



# Mitralisstenose

R.K. Riezebos

Cursus AMC 2019

## 1st case: *bony transformation of the mitral valve*

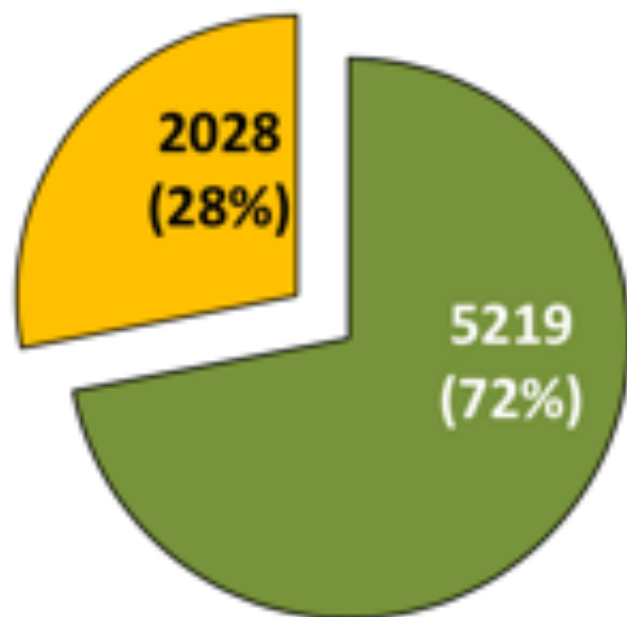
30 jarige man:

*“He was lying on his bed, his head quite high; his respiration seemed to me very difficult, his heart was working with very violent palpitation; his pulse appeared small, feeble & quite unequal, his lips were the color of lead and his eyes sunken; his legs and his hips were swollen; & rather cold than hot.”*

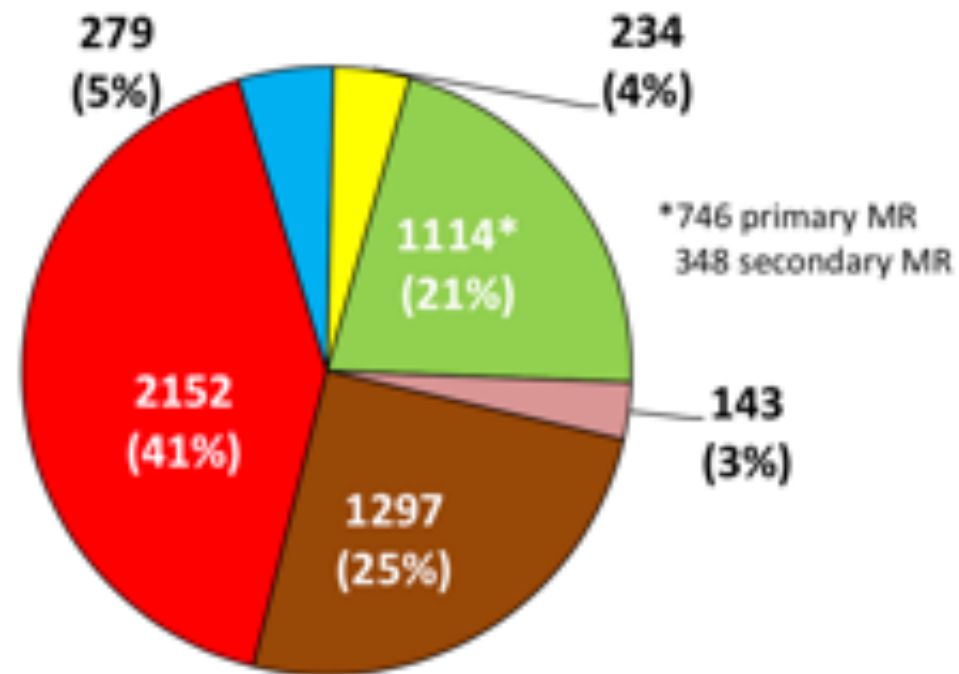


Raymond Vieussens (1641-1715)

# Distributie kleplijden in Europa

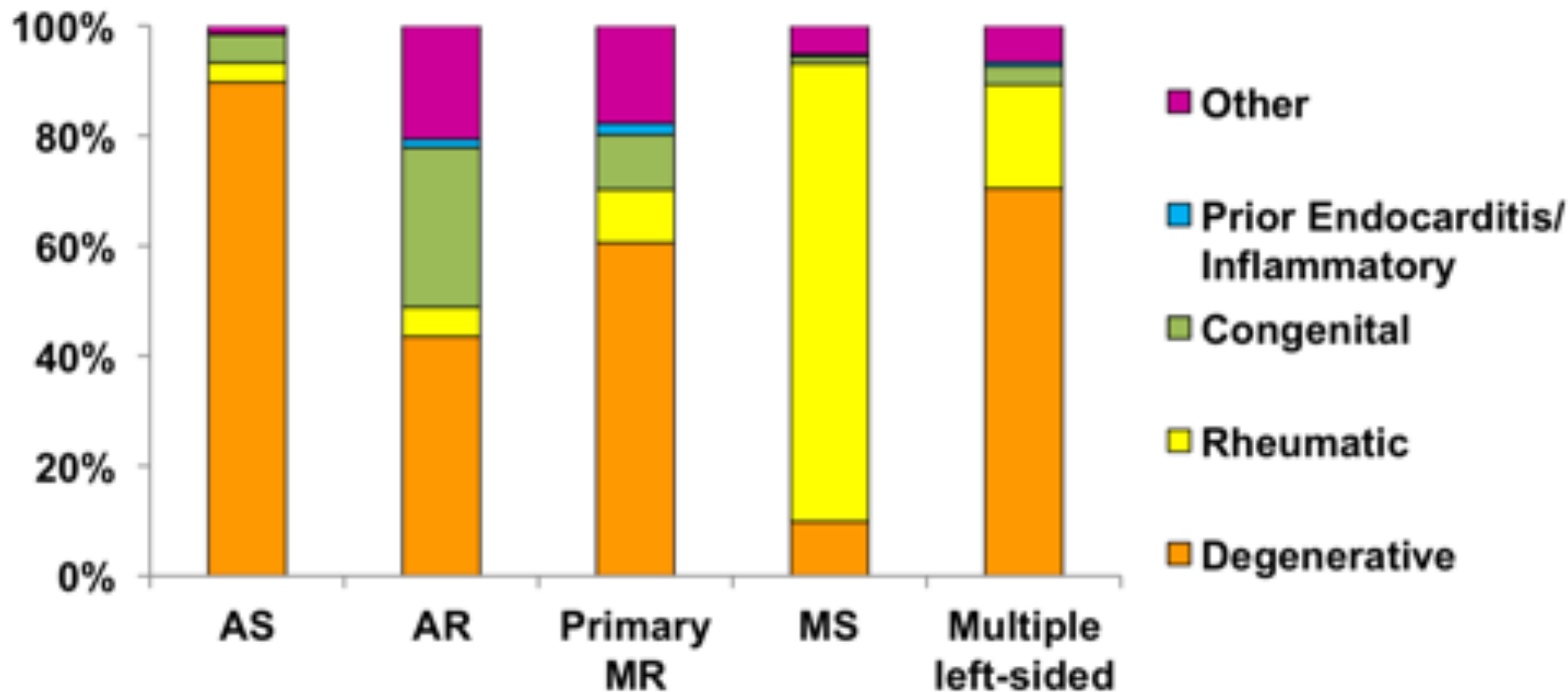


- Native valve disease
- Previous intervention

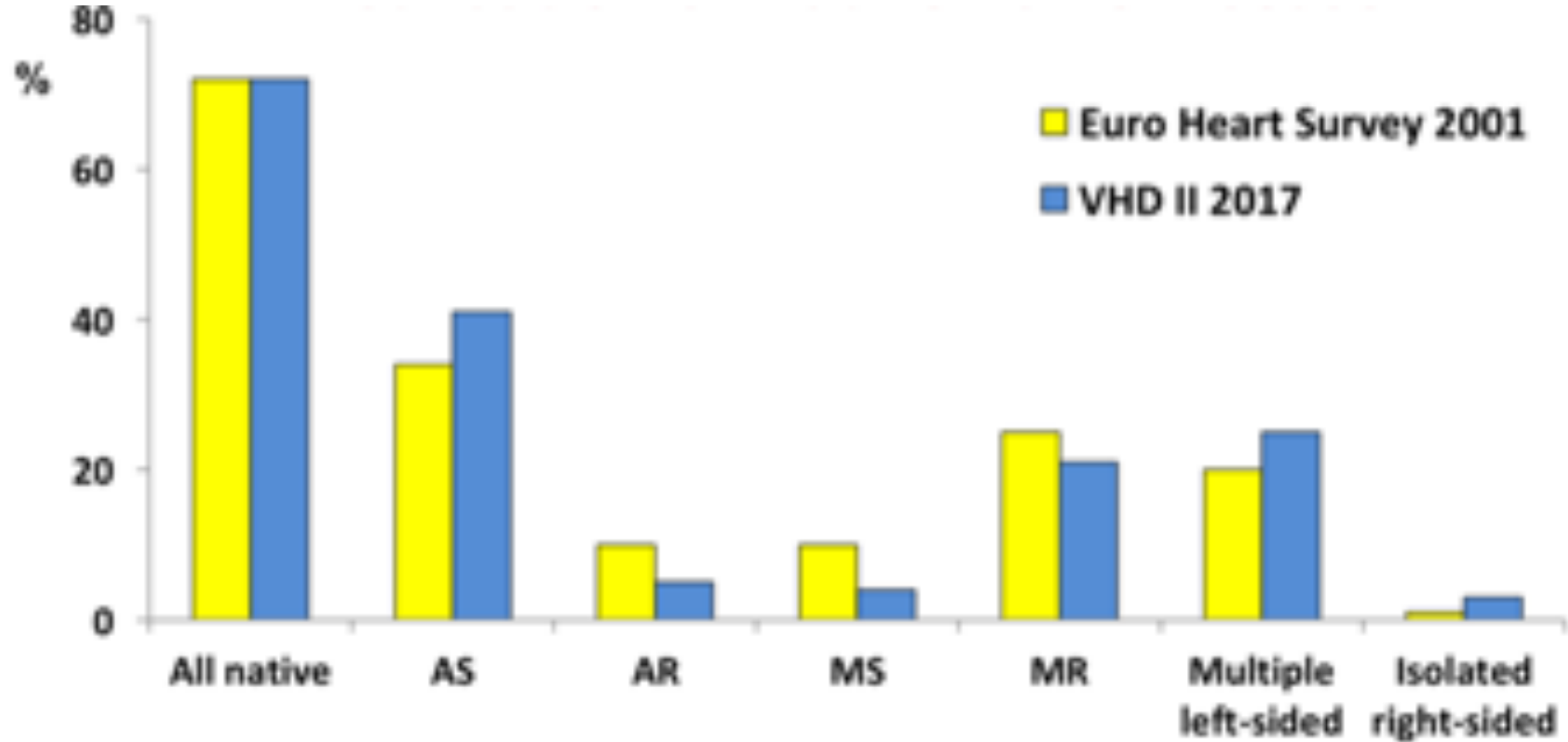


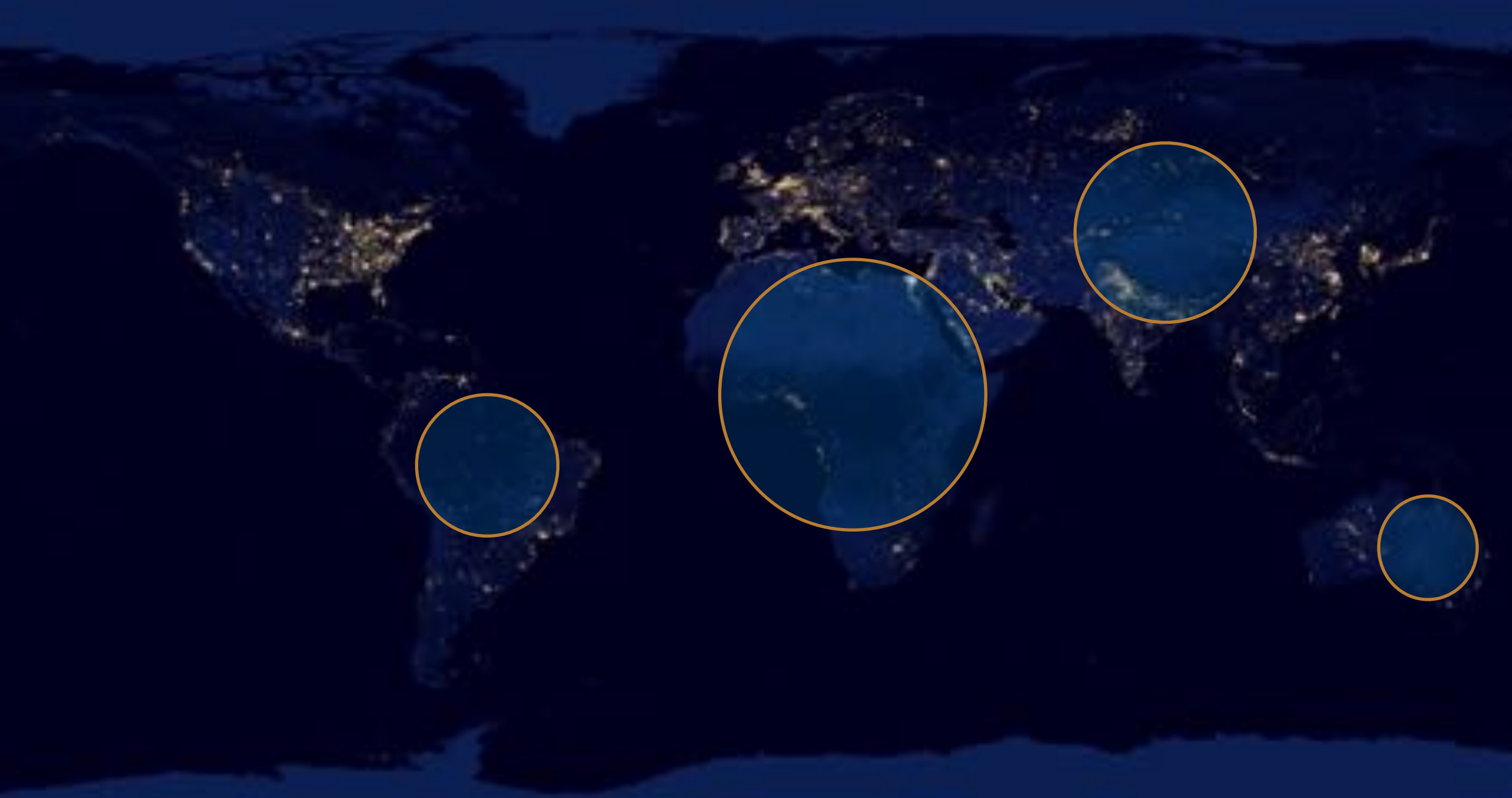
- Aortic stenosis
- Mitral stenosis
- Isolated right-sided
- Aortic regurgitation
- Mitral regurgitation
- Multiple left-sided

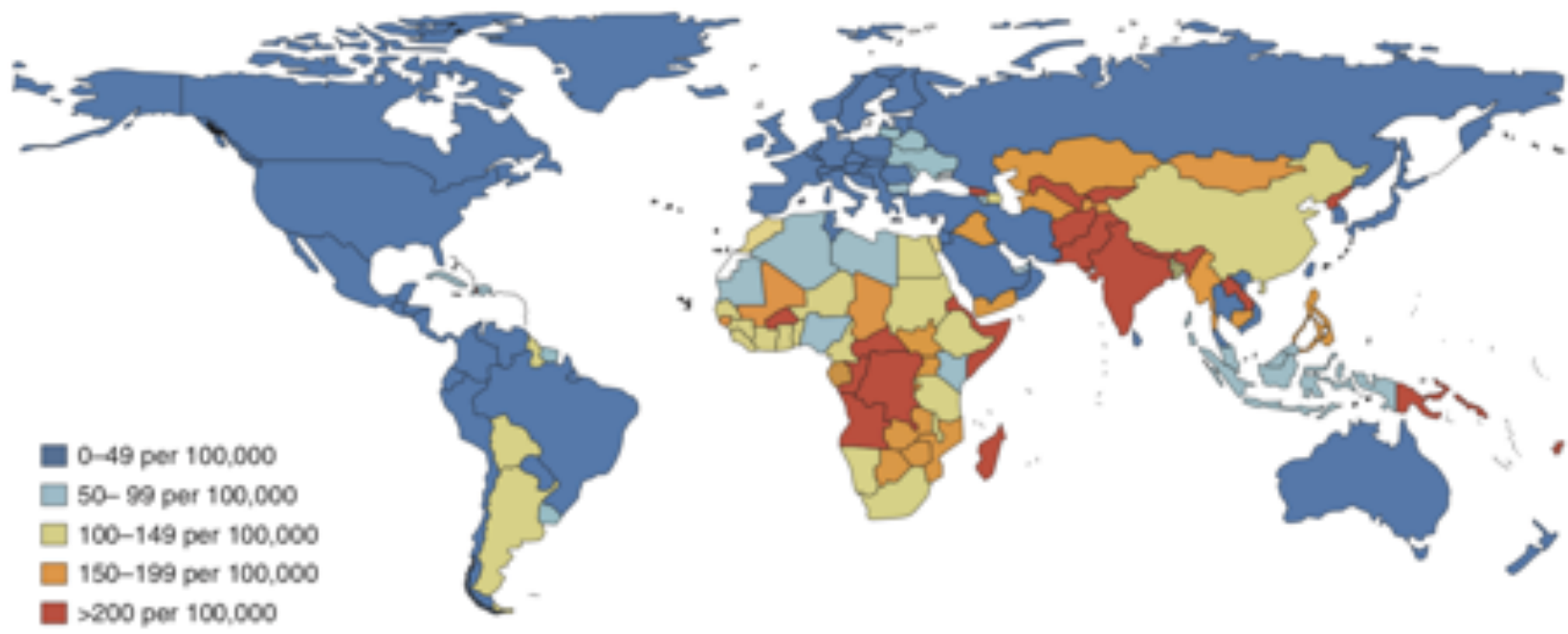
# Etiologie klepvtiaae



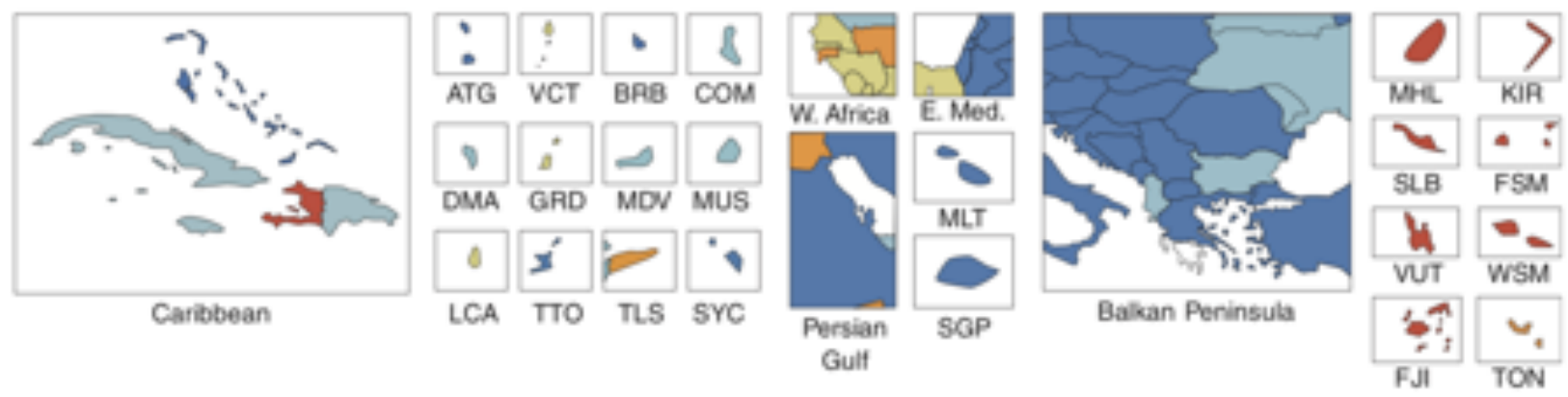
# Distributie VHD in Europa





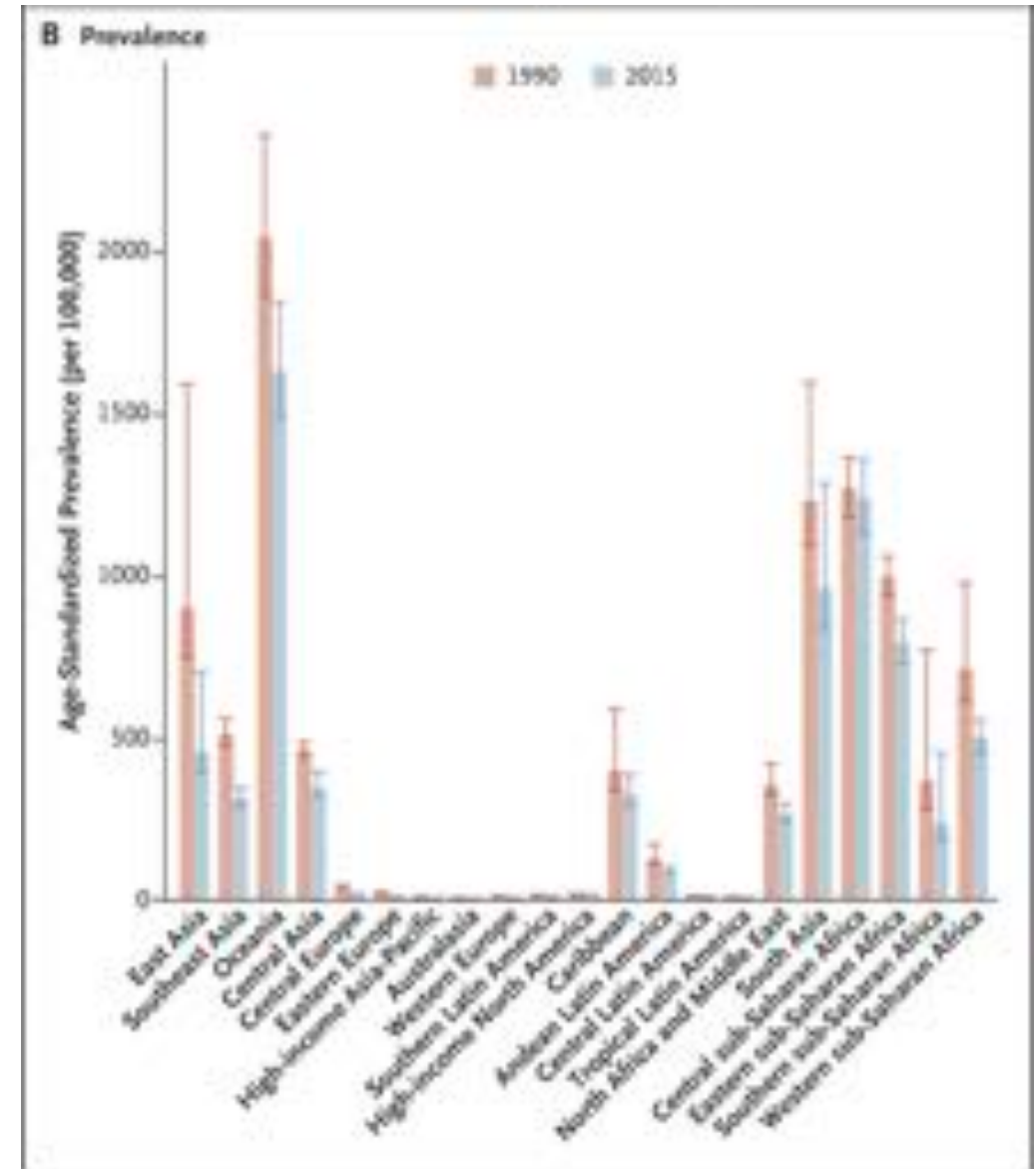
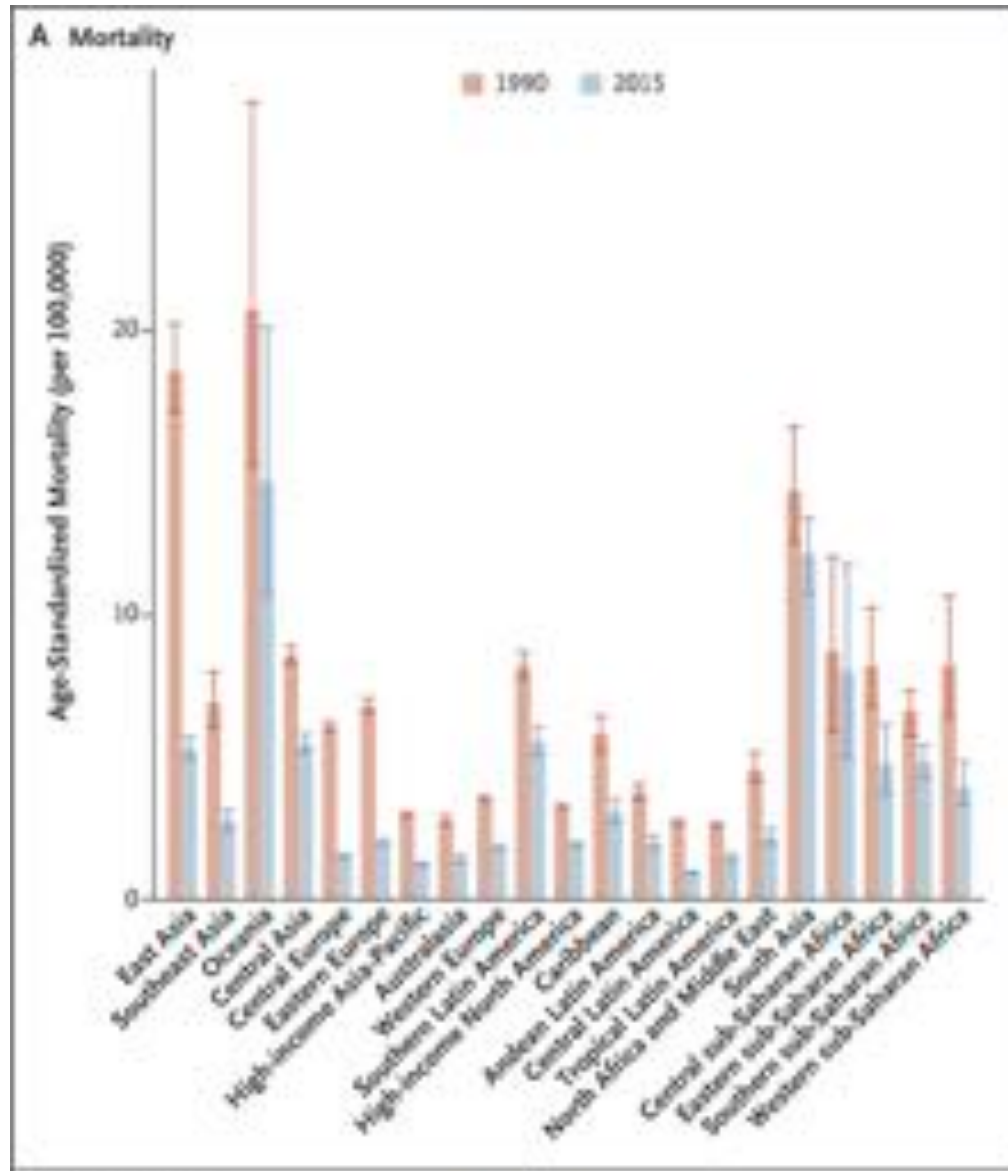


■ 0-49 per 100,000  
 ■ 50-99 per 100,000  
 ■ 100-149 per 100,000  
 ■ 150-199 per 100,000  
 ■ >200 per 100,000



15 Mondiale prevalentie van reumatische hartziekten (aantal gevallen per 100.000 inwoners)<sup>13</sup>

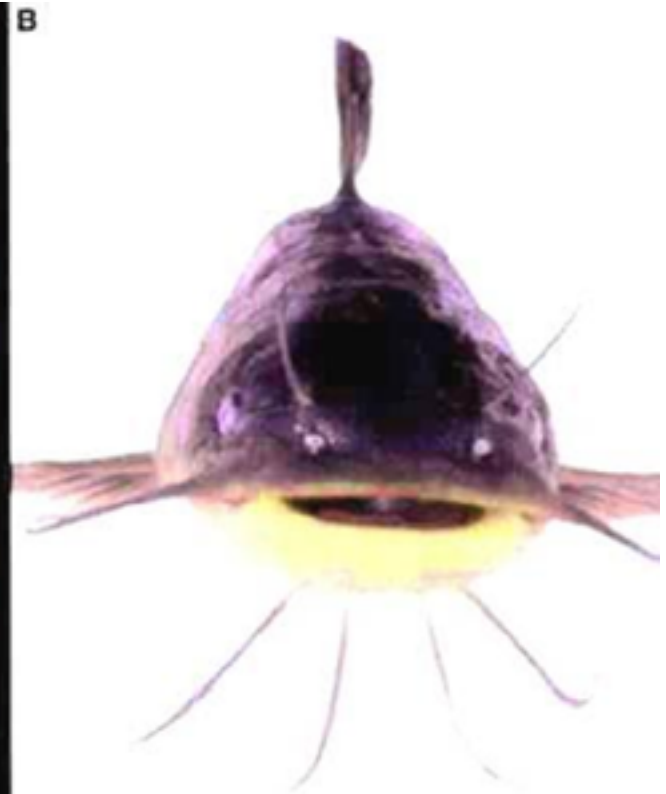
# Age-Standardized Mortality Due to and Prevalence of Rheumatic Heart Disease According to World Region in 1990 and 2015.



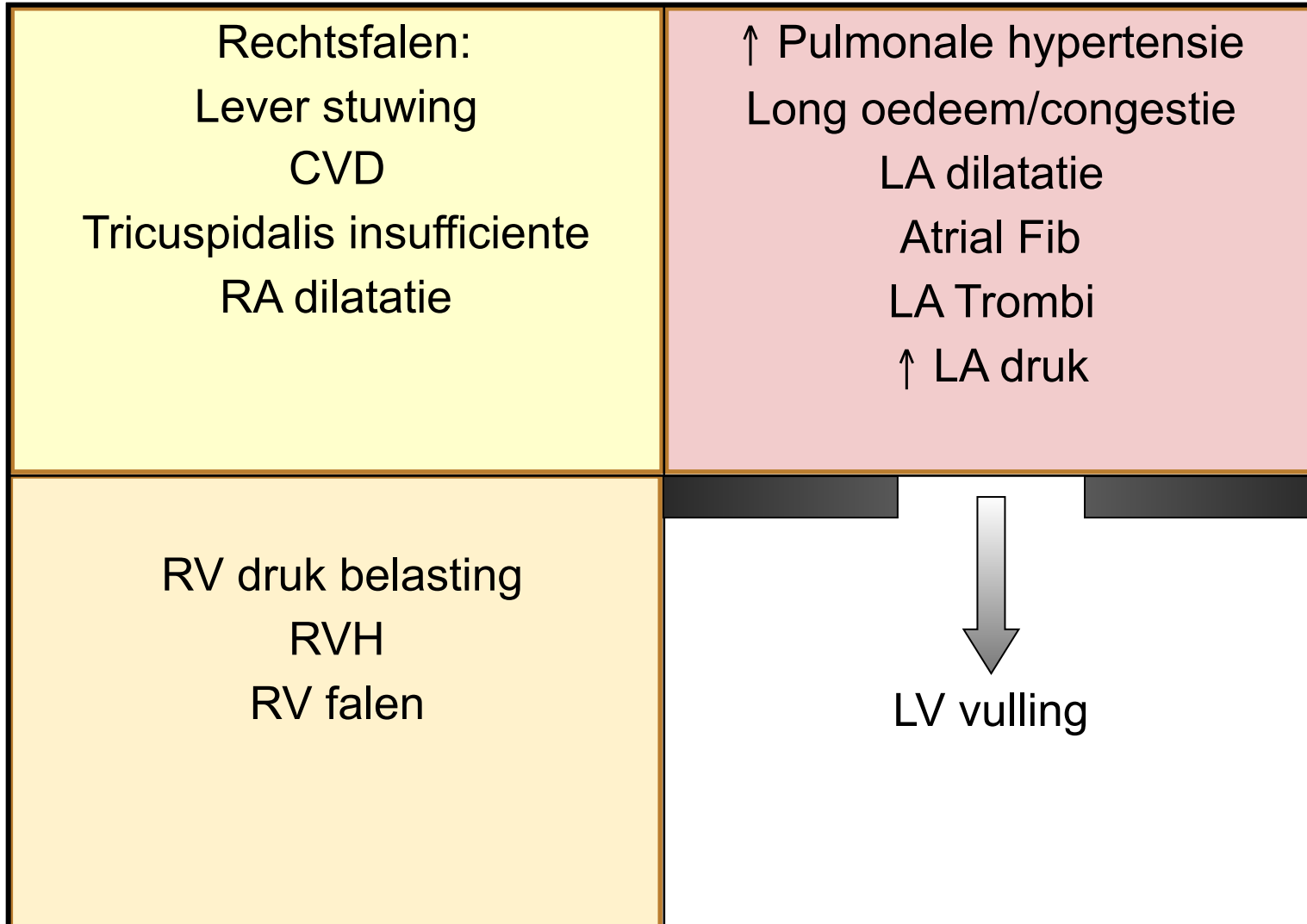
# Complications MS: Floating thrombus



# Fish mouth appearance of the mitral valve



# Mitralis Stenose: Pathofysiologie



## Imaging bij evaluatie kleplijden

1. Wat is de etiologie van het klep vitium?
2. Hoe ernstig is het klep vitium?
3. Wat zijn de hemodynamische consequenties?
4. Zijn er indicaties/contra-indicaties voor interventie?
5. Welke interventie modaliteit heeft de voorkeur en met welke urgentie?
6. Begeleiden van interventie
7. Follow up na interventie



# Oorzaak en anatomie MS

## Rheumatisch (90%)

Commissural fusion

Leaflet thickening

Chordal shortening and fusion

Superimposed calcification



## Degeneratief

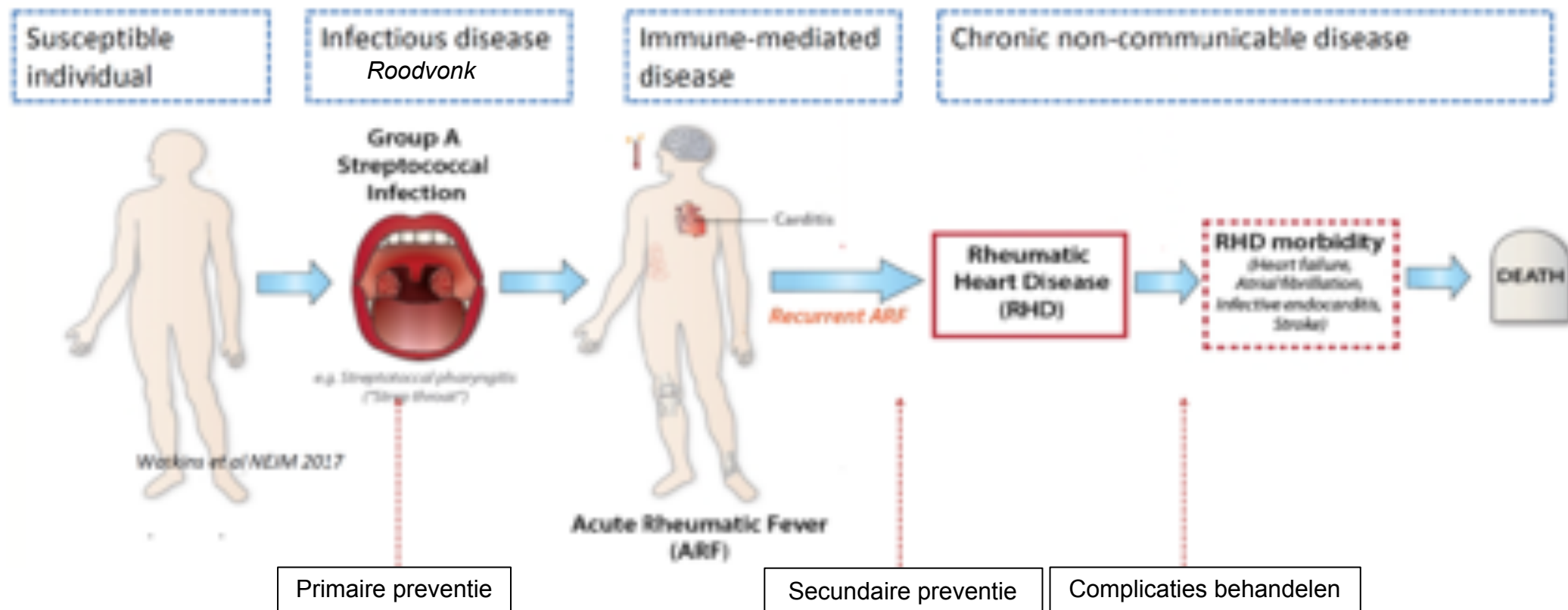
Annular calcification

Rarely leaflet thickening

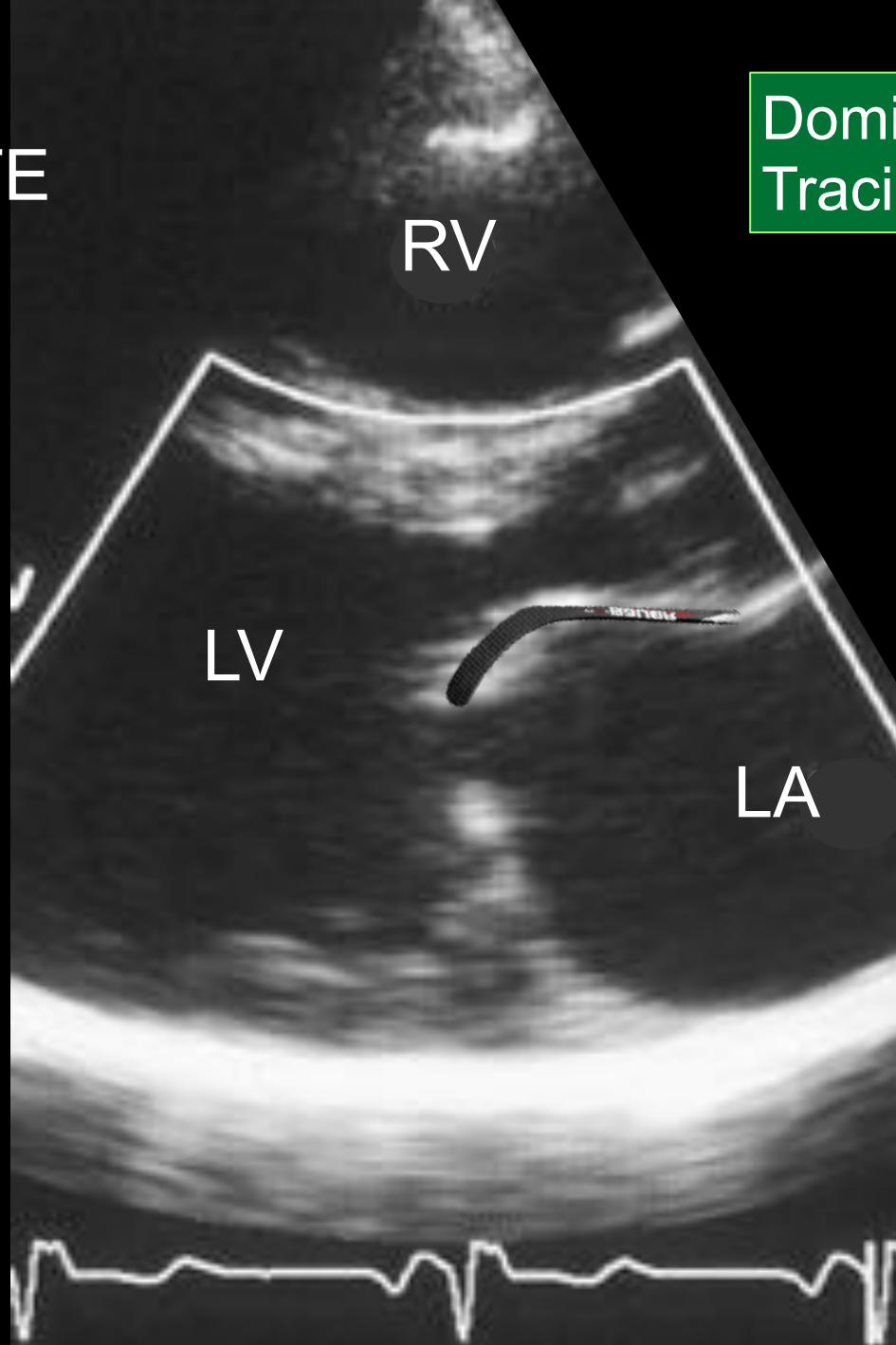
Calcification at base



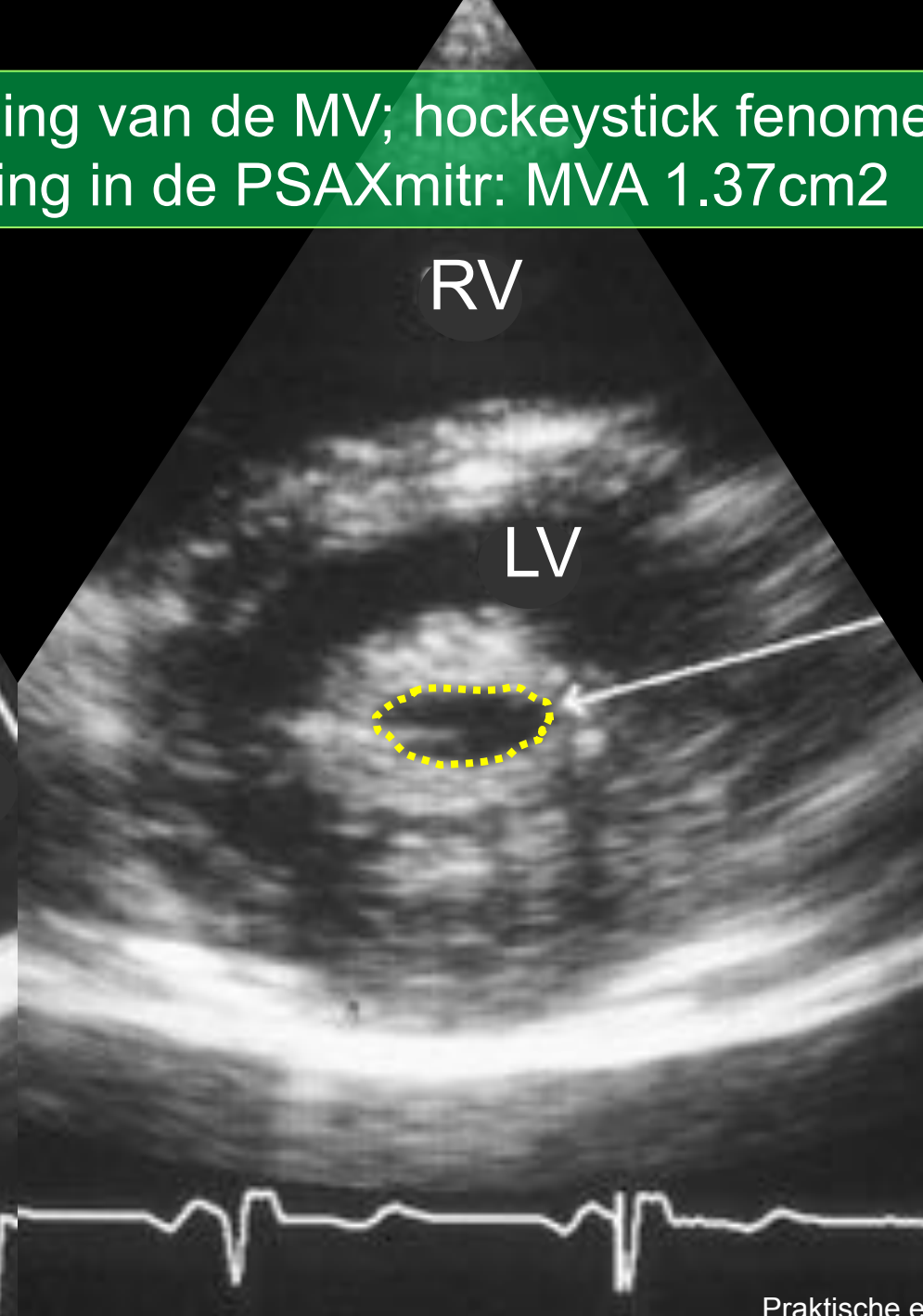
# Pathogenese reumatisch klelijden



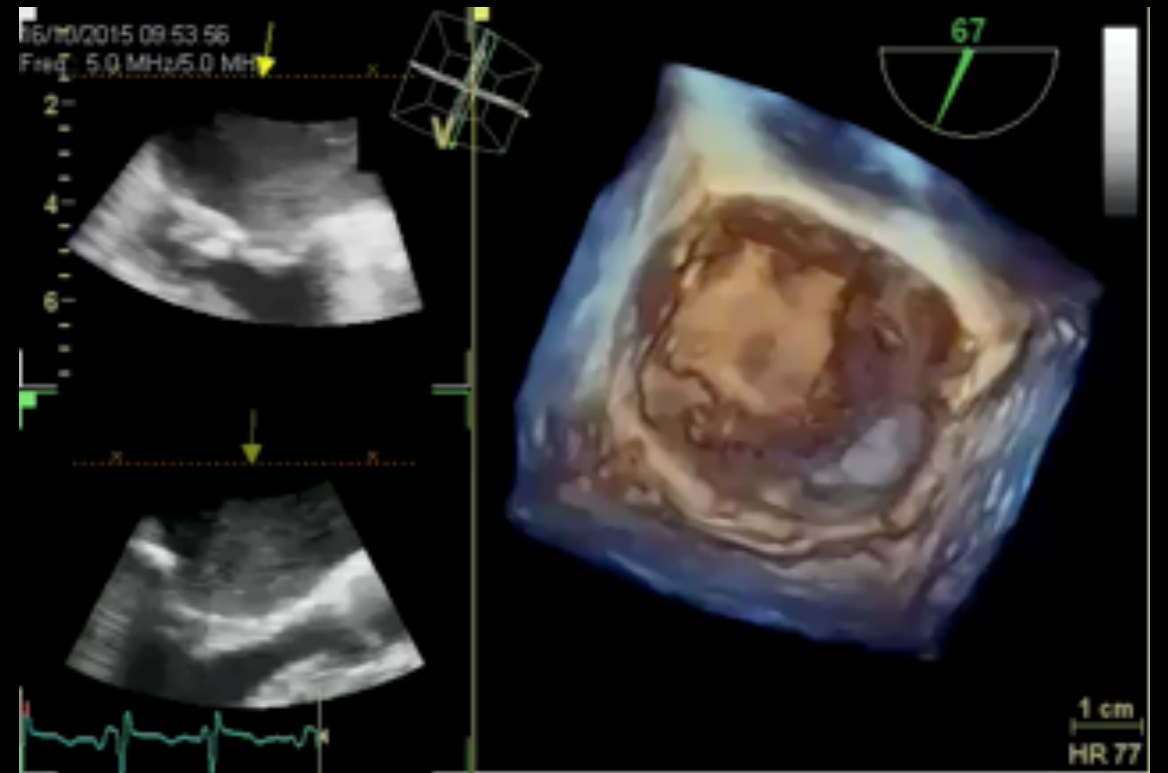
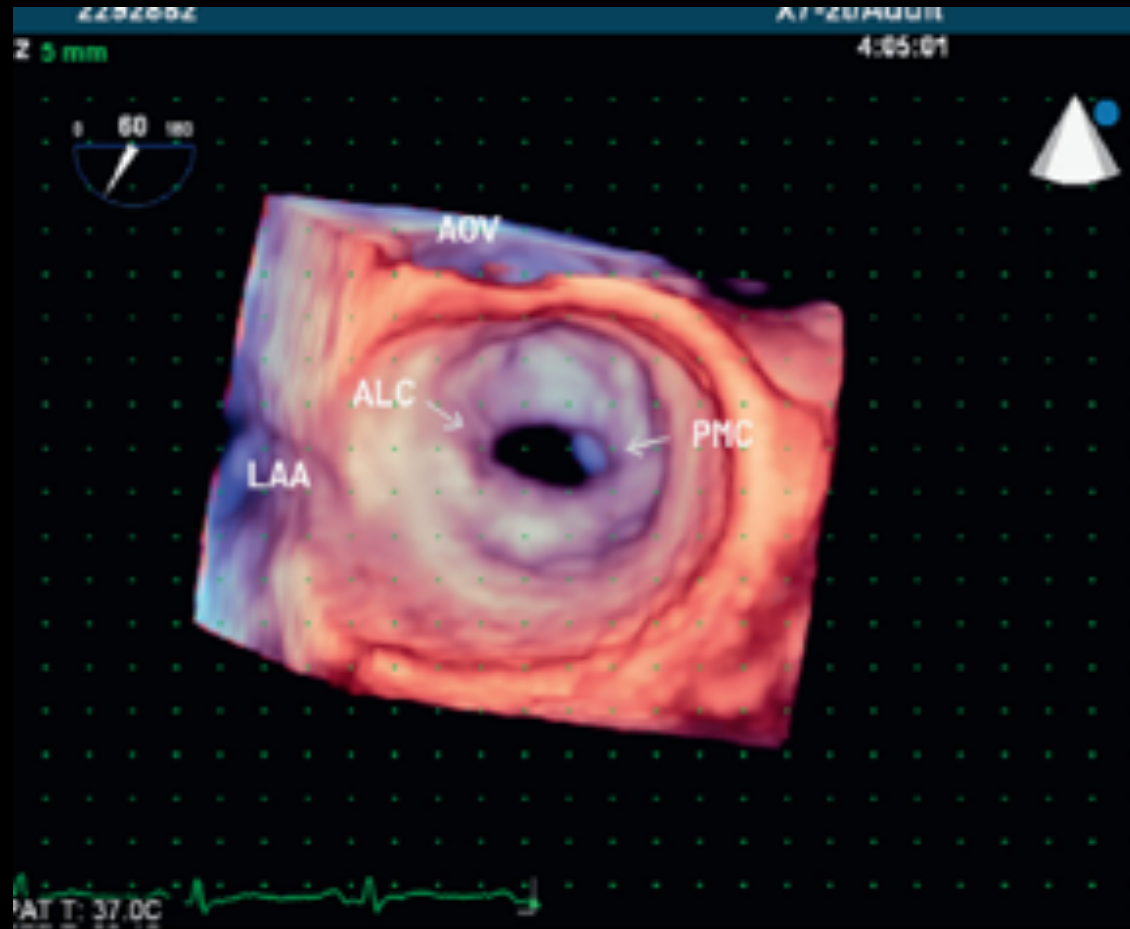
2D TTE



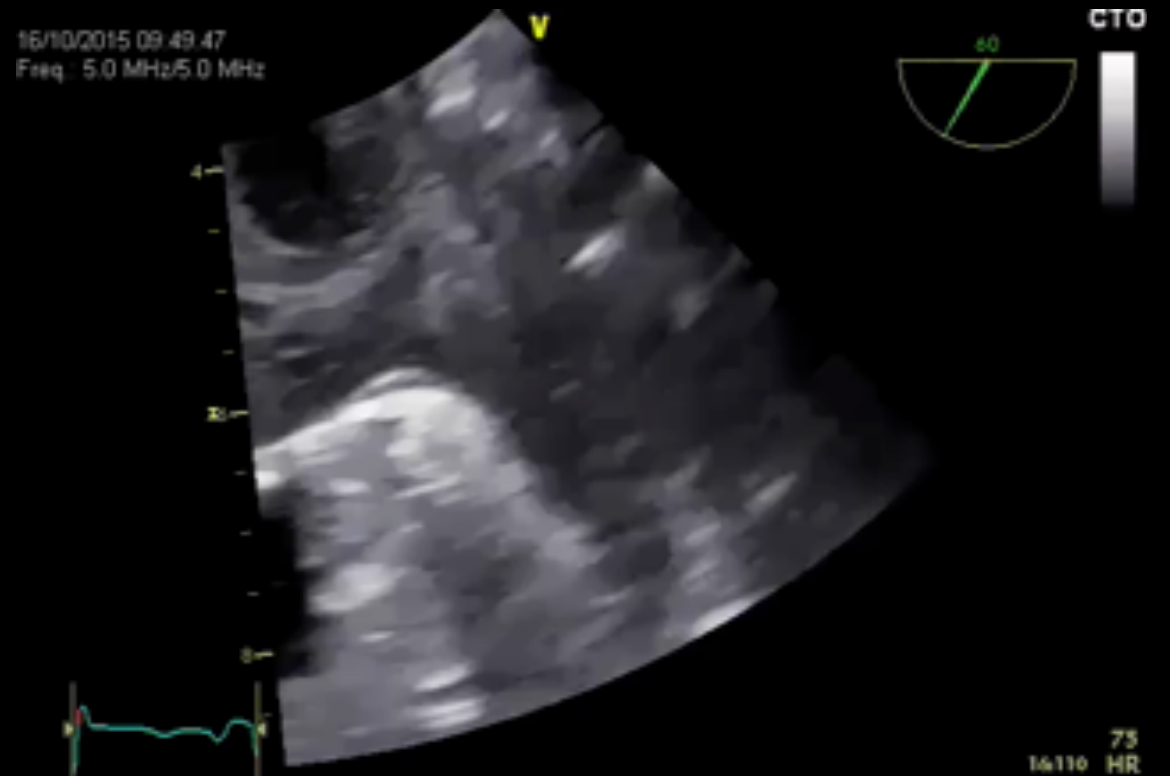
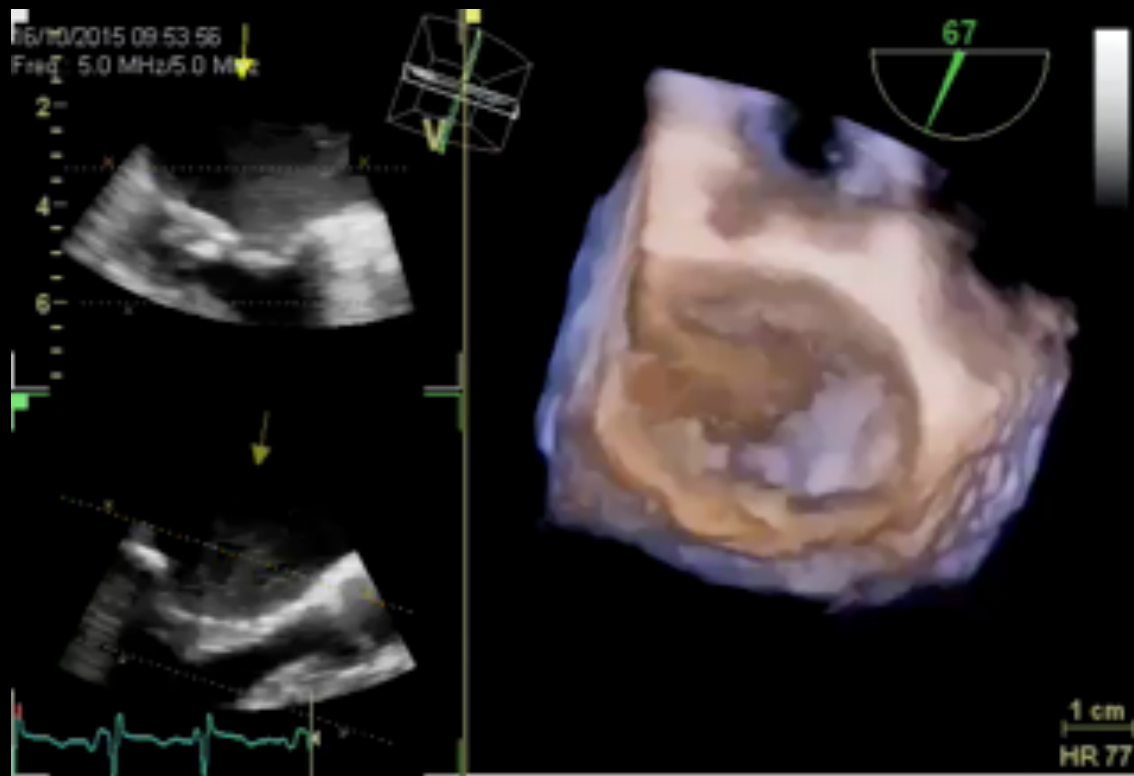
Doming van de MV; hockeystick fenomeen  
Tracing in de PSAXmitr: MVA 1.37cm<sup>2</sup>

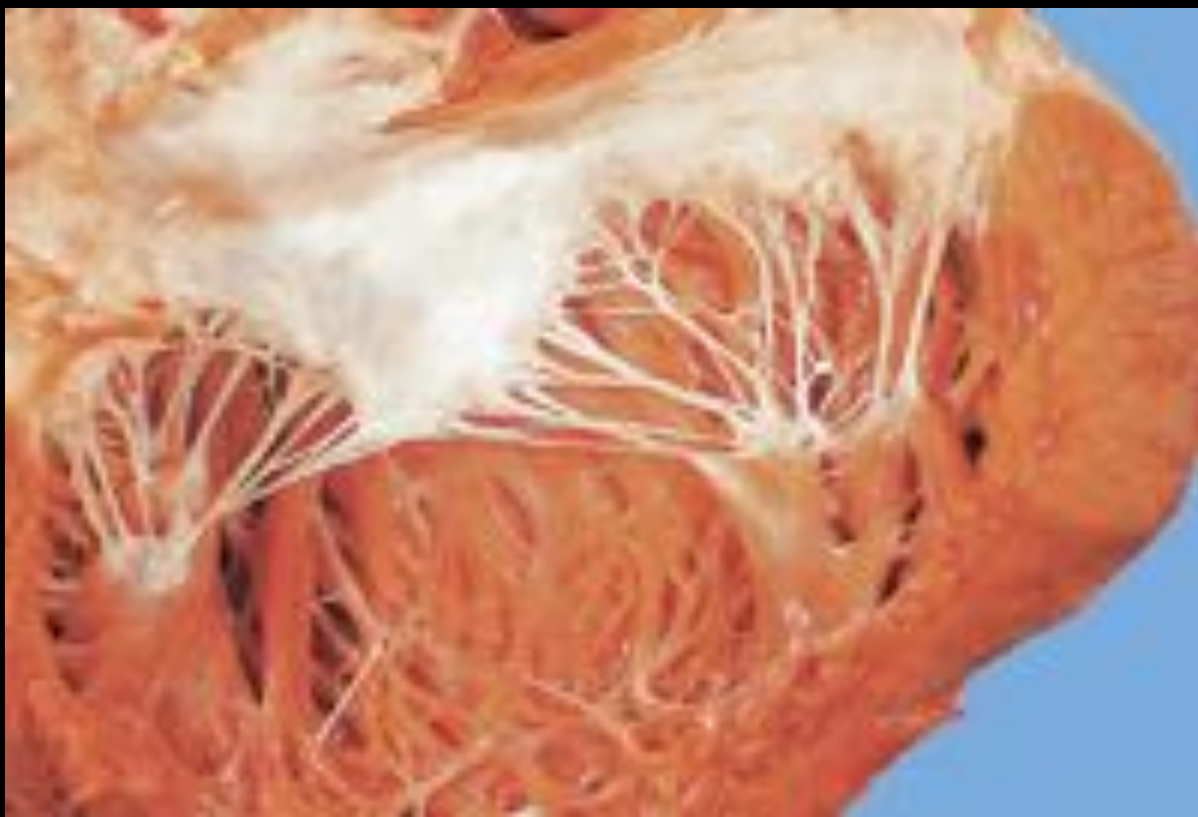


# Mitralisklep stenose

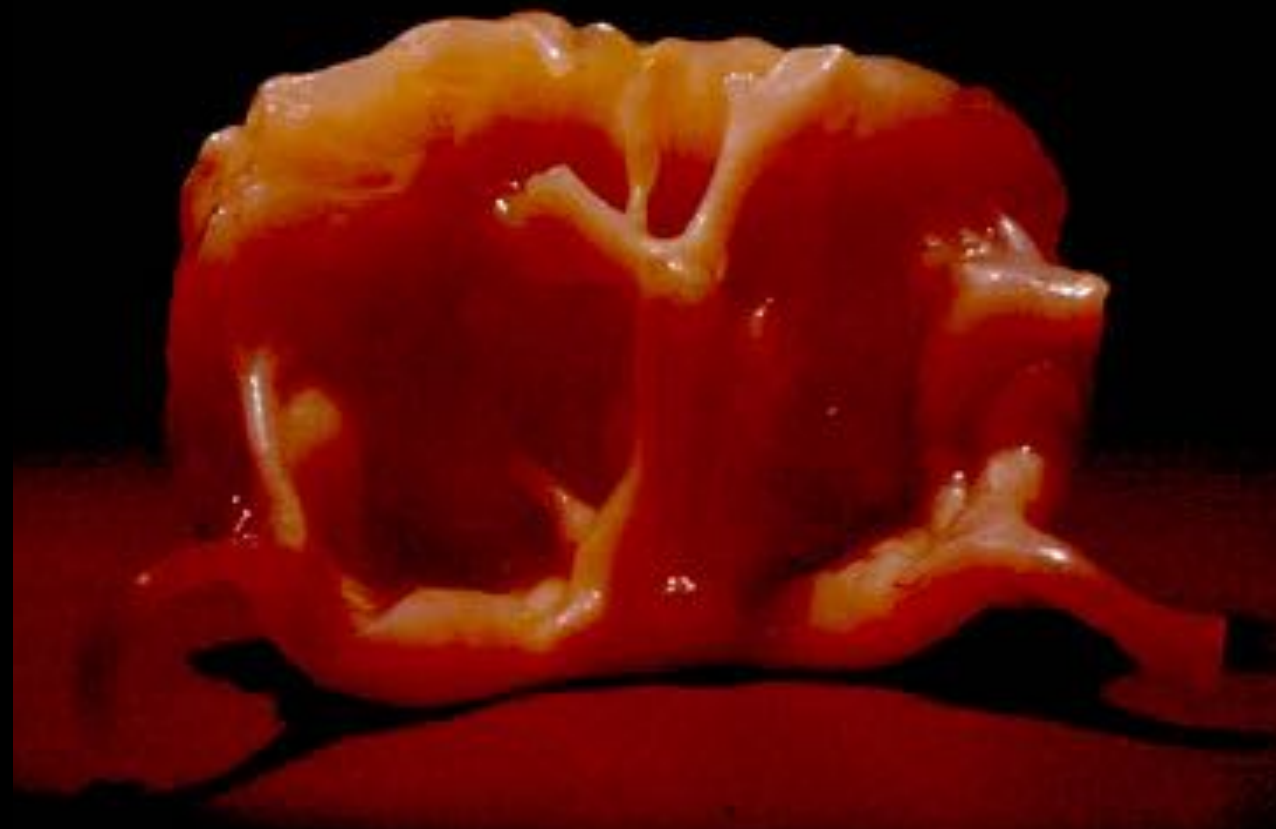


# Mitralisklep stenose





Normale mitralisklep



Reumatische mitralisklep

# Bepalen ernst van de MS met echo

## Fysiologie

MV druk gradiënten

## Anatomische meting MVA:

Mitralisklepostium oppervlak: 2D-echo

Mitralisklepostium oppervlak: 3D

## Berekening MVA:

Mitralisklepostium oppervlak: Pressure-halftime

Mitralisklepostium oppervlak: Continuïteitsvergelijking

Mitralisklepostium oppervlak: PISA methode



## ESC guideline *Valvular Heart Disease* 2017

Echocardiography is the preferred method for diagnosing mitral stenosis and for assessing its severity and haemodynamic consequences.

Valve area using **planimetry** is the reference measurement of mitral stenosis severity, whereas mean transvalvular gradient and pulmonary pressures reflect its consequences and have a prognostic value

# Gradatie van MS

Mitraal stenose			
	Gering	Matig	Ernstig
<b>MVA (cm<sup>2</sup>)</b>	>1.5	1.5-1.0	<1.0
PGmean (mmHg)	<5	5-10	>10
SPAP (mmHg)	<30	30-50	>50

*Echocardiographic valve area is a more constant value than, and should be used in preference to gradient for quantification of disease.*

# Ernst MS

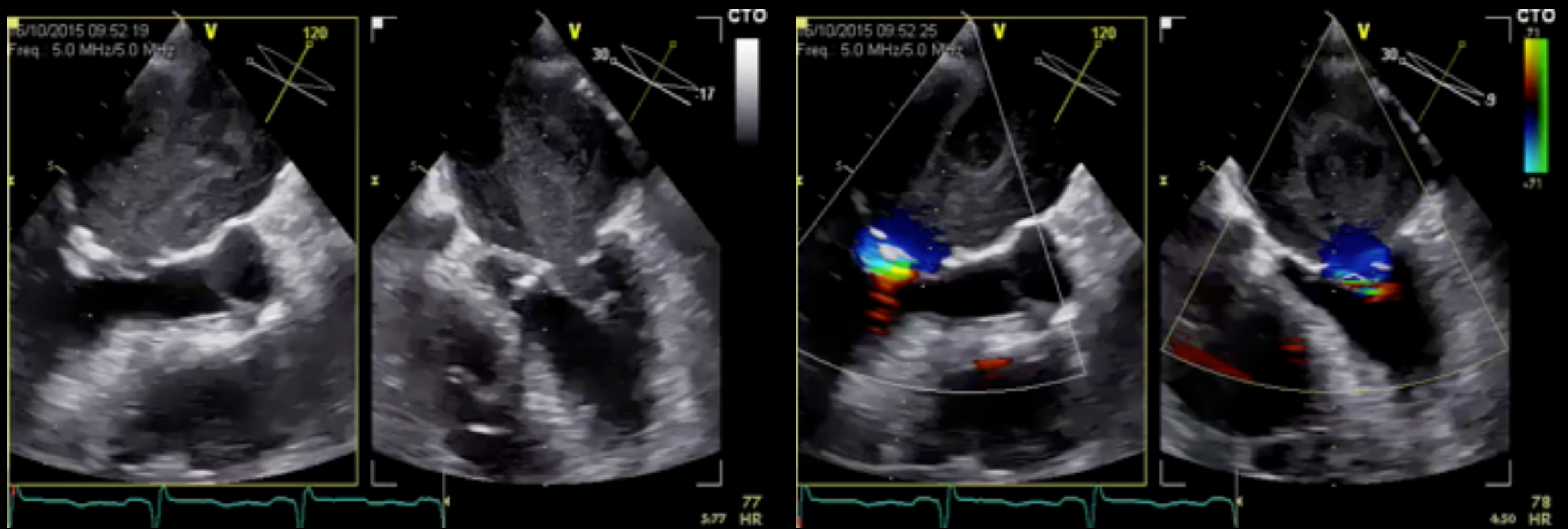


Ernstig

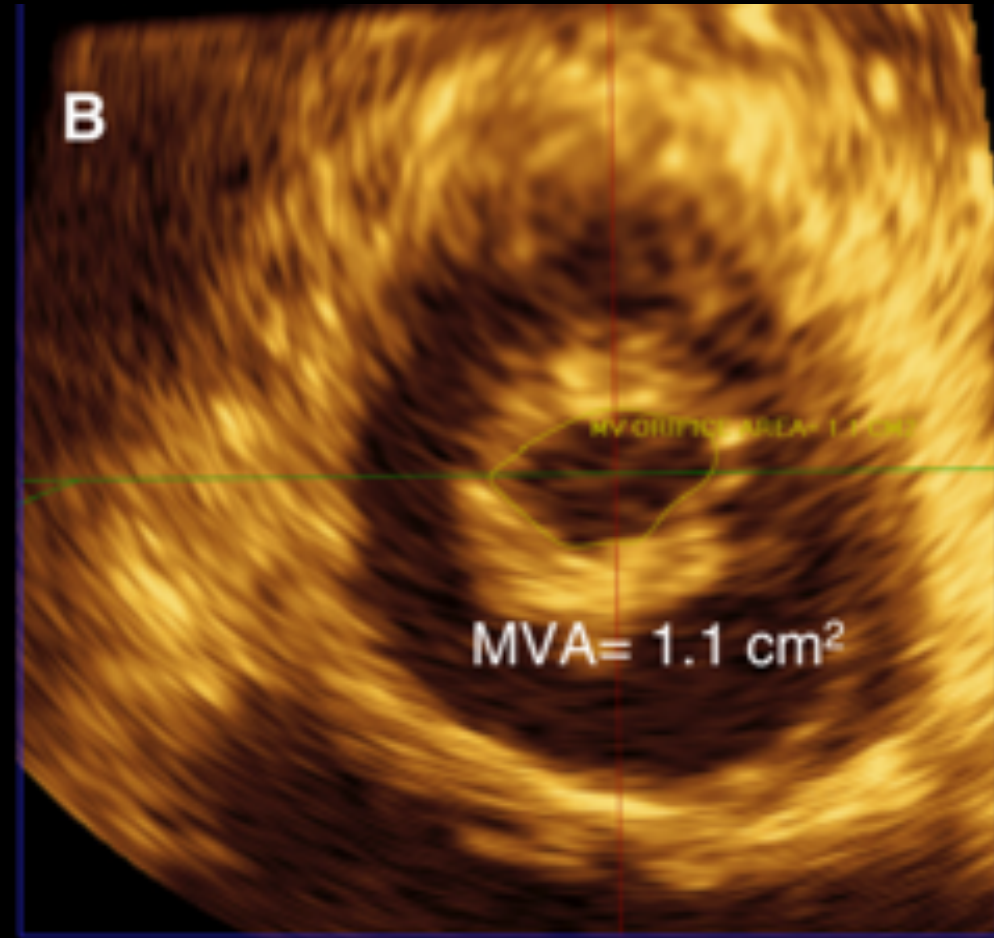
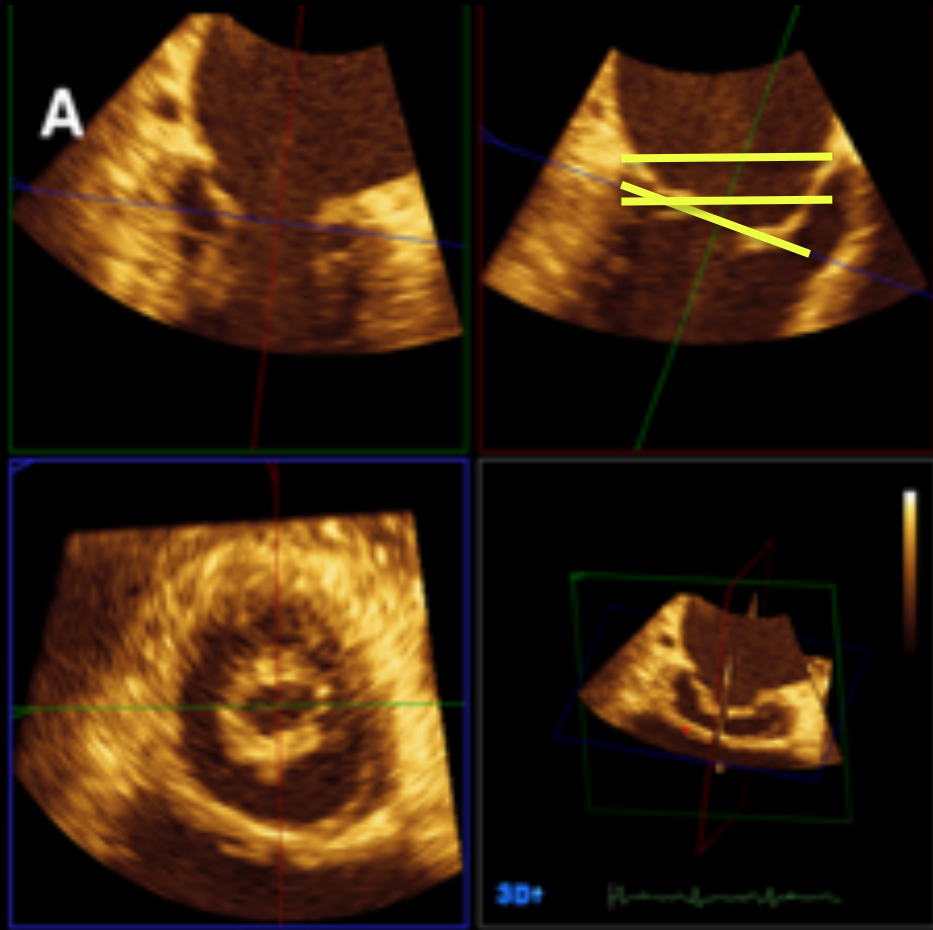
Matig

Gering

# TEE: Mitralisstenose

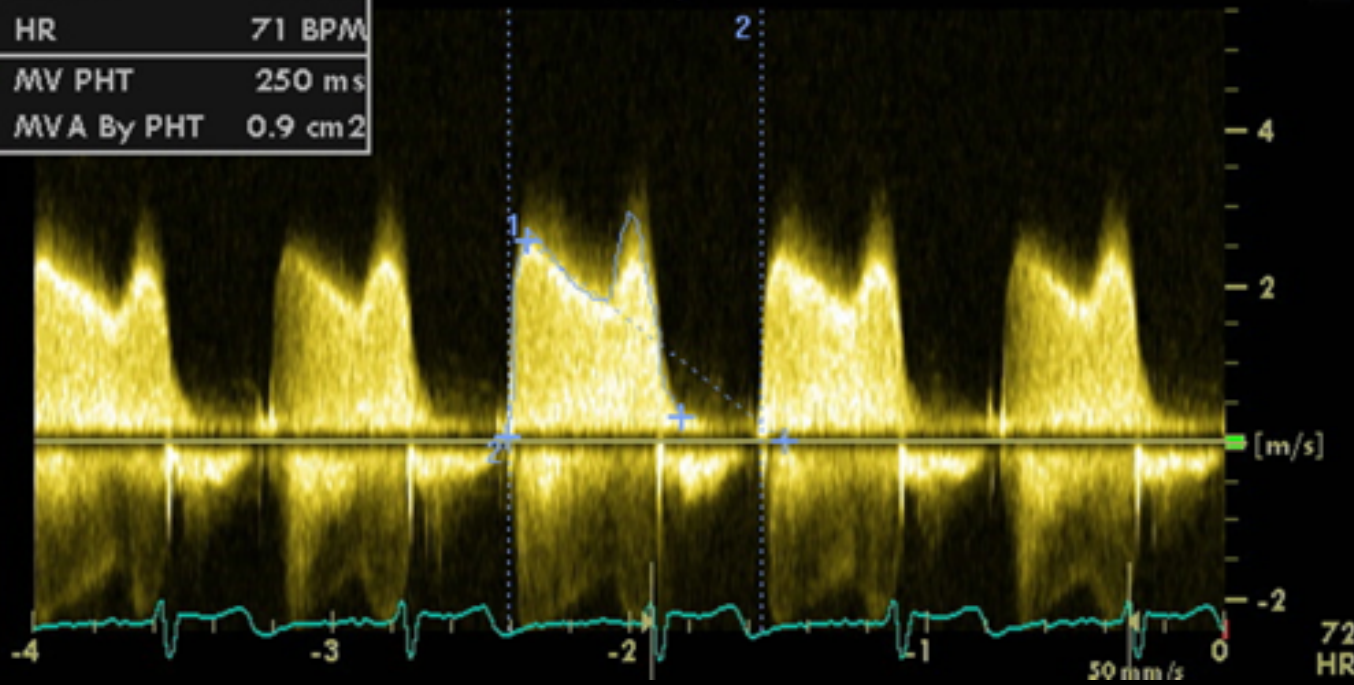
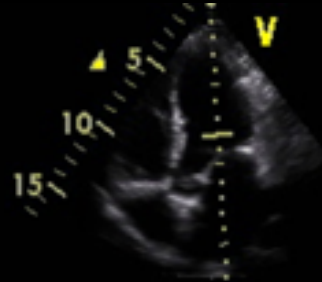


# Planimetrie MVA middels 3DTEE



# Doppler tracing MS

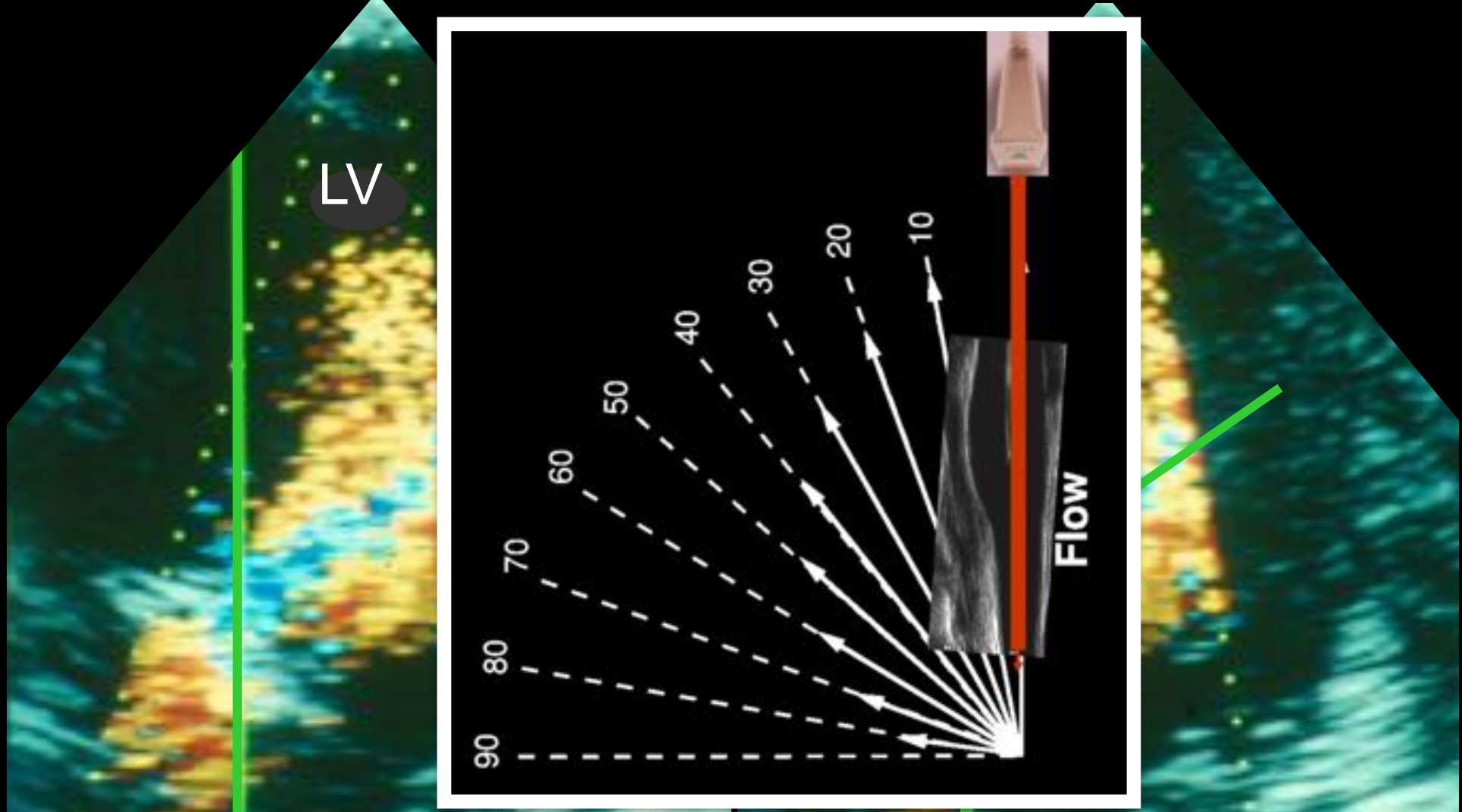
2	MV Vmax	2.9 m/s
	MV Vmean	2.0 m/s
	MV maxPG	34 mmHg
	MV meanPG	18 mmHg
	MV VTI	116 cm
	HR	71 BPM
1	MV PHT	250 ms
	MVA By PHT	0.9 cm <sup>2</sup>



## Mean gradient

Wordt beïnvloed door

- Evt MI
- Cardiac output - flowstatus
- Hartfrequentie

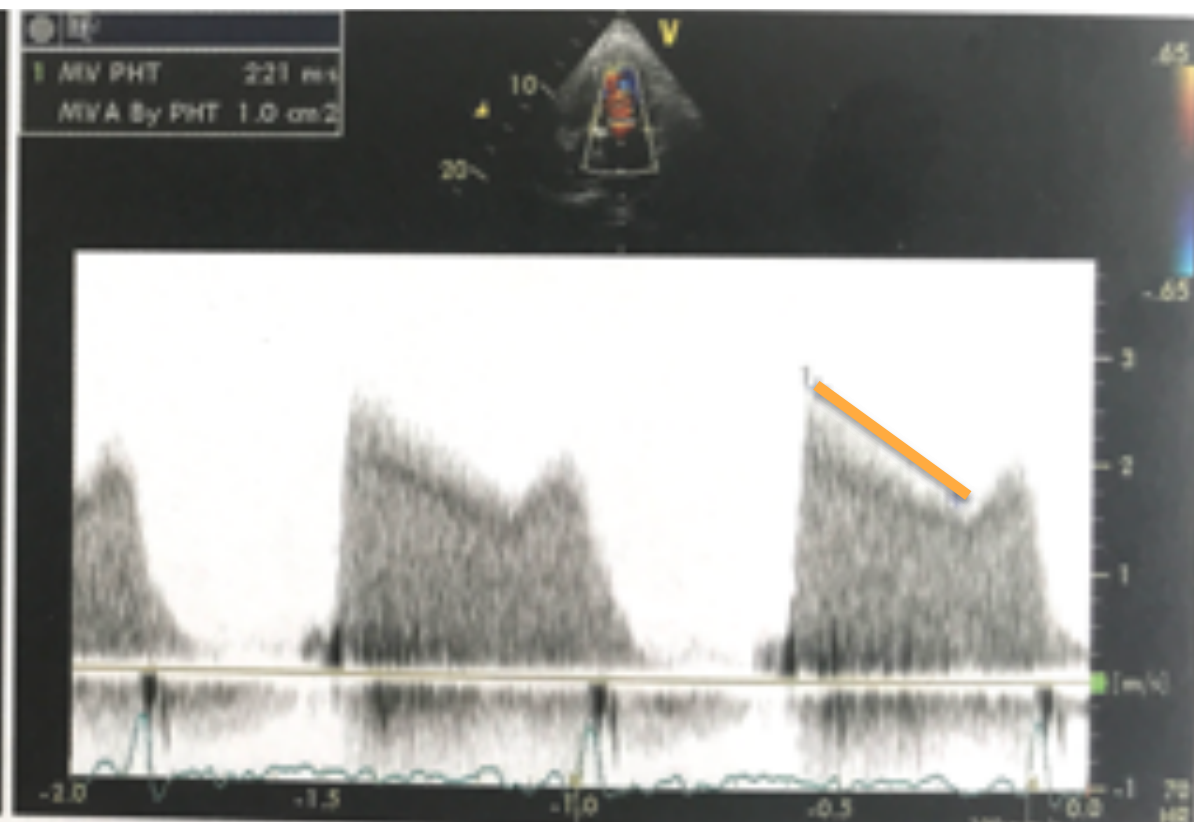
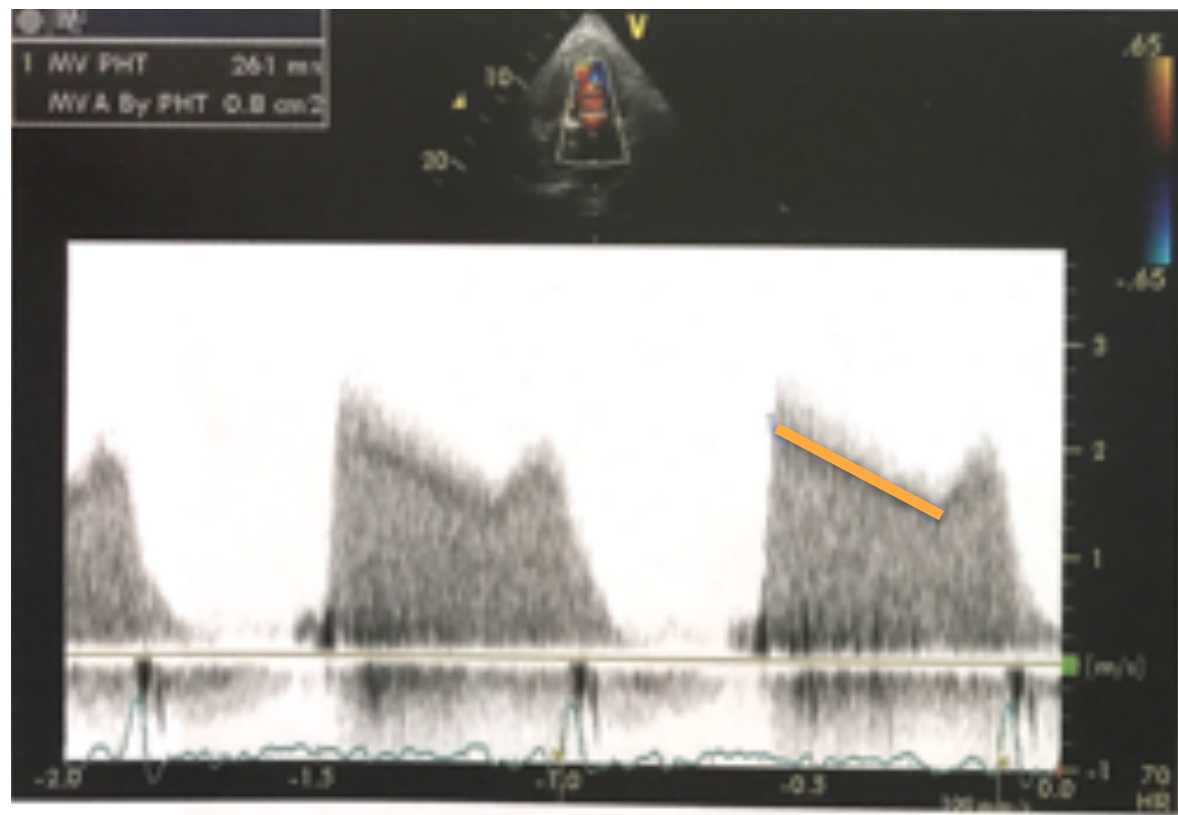


LA

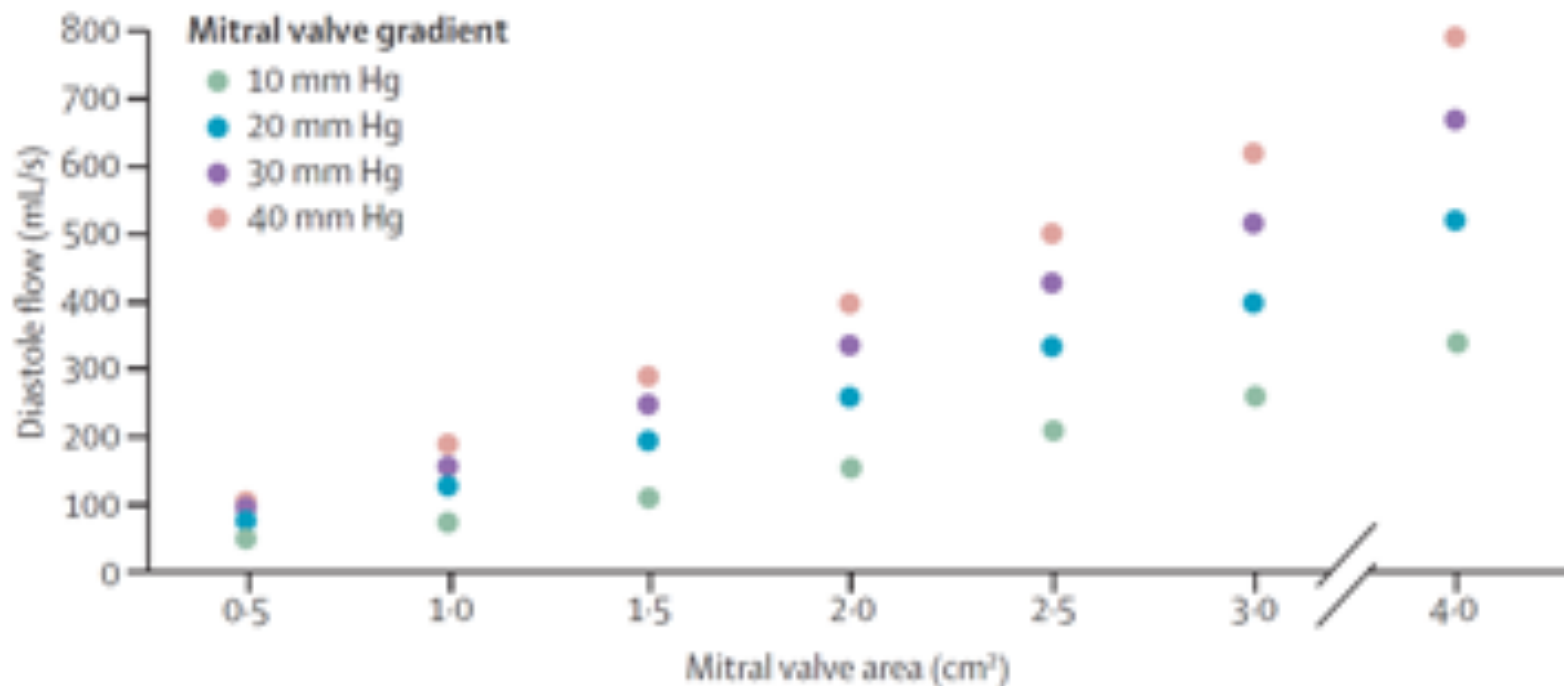
piek gr 6,0 mm Hg  
 mean gr 2,4 mm Hg  
 HF 74 sl/min

piek gr 17,0 mm Hg  
 mean gr 7,1 mm Hg  
 HF 74 sl/min

# Pitfalls: meet over de “modale” snelheden



# Relatie MVA, flow en gradient



For any given valve area, mitral gradient varies in proportion with (mitral flow in diastole)<sup>2</sup> and inversely with time in diastole.

The graph estimates the effect of increased flow on gradients and symptoms in mitral stenosis. Even moderate disease can become symptomatic in high-flow conditions like pregnancy or anaemia. Similarly, a small increase in flow can increase the gradient substantially in a severely stenotic valve.

1. Zelf matige MS kan symptomatisch worden in een “high flow state”
2. Bij een ernstige MS kan een kleine toename in flow een forse toename geven in de gradiënt

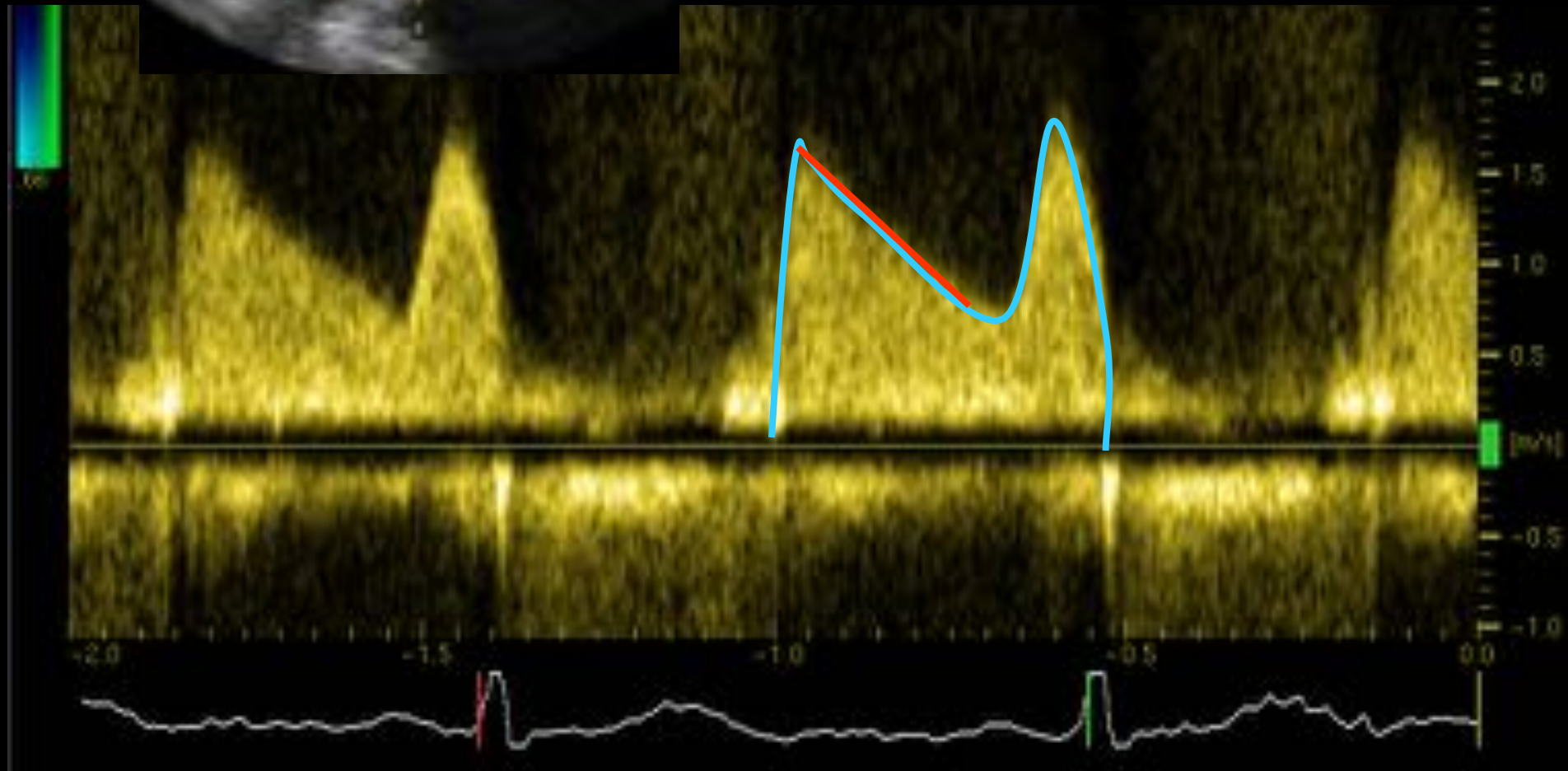


piekgradiënt 13,80 mm Hg

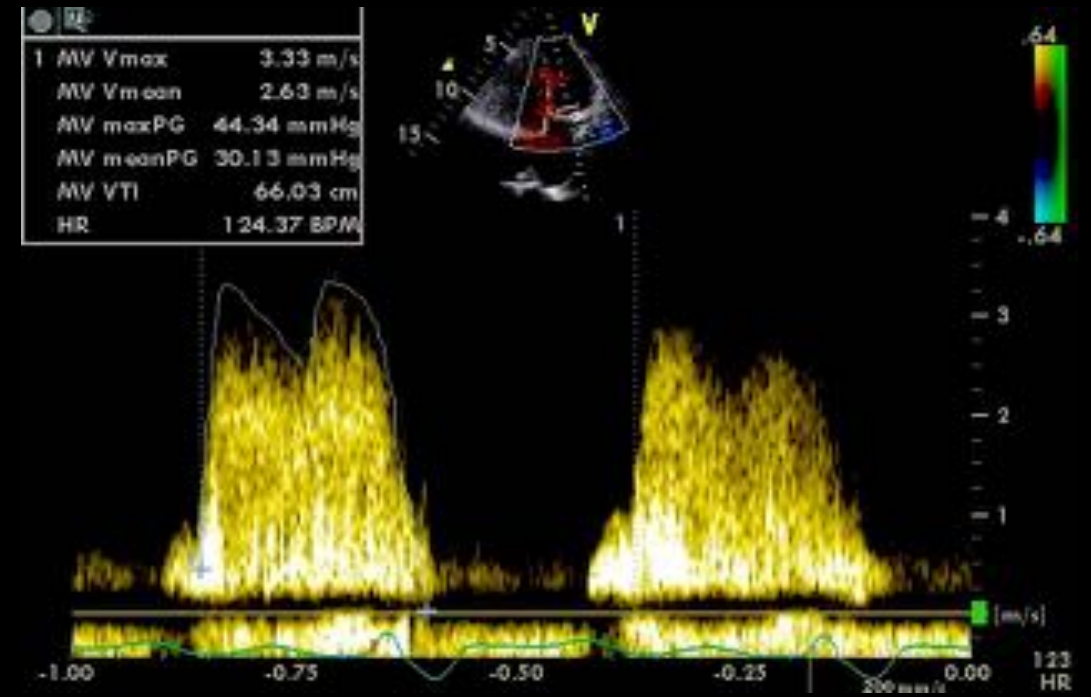
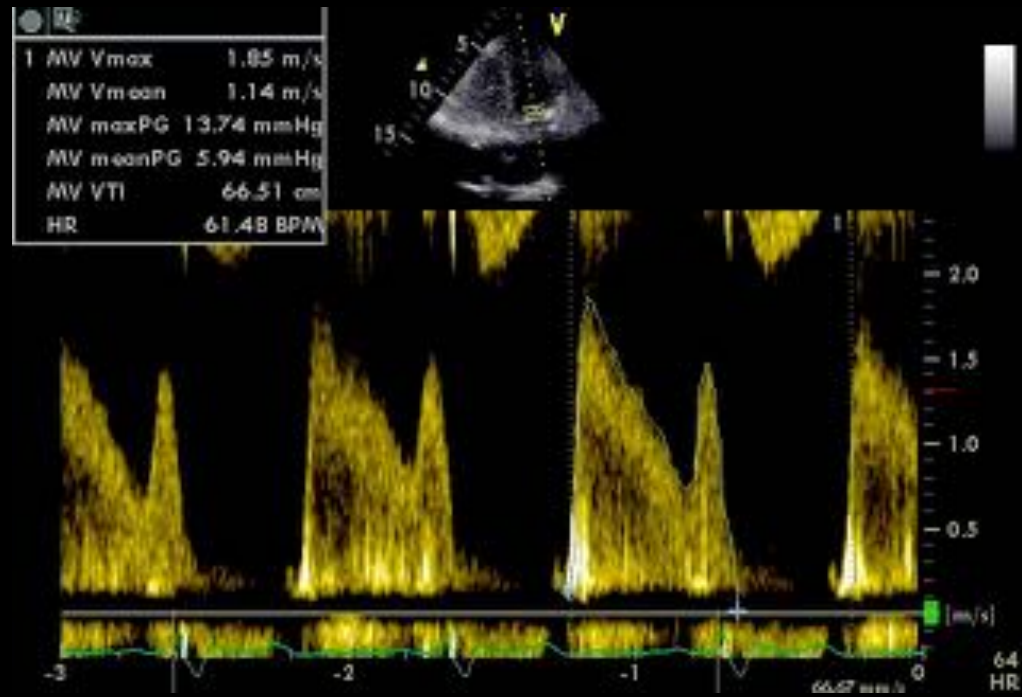
meangradiënt 6,23 mm Hg

$t_{1/2p}$  150 ms

HF 70 sl/min

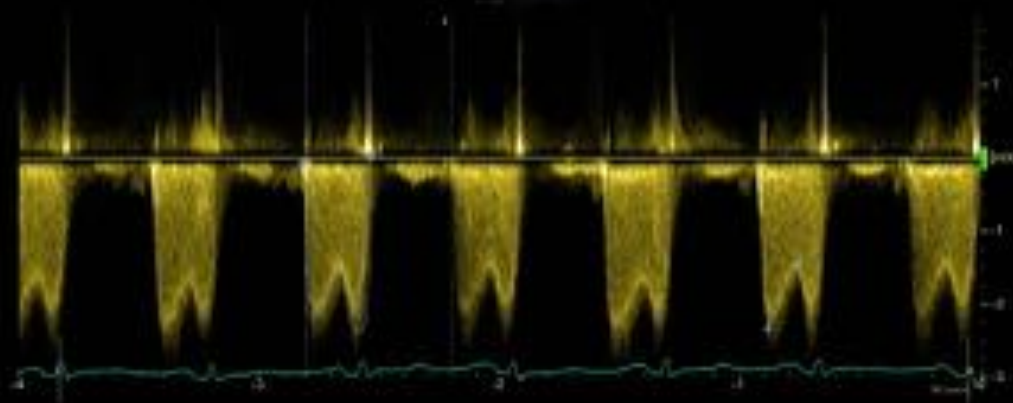
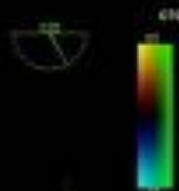


# MS invloed inspanning

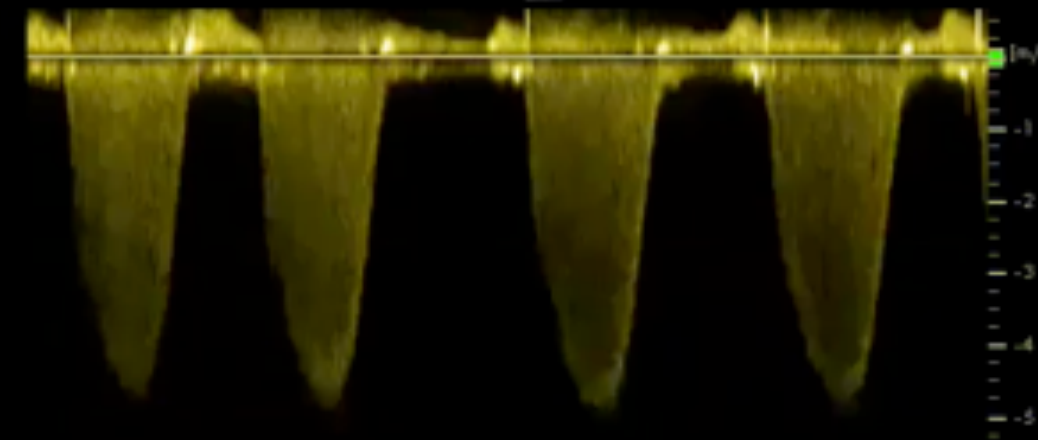
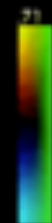
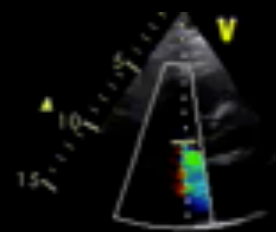


# Doppler met TEE

SVV Mean	2.4 m/s
SVV Mean	1.3 m/s
SVV maxPG	30 mmHg
SVV maxPG	15 mmHg
SVV VTI	32 cm
HR	68 bpm



16/10/2015 09:20:28  
Freq. 2.3 MHz/4.6 MHz



# PHT methode voor MS

## Dubbeldruk meting PHT invasief

ATRIOVENTRICULAR PRESSURE HALF-TIME

145

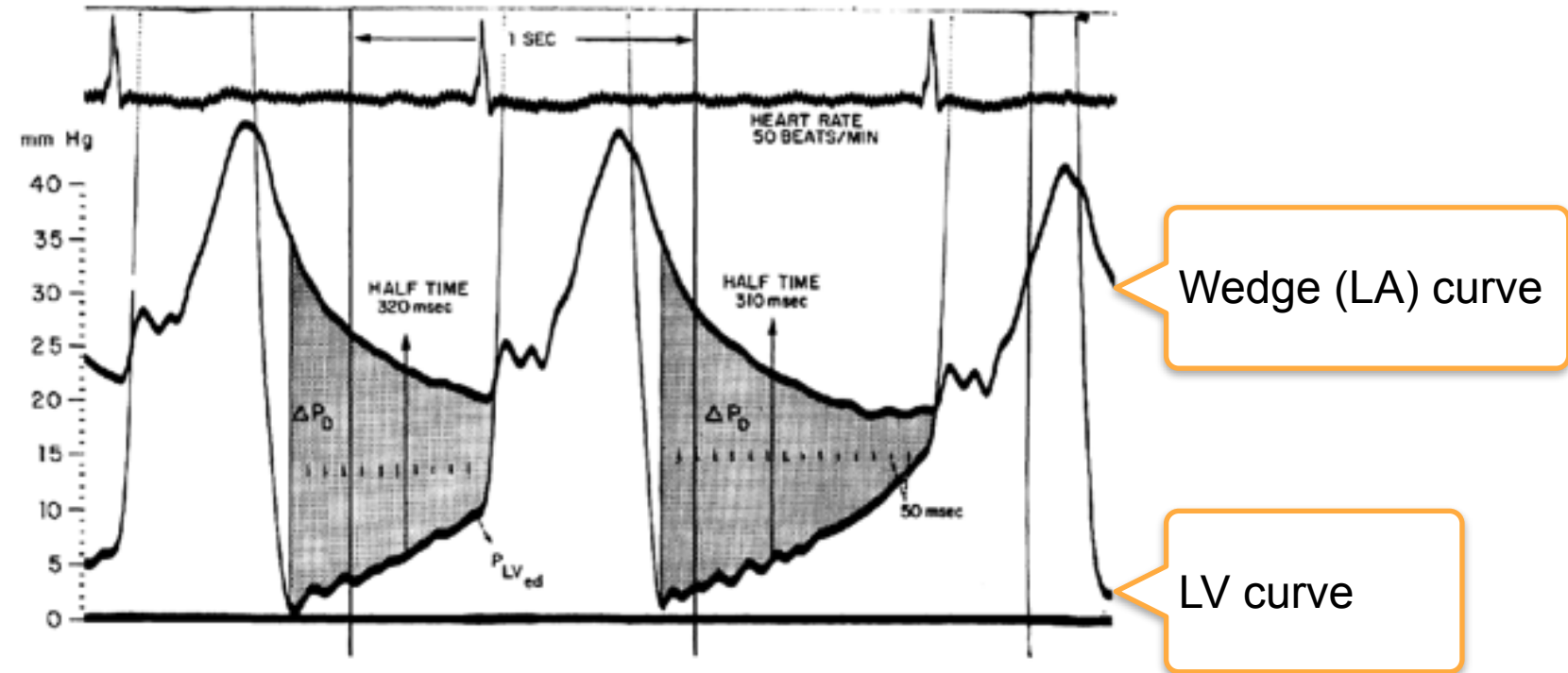
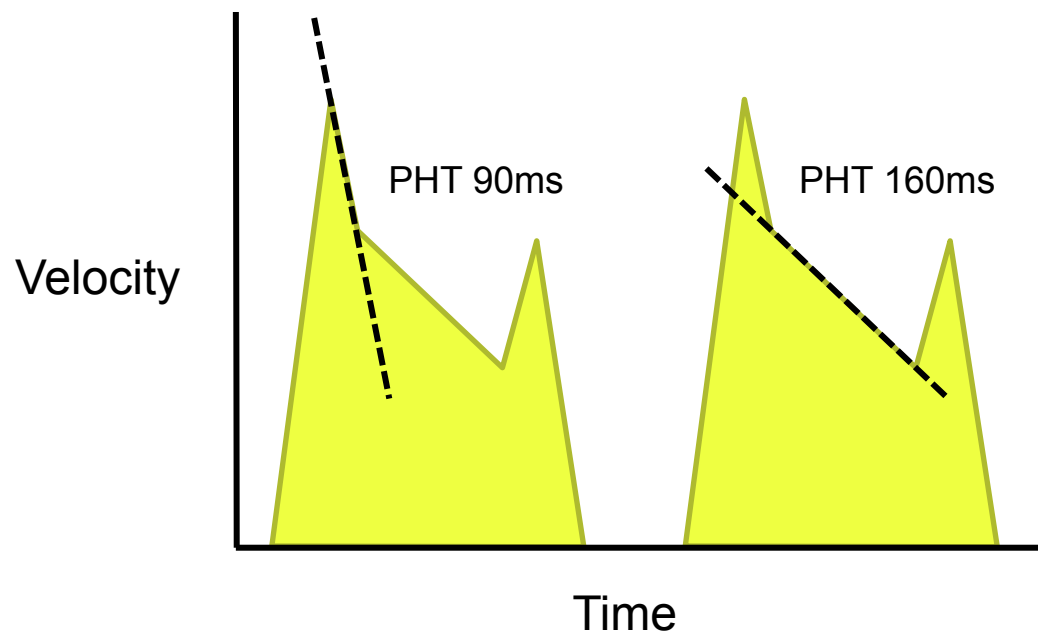


Figure 1

Simultaneous left atrial and ventricular diastolic pressures in a patient with severe mitral stenosis at rest. The horizontal axis is time. The original recording speed was 100 mm/second. The diastolic pressure difference starting at the onset of the rise in ventricular pressure is measured at 50-msec intervals (short vertical lines). The shaded area shows the changing atrioventricular pressure gradient. Symbols:  $P_{LV_{ed}}$  end-diastolic left ventricular pressure;  $\Delta P_D$ , atrioventricular diastolic pressure difference.

# Vaststellen van ernst MS mbv PHT methode

PHT of DT tracing



Een normale range PHT is 20-90ms

MS heeft een PHT >90ms

Berekening MVA:  $220/PHT$  (Empirisch)

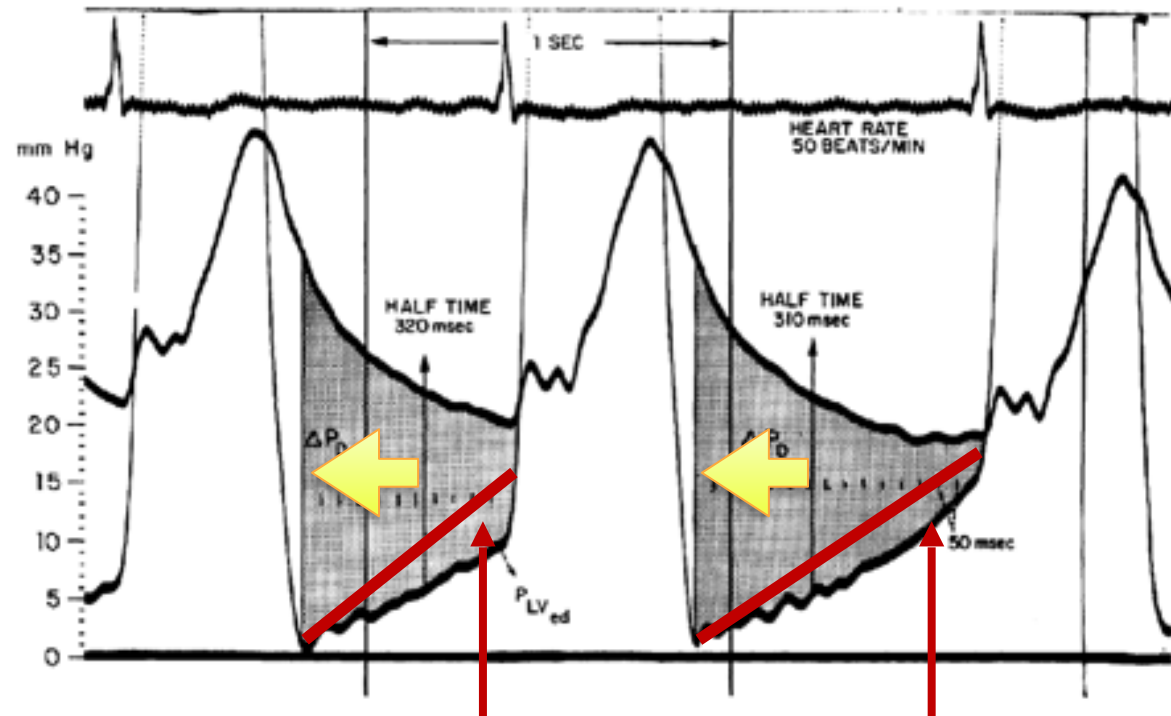
$$MVA \ 220/90=2.4cm^2$$

$$MVA \ 220/160=1.4cm^2$$

# Beware: PHT methode voor MS bij Aol

ATRIOVENTRICULAR PRESSURE HALF-TIME

145



PHT invasief

Ernstige Aol geeft verhoging van de LVED

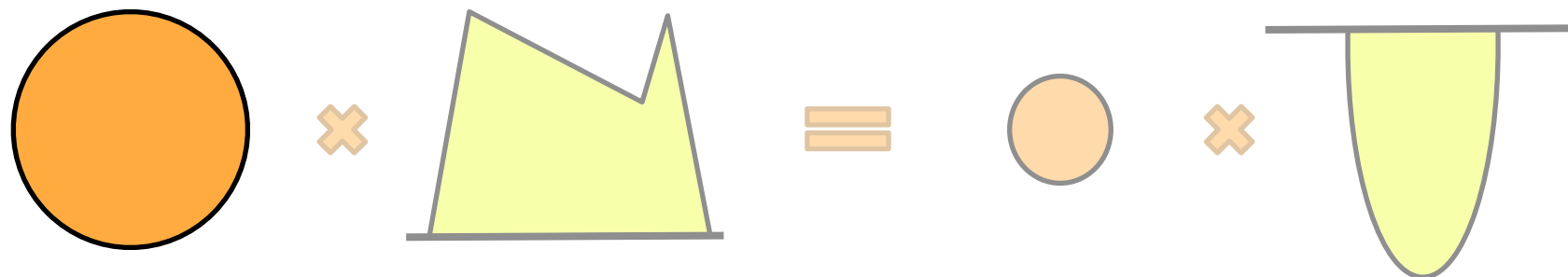
Dit resulteert in een snellere LA-LV druk equilibratie

Dit geeft een kortere PHT

Via de berekening  $220/PHT$  bereken je een groter MVA

*Bij een ernstige Aol onderschat je dus de ernst van de MS (bij de PHT methode)*

# Continuïteitsvergelijking



Mitral valve area

Mitral TVI

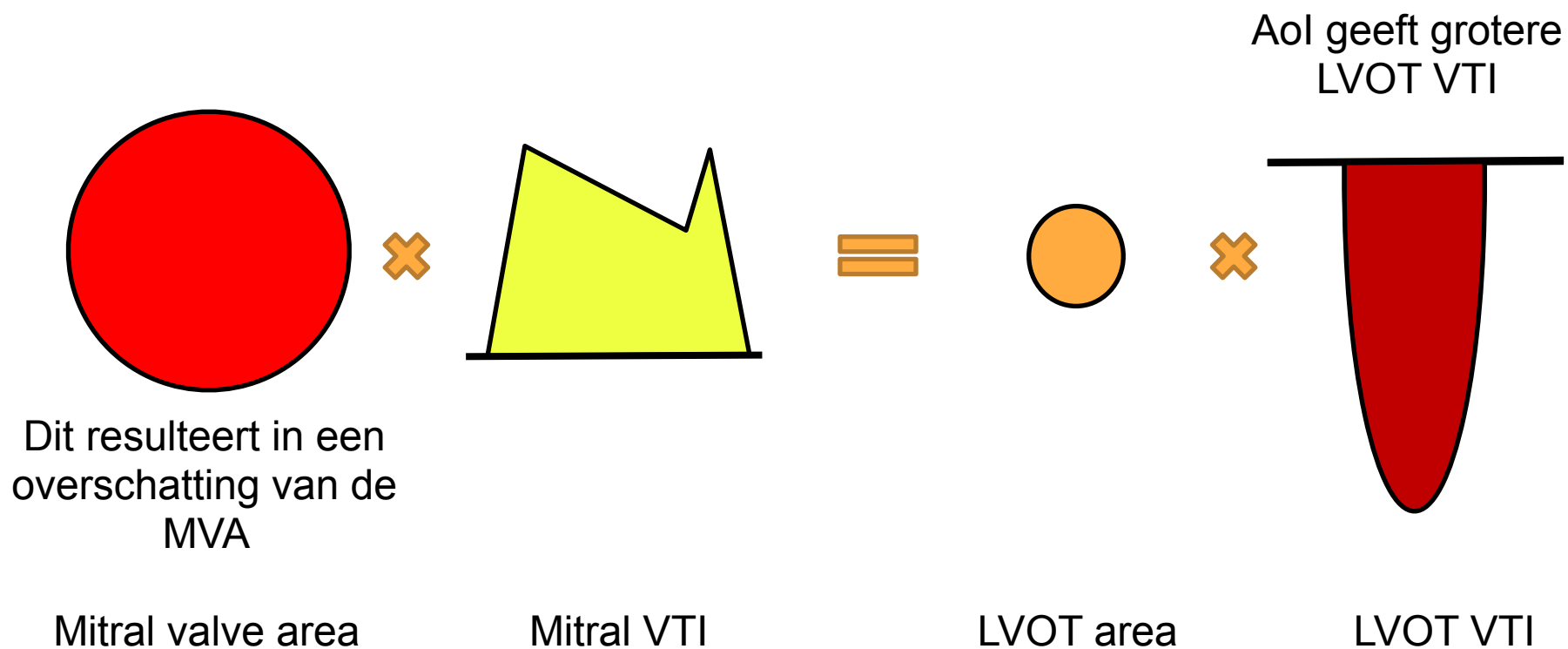
LVOT area

LVOT TVI

Slag volume MV

= Slag volume LVOT

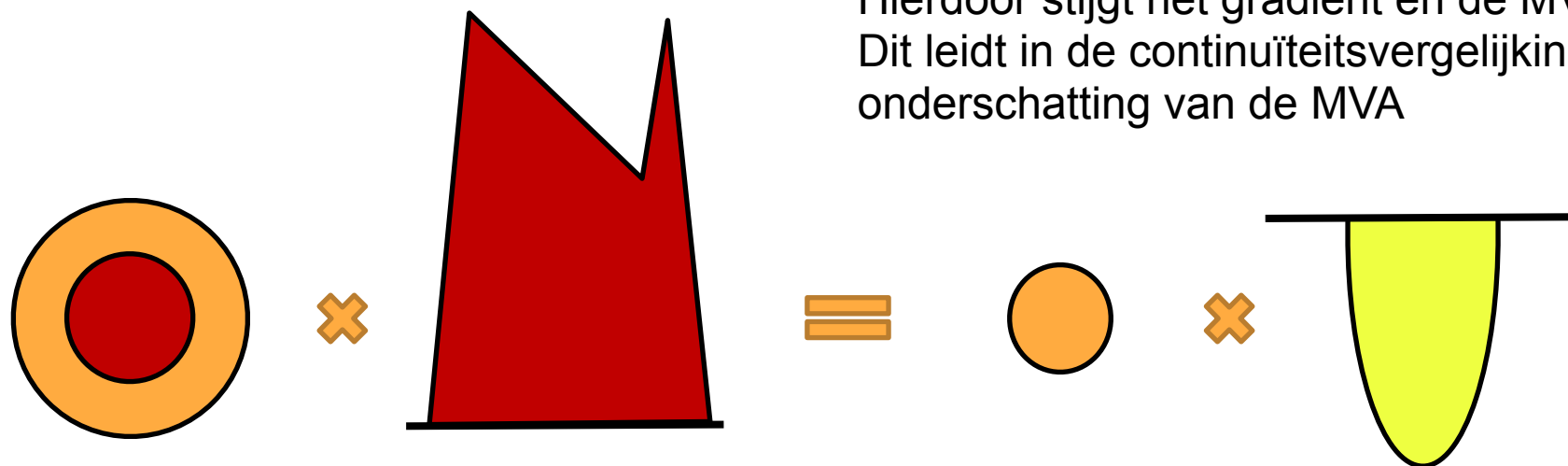
# Continuïteitsvergelijking MS EN AoI



**Slag volume MV = Slag volume LVOT**

# Continuïteitsvergelijking MS EN MI

MI: geeft door regurgitatie een verhoging van het antegraad diast volume door de MV.  
 Hierdoor stijgt het gradiënt en de MVTVI  
 Dit leidt in de continuïteitsvergelijking tot een onderschatting van de MVA



Mitral valve area

Mitral VTI

LVOT area

LVOT VTI

Slag volume MV

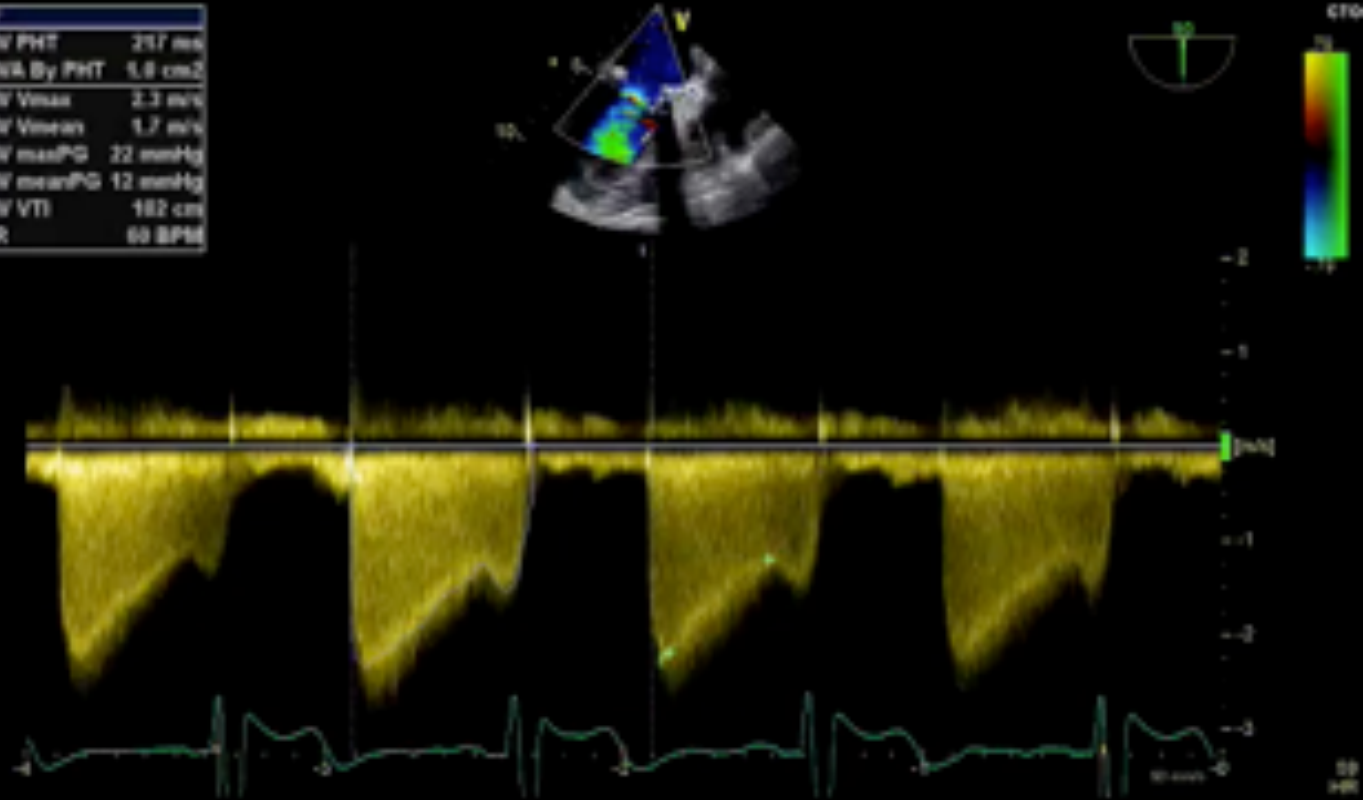
= Slag volume LVOT

# Gebruik van TEE bij MS obv gedegenerereerde bioprothese

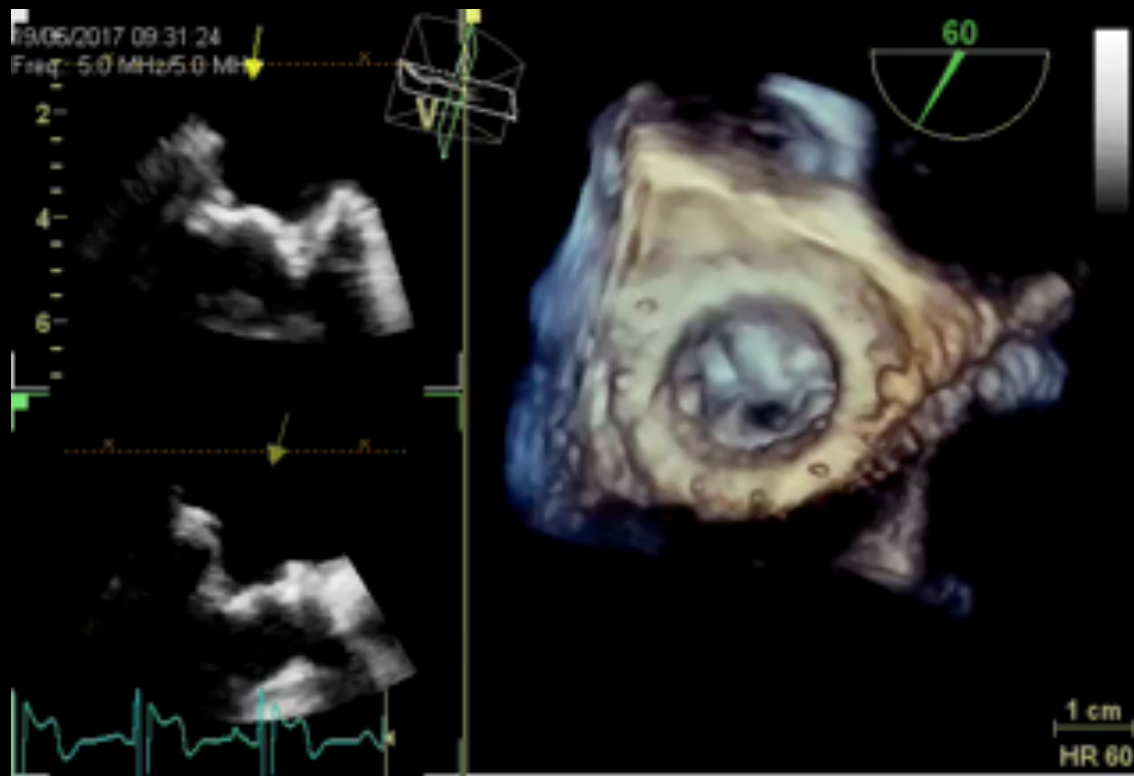


# MV CW signaal bij TEE

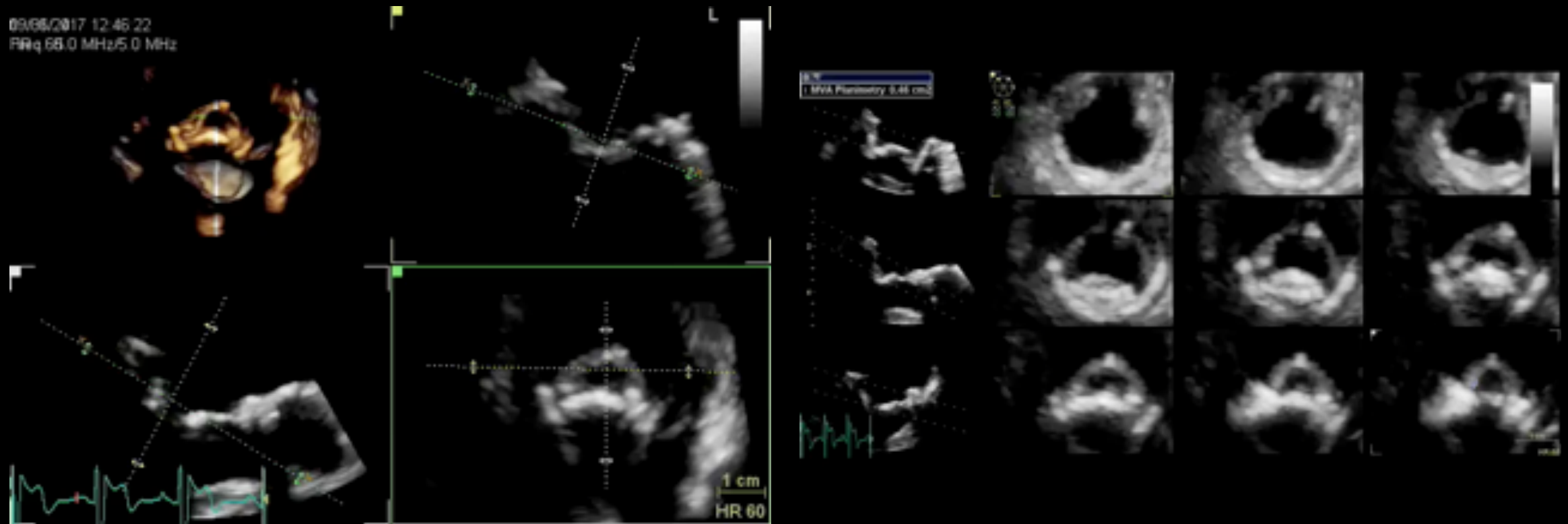
CW	
r MV PHT	237 ms
MVA By PHT	1.6 cm <sup>2</sup>
r MV Vmax	2.3 m/s
MV Vmean	1.7 m/s
MV maxPG	22 mmHg
MV meanPG	12 mmHg
MV VTI	182 cm
HR	69 BPM



# 3D TEE bij MS obv gedegenerereerde bioprothese



# MVA bepalen door tracing in 2D vlak



# Etiologie overige

Congenital MS

Subvalvular apparatus abnormalities

Cor triatriatum

Inflammatory-SLE

Infiltrative

Carcinoid heart disease

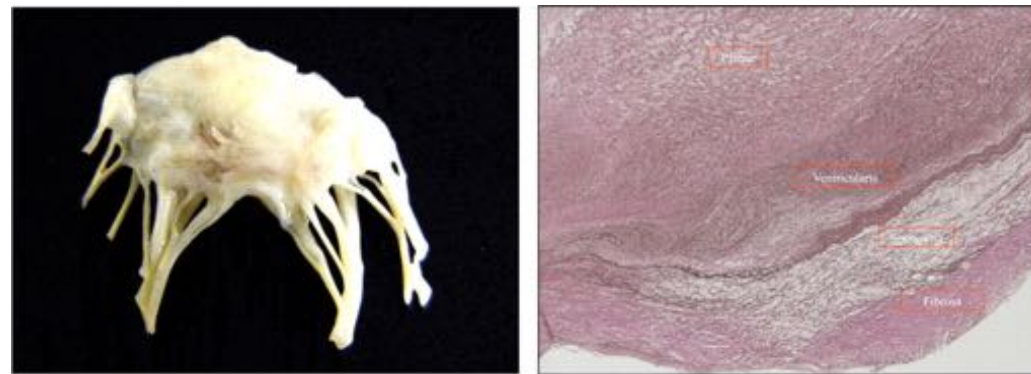
Status na MVP

Neoplasmata

Drug induced valve disease

Leaflet thickening and restriction

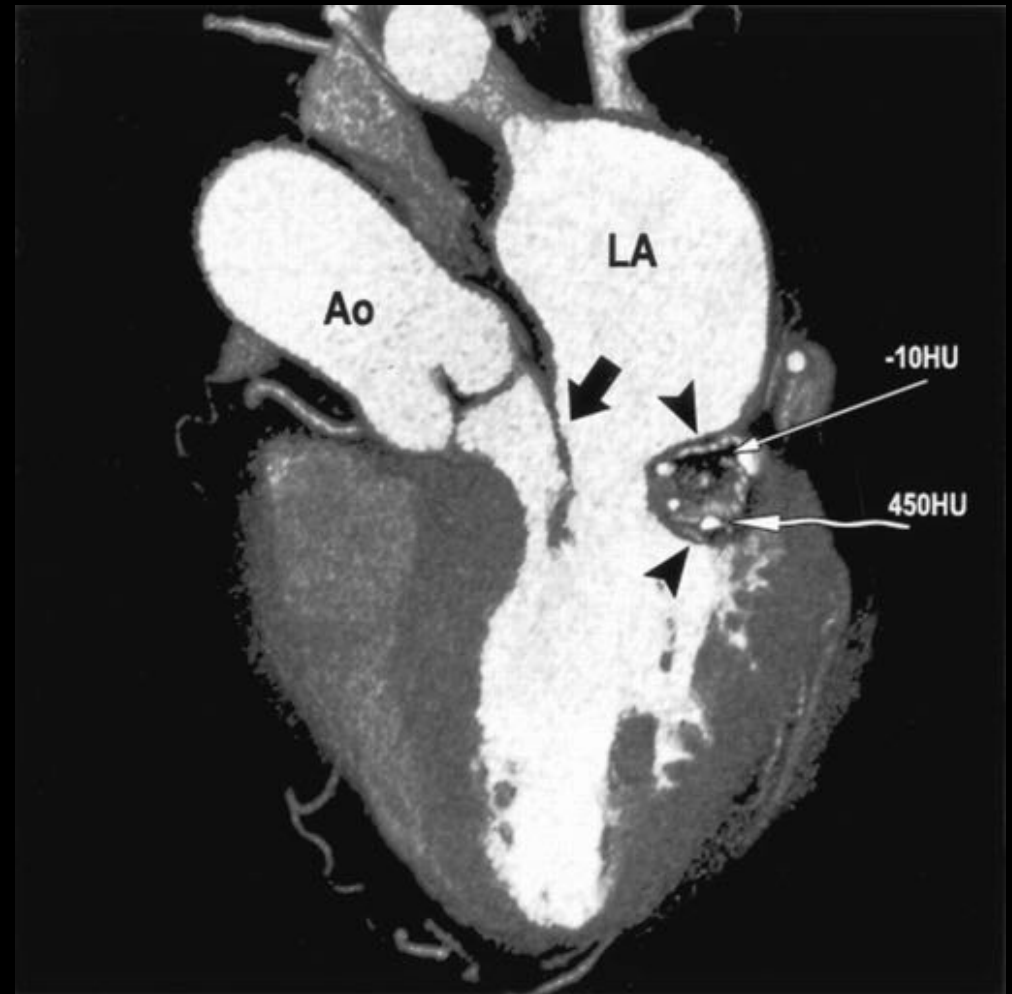
Rarely commissural fusion



Pergolide induced MS. Eur Heart J 2003;24

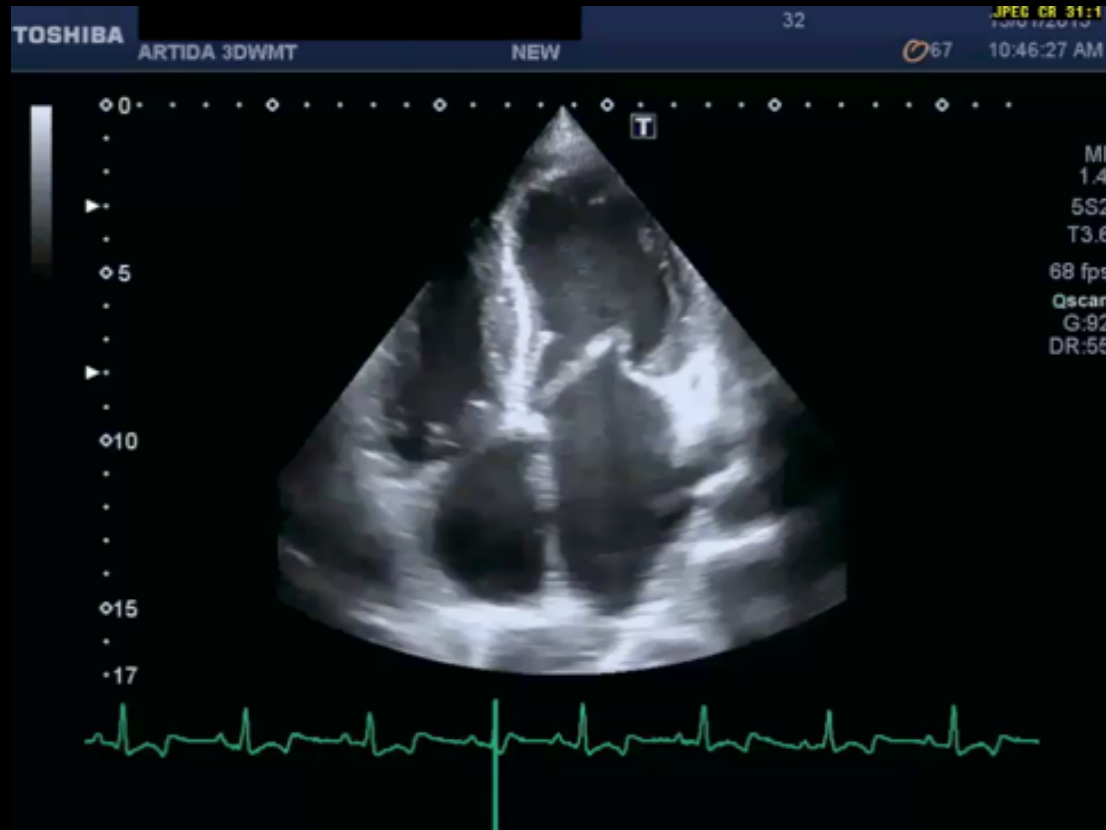


Caseous calcification of the mitral valve

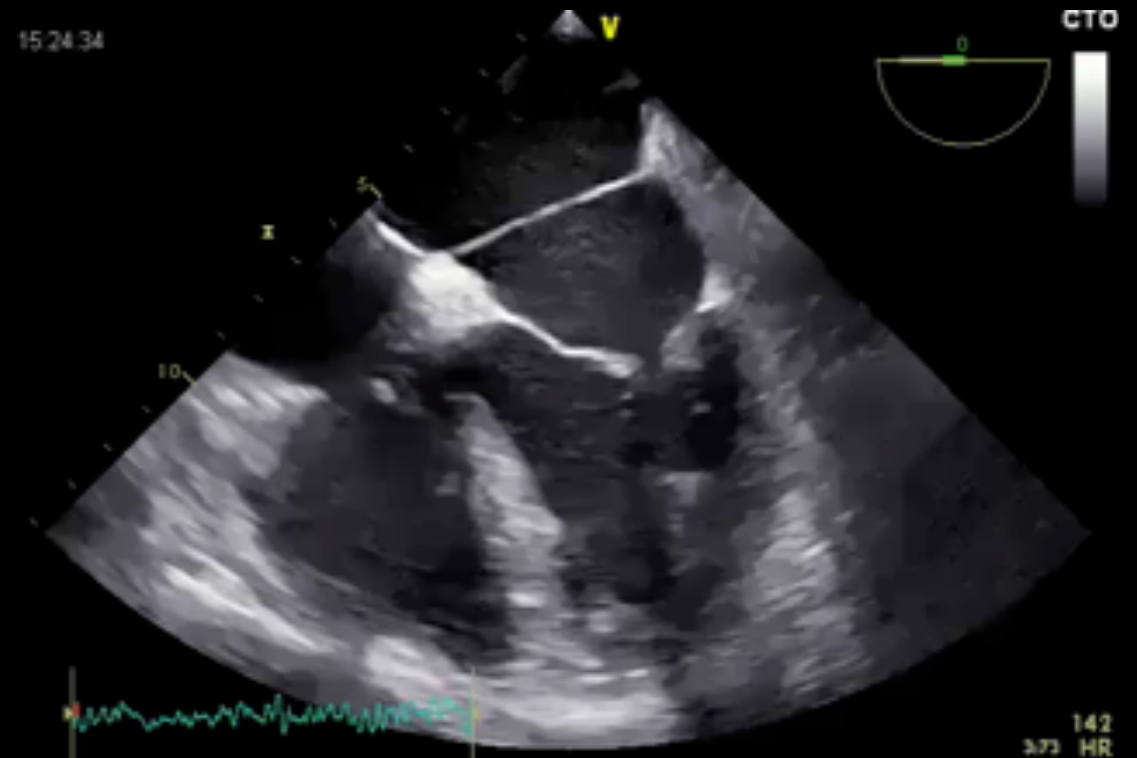


# Congenitale afwijkingen die MS kunnen geven

## Parachute valve

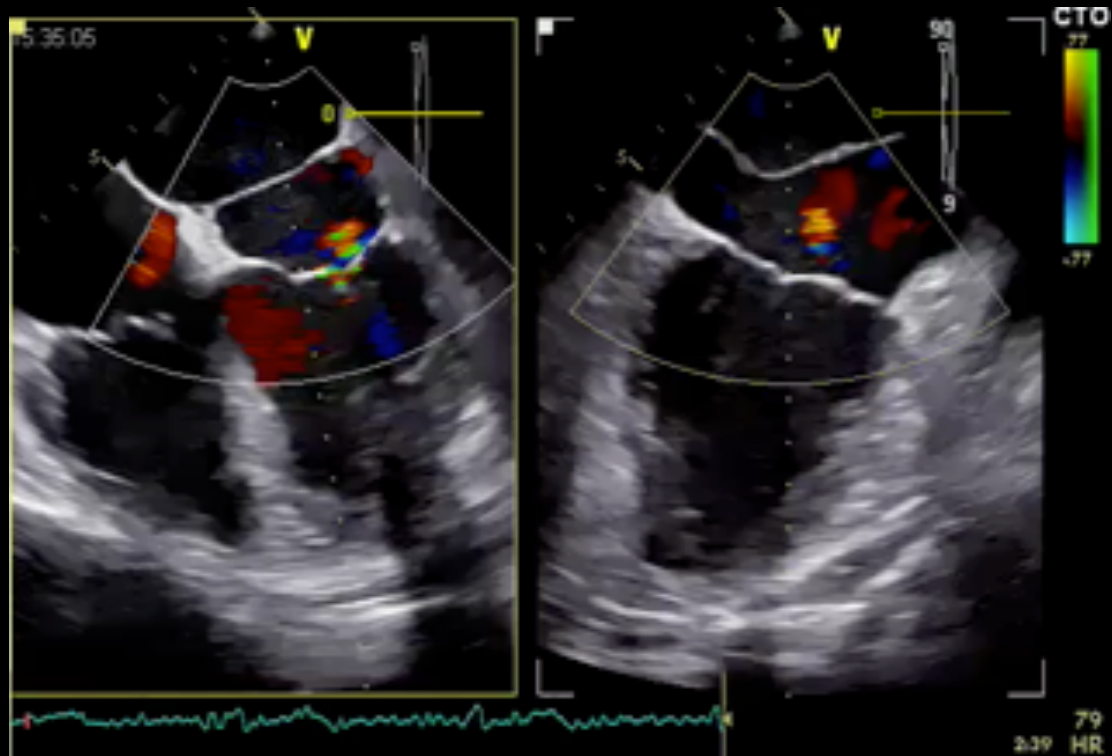


## Cor triatriatum

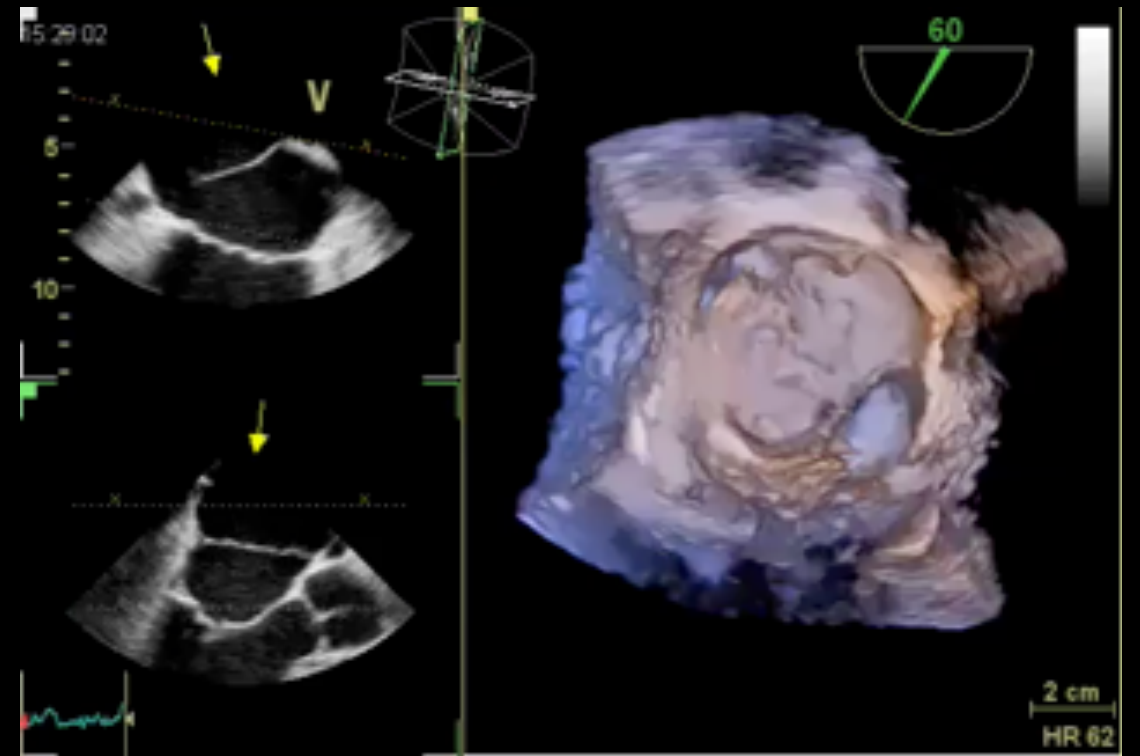


# Cor triatriatum

## Biplane TEE

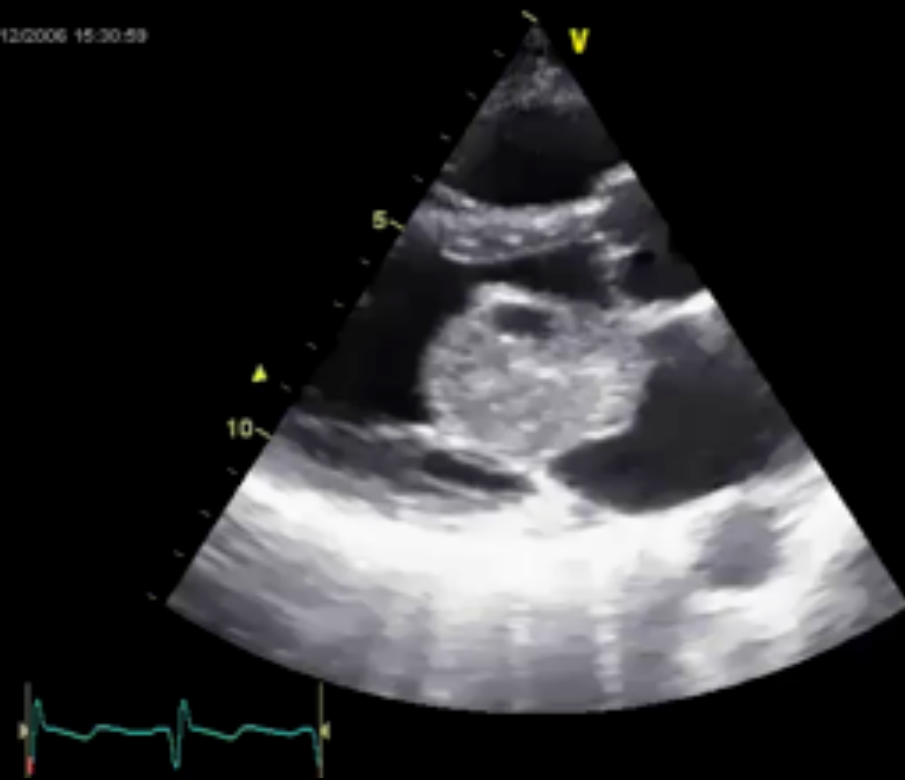


## 3D LA visual

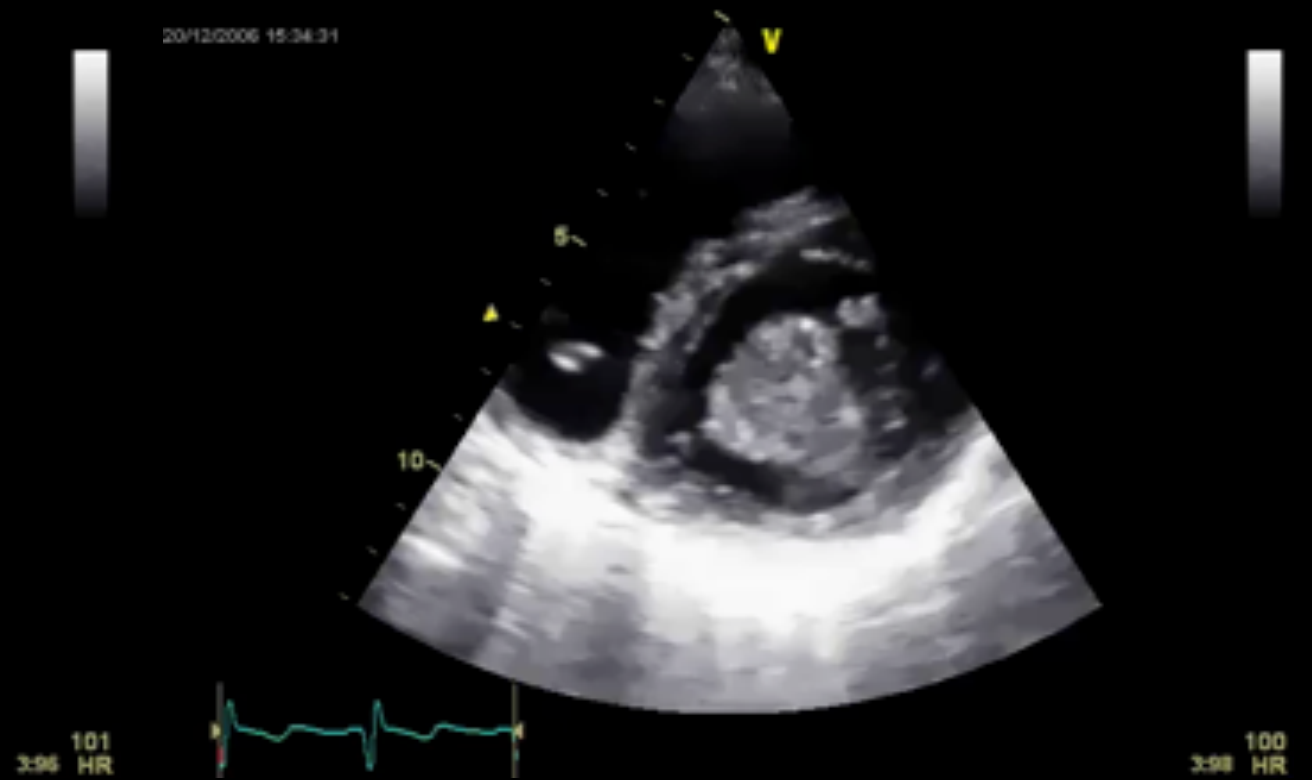


# Neoplasms: Myxoma cordis

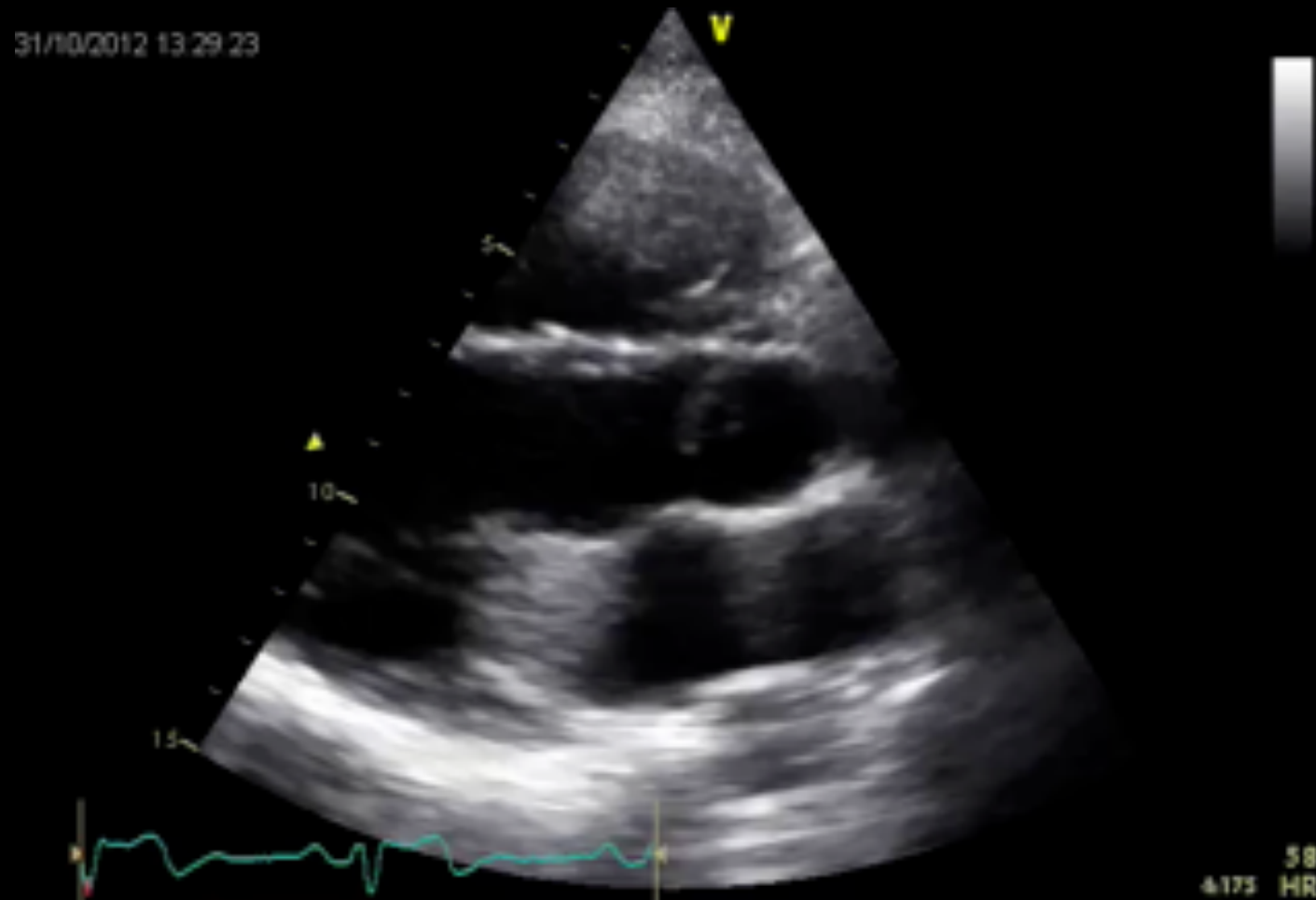
20/12/2006 15:30:59

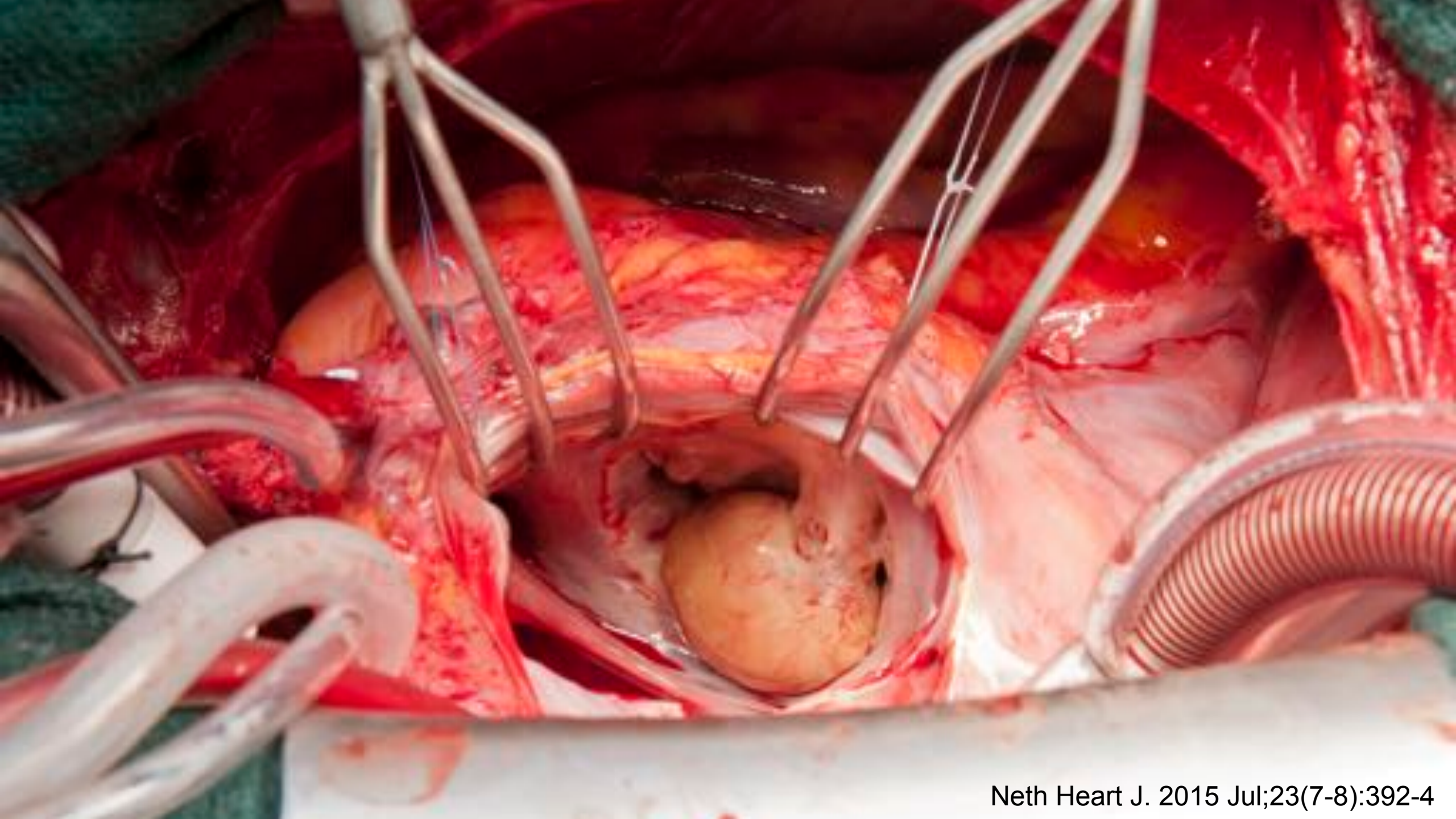


20/12/2006 15:34:31

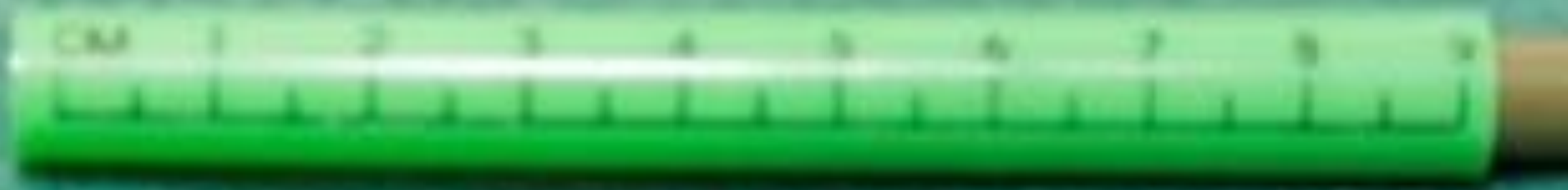


Man 23 jaar. Dyspnoe d'effort. ASD2 sluiting (2jr)





# Giant intracardiac blood cyst

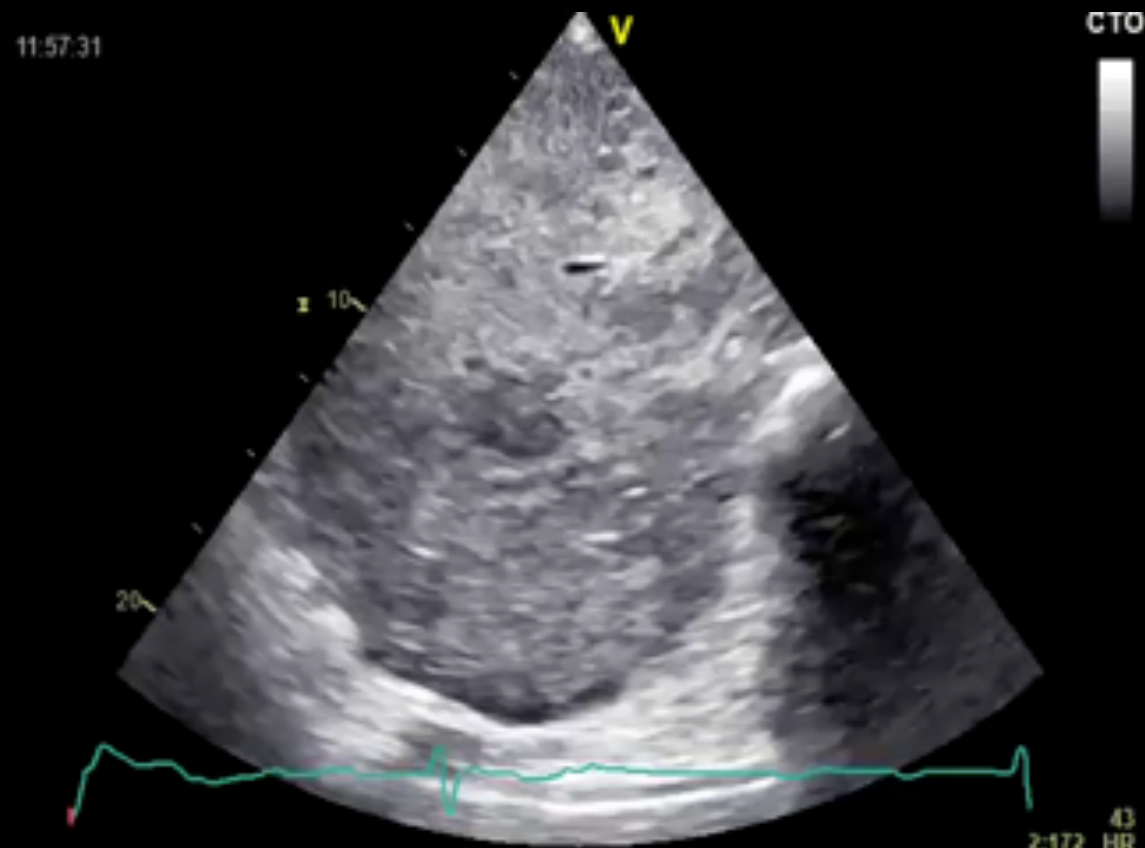


# Carcinoid Heart Disease



CTO

2:107 54 HR



CTO

# Drug induced valvular heart disease

## Fenfluramine/Phentermine (fen-phen)

- Anorexigenic drug 1996
- 1st year 18M prescriptions
- 1997 NEJM report on valvular disease
- Most common: left sided; AR and MR
- Cause: fenfluramine
- Plaque-like valvulopathy (carcinoid like)
- 5HT<sub>2b</sub> receptor involvement -> fibroblast stimulation



The advertisement features a central image of a magazine cover with a woman's torso and the headline "THE HOT NEW DIET PILL". Below the magazine is a wooden gavel resting on a block. To the right, the text reads: "Fen Phen Lawsuits Are Now Being Reviewed Nationwide". At the bottom, the phone number "866-588-0600" is displayed, along with the text "Call 24 hours/day Free Case Evaluation".

*NEJM: "We report 24 cases of unusual valvular disease in patients taking fenfluramine-phentermine,"*

# Drug induced VHD and the serotonin hypothesis

Dose-dependent relation & potential reversibility

Other drugs (5HT<sub>2b</sub>)

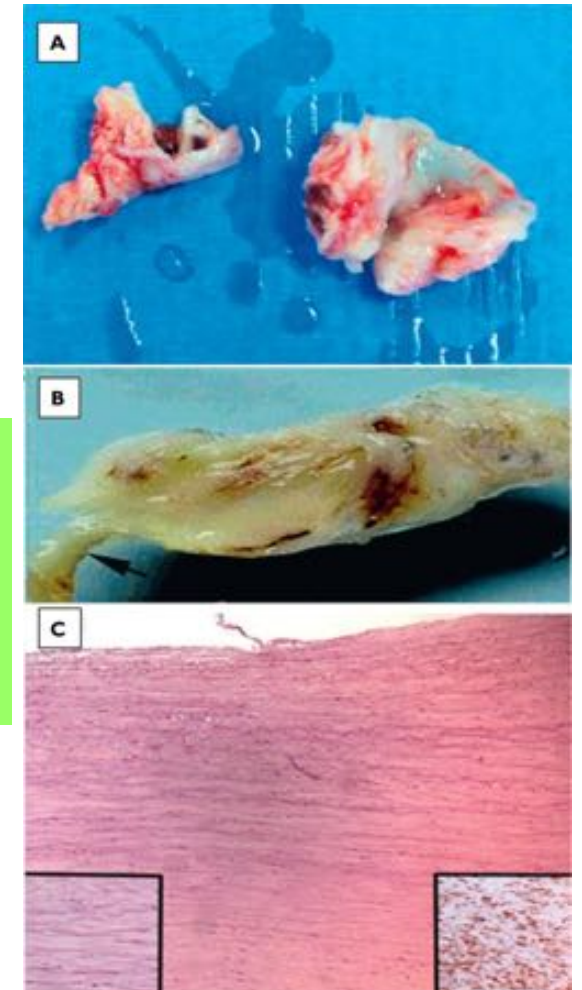
- Ergotamine, Methysergide (MS/MR)
- Pergolide and bromocriptine

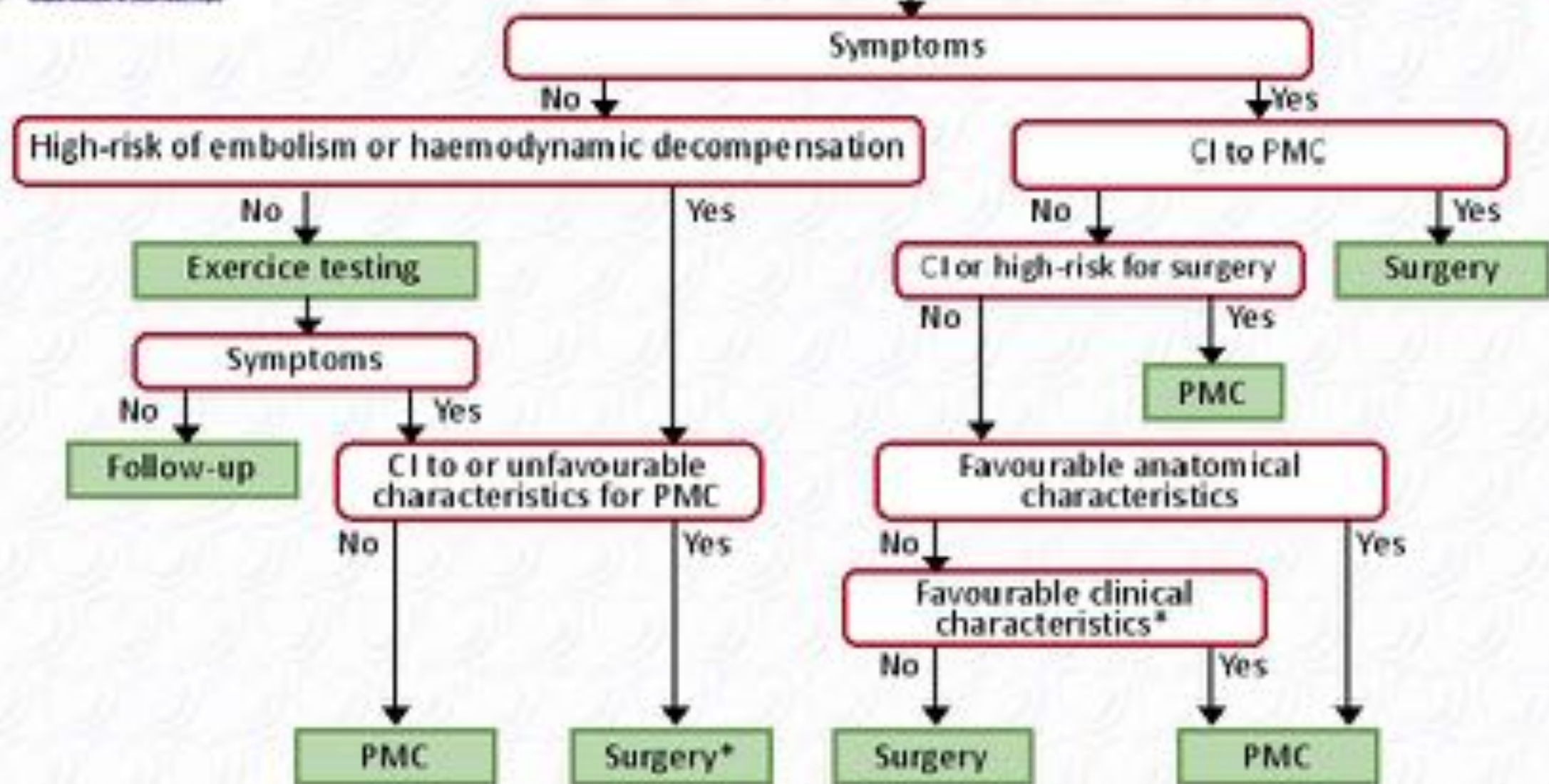
DOA

- MDMA (XTC)

SSRIs: no 5-HT<sub>2B</sub> agonistic properties

*This is the first case of VHD with pathological confirmation related to long term exposure to ecstasy. Except for an in vitro study [1], few data are available [1]. Among 29 subjects using ecstasy, eight had abnormal mitral valve echocardiography vs. 0 in controls [2]. The fact that the lesions in our patient were very similar to those described with appetite-suppressant drugs [3] and the ability of ecstasy to activate 5-HT<sub>2B</sub> receptors, like fenfluramine [1, 4], suggests its role in the pathophysiology of this VHD. VHD is unusual in young subjects.*





See table of recommendations \*If symptoms occur for a low level of exercise and operative risk is low

# Chirurgische technieken.

Gesloten commissurotomie



Open commissurotomie



MV vervanging

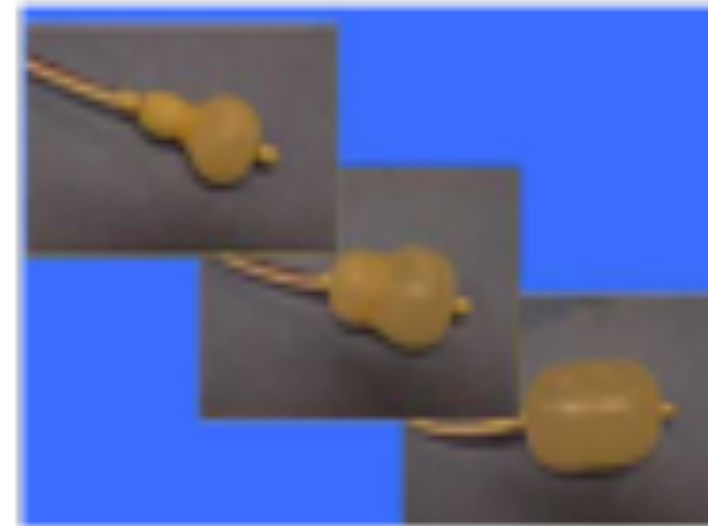
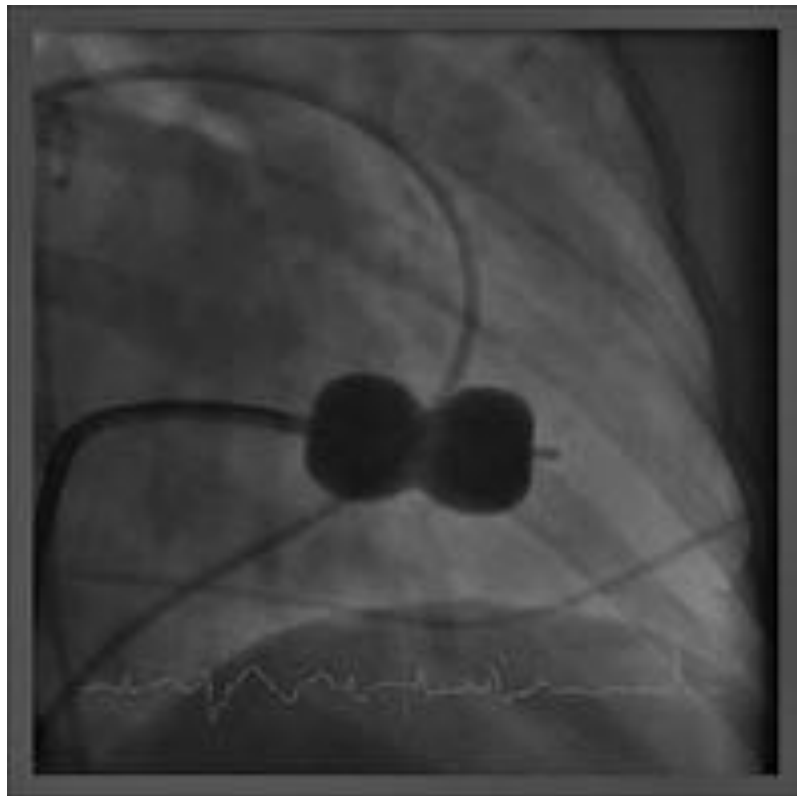


Br Med J. 1925;2:603–6. Souttar HS.  
The surgical treatment of Mitral stenosis.

# Balloon valvuloplasty (PMC)

1984 Inoue

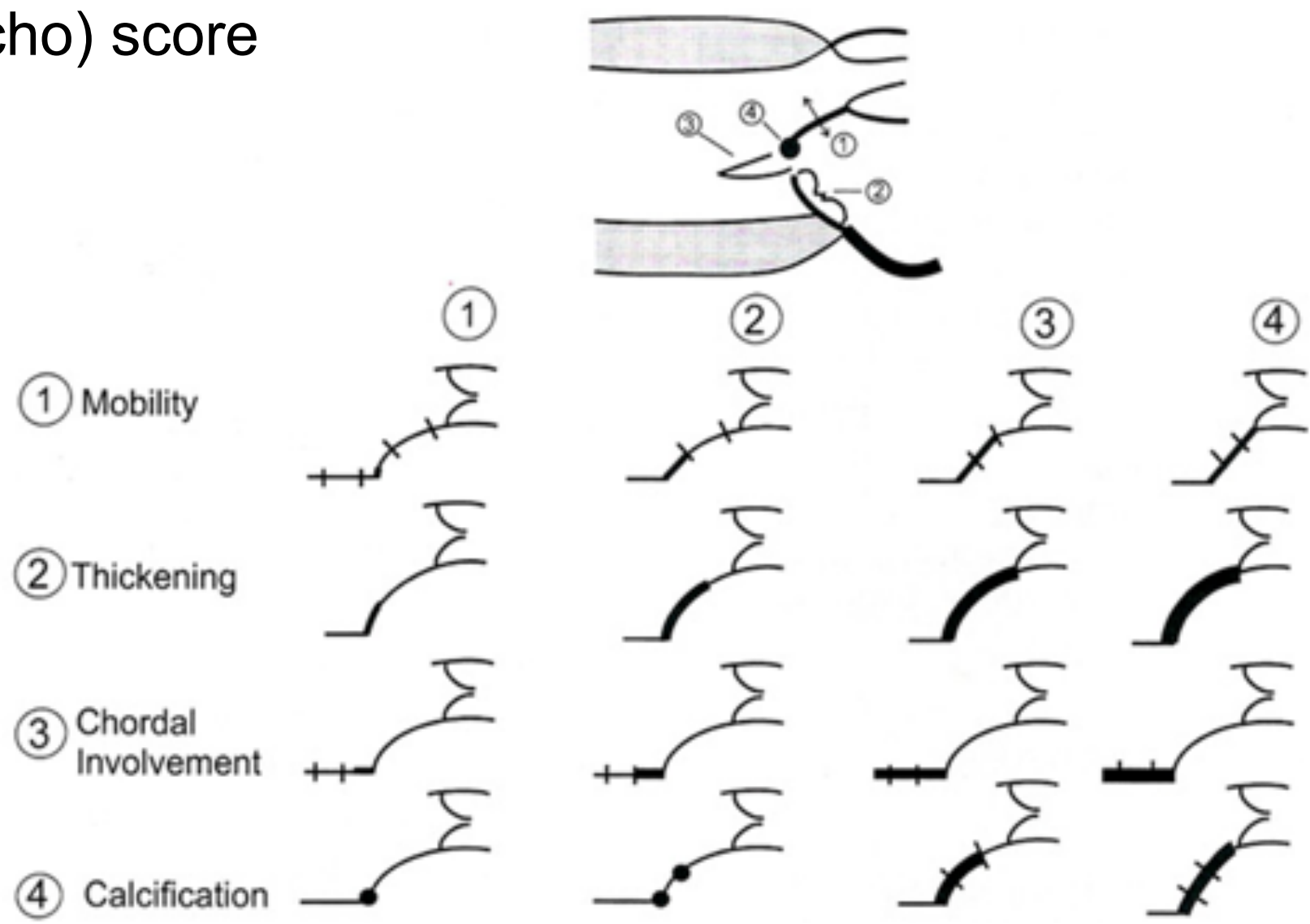
Eerste niet-chirurgische interventie voor VHD



J Thorac Cardiovasc Surg 1984; 87: 394–402

Rebecca S. Norrad, and Omid Salehian Circulation. 2011;124:2756-2760

# Wilkins (echo) score

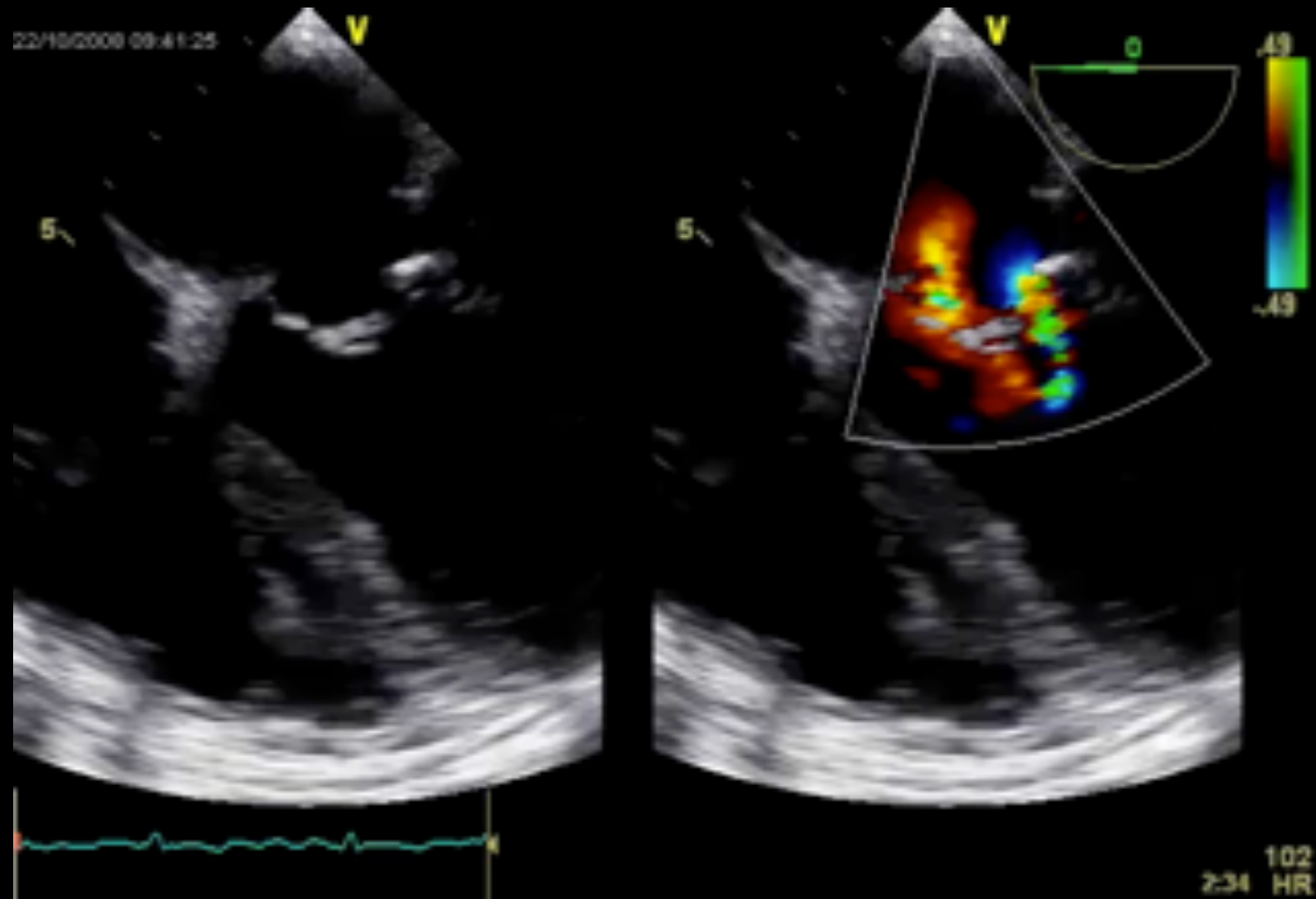


# Wilkins (echo) score

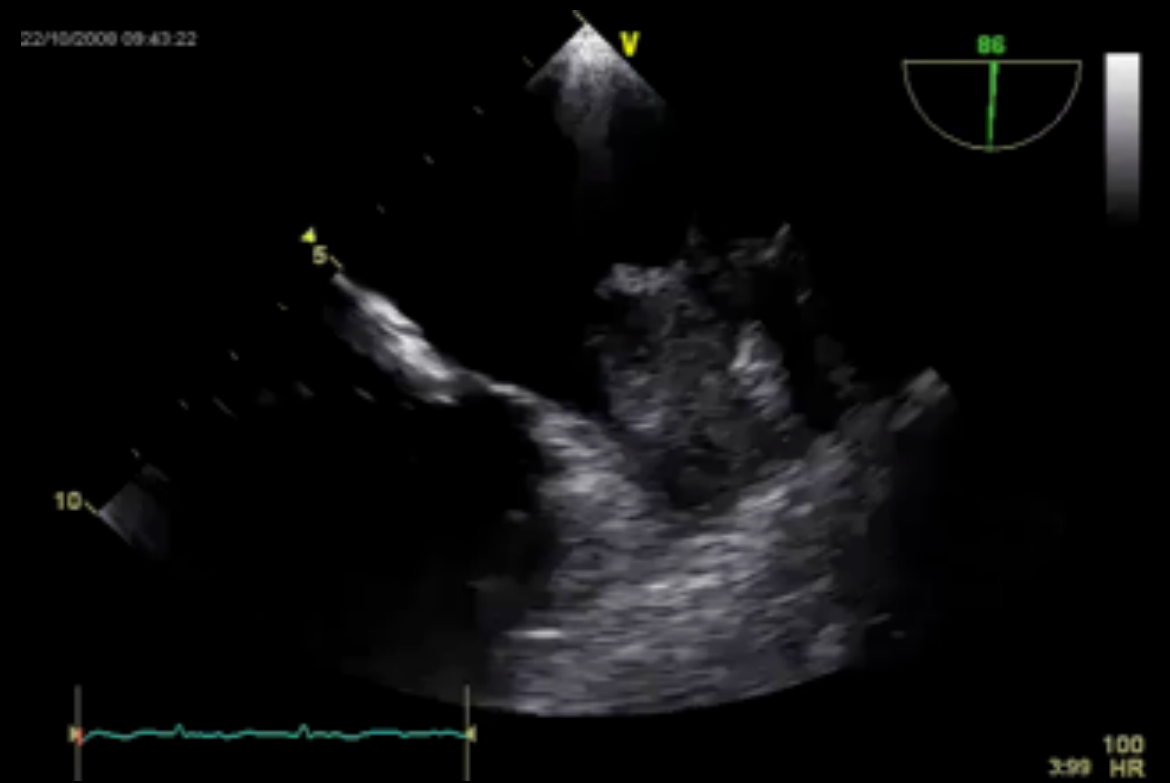
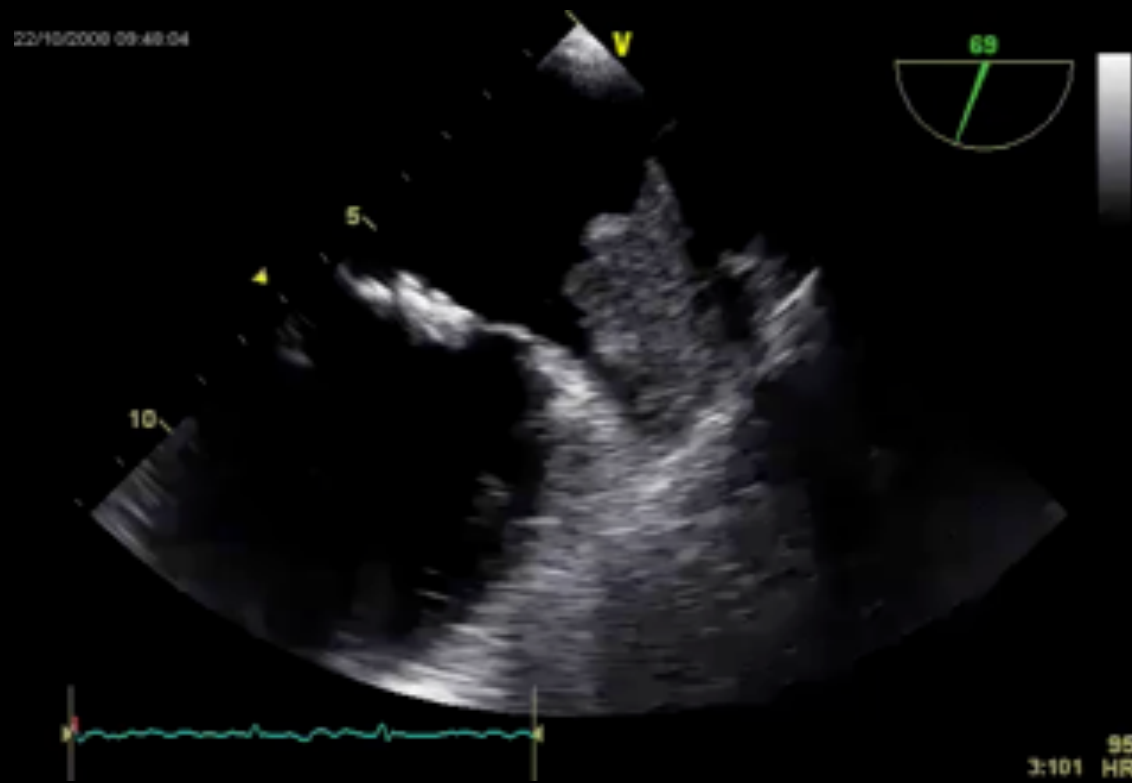
Grade	Mobility	Thickening	Calcification	Subvalvular Thickening
1	Highly mobile valve with only leaflet tips restricted	Leaflets near normal in thickness (4-5 mm)	A single area of increased echo brightness	Minimal thickening just below the mitral leaflets
2	Leaflet mid and base portions have normal mobility	Midleaflets normal, considerable thickening of margins (5-8 mm)	Scattered areas of brightness confined to leaflet margins	Thickening of chordal structures extending to one-third of the chordal length
3	Valve continues to move forward in diastole, mainly from the base	Thickening extending through the entire leaflet (5-8 mm)	Brightness extending into the mid-portions of the leaflets	Thickening extended to distal third of the chords
4	No or minimal forward movement of the leaflets in diastole	Considerable thickening of all leaflet tissue (>8-10 mm)	Extensive brightness throughout much of the leaflet tissue	Extensive thickening and shortening of all chordal structures extending down to the papillary muscles

Wilkins score -Mitral valve score <8 are excellent candidates for BMV

# Reumatisch kleplijden, evaluatie MI



# Evaluatie LAA thrombus



## Contra indications PMC

Contra-indications
Mitral valve area $>1.5 \text{ cm}^2$ *
Left atrial thrombus
More than mild mitral regurgitation
Severe or bi-commissural calcification
Absence of commissural fusion
Severe concomitant aortic valve disease, or severe combined tricuspid stenosis and regurgitation requiring surgery
Concomitant CAD requiring bypass surgery

## Leerdoelen

Prevalentie en presentatie van MS is afhankelijk van geografie

TTE (en TEE) zijn essentieel voor:

- De diagnostiek

- Zoeken naar de oorzaak

- Het vaststellen van de ernst

- Het bepalen van de therapie

- Het evalueren van de therapie

