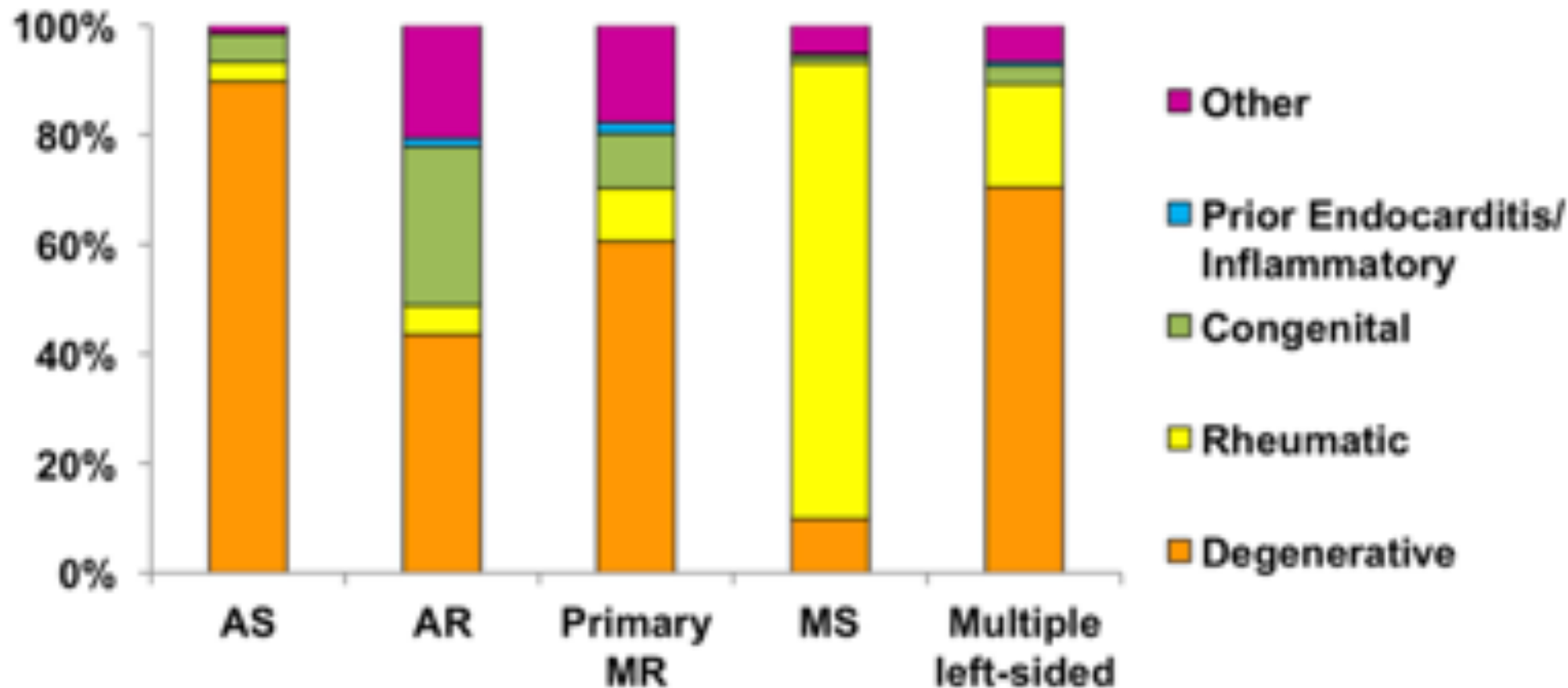


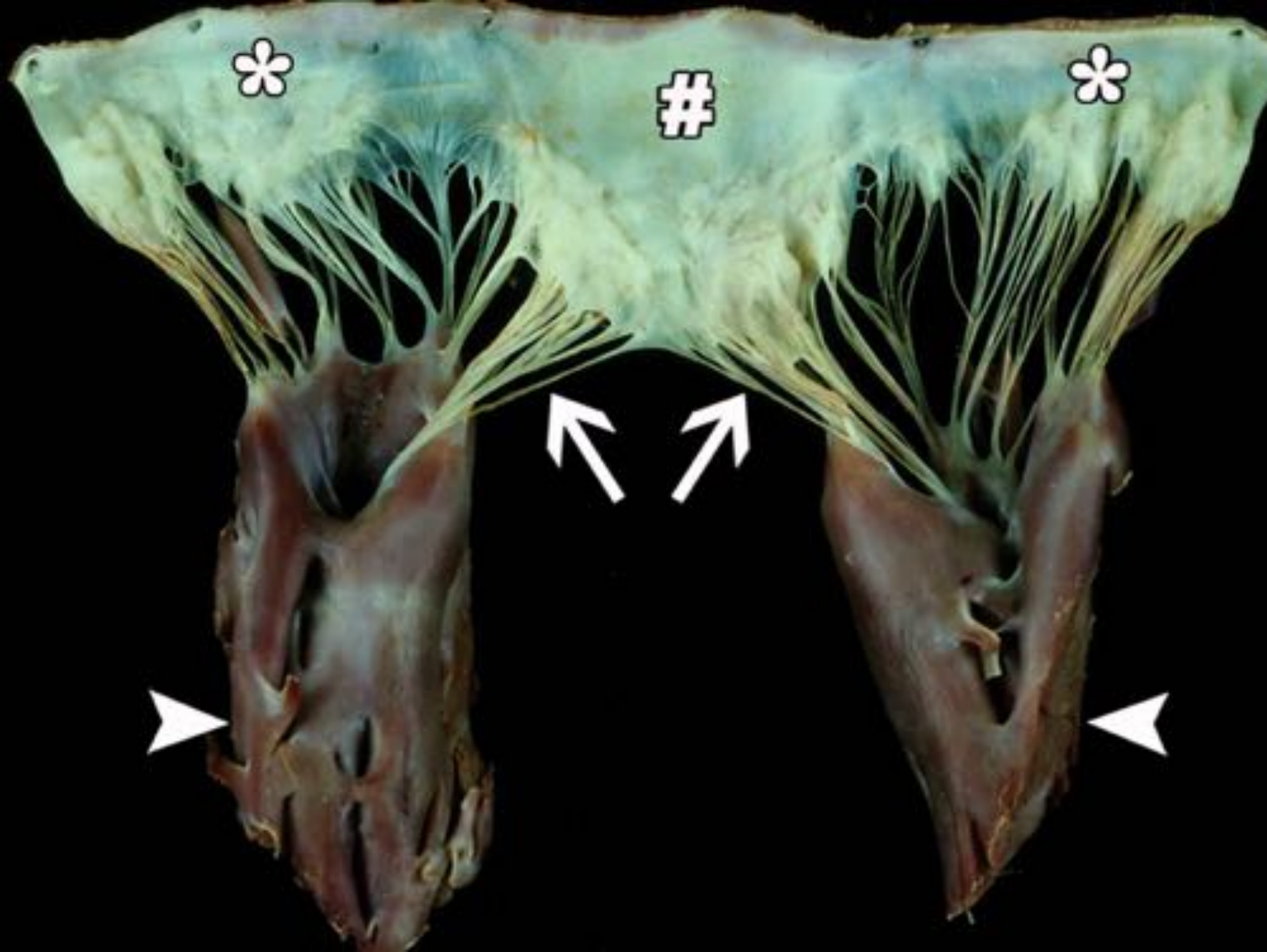
Nkomo et al. 2006, *Burden of Valvular Heart Disease*.



D'Arcy et al. 2016, *Large-Scale Community Echocardiographic Screening Reveals a Major Burden of Undiagnosed Valvular Heart Disease in Older People*

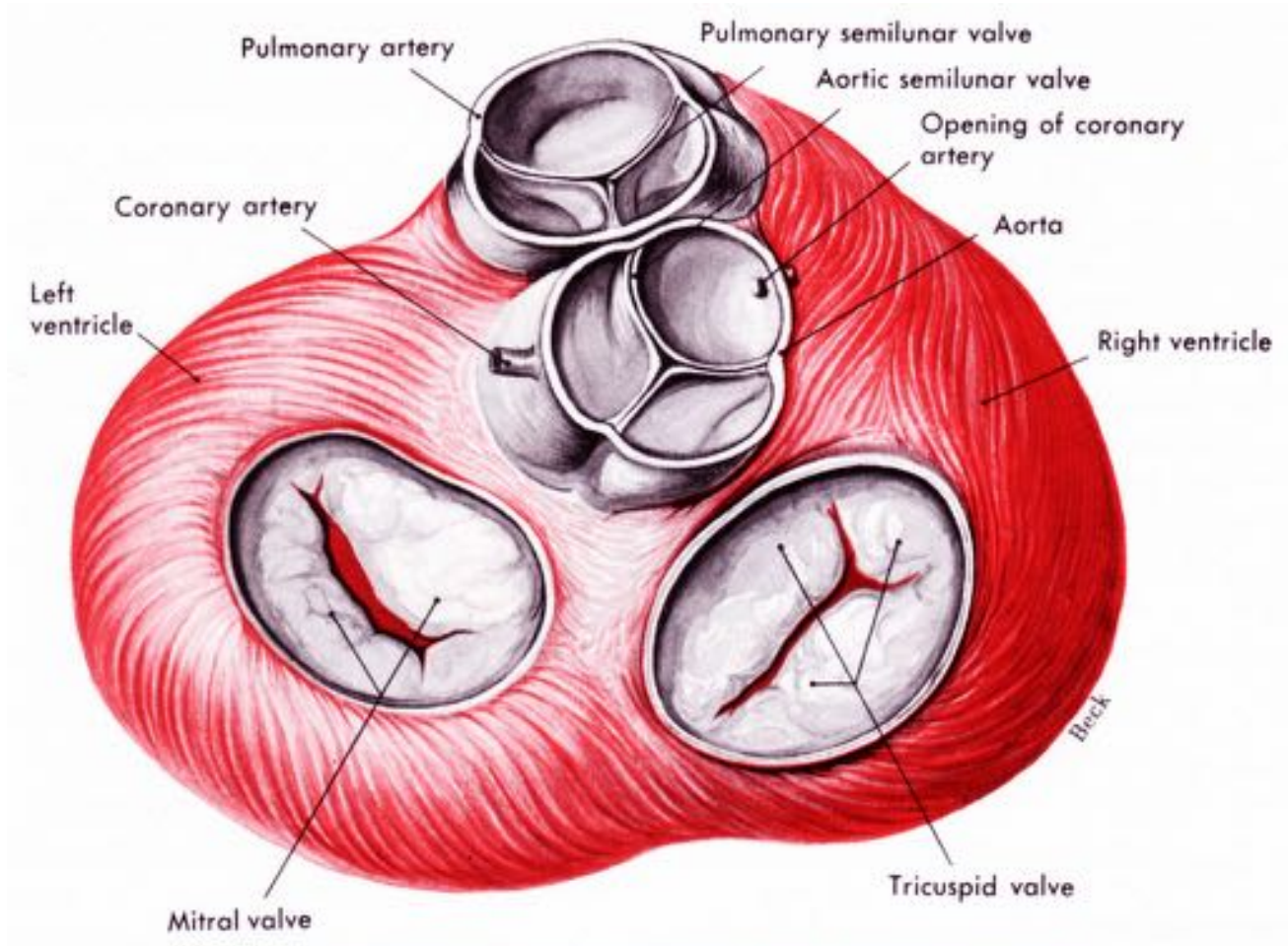
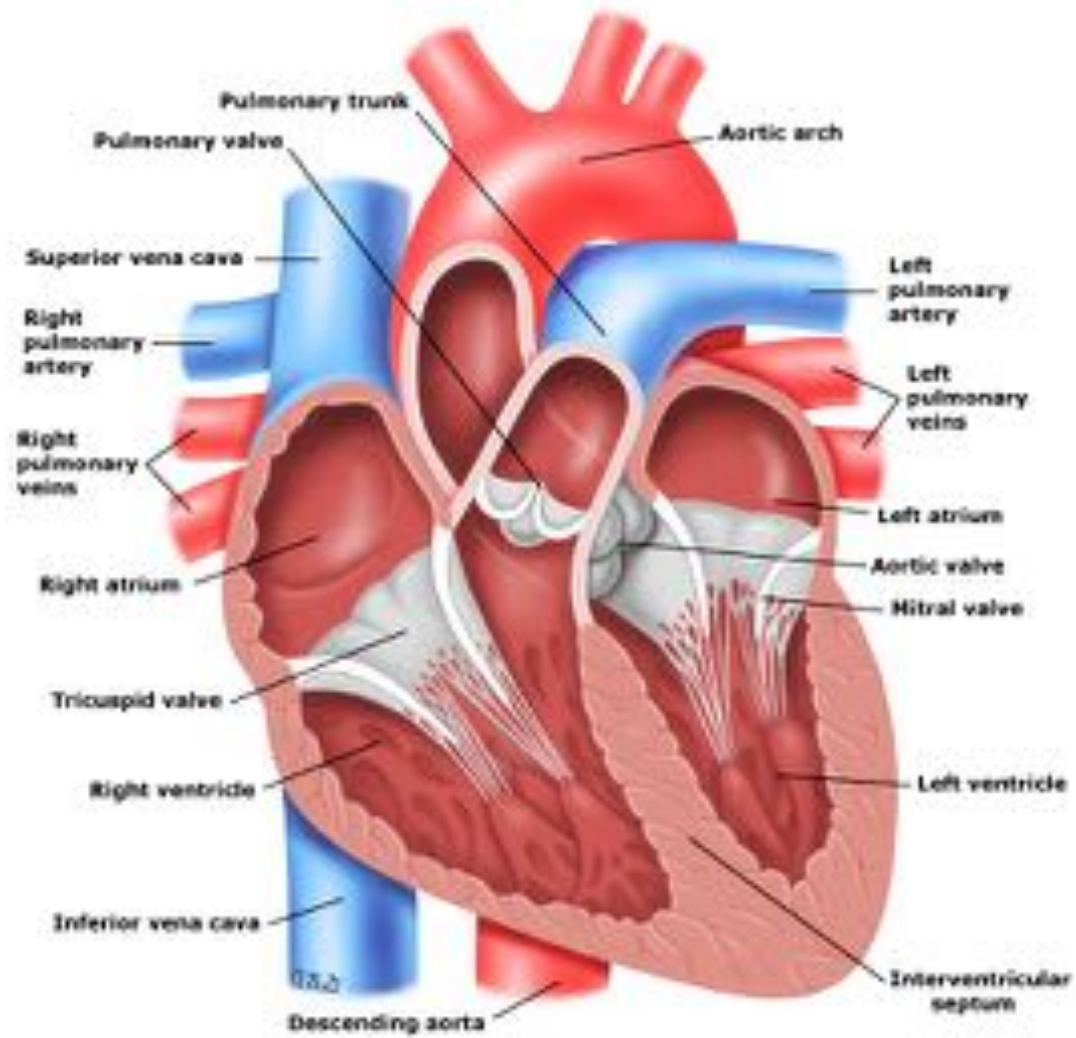
# Aetiologie van hartklepziekte



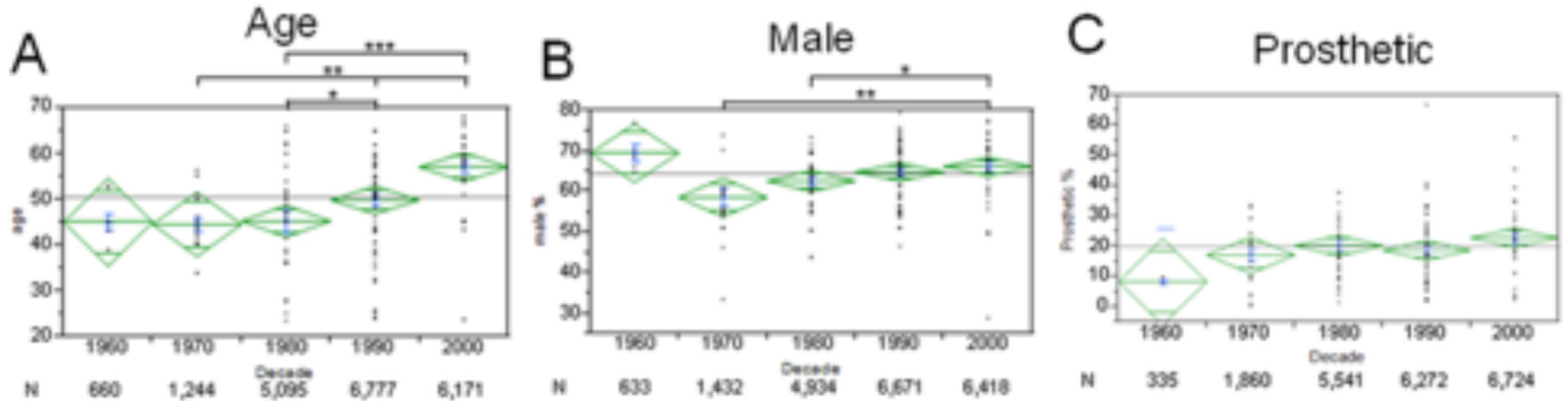




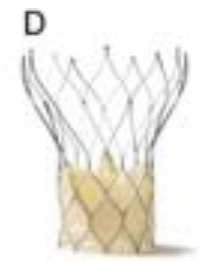
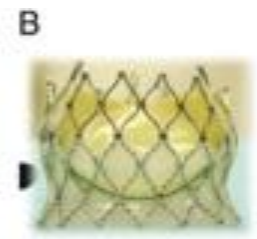
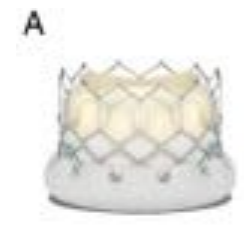
# Valvulaire anatomie



# Epidemiologische ontwikkelingen endocarditis

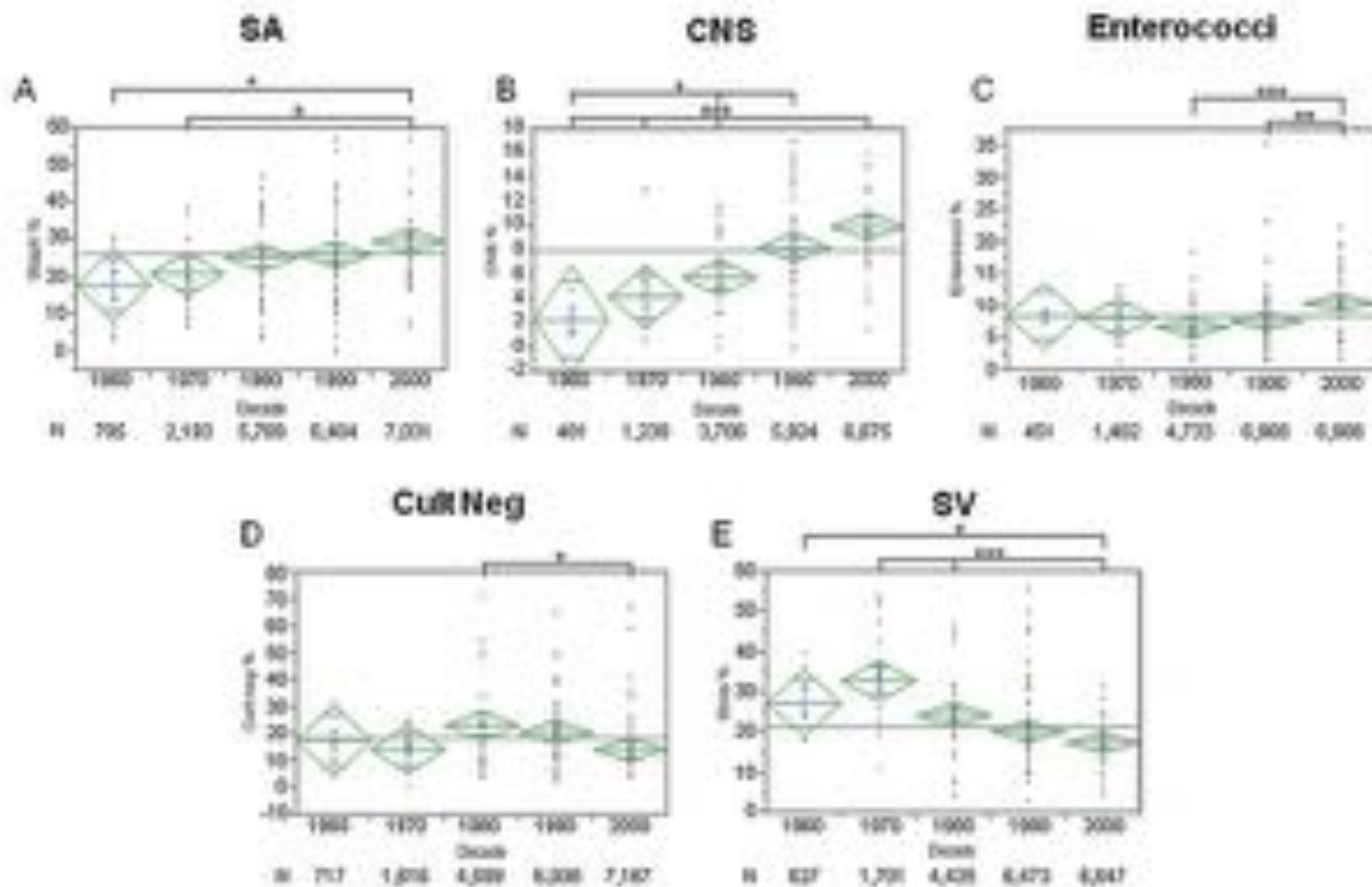


# Toename intracardiale prothesen en devices



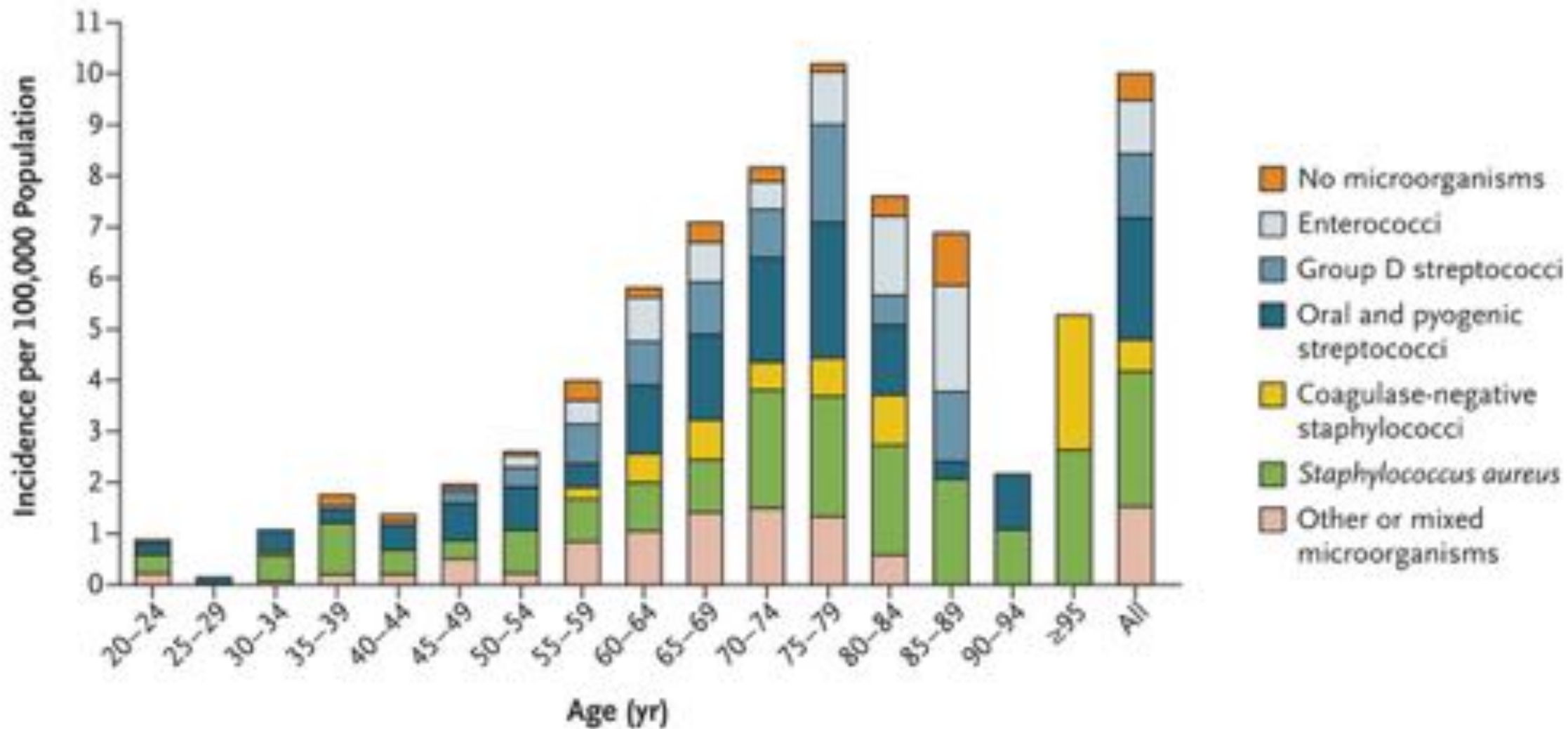


# Microbiologie en worldwide IE





# Incidence of Definite Infective Endocarditis, According to Age and Microorganism.



# Klinische presentatie van IE

## IE must be suspected in the following situations

1. New regurgitant heart murmur
2. Embolic events of unknown origin
3. Sepsis of unknown origin (especially if associated with IE causative organism)
4. Fever: the most frequent sign of IE.<sup>2</sup>

IE should be suspected if fever is associated with:

- a. Intracardiac prosthetic material (e.g. prosthetic valve, pacemaker, implantable defibrillator, surgical baffle/conduit)
- b. Previous history of IE
- c. Previous valvular or congenital heart disease
- d. Other predisposition for IE (e.g. immunocompromised state, IVDA)
- e. Predisposition and recent intervention with associated bacteraemia
- f. Evidence of congestive heart failure
- g. New conduction disturbance
- h. Positive blood cultures with typical IE causative organism or positive serology for chronic Q fever (microbiological findings may precede cardiac manifestations)
- i. Vascular or immunologic phenomena: embolic event, Roth spots, splinter haemorrhages, Janeway lesions, Osler's nodes
- j. Focal or non-specific neurological symptoms and signs
- k. Evidence of pulmonary embolism/infiltration (right-sided IE)
- l. Peripheral abscesses (renal, splenic, cerebral, vertebral) of unknown cause

# Risico groepen voor IE

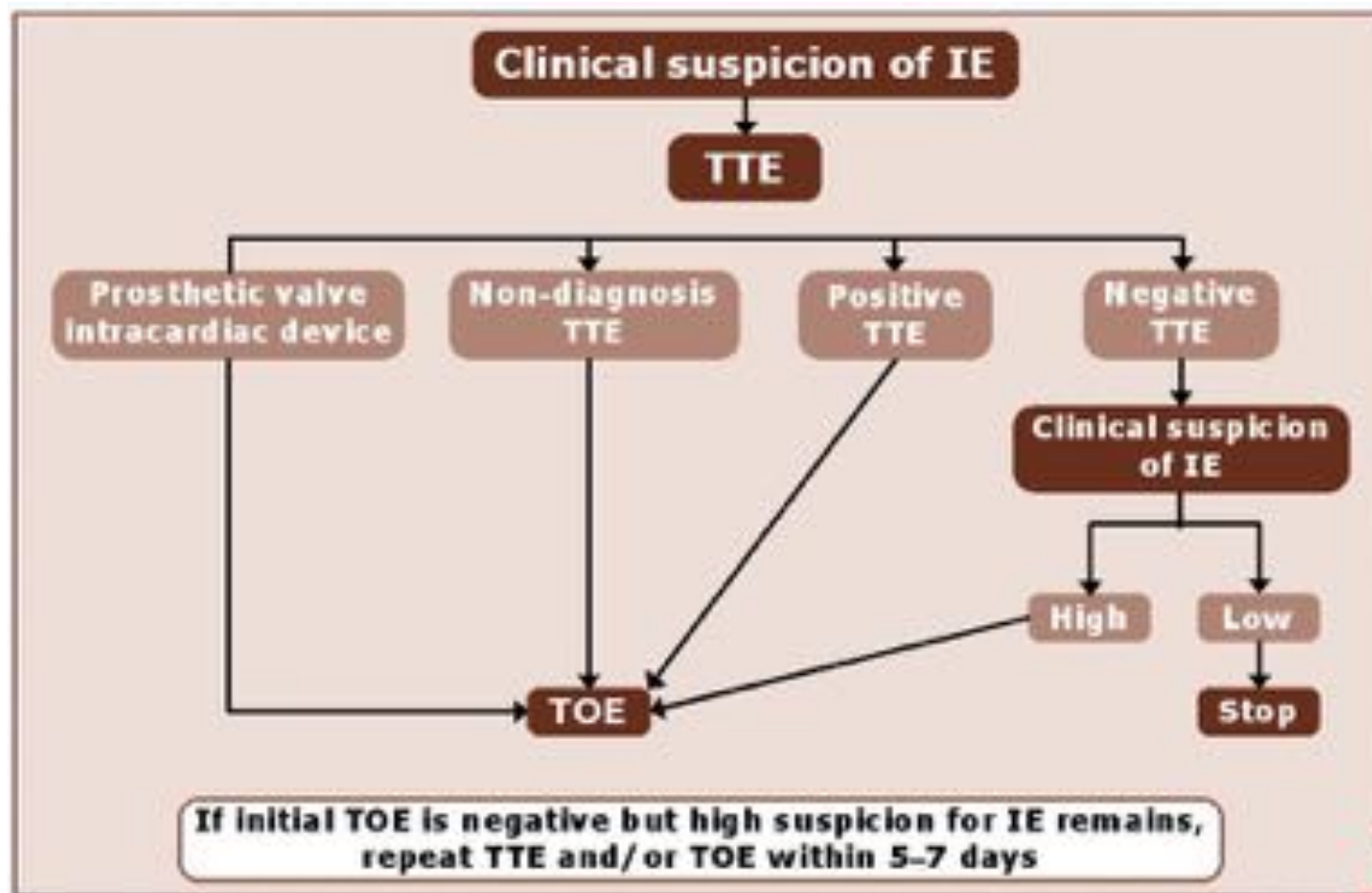
The risk of developing IE in different populations is difficult to quantify - however

Steckelberg and Wilson estimated the lifetime risk of IE per 100,000 patient years in different groups:

- 5 cases per 100,000 patient years for the general population with no known cardiac condition\*
- 52 for heart murmur or rheumatic fever patients (x10)\*
- 383 for patients with a prosthetic valve (x75)\*
- 740 for patients with a previous history of IE (x150)\*
- 2160 for patients with a prosthetic valve + previous IE (x430)\*

AHA/ESC:    - Low Risk \*        - Moderate Risk \*        - High Risk \*

# Indicatie voor echocardiografie





# ESC 2015 modified criteria for diagnosis of IE

Major criteria
<p><b>1. Blood cultures positive for IE</b></p> <p>a. Typical microorganisms consistent with IE from 2 separate blood cultures:</p> <ul style="list-style-type: none"> <li>• <i>Viridans streptococci</i>, <i>Streptococcus gallolyticus</i> (<i>Streptococcus bovis</i>), <i>HACEK</i> group, <i>Staphylococcus aureus</i>; or</li> <li>• Community-acquired enterococci, in the absence of a primary focus; or</li> </ul> <p>b. Microorganisms consistent with IE from persistently positive blood cultures:</p> <ul style="list-style-type: none"> <li>• <math>\geq 2</math> positive blood cultures of blood samples drawn <math>&gt;12</math> h apart; or</li> <li>• All of 3 or a majority of <math>\geq 4</math> separate cultures of blood (with first and last samples drawn <math>\geq 1</math> h apart); or</li> </ul> <p>c. Single positive blood culture for <i>Coxiella burnetii</i> or phase I IgG antibody titre <math>&gt;1:800</math></p>
<p><b>2. Imaging positive for IE</b></p> <p>a. Echocardiogram positive for IE:</p> <ul style="list-style-type: none"> <li>• Vegetation</li> <li>• Abscess, pseudoaneurysm, intracardiac fistula</li> <li>• Valvular perforation or aneurysm</li> <li>• New partial dehiscence of prosthetic valve</li> </ul> <p>b. Abnormal activity around the site of prosthetic valve implantation detected by <math>^{18}\text{F}</math>-FDG PET/CT (only if the prosthesis was implanted for <math>&gt;3</math> months) or radiolabelled leukocytes SPECT/CT.</p> <p>c. Definite paravalvular lesions by cardiac CT.</p>

# 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°C.
3. Vascular phenomena ( <b>including those detected only by imaging</b> ): 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.

# Duke criteria endocarditis

## **Definite infective endocarditis**

### *Pathological criteria*

Microorganism: demonstrated by culture or histology in a vegetation or in a vegetation that has embolized, or in an intracardiac abscess or

Pathologic lesions : vegetation or intracardiac abscess present confirmed by histology showing active endocarditis

### *Clinical criteria,*

- 1 major and 3 minor,
- or 5 minor

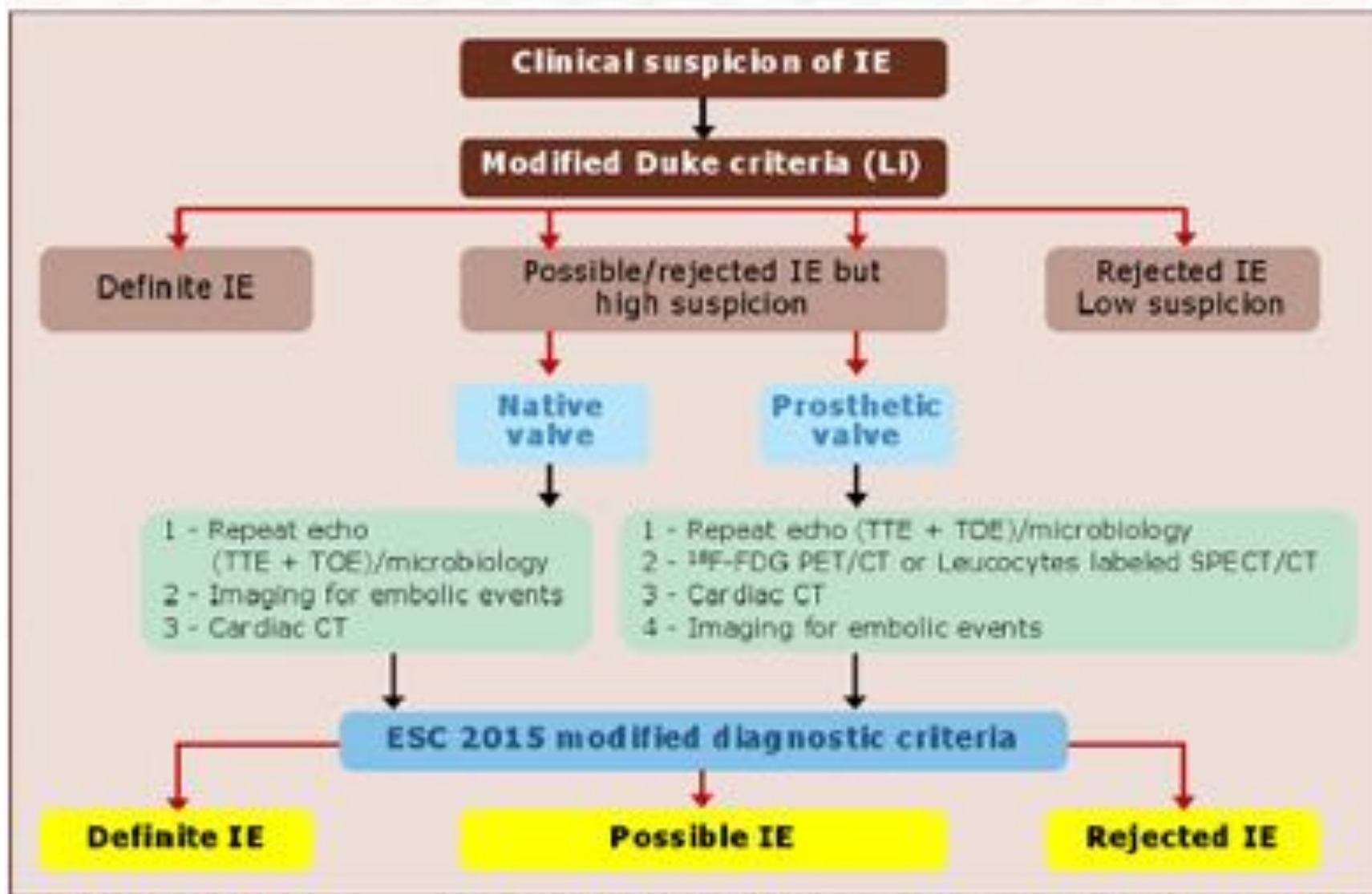
## **Possible infective endocarditis**

- at least 1 major and 1 minor, or
- 3 minor

## **Rejected**

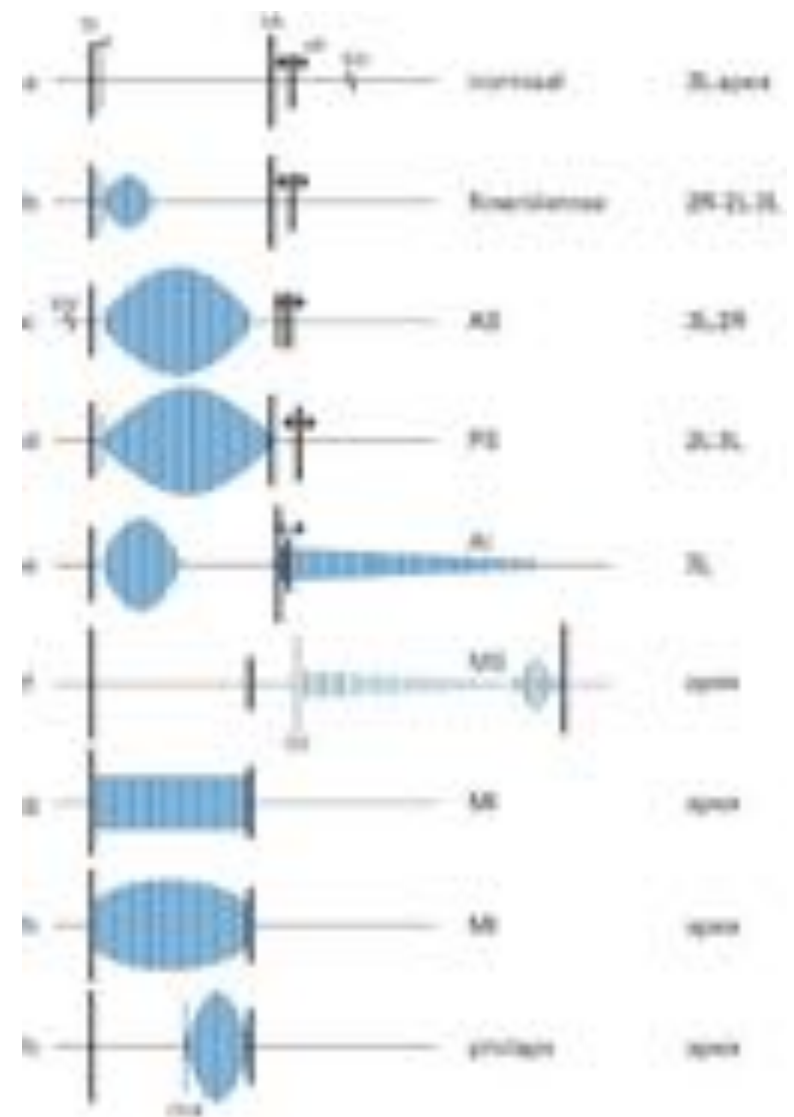
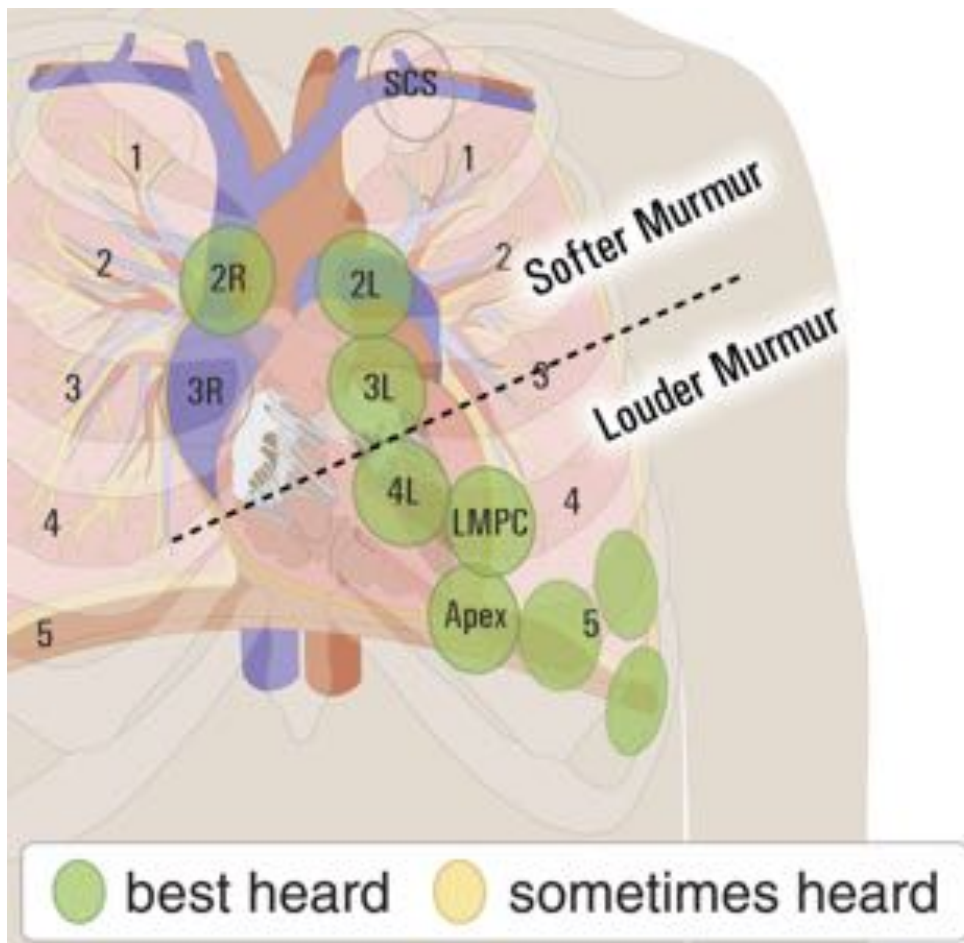
- Firm alternate diagnosis explaining evidence of infective endocarditis, or
- Resolution of infective endocarditis syndrome, with antibiotic therapy for 4 days or less, or
- No pathologic evidence of infective endocarditis at surgery or autopsy, with antibiotic therapy for 4 days or less

# ESC 2015 algoritme voor de diagnose IE

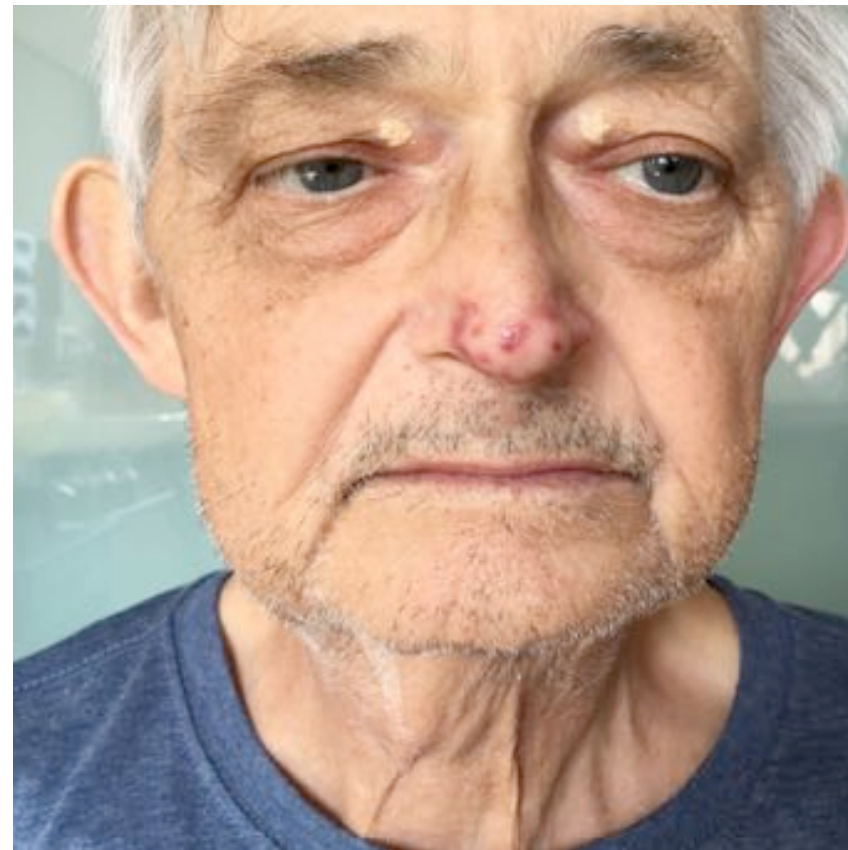




# Kliniek van endocarditis: auscultatie



# De kliniek van endocarditis



Xanthelasmata, osler noduli, cachexie

# Klinische stigmata op de acra



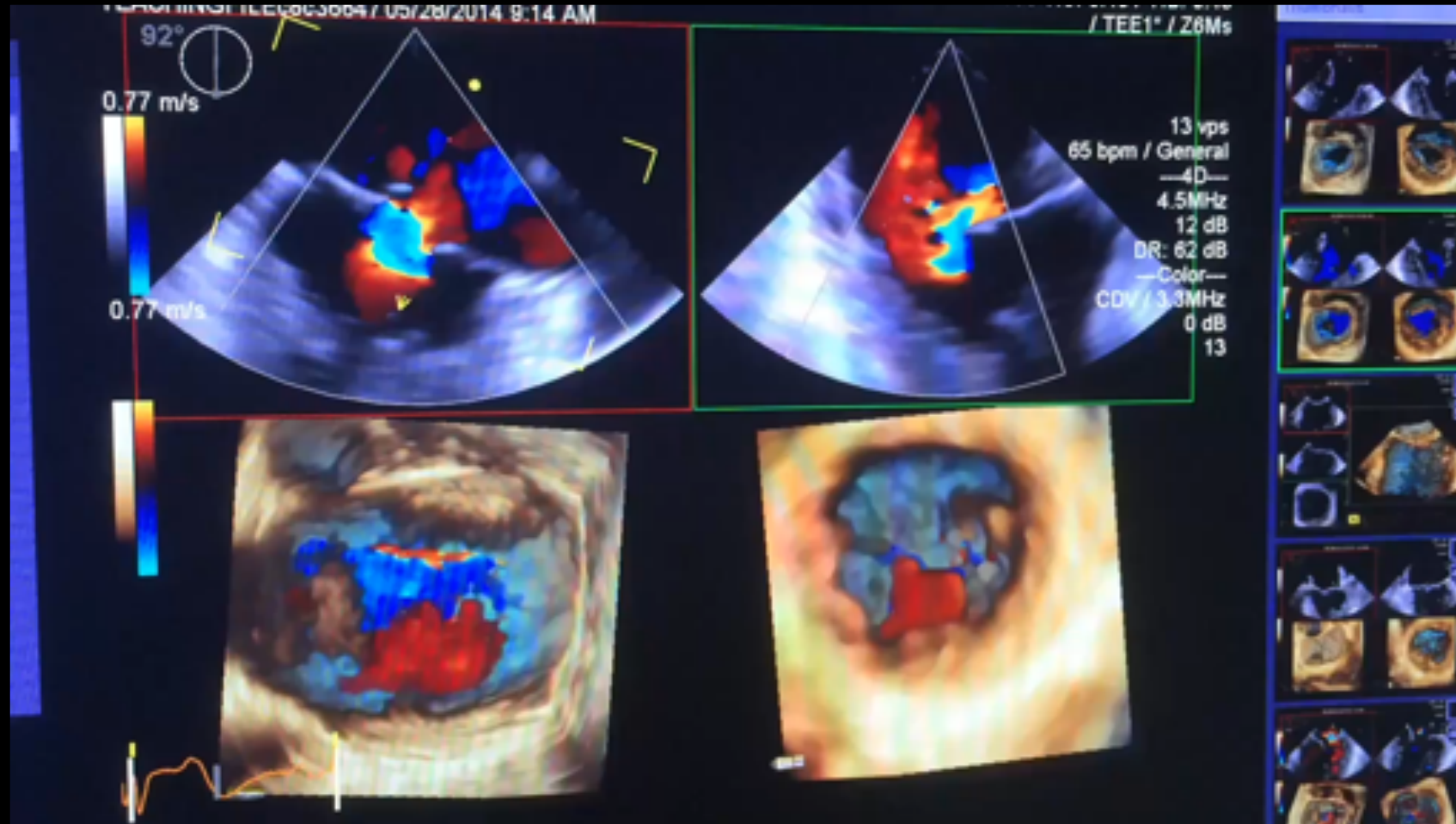


# Subtielere klinische stigmata



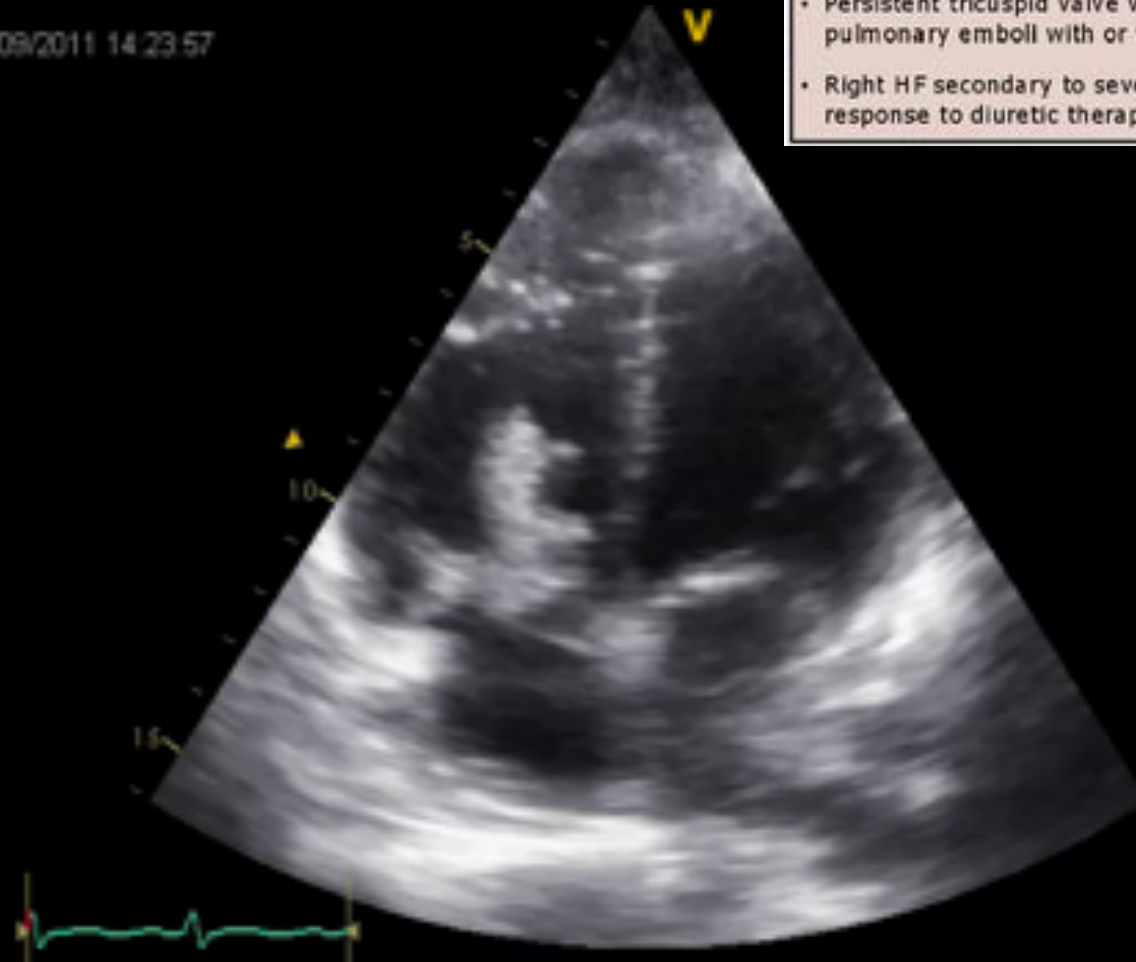


# Valvulaire anatomie en functie met de laatste 3D echo technieken



# Echocardiografie

01/09/2011 14:23:57



## Recommendations

**Surgical treatment should be considered in the following scenarios:**

- Microorganisms difficult to eradicate (e.g. persistent *fungi*) or bacteraemia for >7 days (e.g. *Staphylococcus aureus*, *P. aeruginosa*) despite adequate antimicrobial therapy or
- Persistent tricuspid valve vegetations >20 mm after recurrent pulmonary emboli with or without concomitant right heart failure or
- Right HF secondary to severe tricuspid regurgitation with poor response to diuretic therapy.

Class	Level
IIa	C

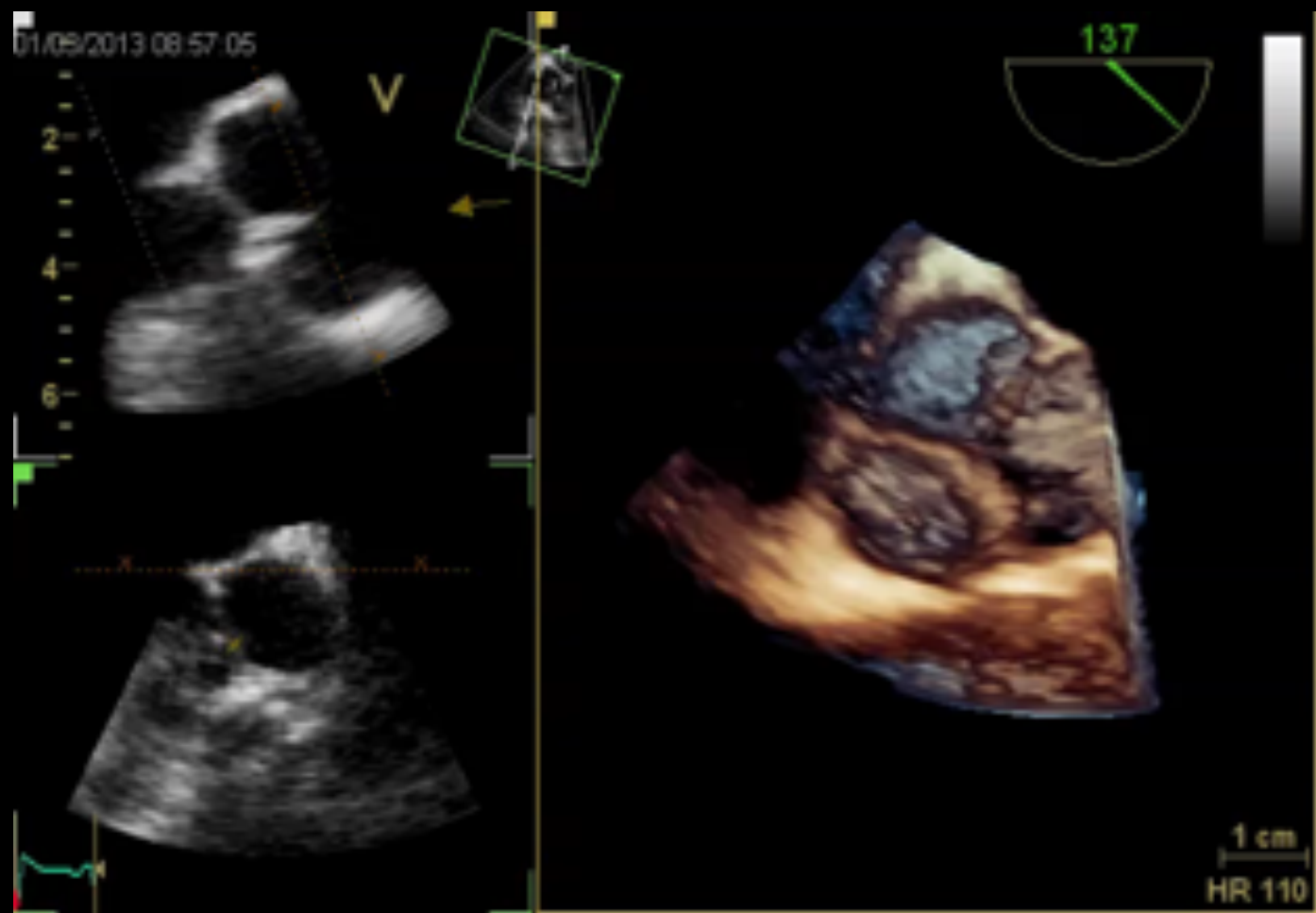
108  
2/23 HR

# Echocardiografie

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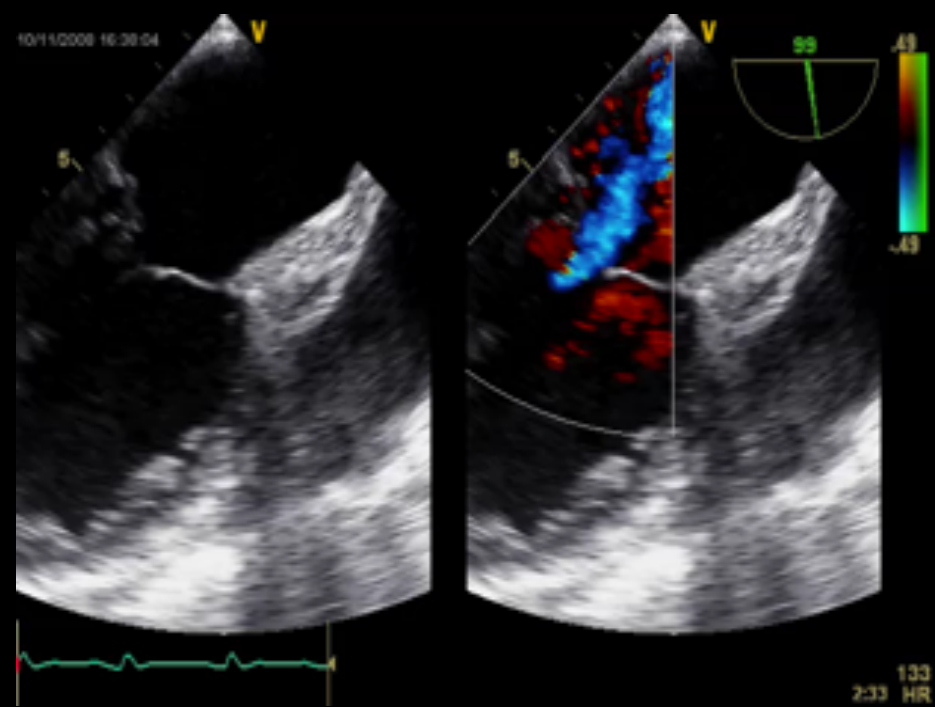
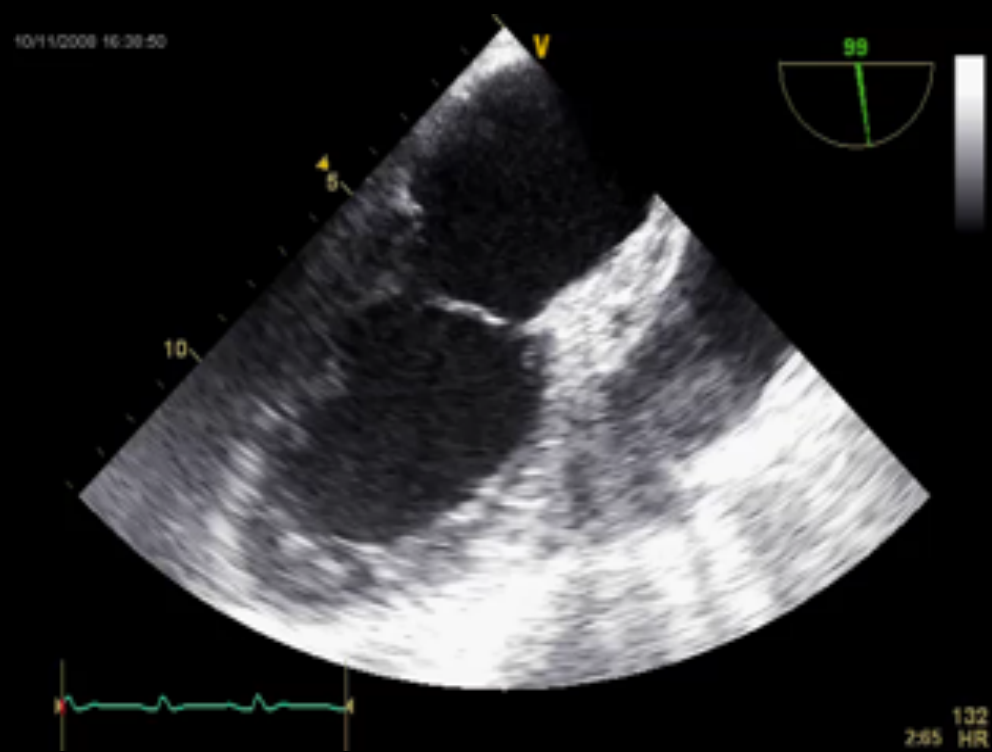


# Echocardiografie

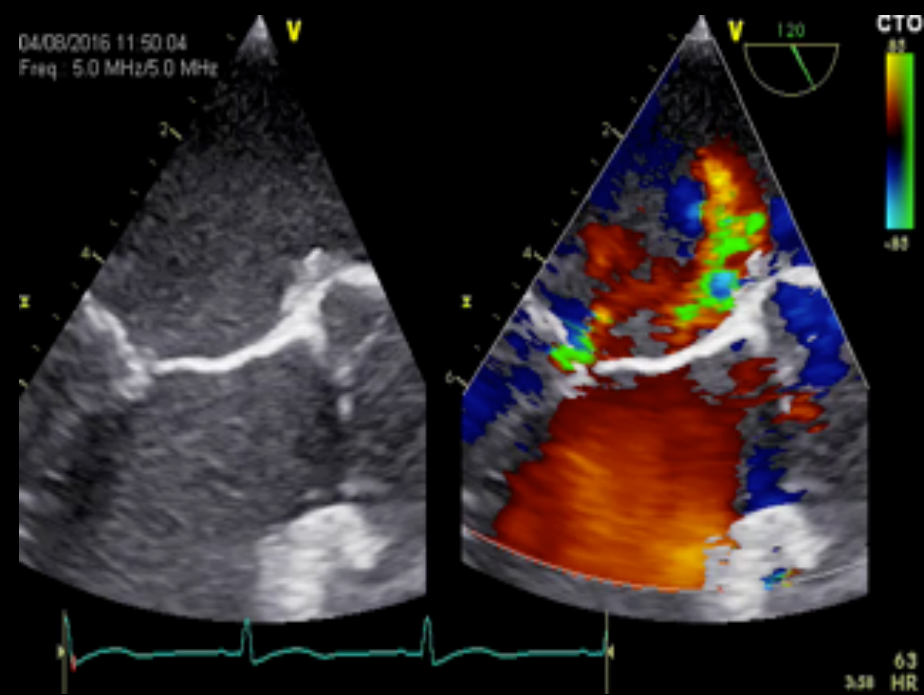
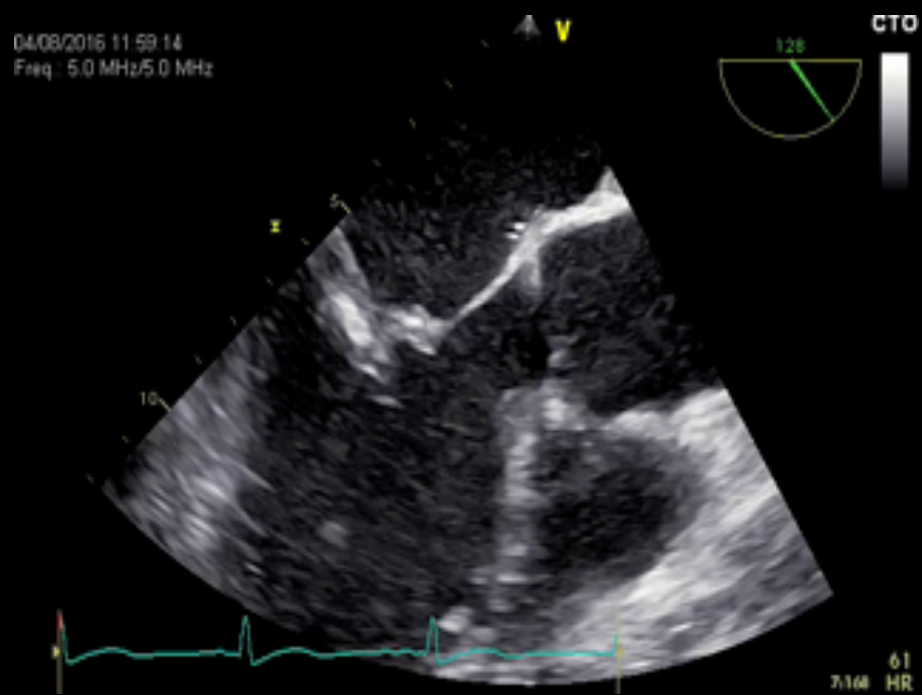




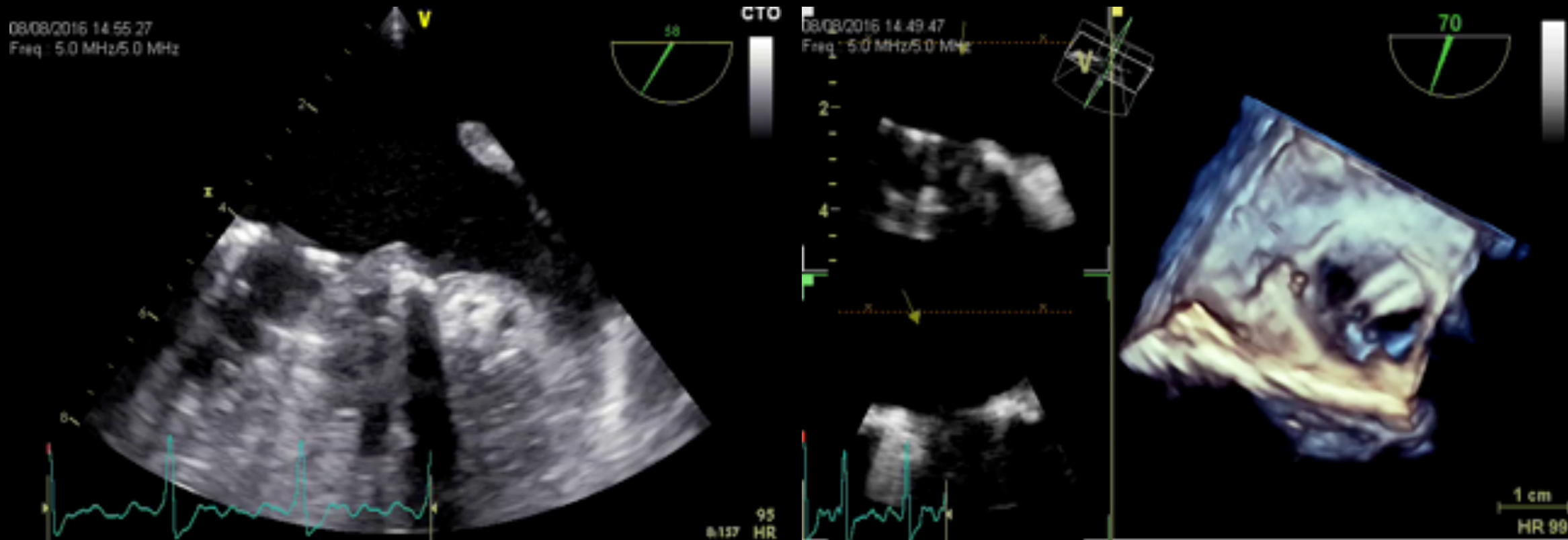
# Mitralisklep



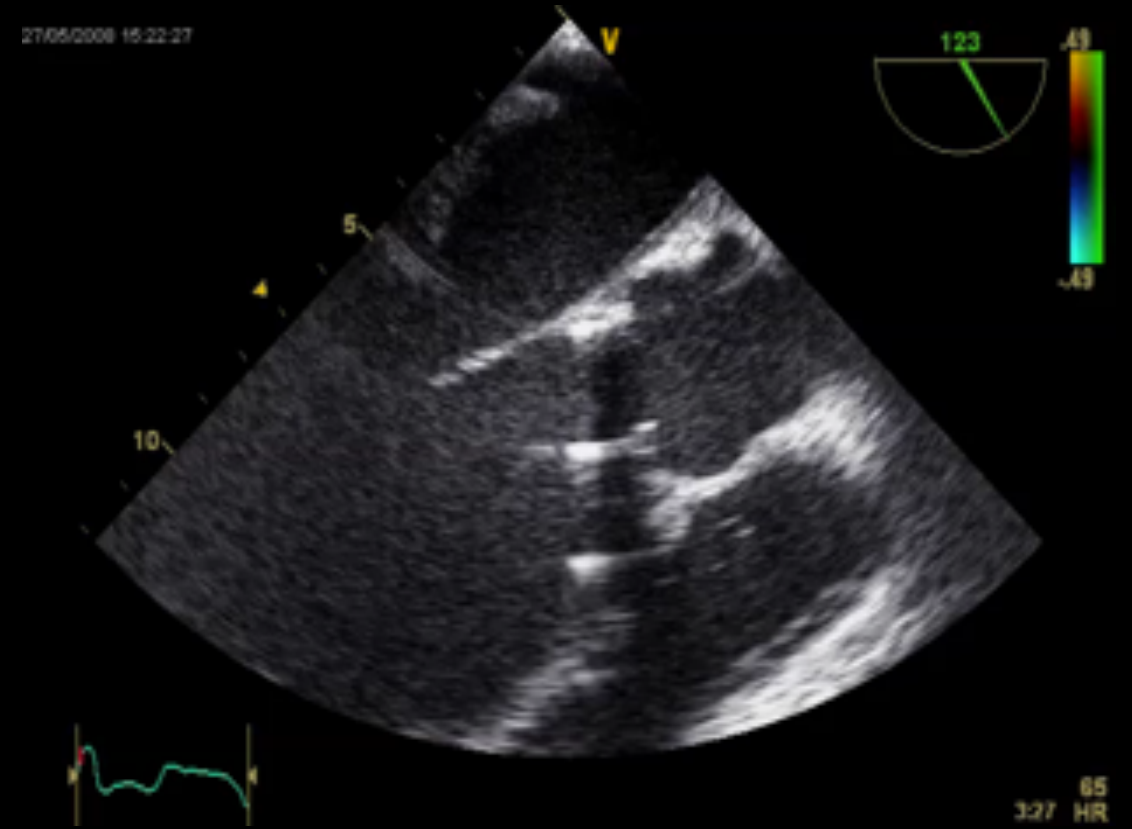
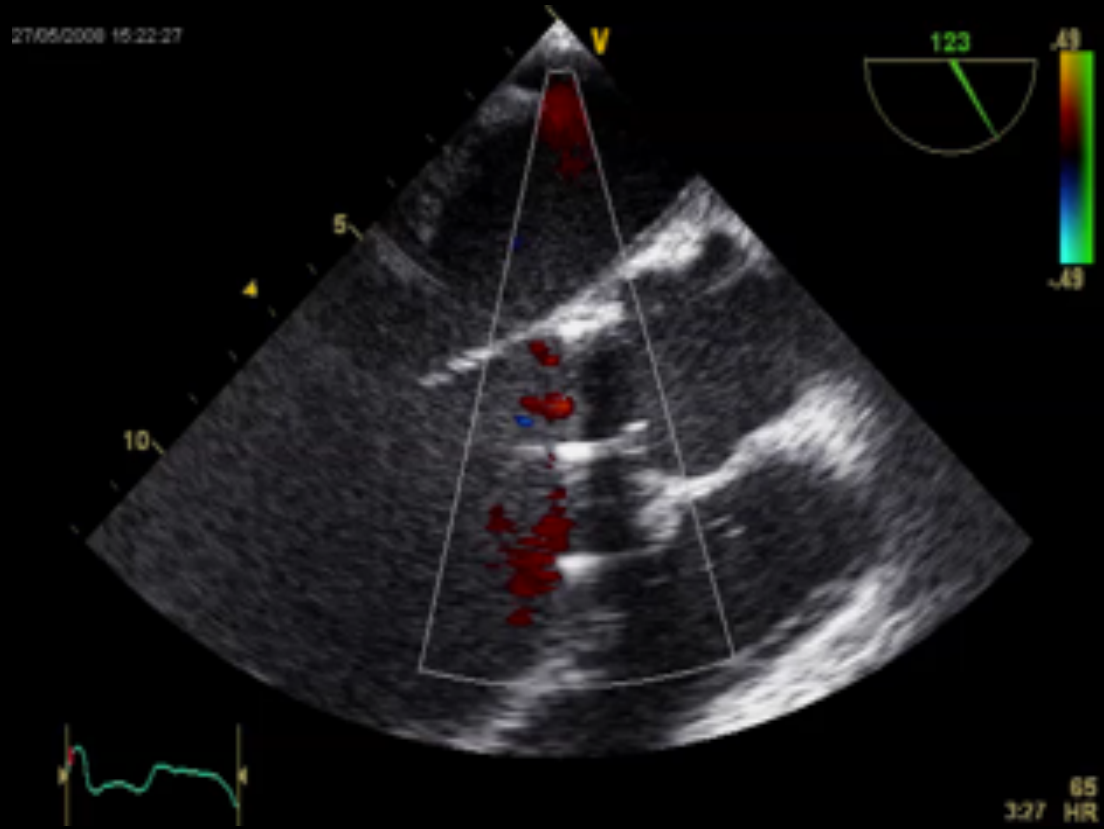
# Endocarditis



# Kunstklep endocarditis

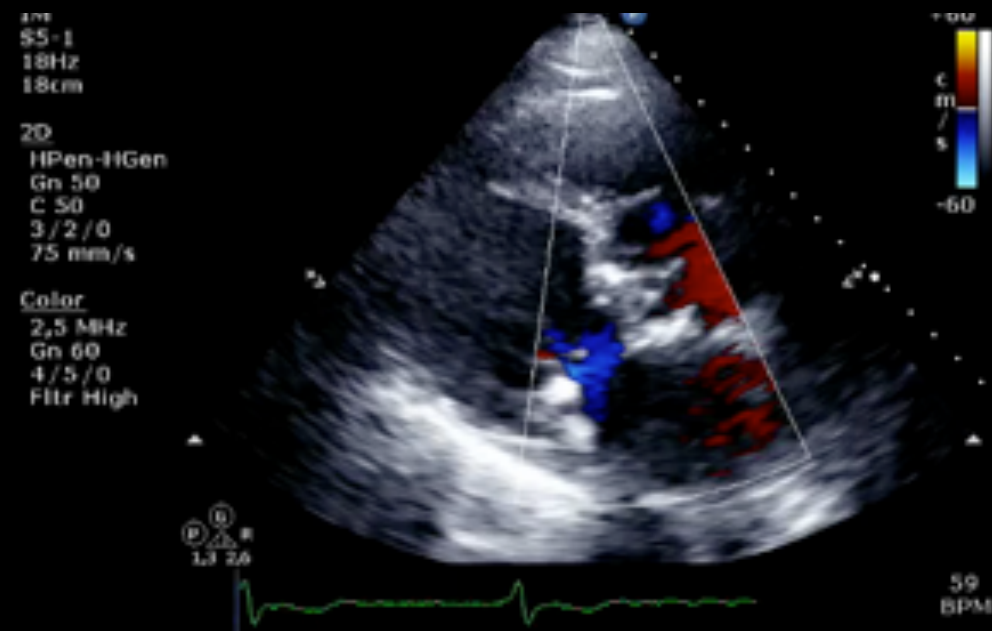
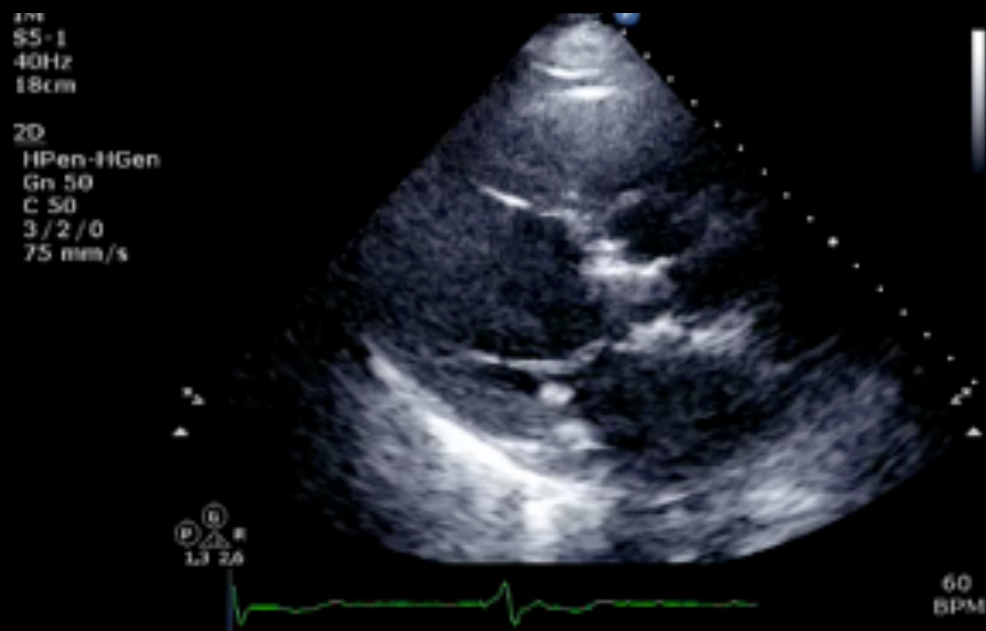


# Kunstklep endocarditis

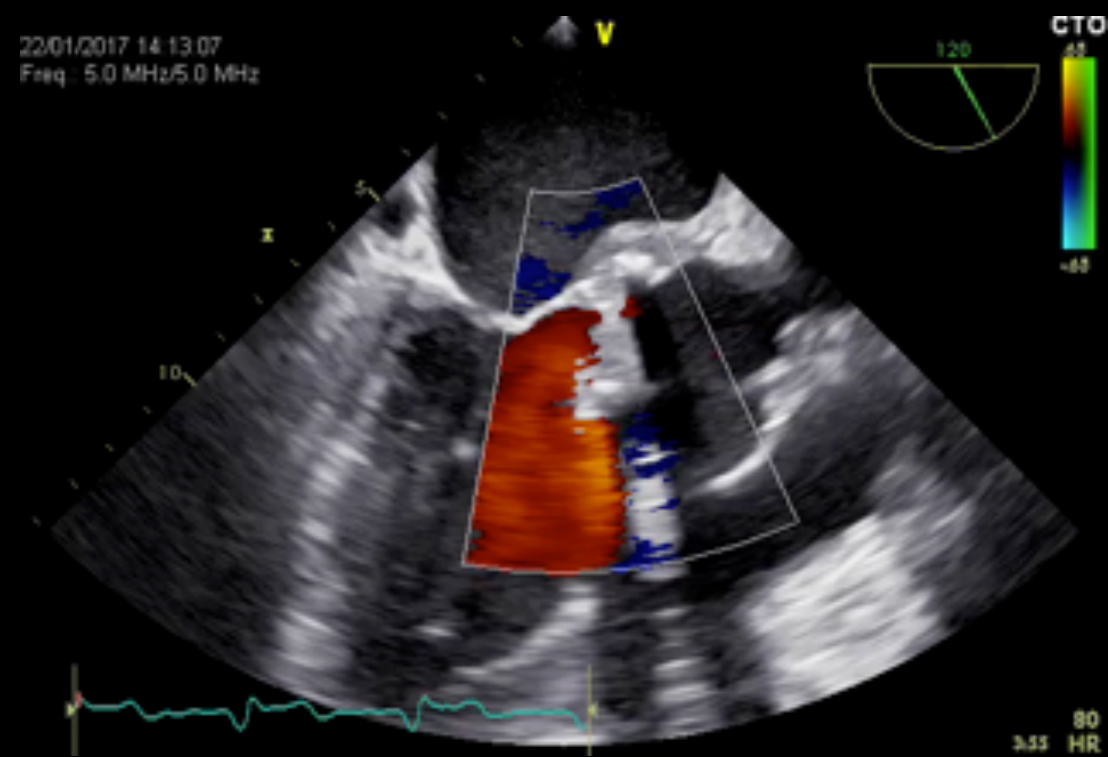
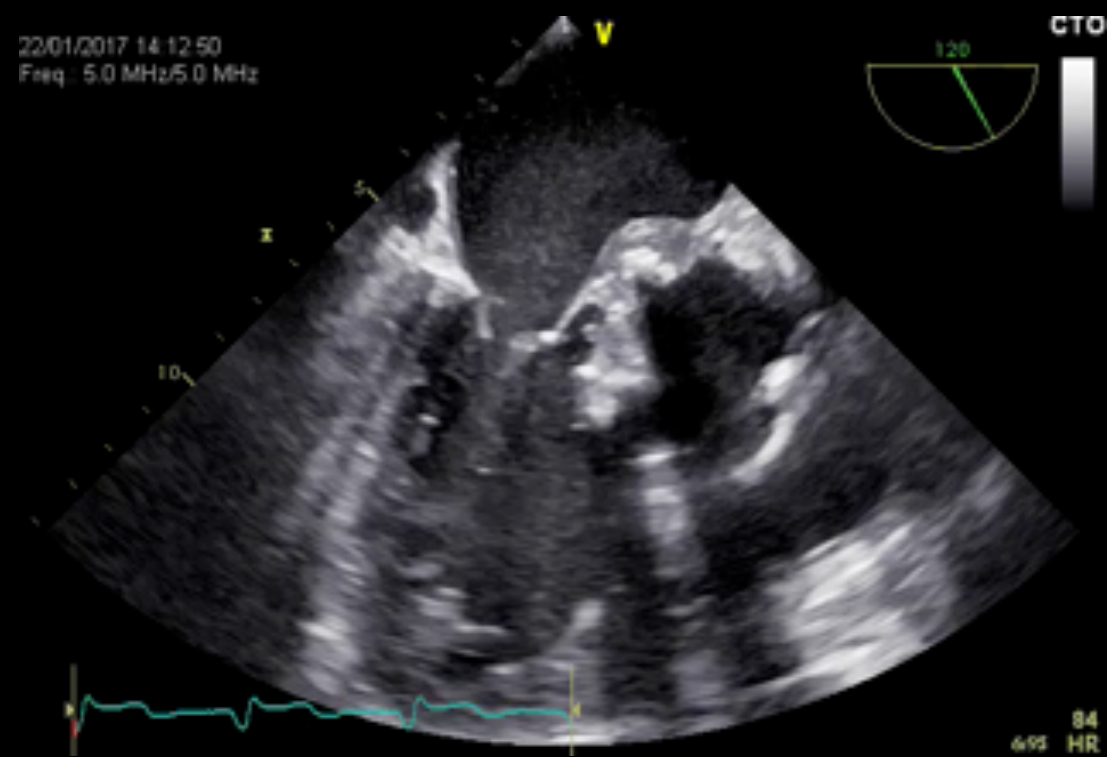




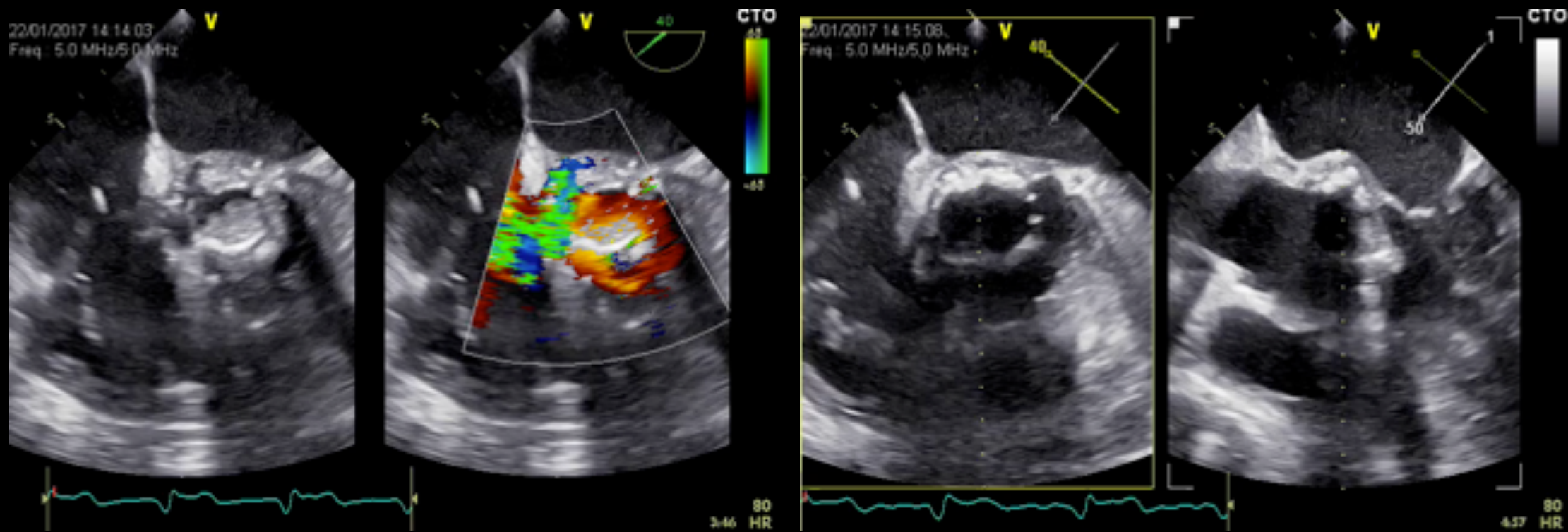
# Rocking valve



# Rocking valve

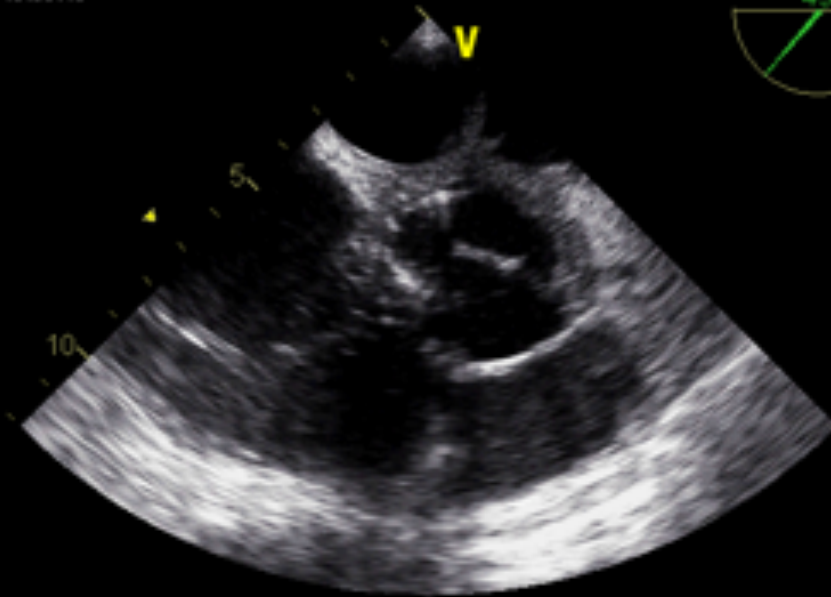


# Rocking valve

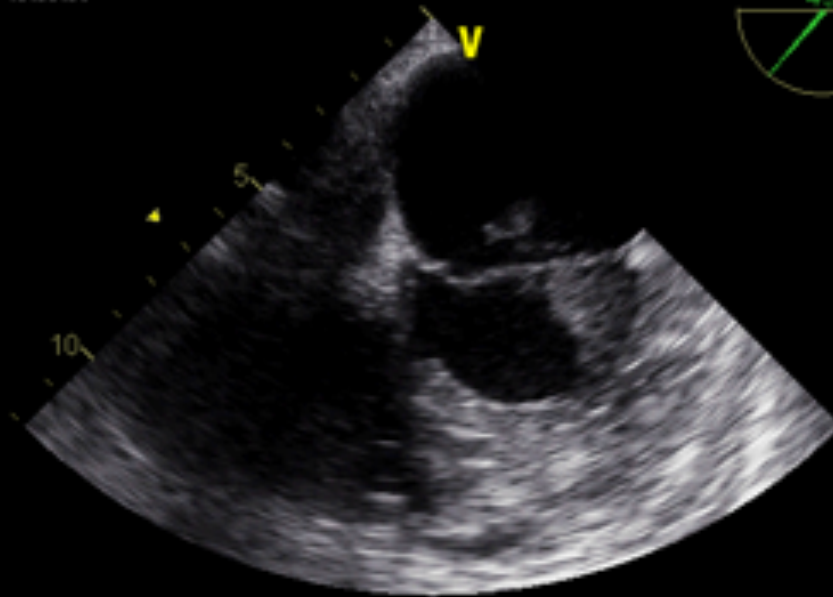


# Koorts en shock

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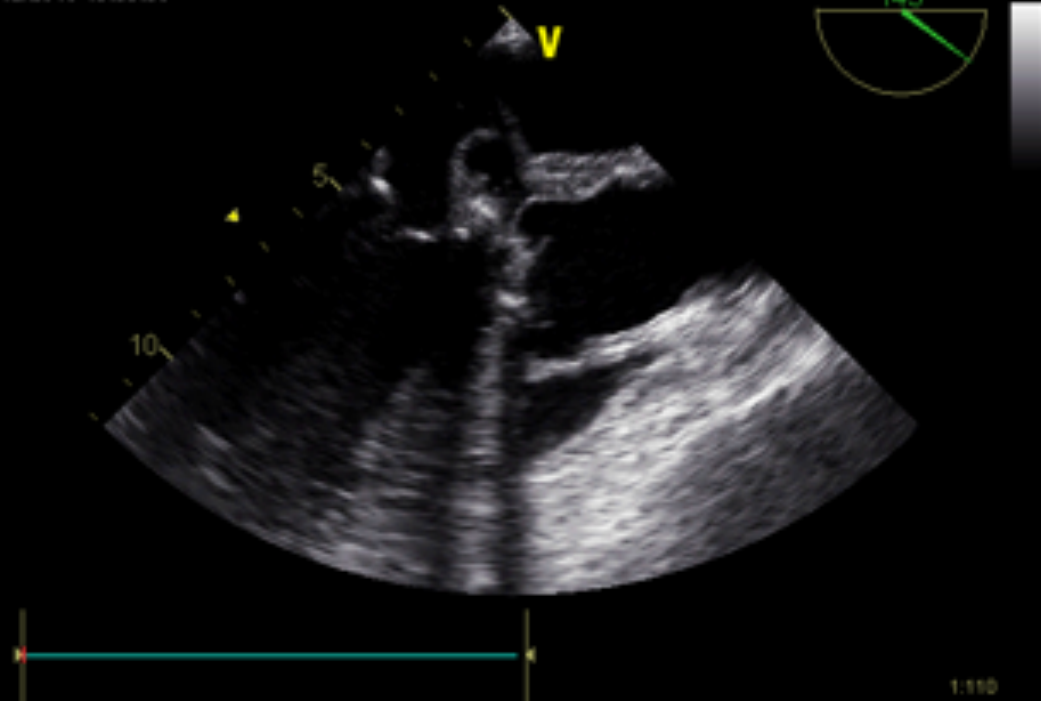
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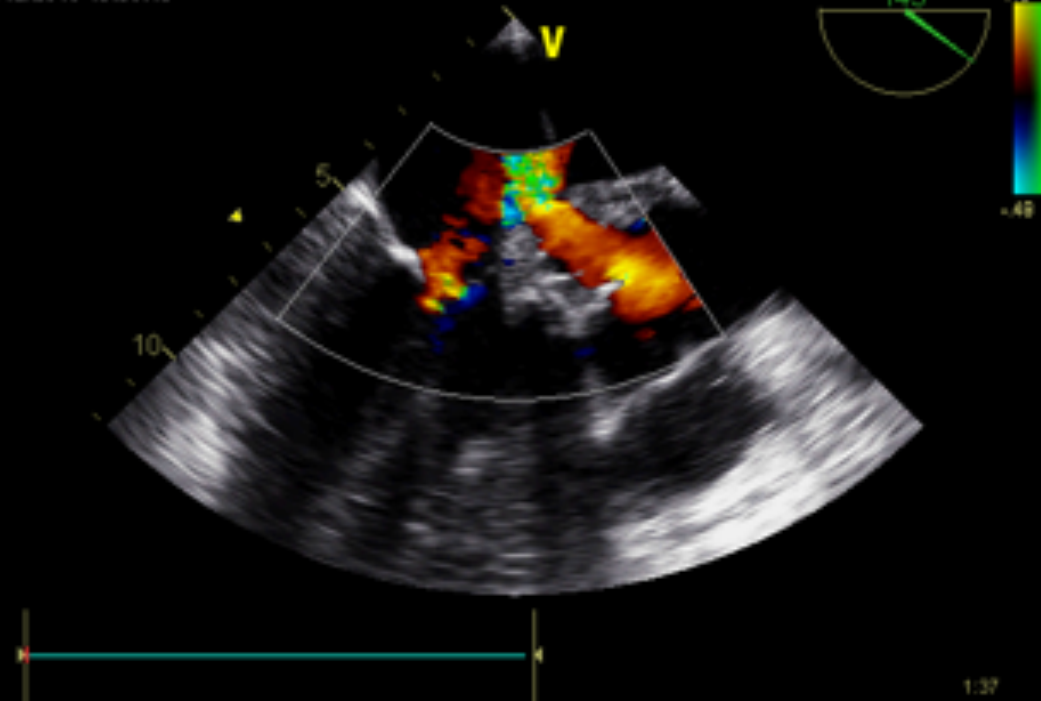


# Perforatie aorta wortel naar LA

12/12/2010 19:55:30

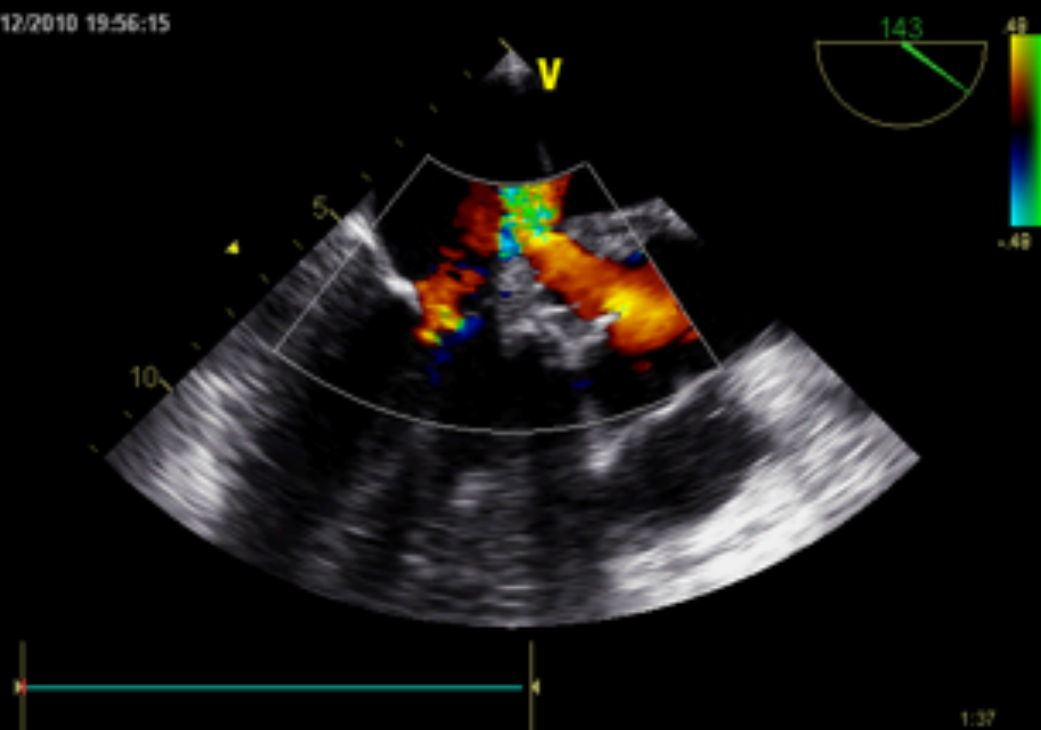


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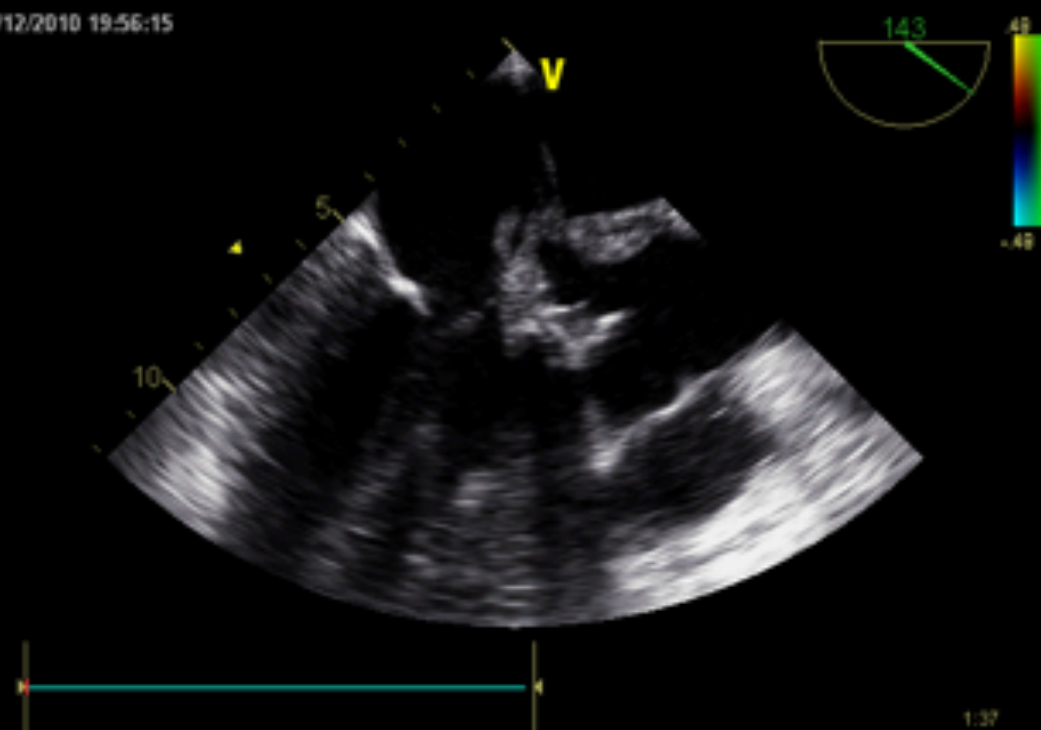


# Perforatie aorta wortel naar LA

12/12/2010 19:56:15



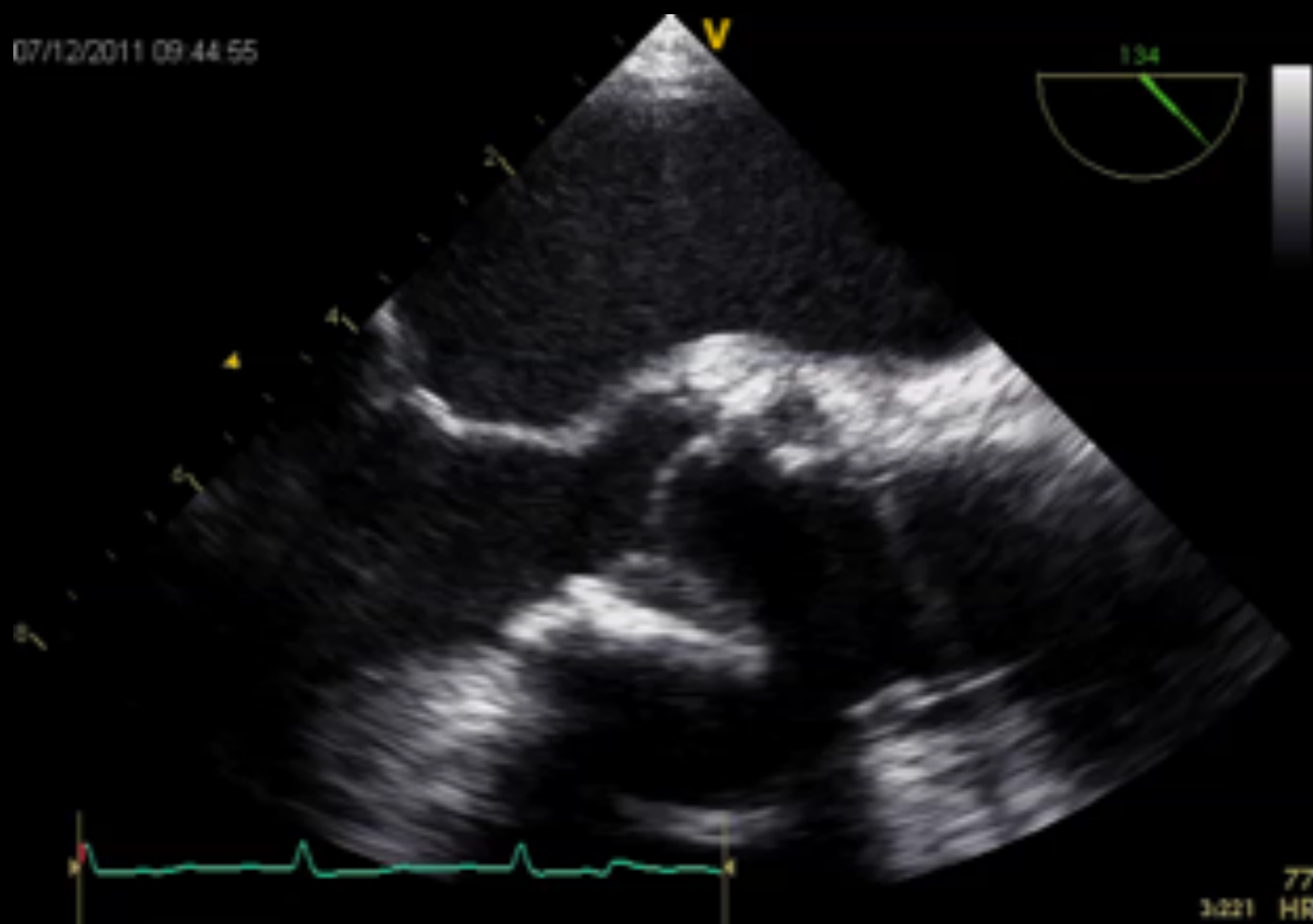
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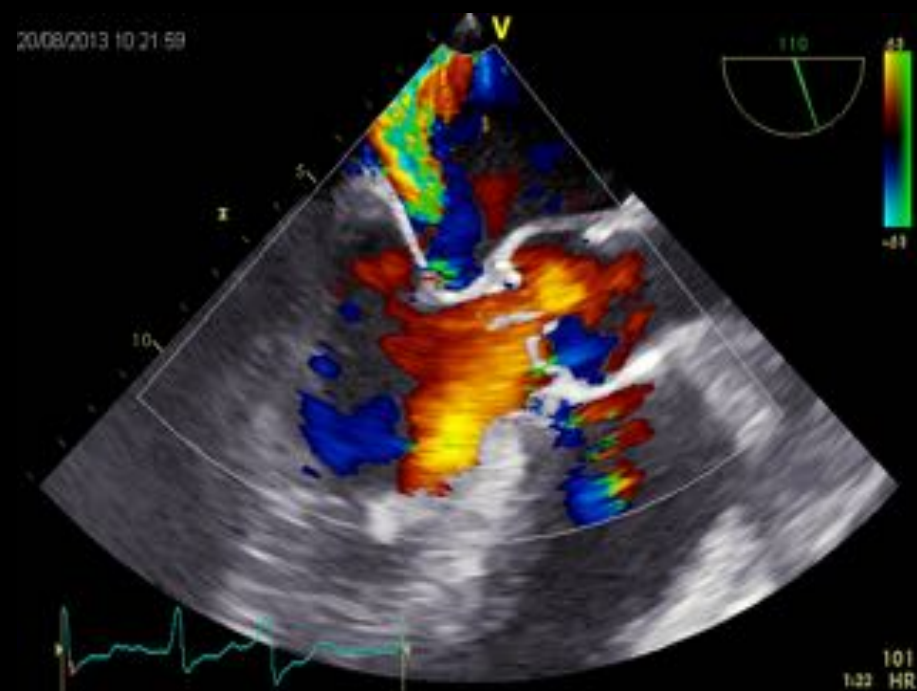
1:37

1:37

# Echocardiografie

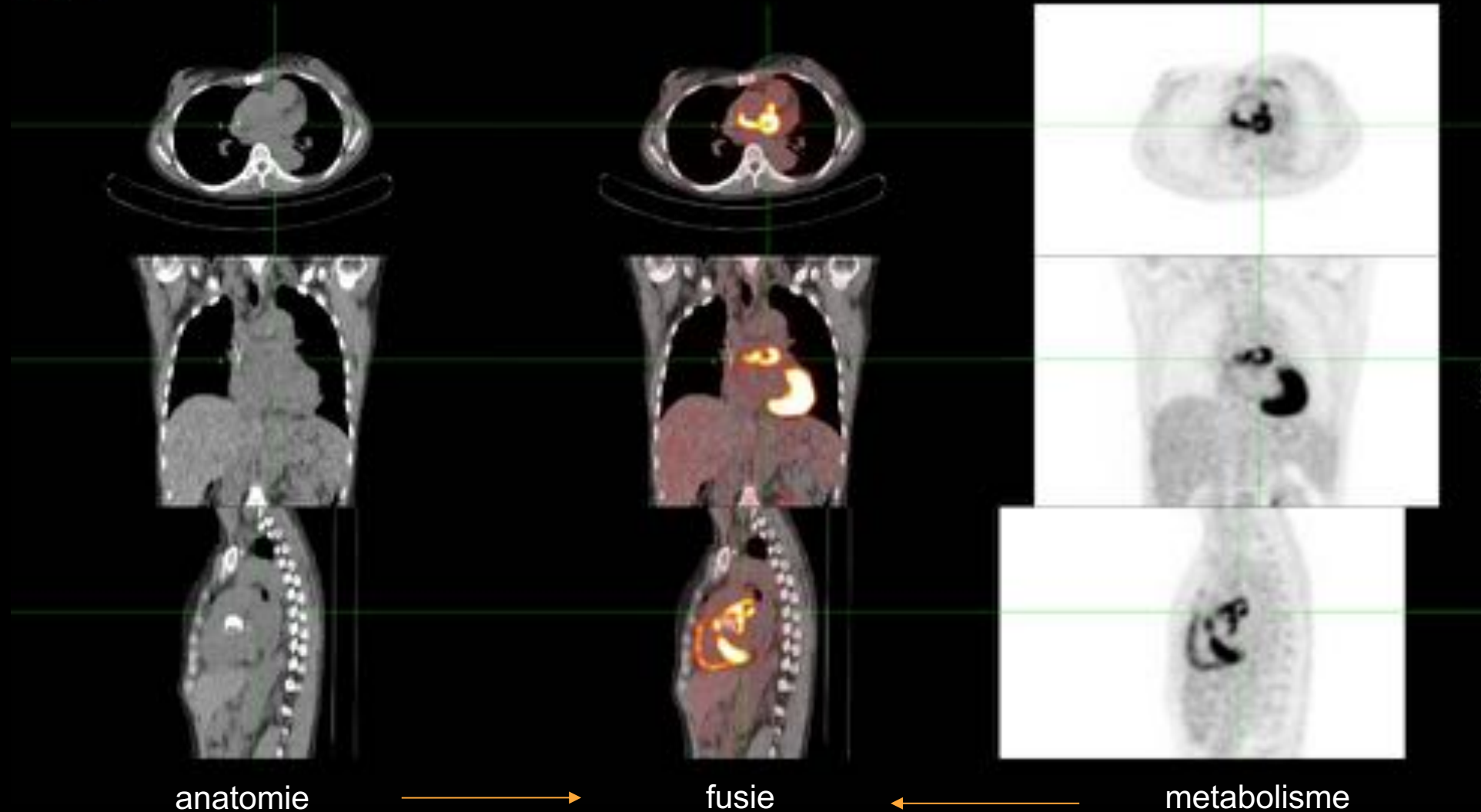


# Echocardiografie





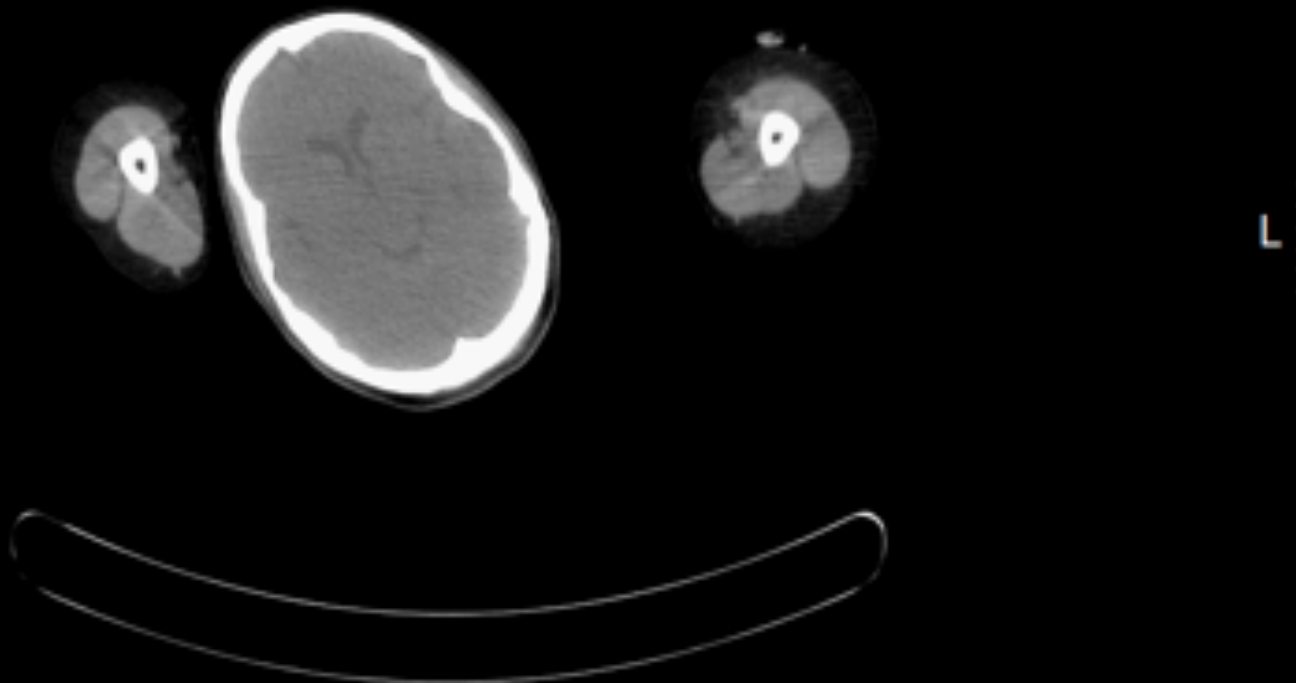
# Combinatie van anatomie en glucose metabolisme: PET CT



# PET CT

Slice: 5mm  
Pos.: 1485mm  
F: B

C: 127,5, W: 255,0

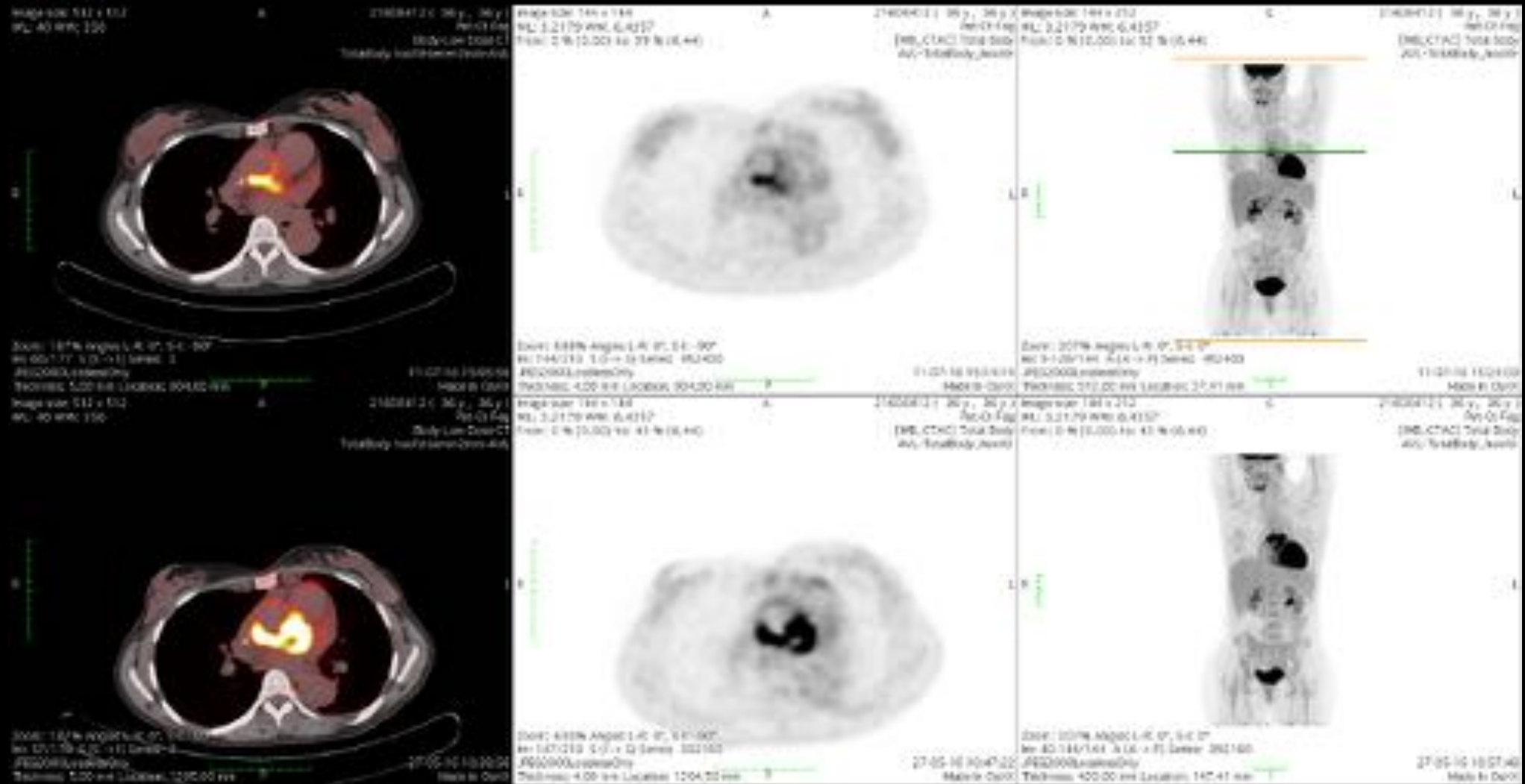


Serie: 5391

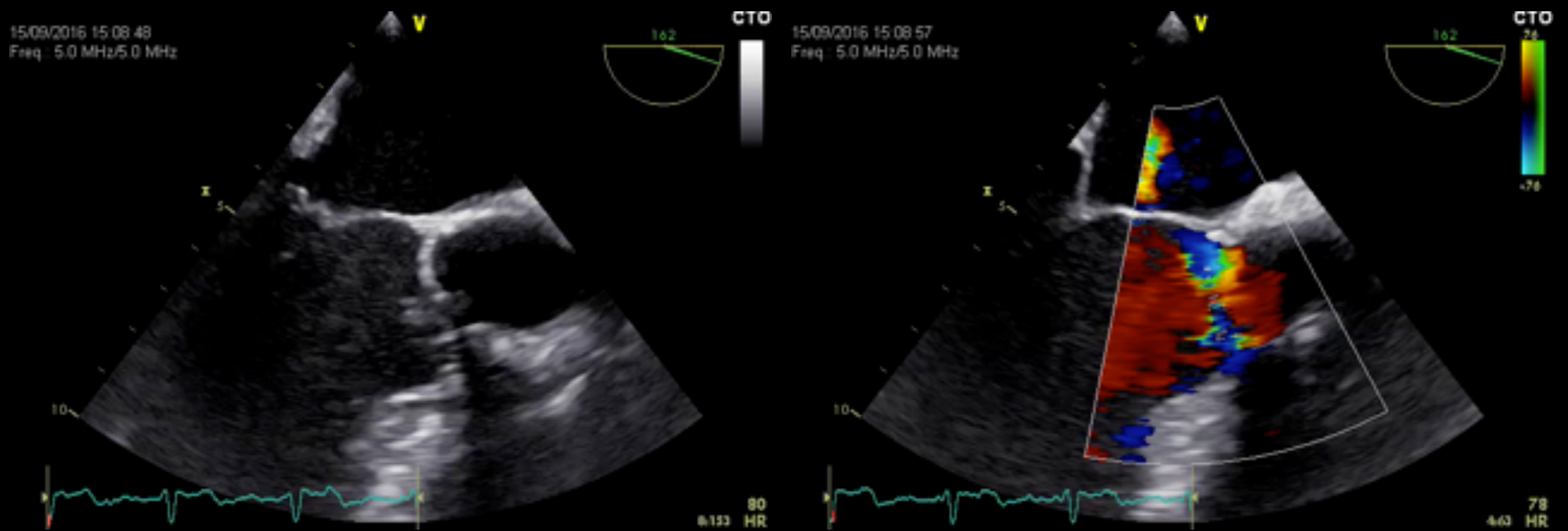
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# Evaluatie therapie

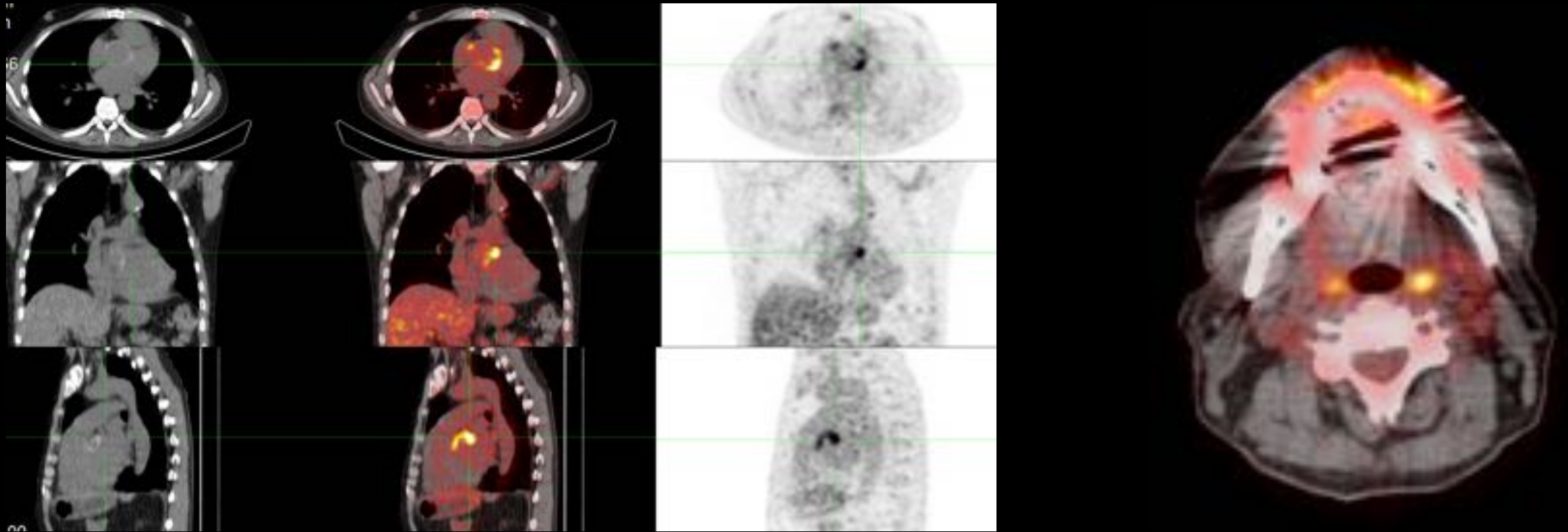


# Man, 50 jaar. Prothese endocarditis met Streptococ Mitis

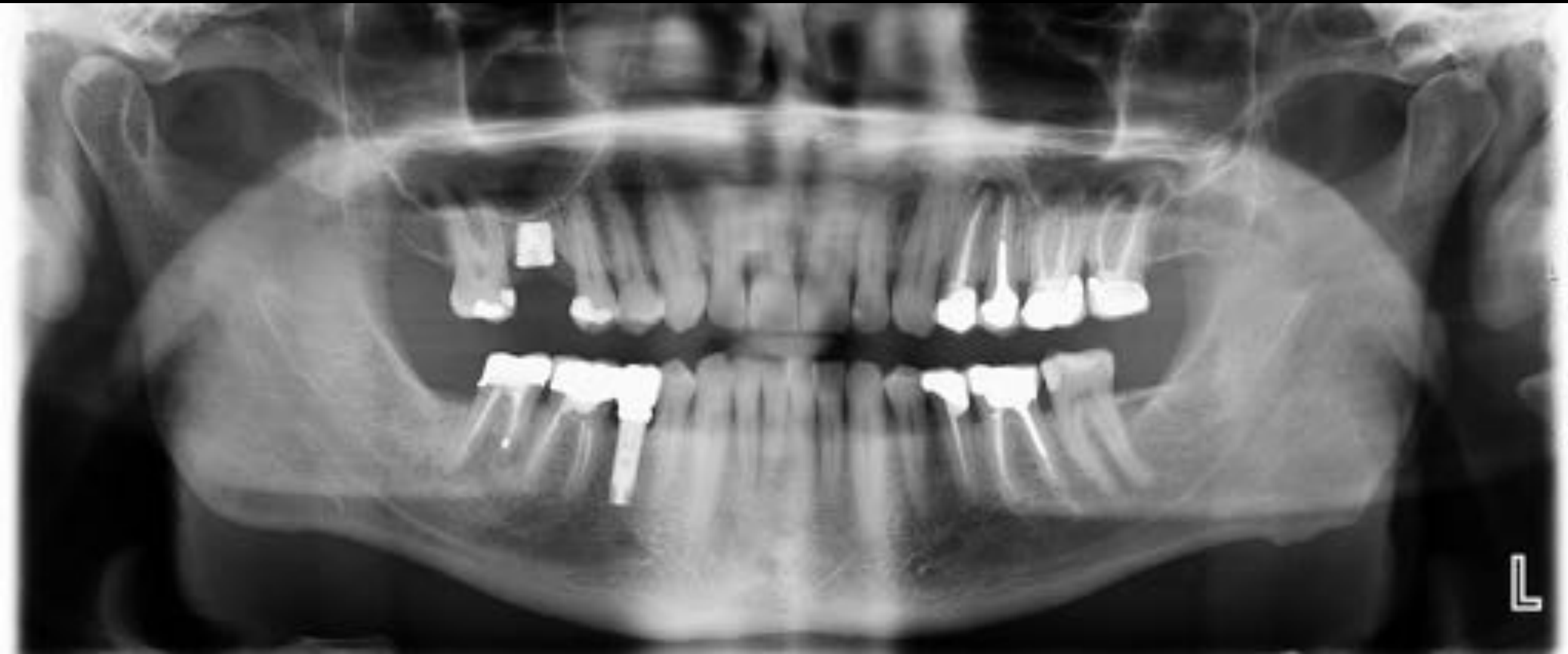




# Opsporen foci en embolisatie



Dentogeen focus 24, 25, 26, 27, waarvoor extractie.  
Hierna succesvolle re-operatie van aortaklep en buisprothese

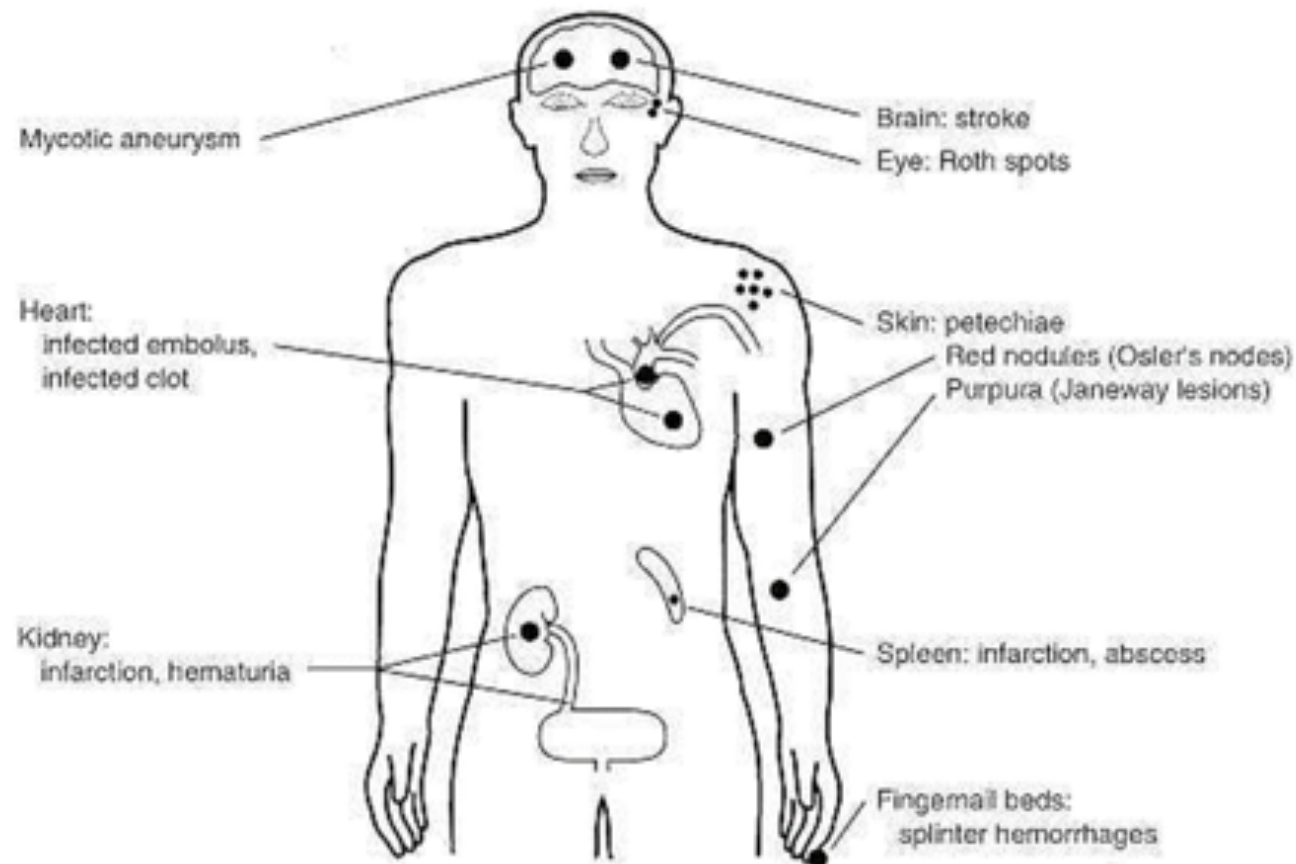
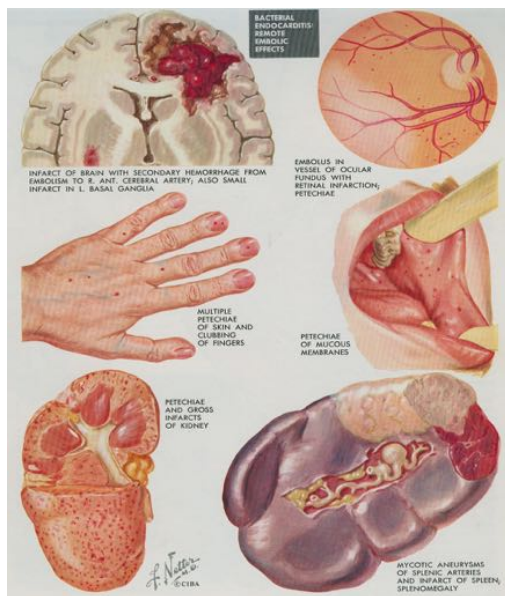


# Complicaties endocarditis

Hartfalen door klep destructie

Geleidingsstoornis, AV blok

Embolisatie van vegetaties



# Embolisatie

Embolisatie komt in meer dan 50% van de patiënten voor is levensbedreigend

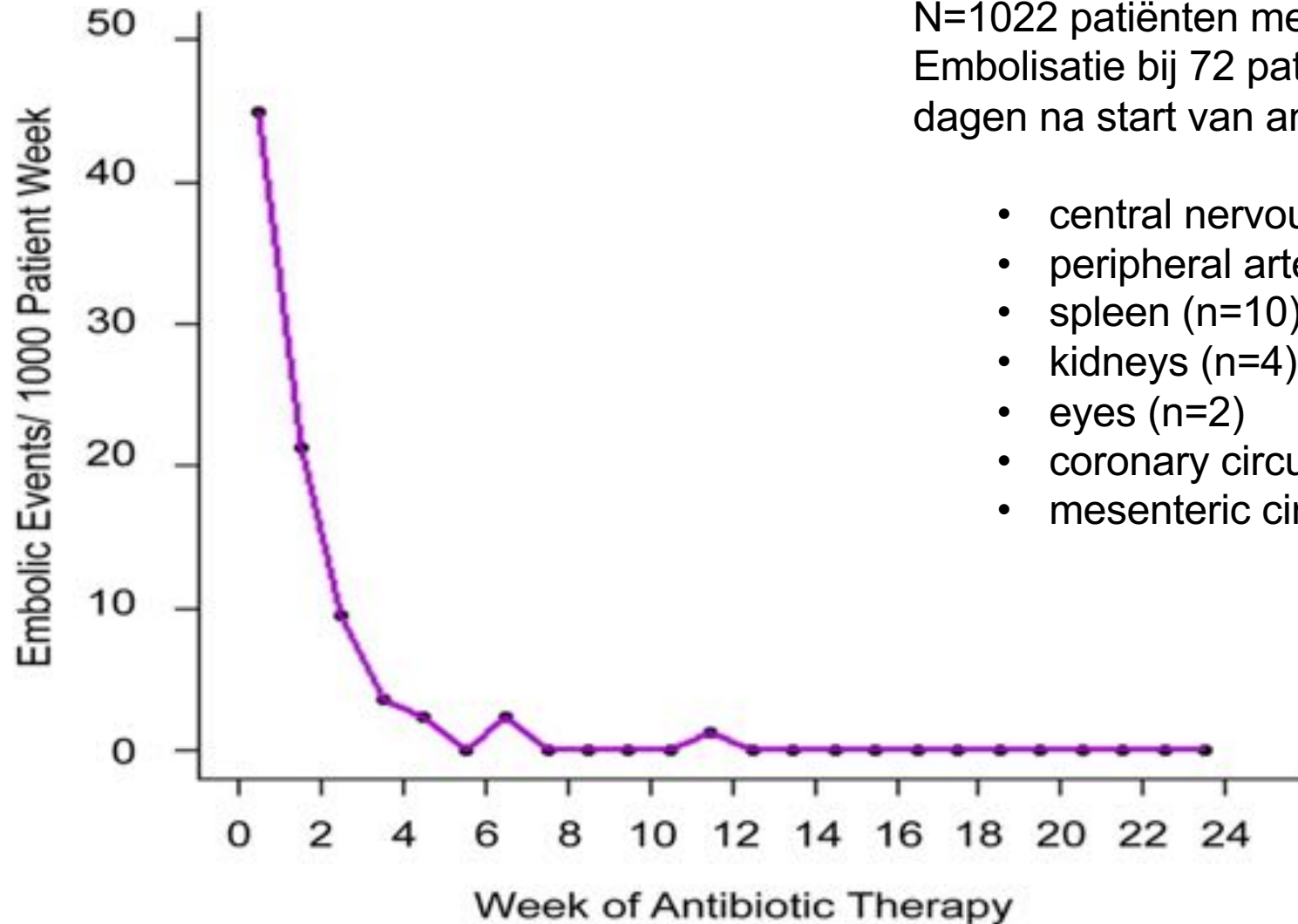
Embolisatie geeft een slechte prognose, in het bijzonder naar de cerebrale circulatie.

Er zijn twee verschillende typen embolisatie:

- 1) De embolisatie die optreedt voor behandeling met antibiotica en kan worden voorkomen door eerder de diagnose te stellen en behandeling te starten
- 2) De embolisatie die optreedt gedurende en na de antibiotische behandeling en die voorkomen kan worden met klepchirurgie



# Embolisatie



N=1022 patiënten met endocarditis  
 Embolisatie bij 72 patiënten (mediaan van 6.5  
 dagen na start van antibiotica)

- central nervous system (n=36),
- peripheral arteries (n=16),
- spleen (n=10),
- kidneys (n=4)
- eyes (n=2)
- coronary circulation (n=2)
- mesenteric circulation (n=2)

# Embolisatie risico

Enkele factoren verhogen het risico op embolisatie:

Lengte en lokalisatie van de vegetatie

Het veroorzakende micro-organisme

De aanwezigheid van eerdere embolieën

DATA AT ADMISSION		
<b>Clinical Data</b>	Age (years)	75
	Diabetes (0: no ; 1: yes)	1
	Previous embolism (0: no ; 1: yes)	1
	Atrial fibrillation (0: no ; 1: yes)	0
<b>Echocardiography</b>	Vegetation >0 to ≤10 mm (0: no ; 1: yes)	0
	Vegetation >10 mm (0: no ; 1: yes)	1
<b>Microorganism</b>	<i>Staphylococcus aureus</i> (0: no ; 1: yes)	1

PREDICTED EMBOLIC RISK CALCULATION		
Time (Days)	Predicted Embolic Risk	
1		5%
2		6%
3		10%
4		13%
5		14%
6		15%
7		16%
10		18%
11		18%
12		20%
13		22%
14		24%
18		24%
19		25%
23		26%
28		27%
35		27%
47		28%
48		28%
180		29%

# Ingrijpende behandeling

## langdurige toediening van i.v. antibiotica

AB behandeling begint breed en hoog gedoseerd.

Na bekend worden van de kweek wordt de antibiotische behandeling versmald

Duur 4 weken – 6 weken

Bij (risico op) complicaties kan worden overgegaan tot OK (50%)

Hartfalen

Onvoldoende reactie op AB

Embolisatie

AB

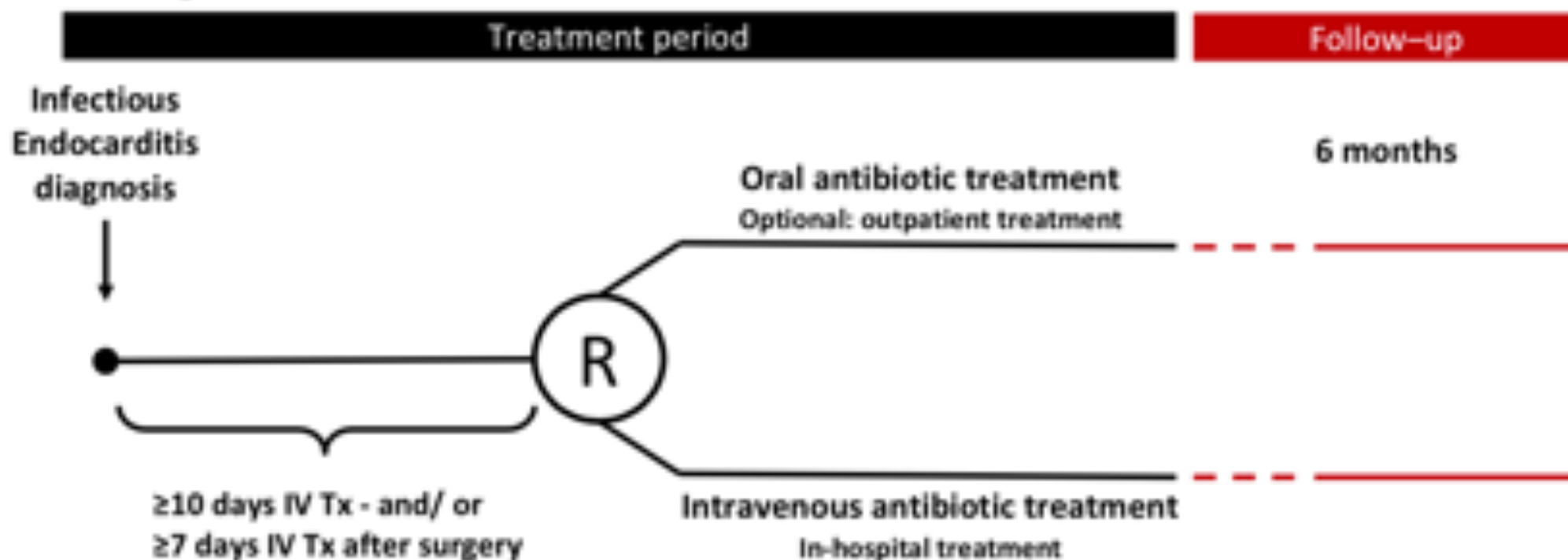
**Table 13** Antibiotic treatment of infective endocarditis due to oral streptococci and group D streptococci\*

Antibiotic	Dosage and route	Duration (weeks)	Level of evidence
Strains fully susceptible to penicillin (MIC <0.125 mg/L)			
Standard treatment			
Penicillin G <sup>a</sup> or Amoxicillin <sup>a</sup> or Ceftriaxone <sup>a</sup>	12–18 million U/day i.v. in 6 doses  100–200 mg/kg/day i.v. in 4–6 doses  2 g/day i.v. or i.m. in 1 dose  <i>Paediatric doses:<sup>f</sup></i> 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.	4 <sup>c</sup>  4 <sup>c</sup>  4 <sup>c</sup>	1B  1B  1B
Two-week treatment <sup>d,e</sup>			
Penicillin G or Amoxicillin <sup>a</sup> or Ceftriaxone <sup>a</sup> <i>with</i> Gentamicin <sup>b</sup> or Netilmicin	12–18 million U/day i.v. in 6 doses  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  <i>Paediatric doses:<sup>f</sup></i> Penicillin, amoxicillin and ceftriaxone as above. Gentamicin 3 mg/kg/day i.v. or i.m. in 1 dose or in 3 equally divided doses.	2  2  2  2	1B  1B  1B  1B



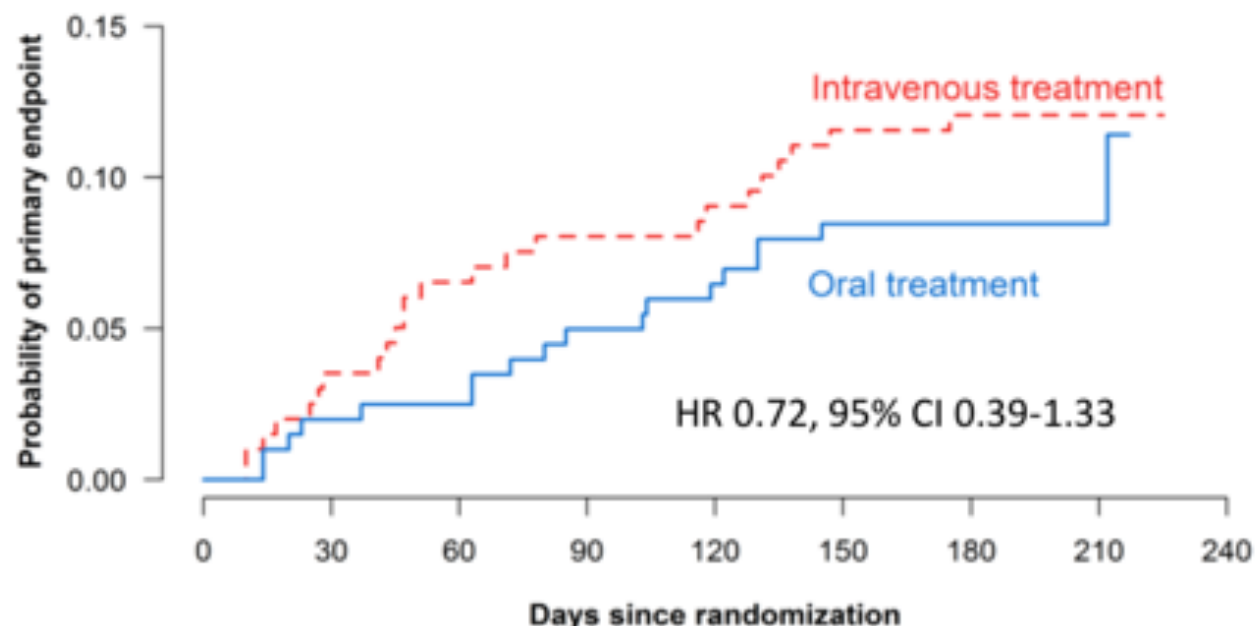
# The POET trial design

Investigator initiated, nationwide, randomised, unblinded clinical trial

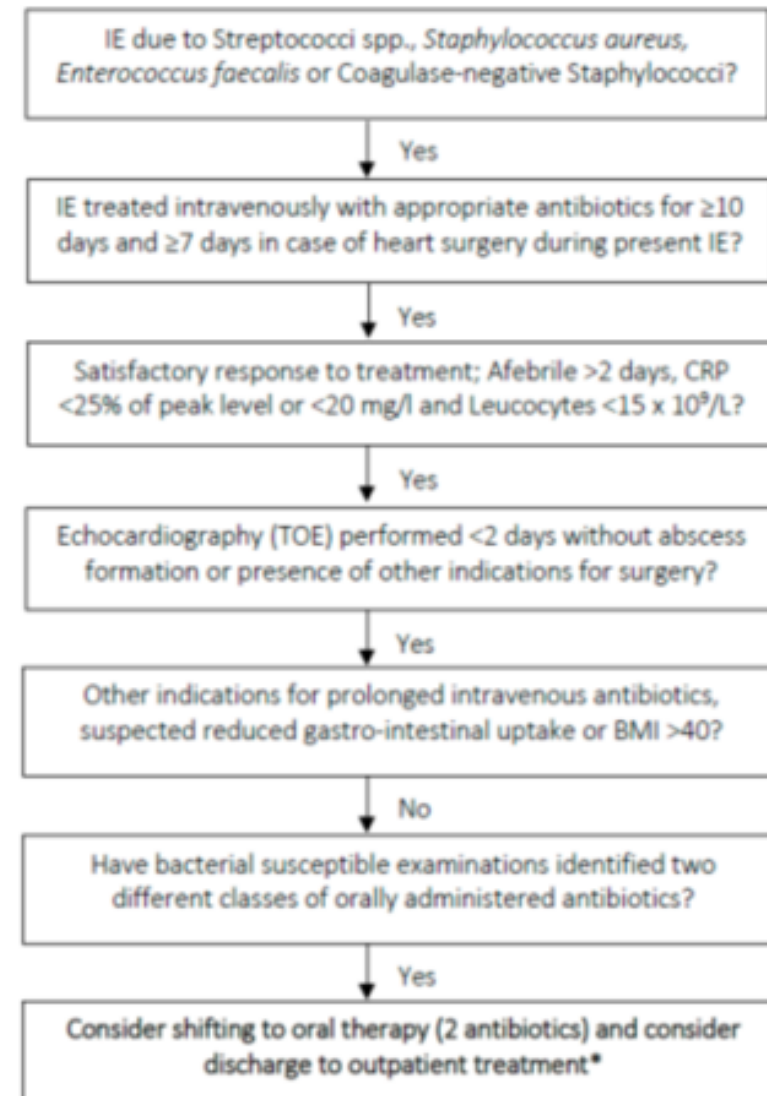


# Primary EP POET trial and proposed algorithm

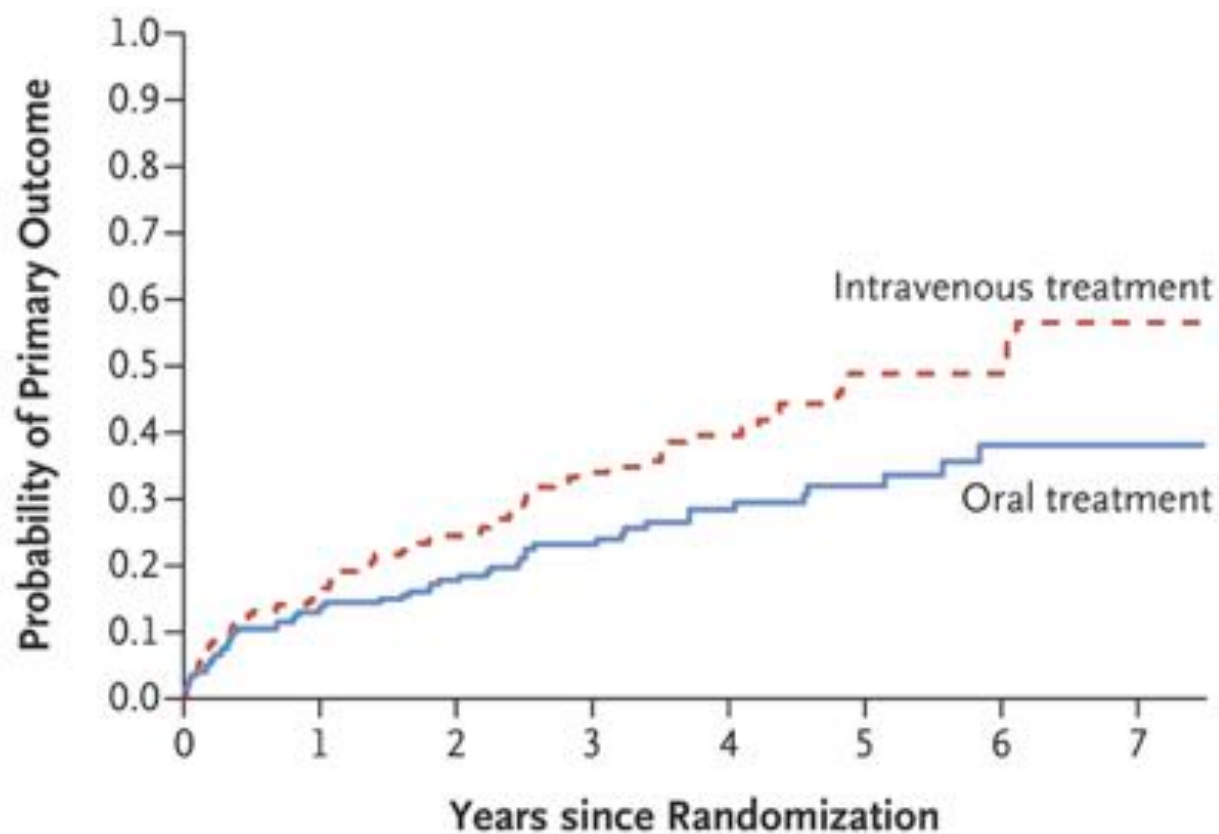
**Difference 3.1%, 95% CI: -3.4% - 9.6%, Non-inferiority met**



No. at Risk	0	30	60	90	120	150	180	210	240
Intravenous treatment	199	192	186	183	181	176	174	28	0
Oral treatment	201	197	196	191	188	184	183	36	0



# Long term follow up POET trial



### No. at Risk

Intravenous treatment	199	168	126	88	56	33	20	4
Oral treatment	201	175	136	99	66	43	25	6

The primary composite outcome:

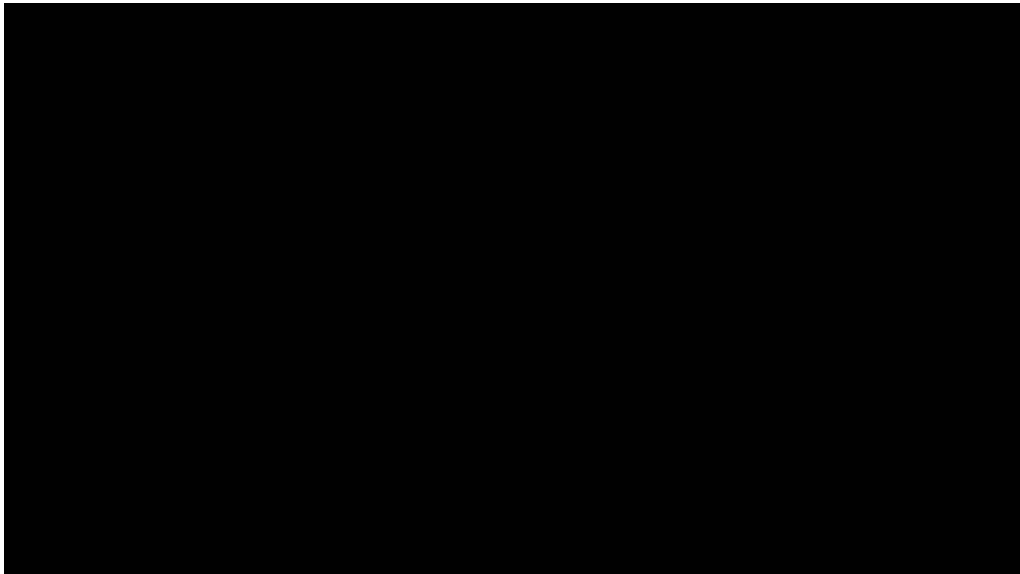
- all-cause mortality
- unplanned cardiac surgery
- embolic events
- relapse of bacteremia

# Indicatie voor operatie en timing

Indications for surgery	Timing	Class	Level
<b>1. Heart Failure</b>			
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
<b>2. Uncontrolled infection</b>			
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
<b>3. Prevention of embolism</b>			
Aortic or mitral NVE or PVE with persistent vegetations >10 mm after one or more embolic episode despite appropriate antibiotic therapy.	Urgent	I	B
Aortic or mitral NVE with vegetations >10 mm, associated with severe valve stenosis or regurgitation, and low operative risk.	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated very large vegetations (>30 mm).	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated large vegetations (>15 mm) and no other indication for surgery.	Urgent	IIb	C

# Indications for and Timing of Surgery

Emergency <24 h  
 Urgent < few days  
 Elective > 1 -2 weeks



**Table 2. Indications for and Timing of Surgery in Patients with Left-Sided, Native-Valve Infective Endocarditis.\***

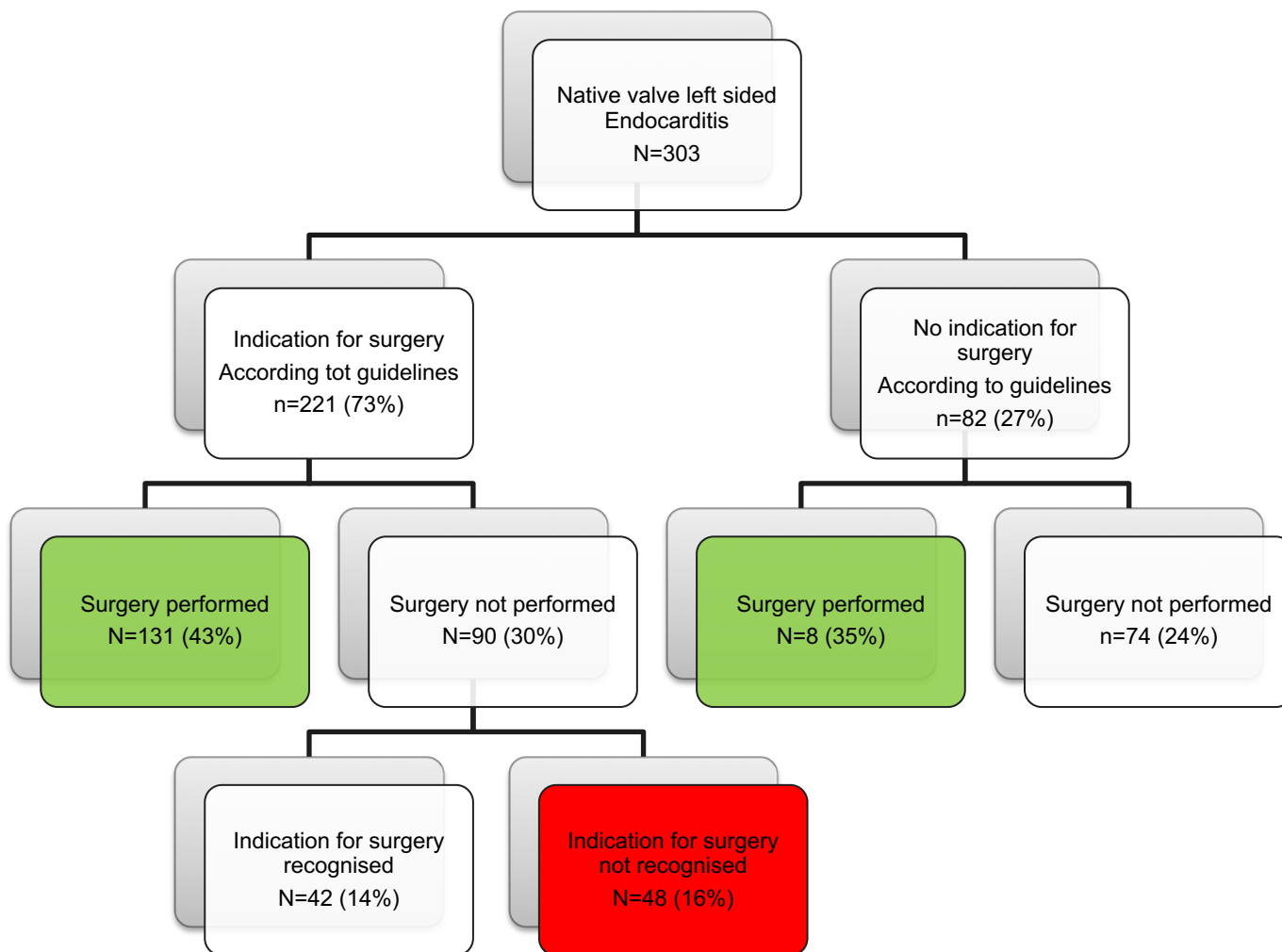
Indication	Timing of Surgery†
<b>Heart failure</b>	
Aortic or mitral-valve infective endocarditis with severe acute regurgitation or obstruction causing refractory pulmonary edema or cardiogenic shock	Emergency
Aortic or mitral-valve infective endocarditis with fistula into a cardiac chamber or pericardium causing refractory pulmonary edema or cardiogenic shock	Emergency
Aortic or mitral-valve infective endocarditis with severe acute regurgitation or obstruction and persistent heart failure or signs of poor hemodynamic tolerance (early mitral-valve closure or pulmonary hypertension)	Urgent
Aortic or mitral-valve infective endocarditis with severe regurgitation and heart failure easily controlled with medical treatment	Elective
<b>Uncontrolled infection</b>	
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation, or dehiscence of prosthetic valve)	Urgent
Persistent fever and positive blood cultures for >5–7 days	Urgent
Infection caused by fungi or multidrug-resistant organisms, such as <i>Pseudomonas aeruginosa</i> and other gram-negative bacilli	Elective
<b>Prevention of embolism</b>	
Aortic or mitral-valve infective endocarditis with large vegetations (>10 mm in length) after one or more embolic episodes, despite appropriate antibiotic therapy, especially during the first 2 weeks of therapy	Urgent
Aortic or mitral-valve infective endocarditis with large vegetations (>10 mm) and other predictors of complicated course (heart failure, persistent infection, or abscess)	Urgent
Isolated, very large vegetations (>15 mm); surgery may be preferred if a procedure preserving the native valve is feasible	Urgent

\* Adapted from Habib et al.<sup>30</sup>

† Emergency surgery was defined as surgery performed within 24 hours after the condition was identified, urgent surgery as that performed within a few days after the condition was identified, and elective surgery as that performed after at least 1 or 2 weeks of antibiotic therapy.



# De behandeling van endocarditis: guideline versus praktijk



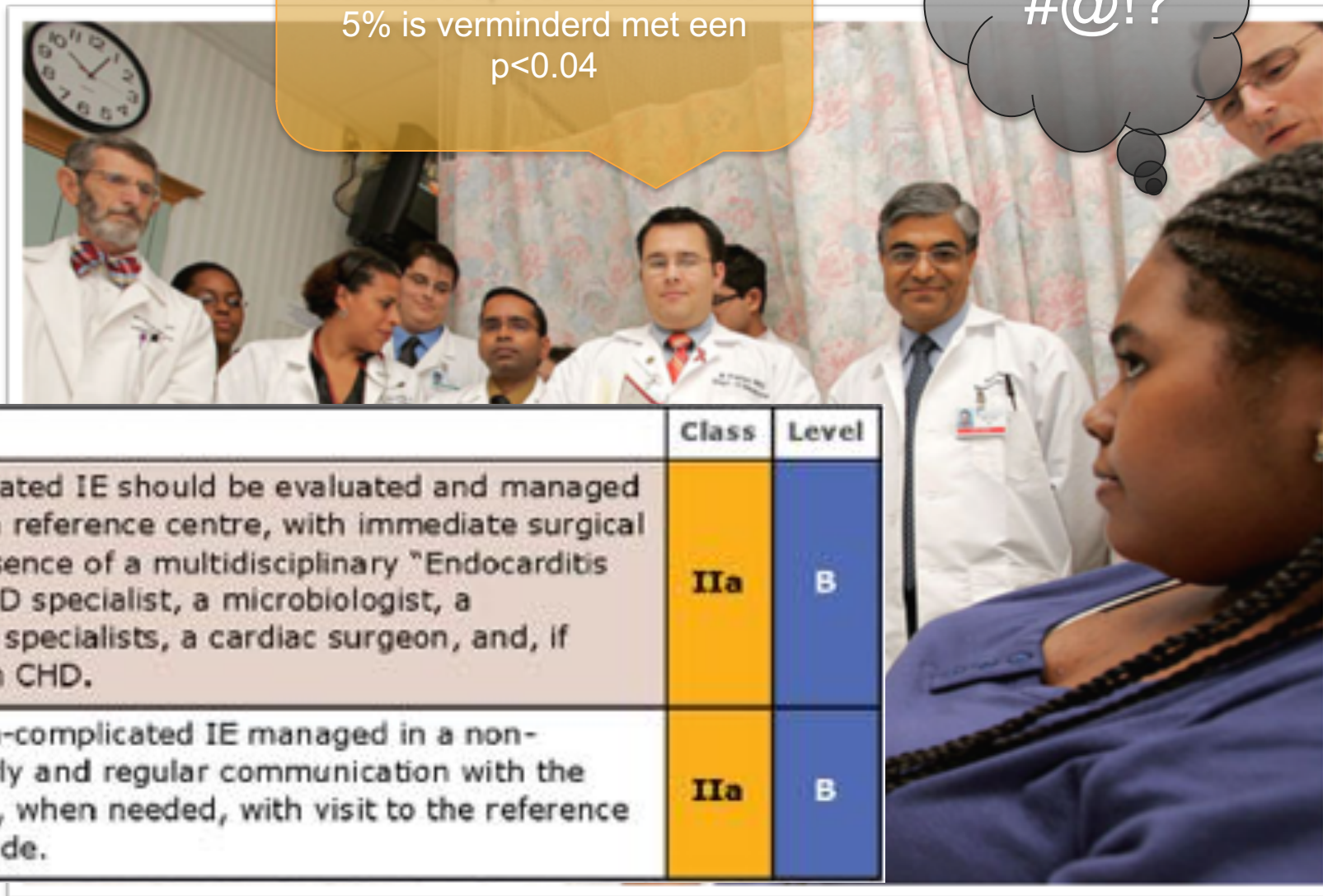
73% van de patiënten had een operatie indicatie tijdens acute endocarditis

Echter 46% onderging een operatie

De operatie indicatie werd niet herkend in 42 van de 90 niet geopereerde patiënten, die volgens de richtlijn een operatie indicatie hadden.

Goed nieuws, we weten dat het risico op een CVA nu met 5% is verminderd met een  $p < 0.04$

#@!?



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.	<b>IIa</b>	<b>B</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.	<b>IIa</b>	<b>B</b>

# Operatieve behandeling

Operatie 6-12 uur – hartlong machine

Operatie risico 2%-70%

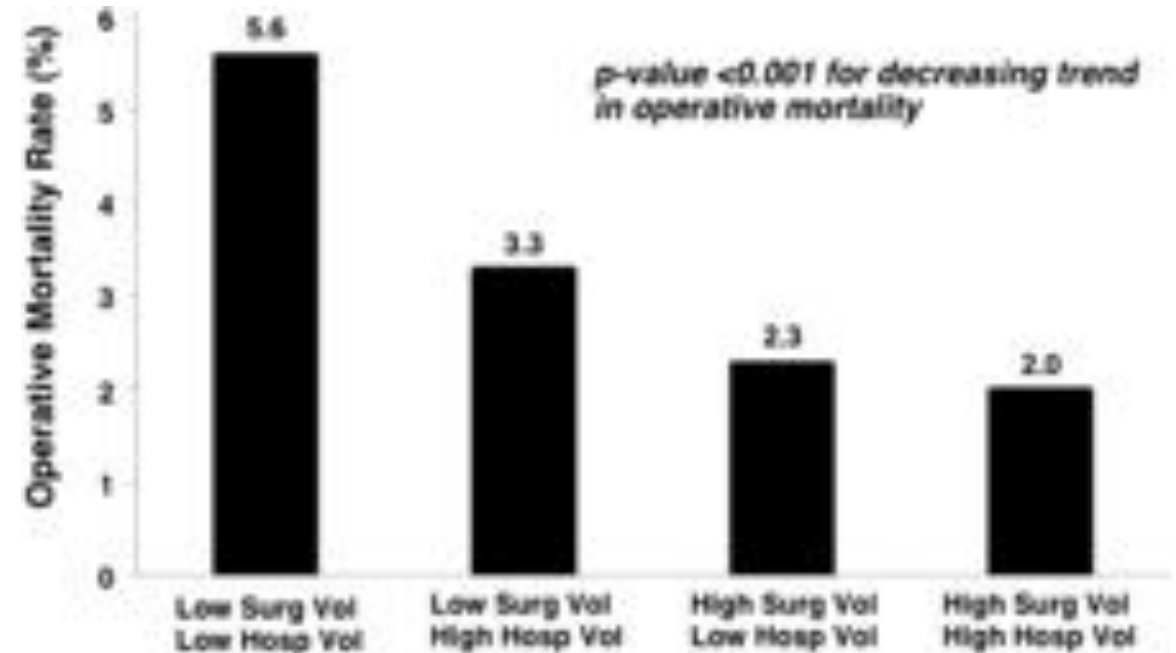
Afhankelijk van leeftijd/pompfunctie

Gespecialiseerde chirurg nodig

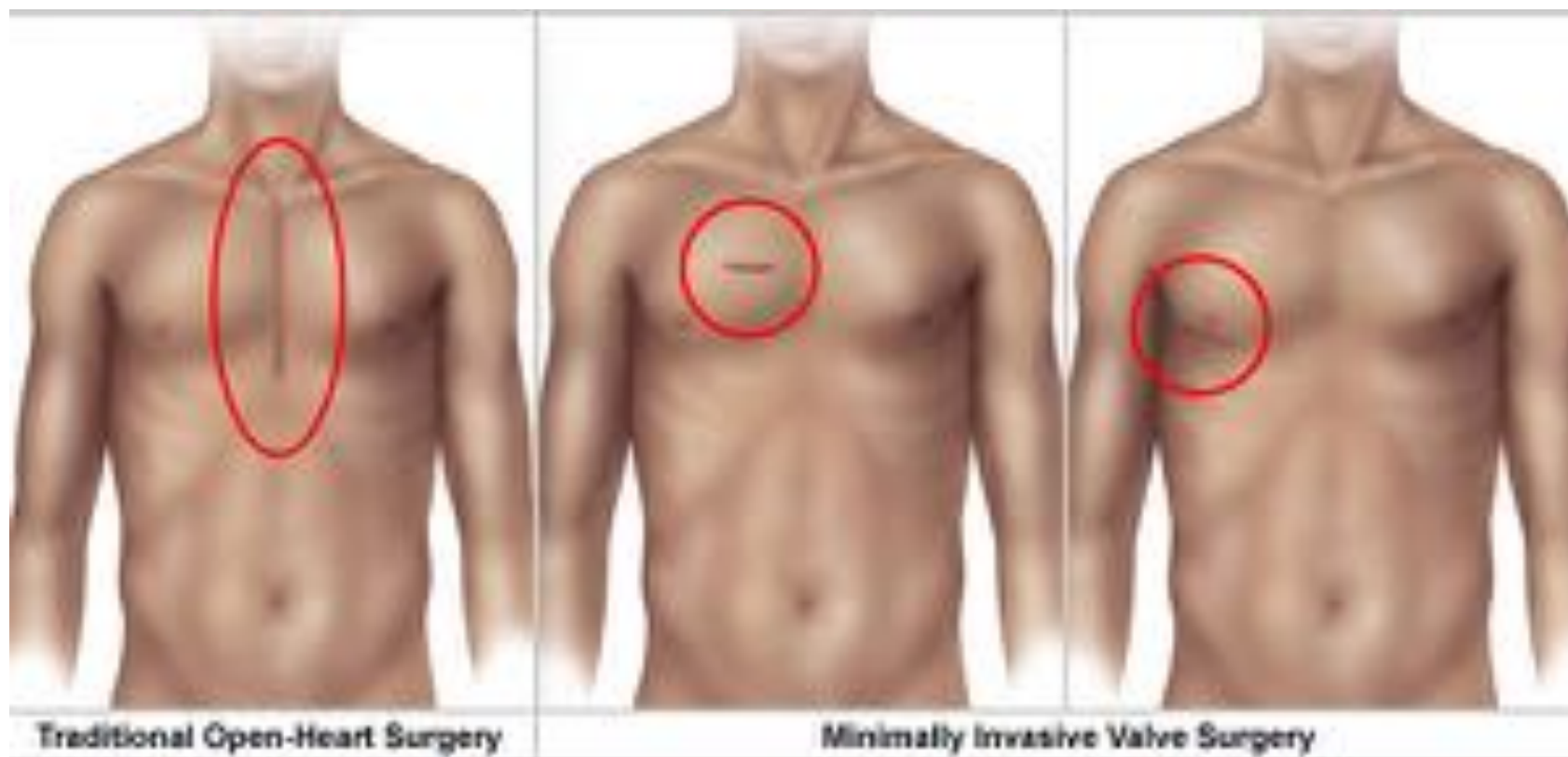
Elke uur opereren staat voor 1 maand revalidatie

Tot na 1 jaar neurocognitieve problemen

Post perfusie syndroom: “pumphead”

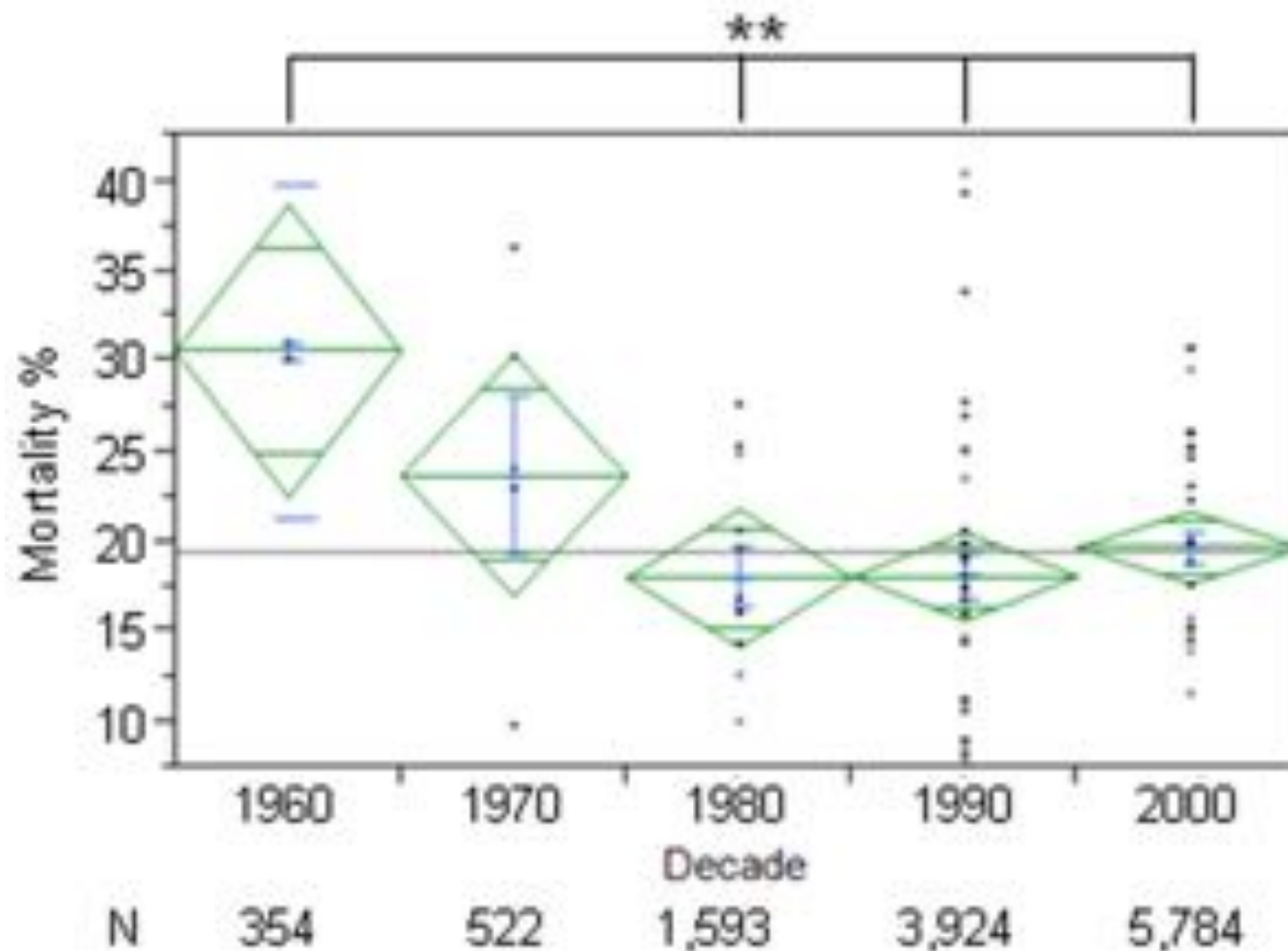


# Hartchirurgie: minimaal invasieve hartklep operaties



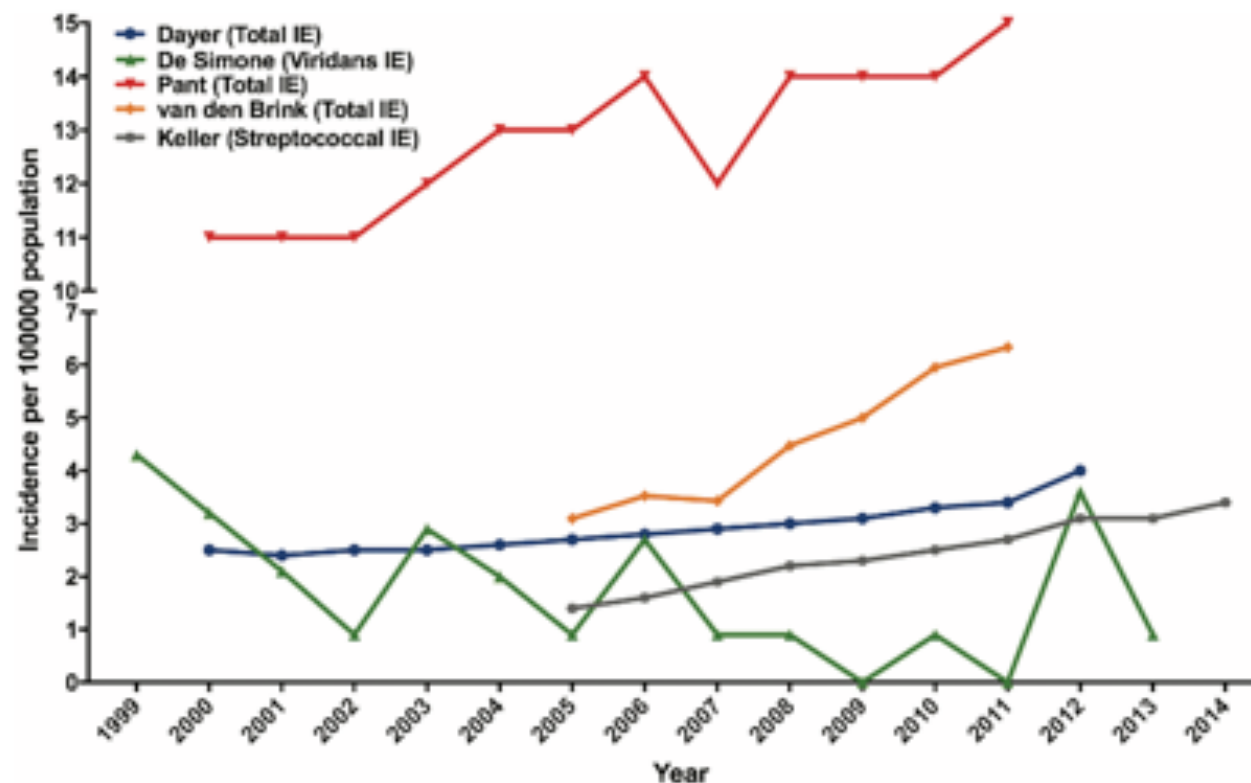
Kortere opname duur, minder pijn, kleinere incisies, sneller herstel

# In-Hospital Mortality of Infectious Endocarditis





# SBE profylaxe – shifting panels...



**Figure 2** Annual incidence of infective endocarditis (IE) reported in time-trend analyses. The data for annual incidence or prevalence were reported in three studies<sup>17,18,20</sup> and obtained from the authors for two studies.<sup>19,20</sup> The incidence of viridans streptococcal IE in DeSimone *et al* was 0 in 2009 and 2011. The incidence values for Pant *et al*<sup>17</sup> were higher than other studies due to the inclusion of IE as both a primary and secondary diagnosis (included solely as a primary diagnosis in the other studies).

## Conclusies

Endocarditis is een ernstige en vaak fatale ziekte

De diagnose is vaak lastig te stellen

Vroege behandeling is belangrijk ter voorkoming van complicaties

Complicaties zijn hartfalen, geleidingstoornissen en embolisatie

Embolisatie kan soms voorkomen worden door hart chirurgie

Operatie moet vroeg in het ziekte beloop



Boek omslaan

## Emboliebron in beeld

De rol van echocardiografie bij de evaluatie van een cardiale emboliebron

Auteur: dr. Robert Riezebos

ISBN: 978-94-92467-17-1

Wereldwijd worden ieder jaar vijftien miljoen mensen getroffen door een beroerte. Ongeveer een derde van de herseninfarcten is het gevolg van een cardiale emboliebron. Embolisatie ontstaat meestal als gevolg van trombi, maar kan ook in het kader van tumoren en vegetaties of via een rechts-linkshunt optreden. Echocardiografie is het onderzoek om bij infarcering een cardiale emboliebron aan te tonen.

In dit boek geeft dr. Robert Riezebos, cardioloog bij OLVG in Amsterdam, aan de hand van veel tabellen en figuren en beeldvorming uit de dagelijkse praktijk praktisch toepasbaar overzicht.

De opgenomen foto's in het boek zijn beschikbaar als volledige filmpjes.

BESTELLEN