



UNIVERSITATEA DE MEDICINĂ ȘI FARMACIE
GRIGORE T. POPA IAȘI



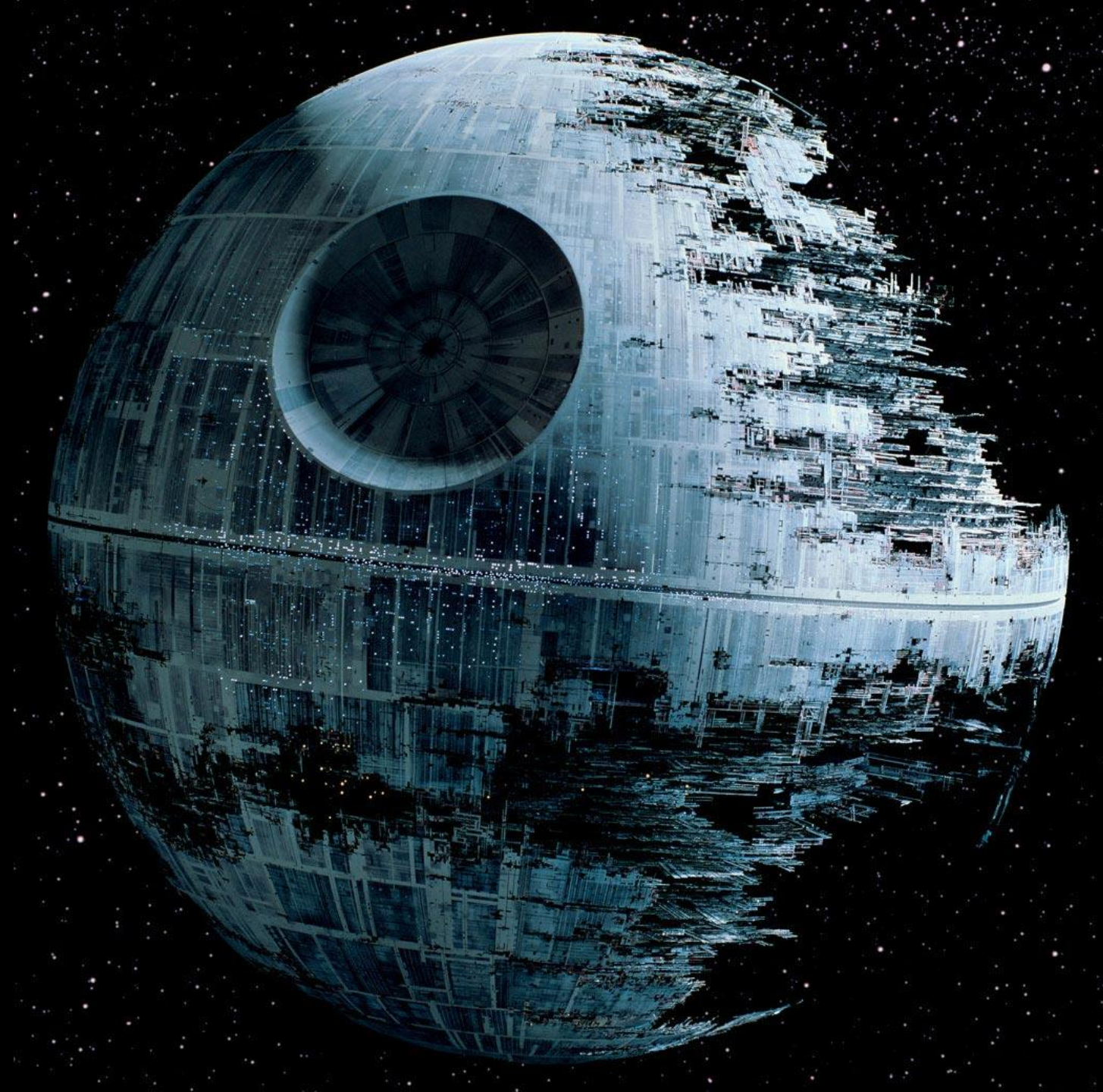
VHD

...VALVULAR HEART DISEASE

...or...Vader's Heart Disease

D. MARCU
PROF. DR. M. FLORIA

A long time ago in a galaxy far,
far away....







MUST HAVE BEEN...

...A VALVULAR HEART DISEASE PATIENT



European Society
of Cardiology

European Heart Journal (2025) **00**, 1–102

<https://doi.org/10.1093/eurheartj/ehaf194>

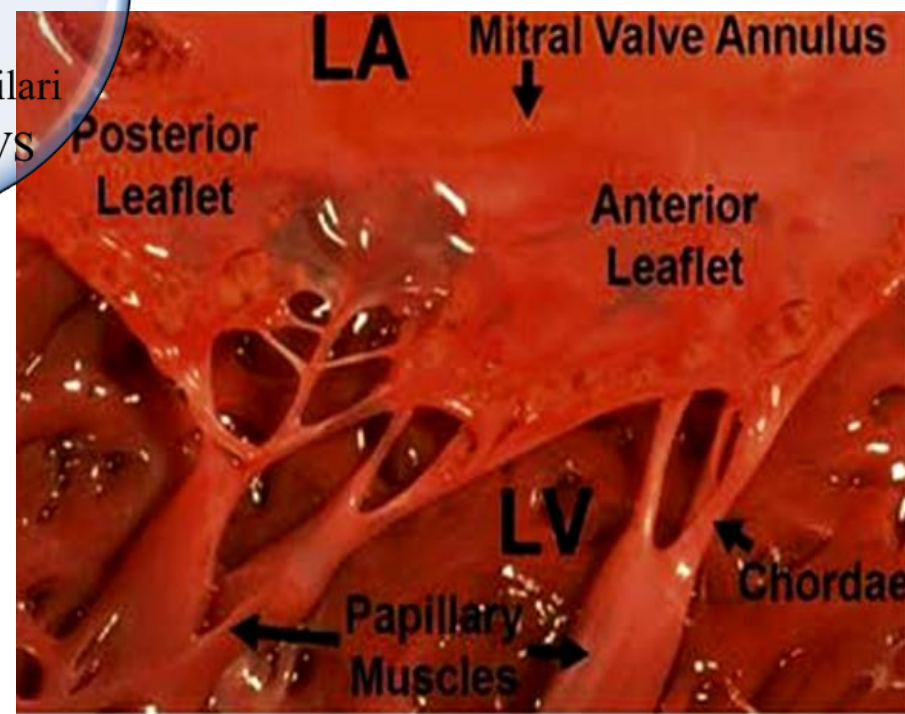
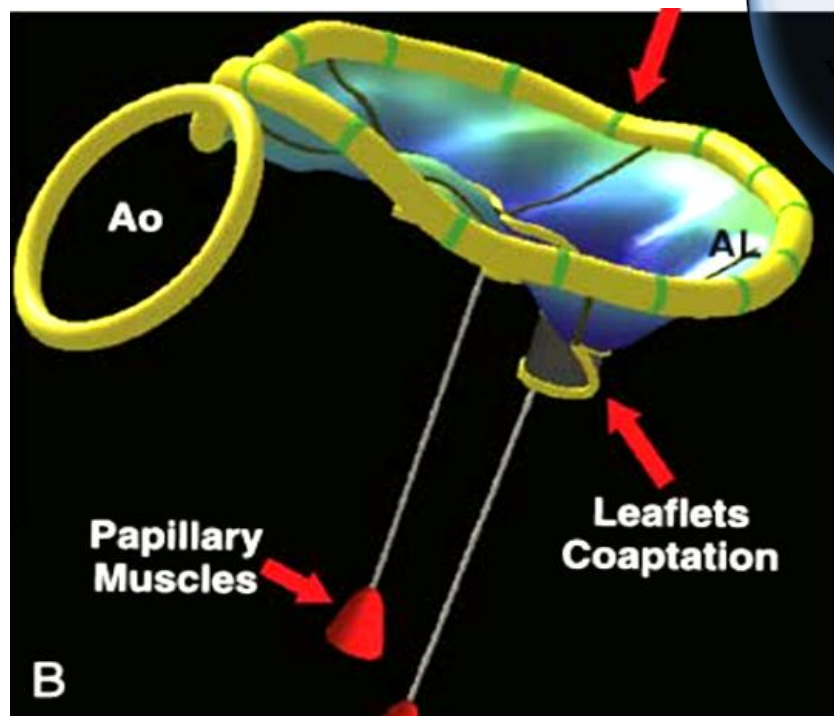
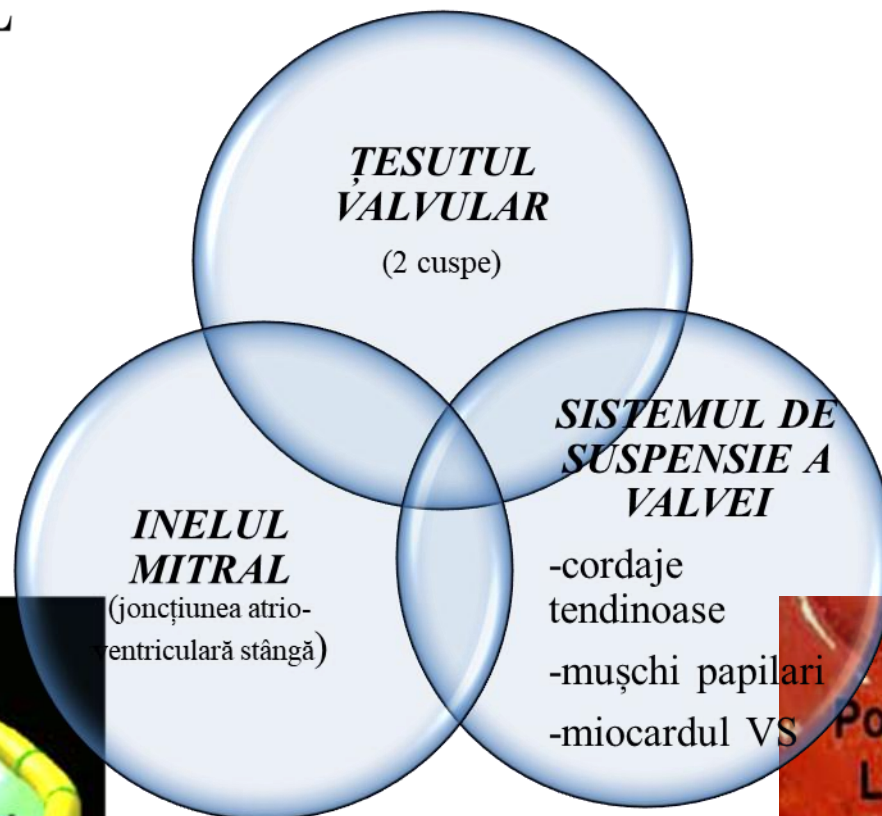
ESC GUIDELINES

2025 ESC/EACTS Guidelines for the management of valvular heart disease

**Developed by the task force for the management of valvular heart
disease of the European Society of Cardiology (ESC) and the
European Association for Cardio-Thoracic Surgery (EACTS)**

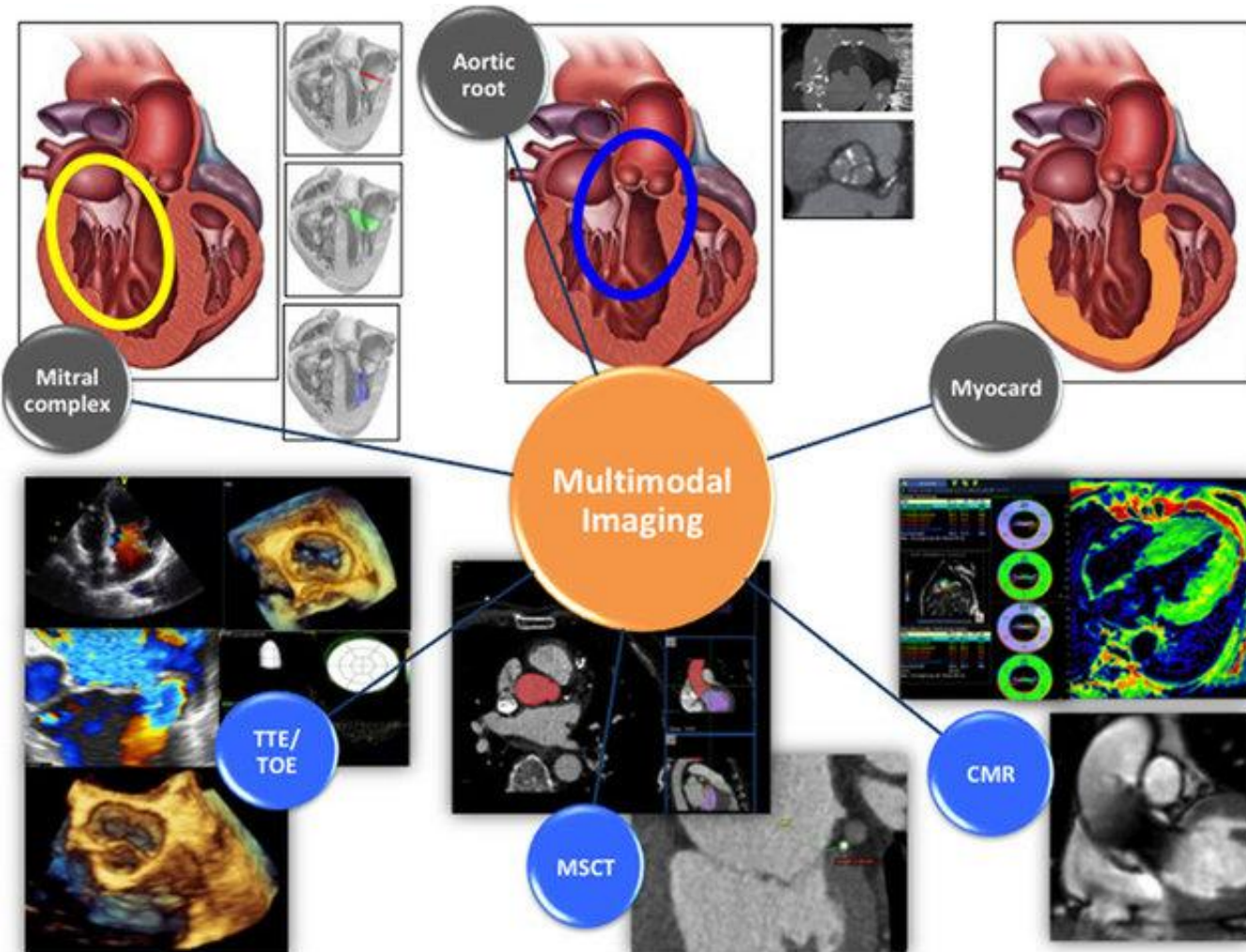
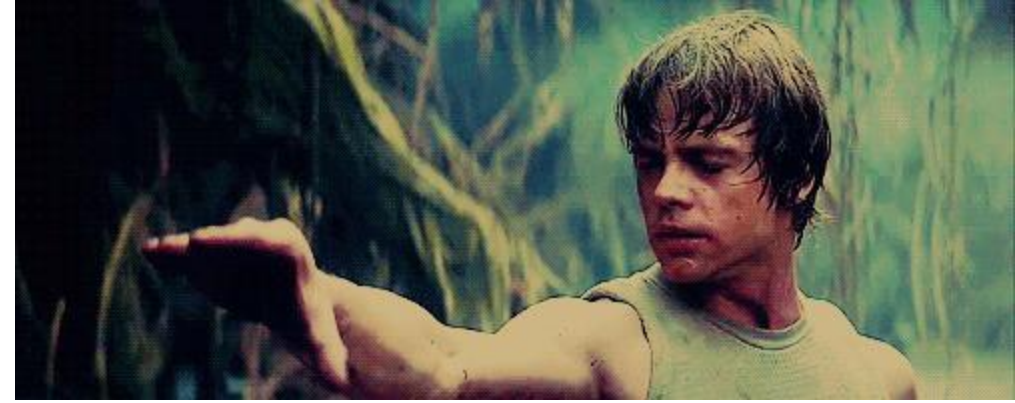


APARATUL VALVULAR MITRAL



- Non-invasive evaluation using

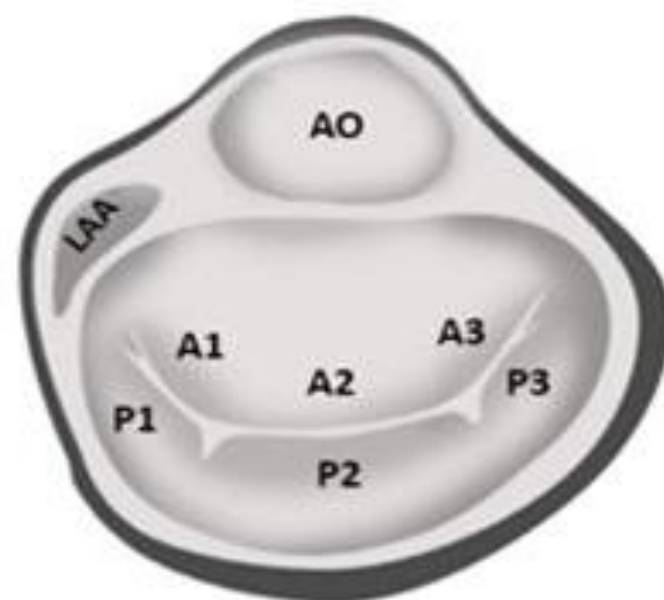
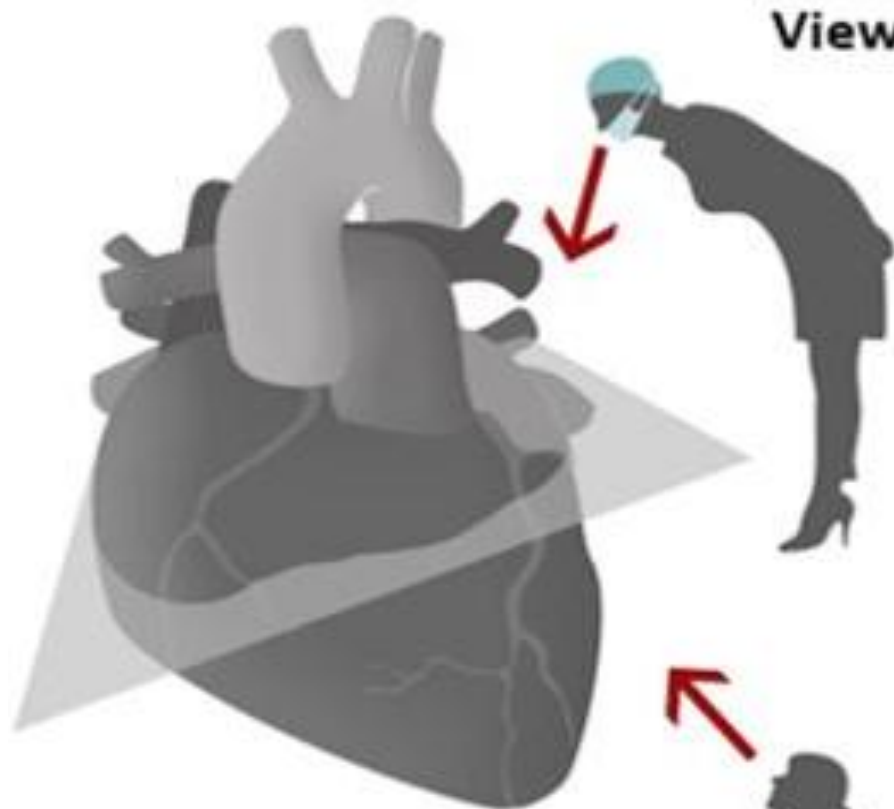
THE FORCE



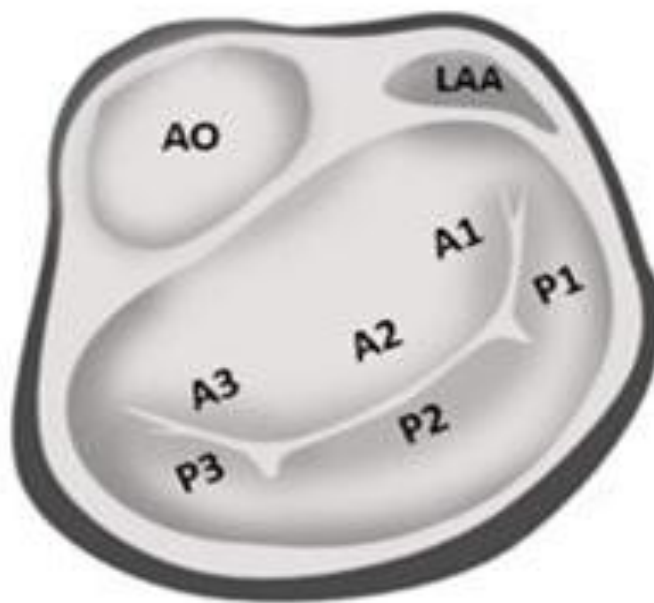
THE FORCE

- **THREE-DIMENSIONAL (3D) ECHOCARDIOGRAPHY**
- **CARDIAC COMPUTED TOMOGRAPHY (CCT)**
- **CARDIAC MAGNETIC RESONANCE (CMR)**
- **BIOMARKERS PLAY A MORE CENTRAL ROLE**

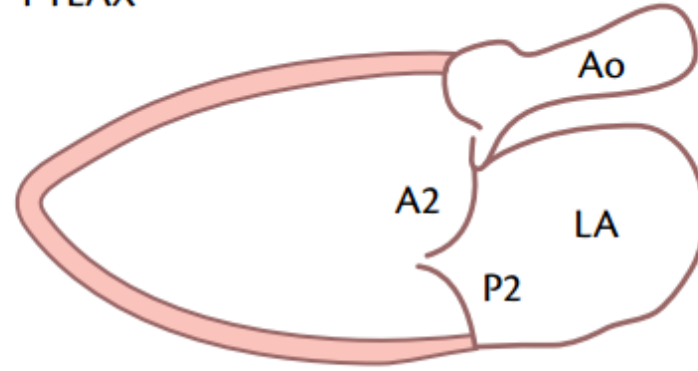
**Surgeon's
View**



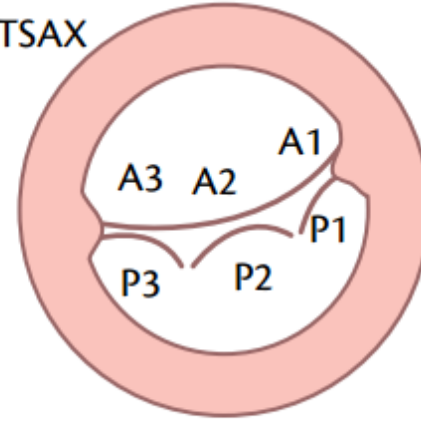
**Sonographers
View**



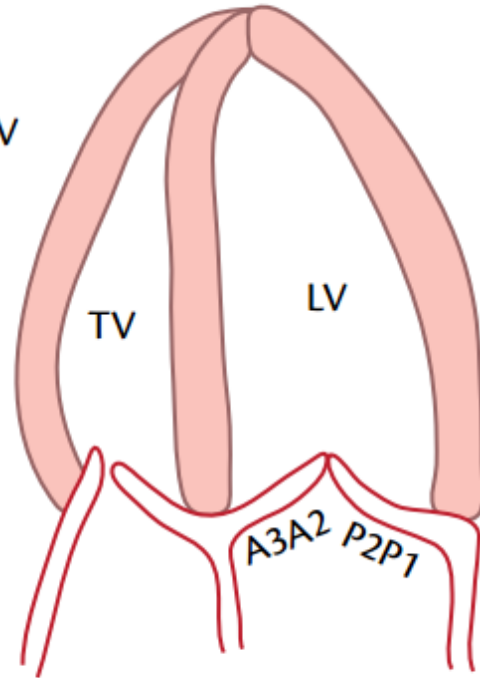
A PTLAX



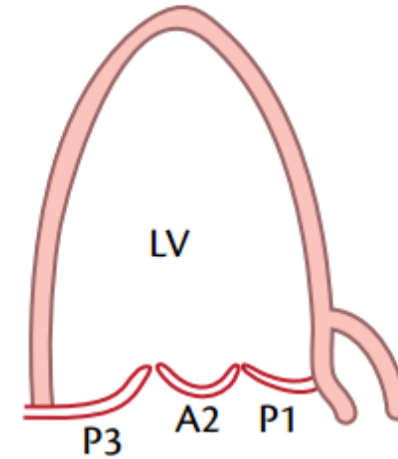
B PTSAX



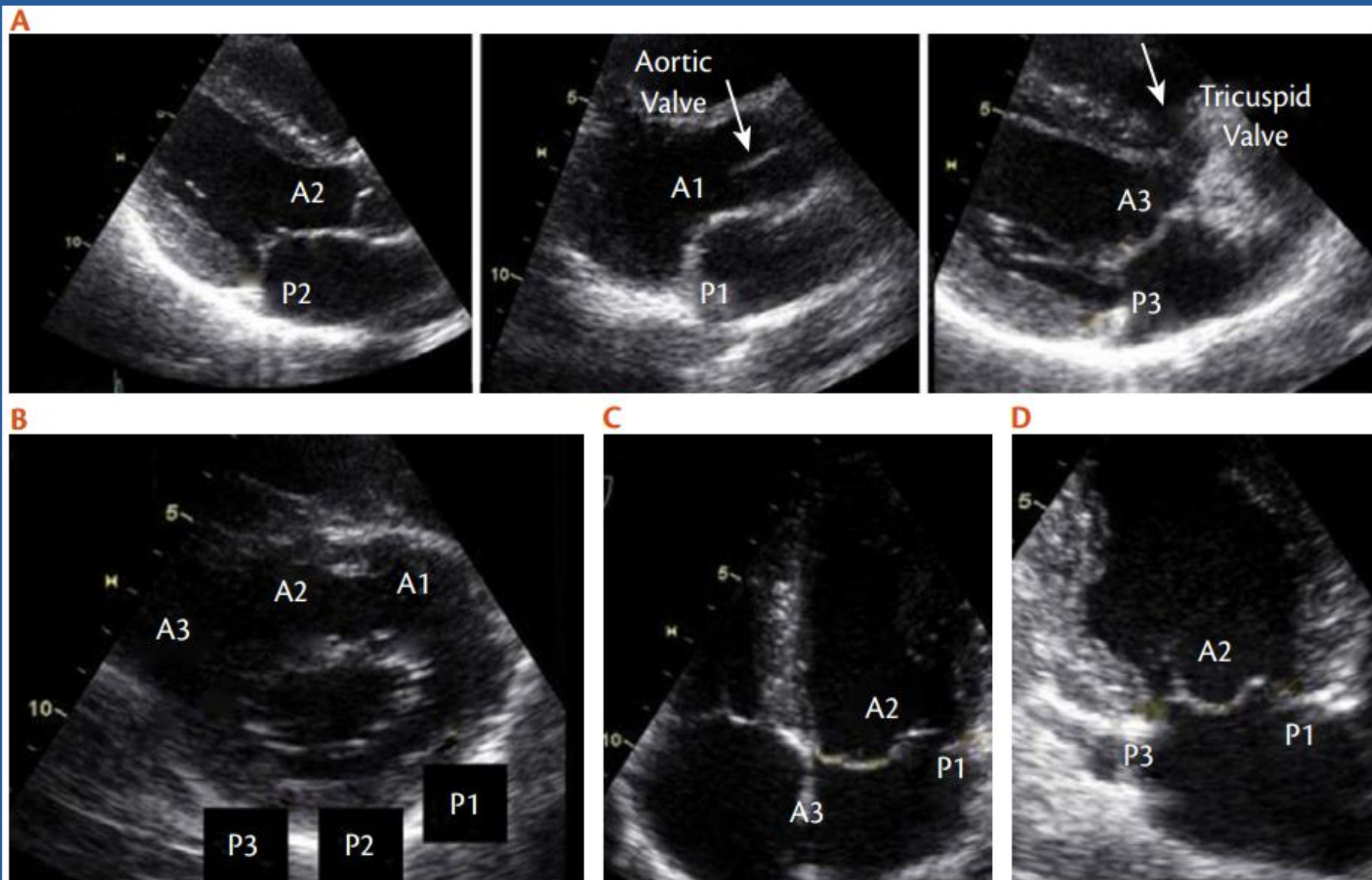
C AP 4CV



D AP 2CV
Bi-COM



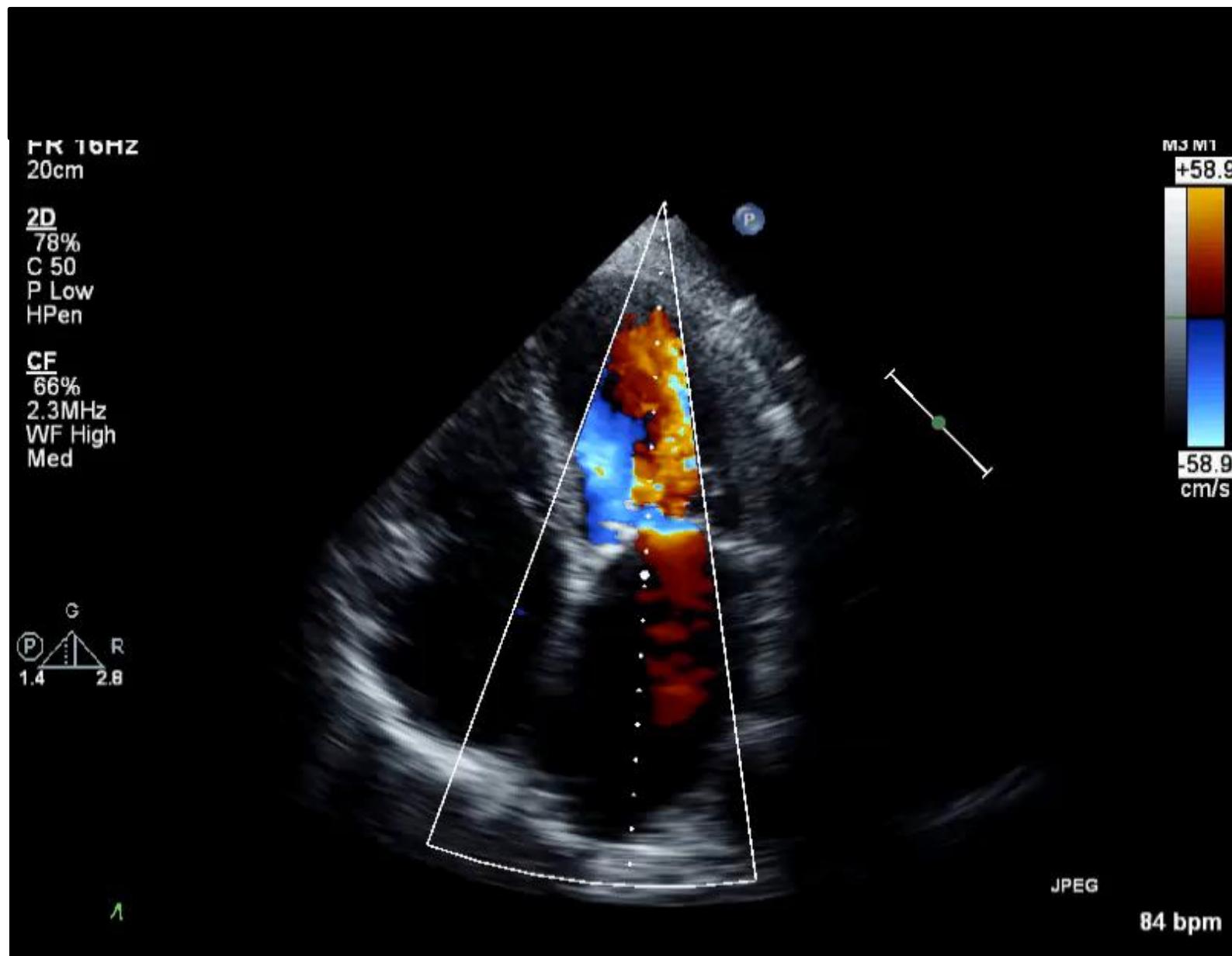
MVI: TTE Diagrams of each section of the mitral valve: (A) PTLAX;
(B) PTSAX; (C) AP 4CV; (D) AP 2CV



MVI: TTE echograms of each section of the mitral valve: (A) PTLAX; (B) PTSAX; (C) AP 4CV; (D) AP 2CV

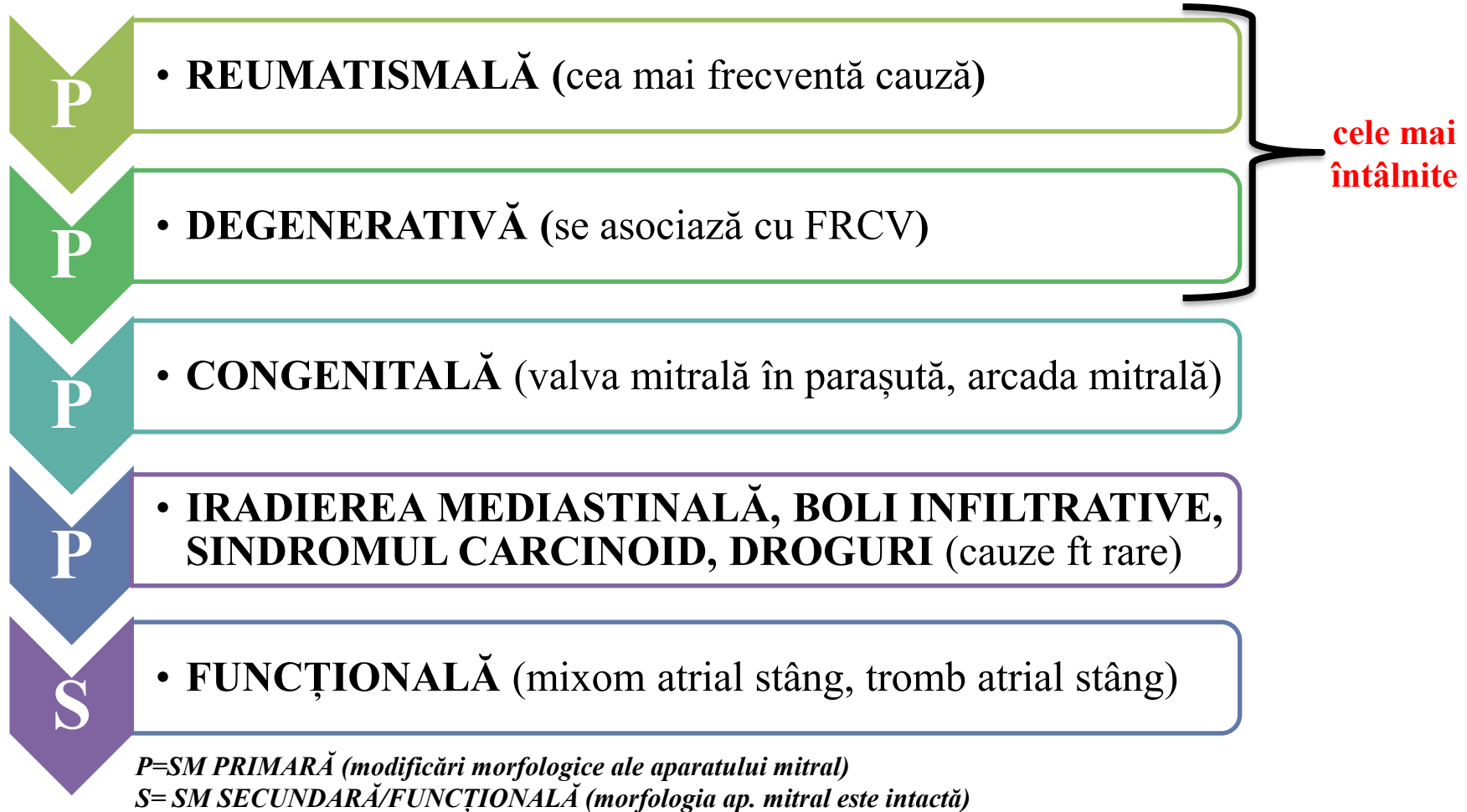
MITRAL STENOSIS



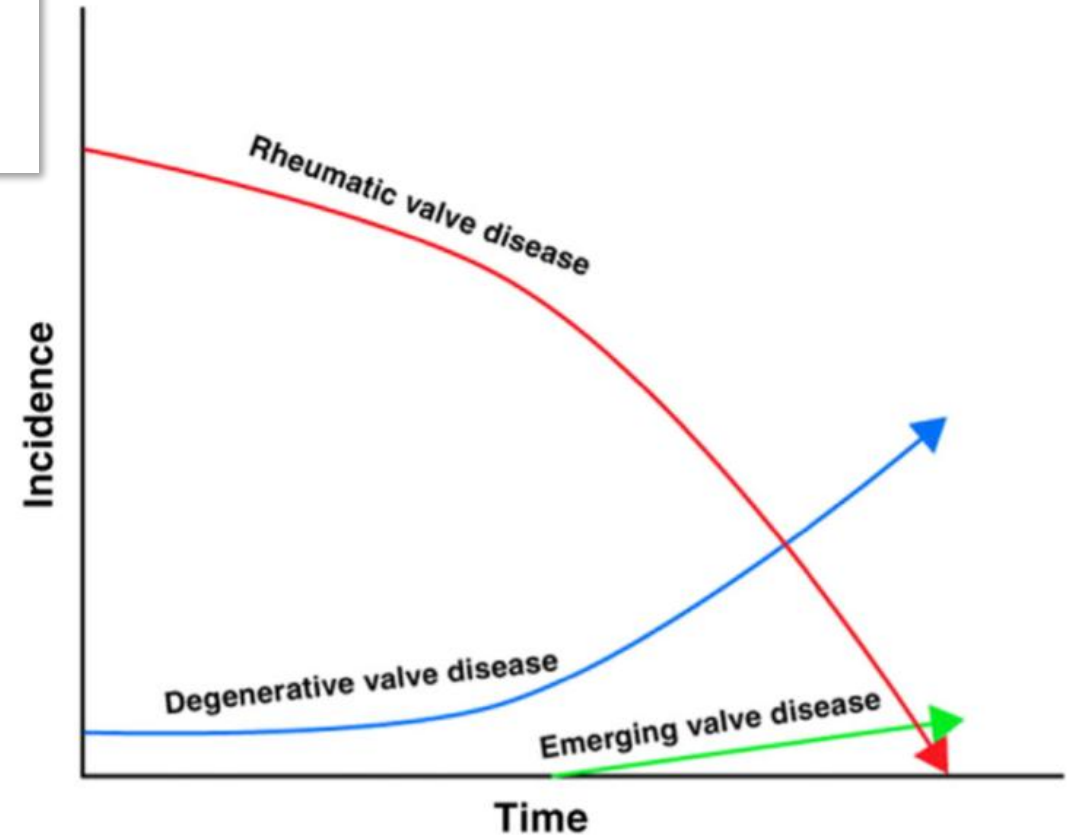
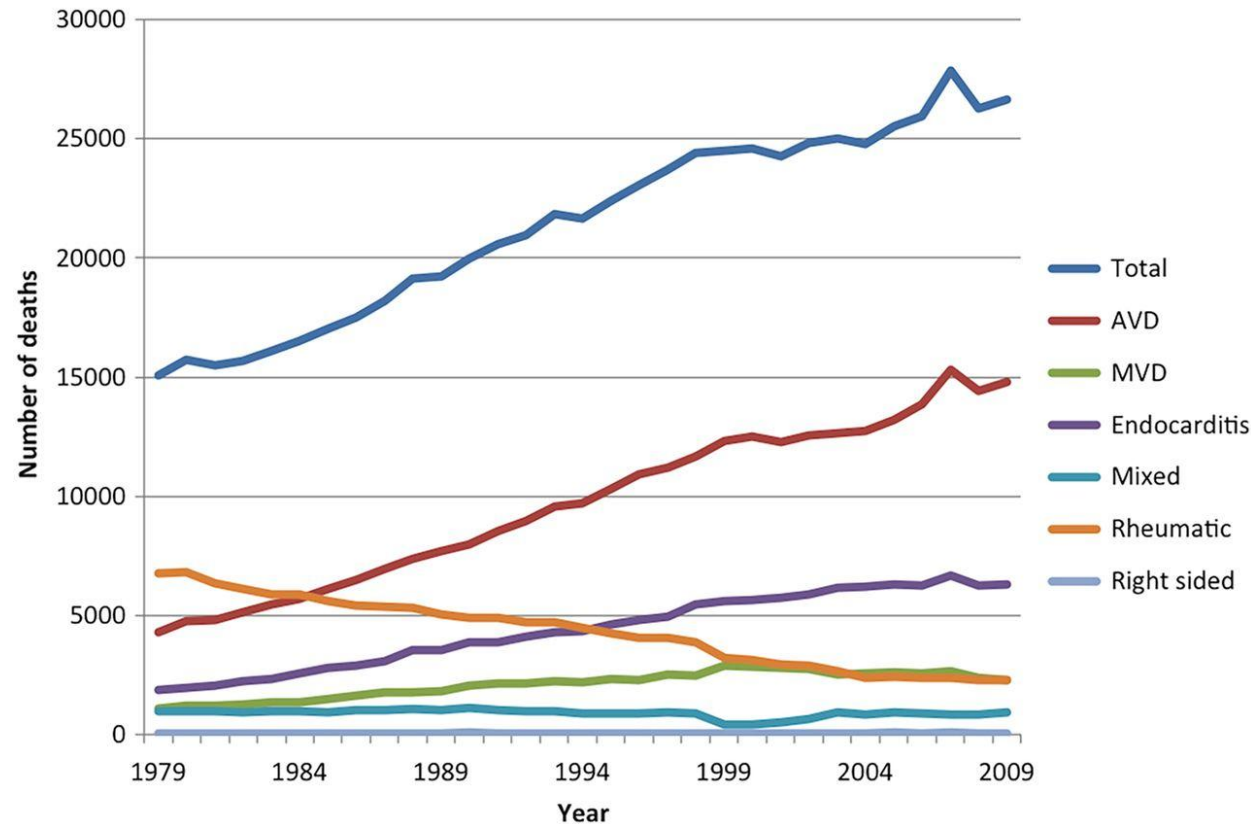


!!! Prezența unui jet diastolic turbulent prin orificiul mitral la interogarea Doppler color, trebuie sa ridice suspiciunea de SM.

ETIOLOGIA SM



- Epidemiology: the incidence of the degenerative aetiology has increased in industrialized countries while, unfortunately, rheumatic heart disease is still too frequently observed in many parts of the world.^{1–3}

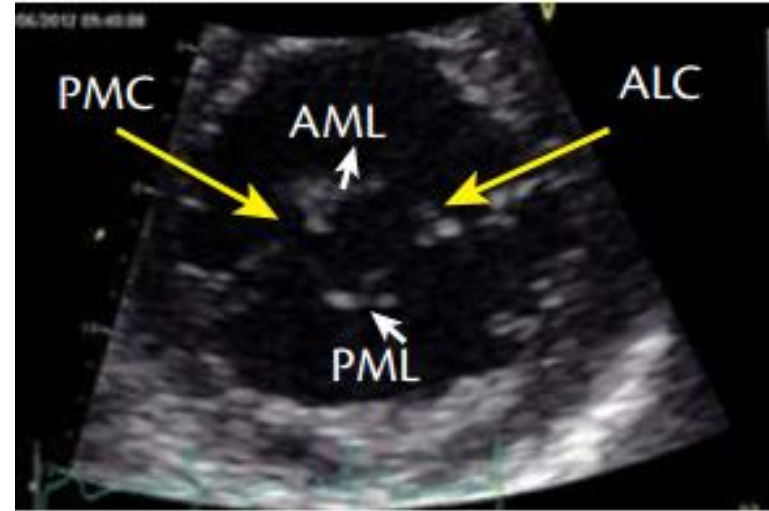


ESC
European Society
of Cardiology

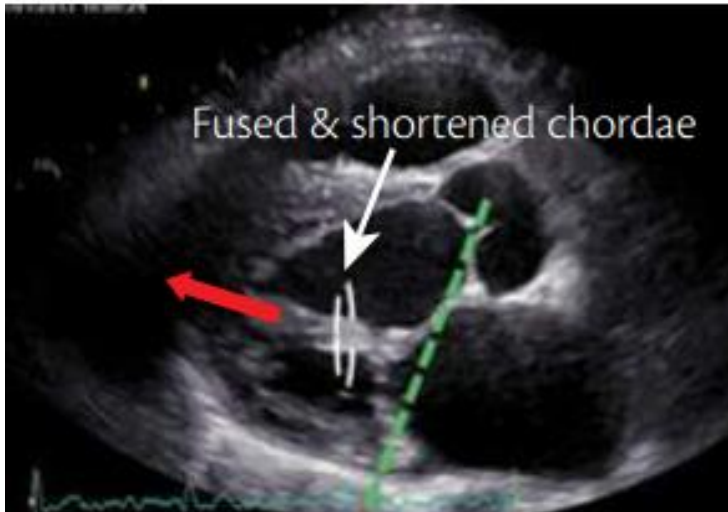
SM REUMATISMALA



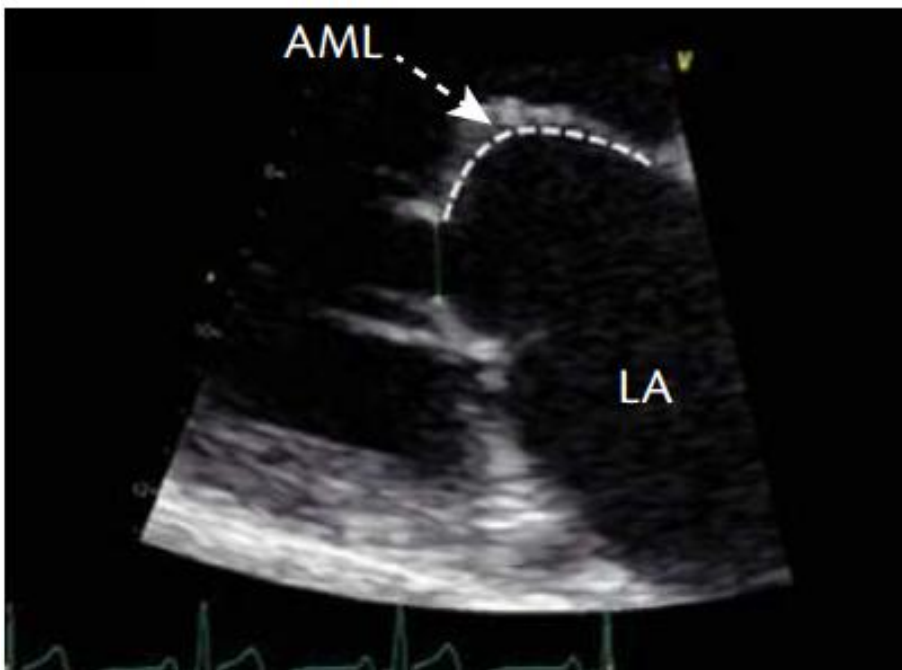
1. **Îngroșarea marginilor cuspelor** (≥ 5 mm) - prima modificare



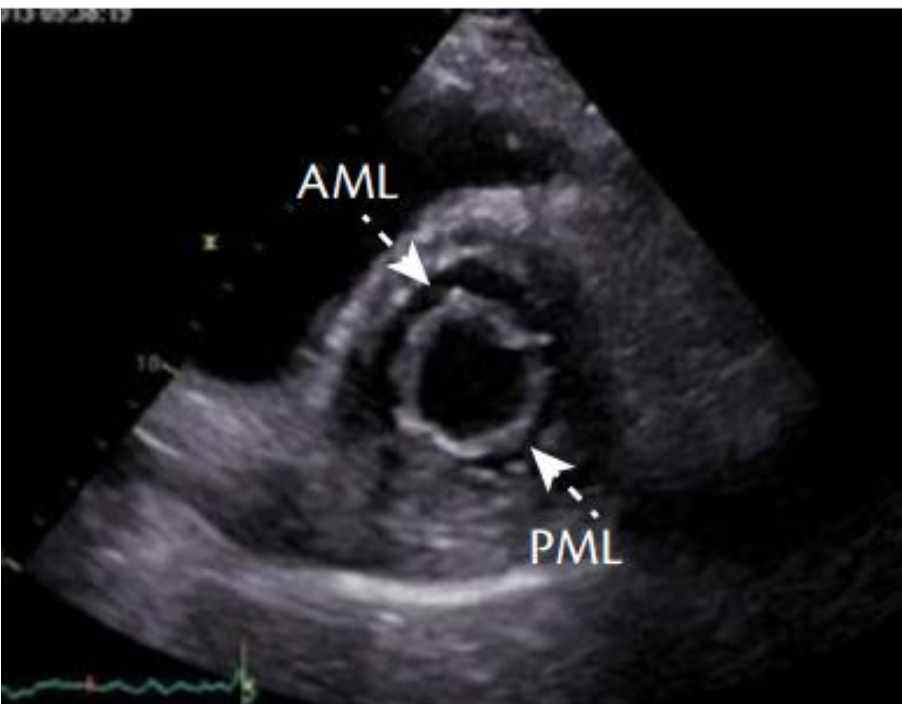
2. **Fuziunea comisurilor** - PATOGNOMONICĂ



3. **Scurtarea și fuziunea cordajelor** - contribuie într-o proporție mai redusă la SM (are un rol mult mai important în generarea RM)



4. **Doming diastolic al CMA** în PLAX - cel mai specific semn ecografic pentru SMR



5. Aspectul de „gură de peșce”



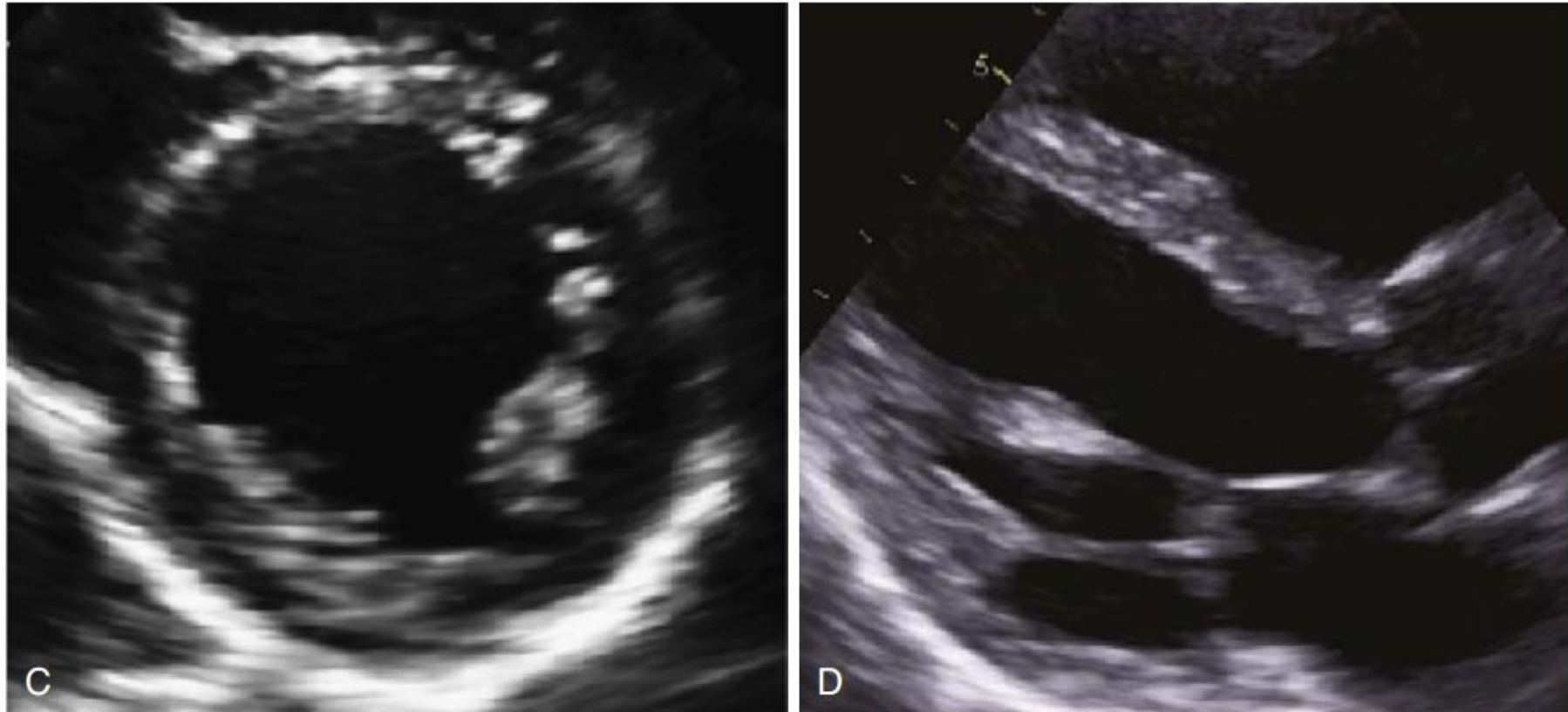


6. Apectul de „**crosă de hochei**” al CMA (creat de îngroșarea marginii cuspelor + doming-ul diastolic al CMA)

SM CONGENITALĂ

1. VM ÎN PARAȘUTĂ

- atașarea cordajelor la nivelul unui **singur MP**, localizat central
- **Cordajele sunt tipic scurte și îngroșate**, rezultând restricția cuspelor și grade variate de stenoză.



SAMSUNG

CLINICA MEDICALA I

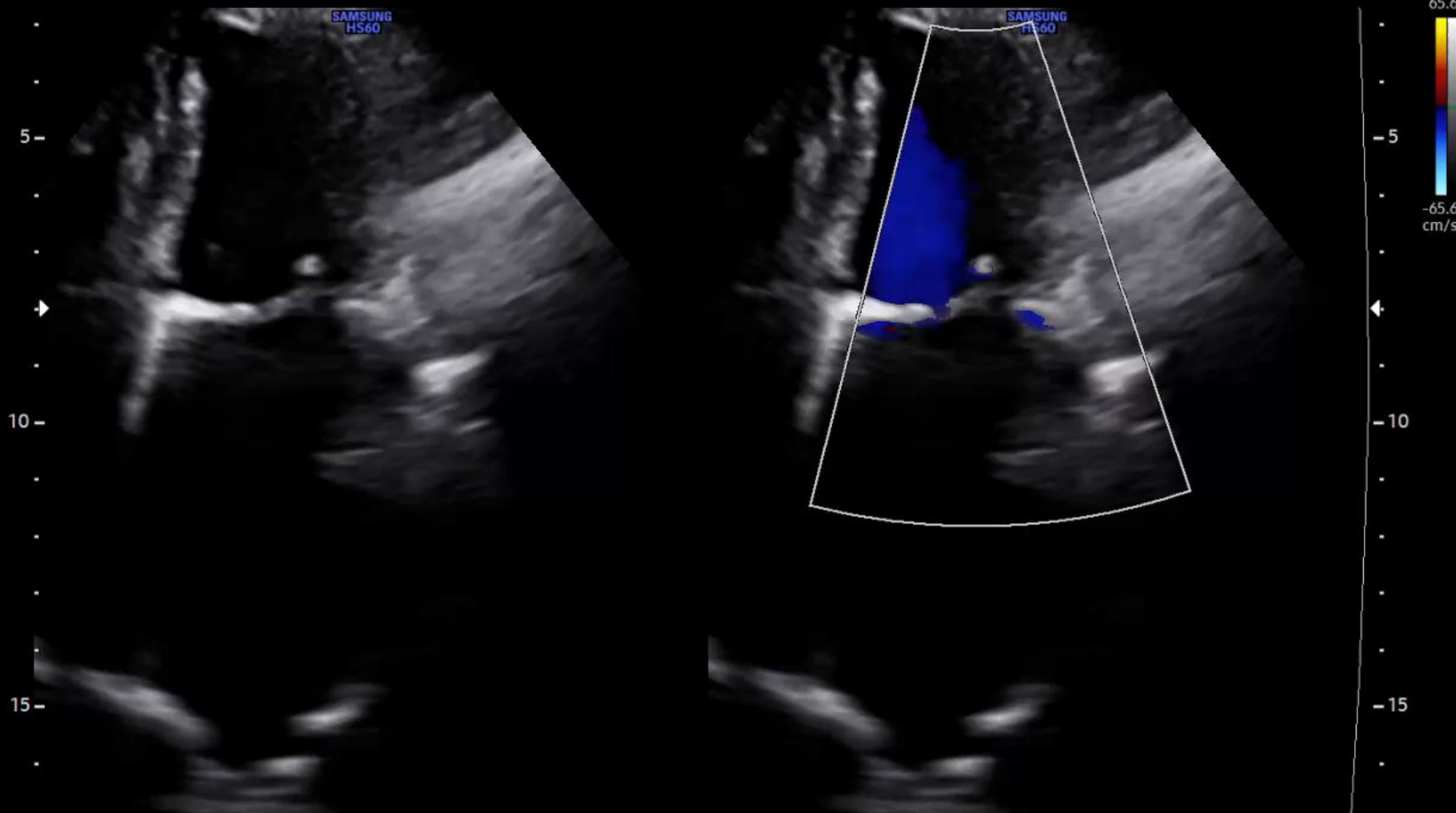
TIs 1.3 MI 1.1

24-05-2023

08:46:54

Adult Echo*/PA1-5A/17.0cm/21Hz [2D] Gen/Gn35/DR92/FA5/P100%

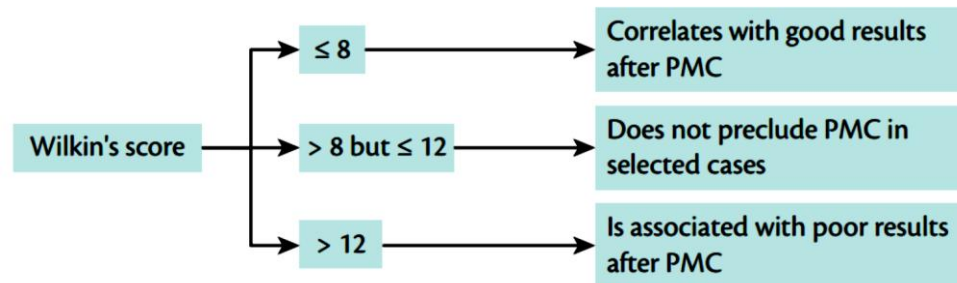
[C] Gen/Gn50/PRF4.0kHz/P90%



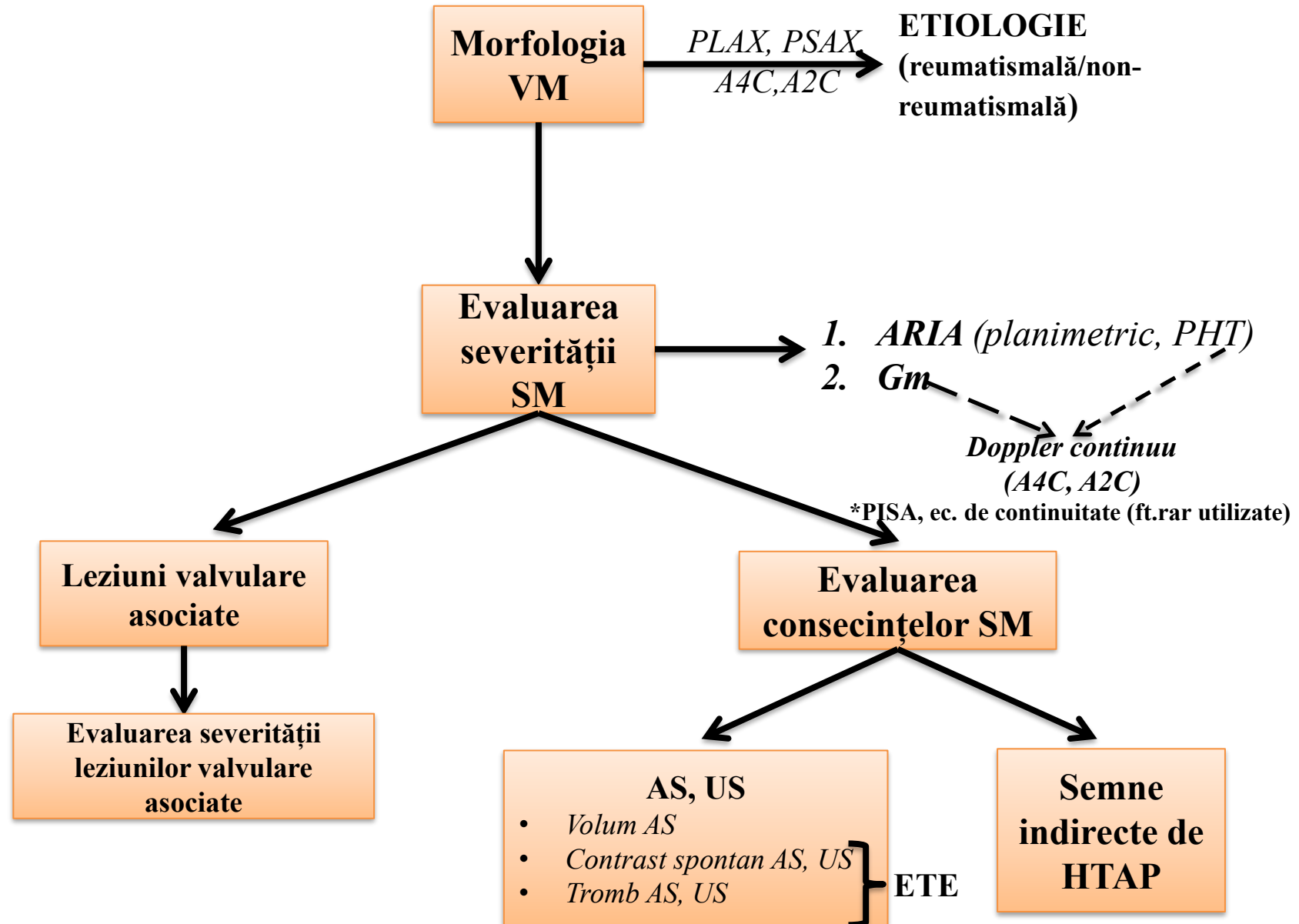
SCORURI DE MORFOLOGIE (evaluează morfologia ap. mitral, când se ia în calcul comisurotomia mitrală percutană)

Cormier score	
Echocardiographic group	Mitral valve anatomy
Group 1	Pliable non-calcified anterior mitral leaflet and mild subvalvular disease (thin chordae ≥ 10 mm long)
Group 2	Pliable non-calcified anterior mitral leaflet and severe subvalvular disease (thickened chordae < 10 mm long)
Group 3	Calcification of mitral valve of any extent, whatever the state of subvalvular apparatus

Wilkin's score				
Grade	Mobility	Thickening	Calcification	Subvalvular thickening
1	Highly mobile valve. Only leaflet tips have restricted motion	Leaflet thickness normal or thickening in the range of 4–5 mm	A single area of increased echo brightness	Minimal thickening just below the leaflets
2	Leaflet mid and basal segments have normal mobility	Mid segments of the leaflet are normal but there is considerable thickening of the edges (5–8 mm)	Scattered areas of brightness confined to leaflet's edges	Thickening of chordae extending to one of the chordae length
3	Valve continues to move forward in diastole mainly from the basal segments	Thickening of the leaflets on all segments (edges, mid and basal segments) between 5–8 mm	Calcifications extending to the mid segment of the leaflets	Thickening extending to distal third of the chordae
4	No or minimal forward movement of the leaflets in diastole	Considerable thickening of all leaflets (> 8 –10 mm)	Extensive calcification extended to all segments of the leaflets	Extensive thickening and shortening of all chordae structures extending down to the papillary muscles



ALGORITM DE EVALUARE A SM

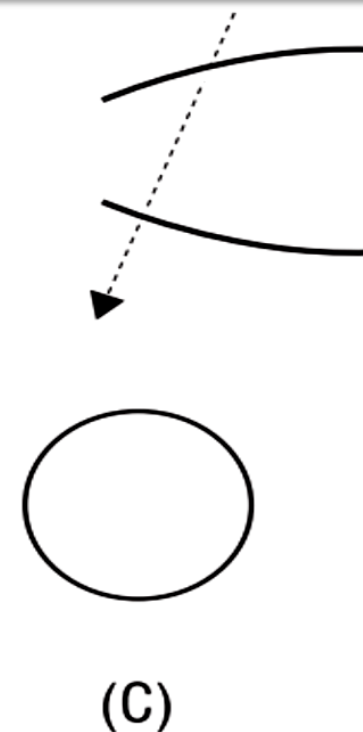
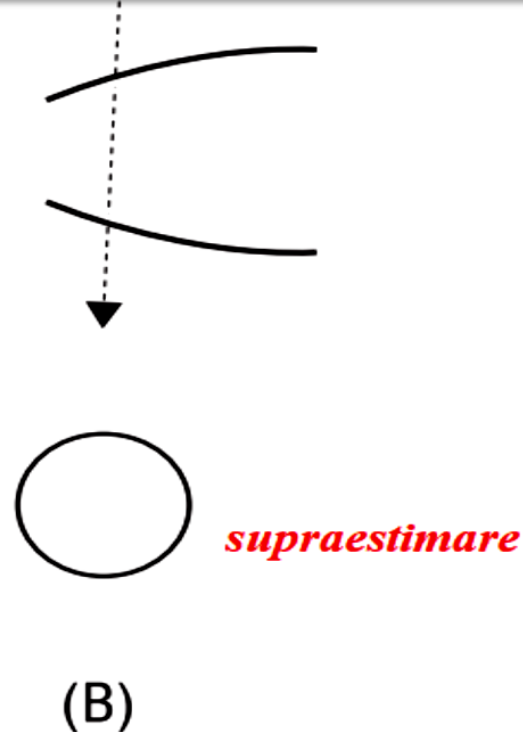
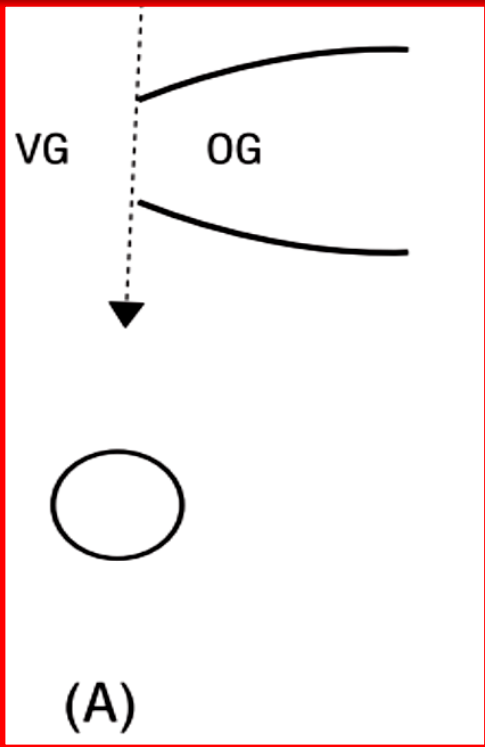


CUANTIFICAREA ARIEI VM

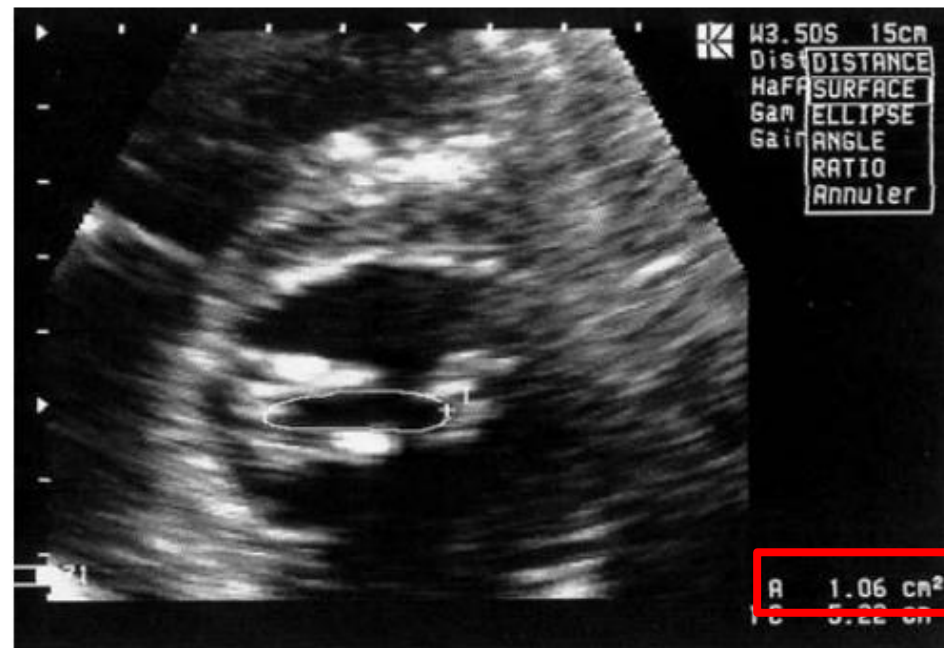
A. Planimetria VM:

- aria anatomică - **măsurătoarea de referință pentru evaluarea SM** (este independentă de hemodinamică + statusul AS și VS)
- PSAX la nivelul VM (cu ZOOM): se trasează cel mai îngust orificiu, la interfața alb-negru, în mezodiastolă (deschiderea maximă a VM)
- Difícil de realizat: la pacienții obezi, VM + ap. subvalvular intens calcificate (reverberații-subestimează SM reală)

Planul de secțiune este perpendicular prin vârful cuspelor mitrale!!!



Se recomandă
efectuarea mai
multor planimetrii,
cu media acestora!

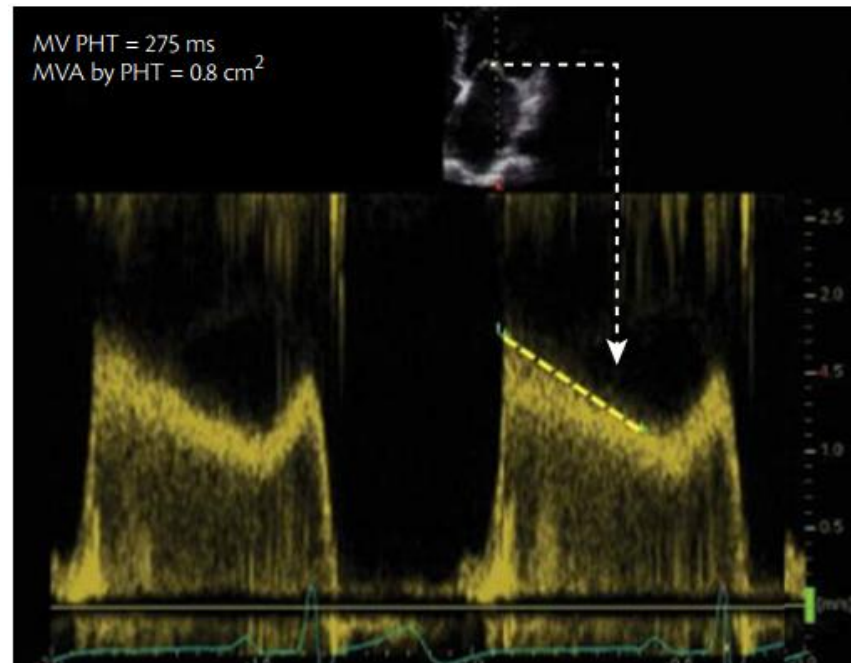


PRESSURE HALF TIME

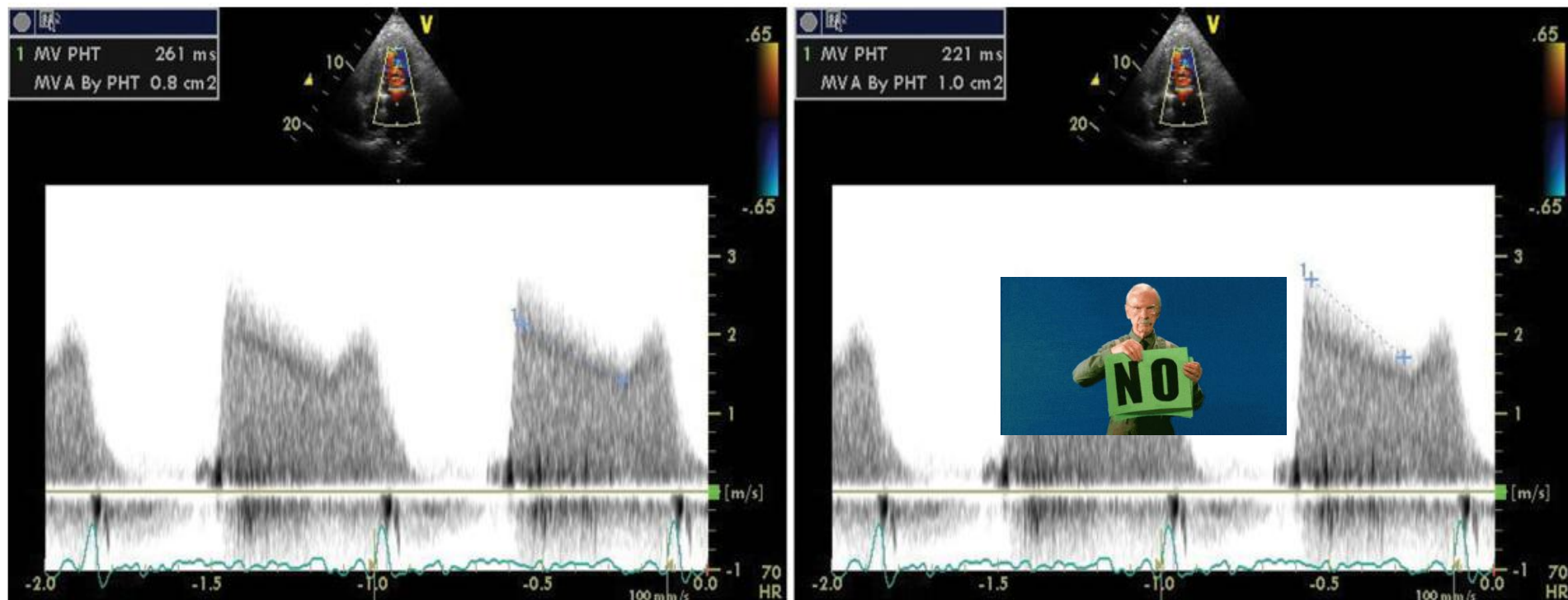
- PHT=intervalul de timp (msec) necesar reducerii la jumătate a gradientului transmitral inițial
- AVM planimetrie = AVM funcțională
- Este validată doar pentru SM pe valvă nativă. Nu este validă în primele 24-72 h post CMP.
- **TEHNICĂ MĂSURARE:** A4C, pe anvelopa doppler de SM se măsoară PHT-ul folosind panta de decelerare a unde E dominantă (în caz de pantă bifazică se va utiliza cea mai lentă).
- **!!!** Fia: se evită ciclurile cardiace scurte și se realizează măsurători multiple (cel puțin 5 cicluri cardiace consecutive) cu media acestora.

Formula lui Hatle: $AVM (cm^2) = 220 / PHT$

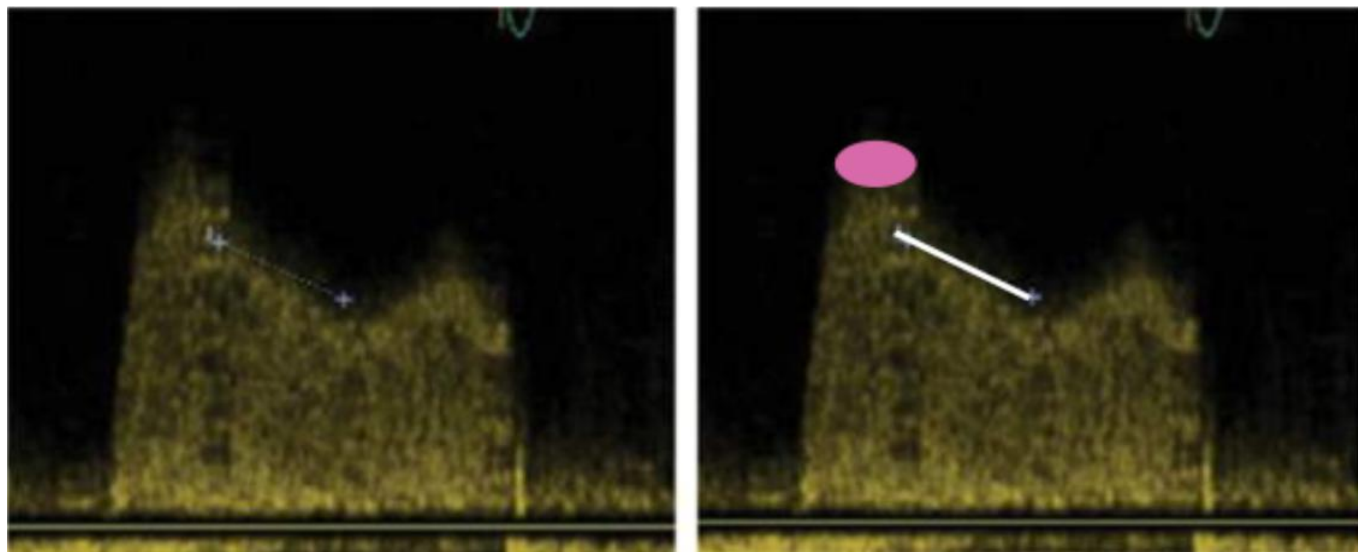
!!! (PHT-ul are o corelație inversă cu AVM)



Eșantionul Doppler este plasat la nivelul celei mai mici deschideri a VM.



Se măsoară la interfața alb-negru, acolo unde marginea pantei diastolice este clar definită.





SURSE DE EROARE

PHT-ul se scurtează (AVM supraestimată)

Scădere mai rapidă a presiunii în AS:

- DSA
- compliance redusă a AS

PHT-ul se scurtează (AVM supraestimată)

Compliance redusă a VS:

- HVS
- ischemie

PHT-ul se scurtează (AVM supraestimată)

RA severă determină creșterea mai rapidă a presiunii VS în diastolă

PHT > 220 msec → SM este cel mai probabil severă

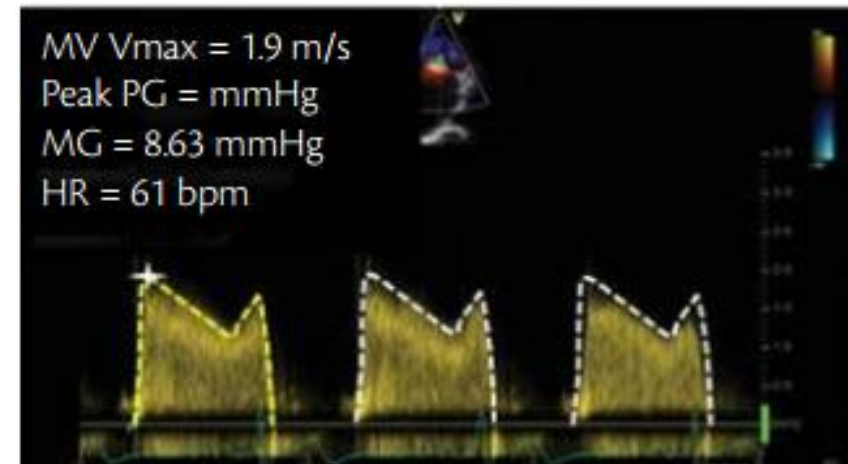
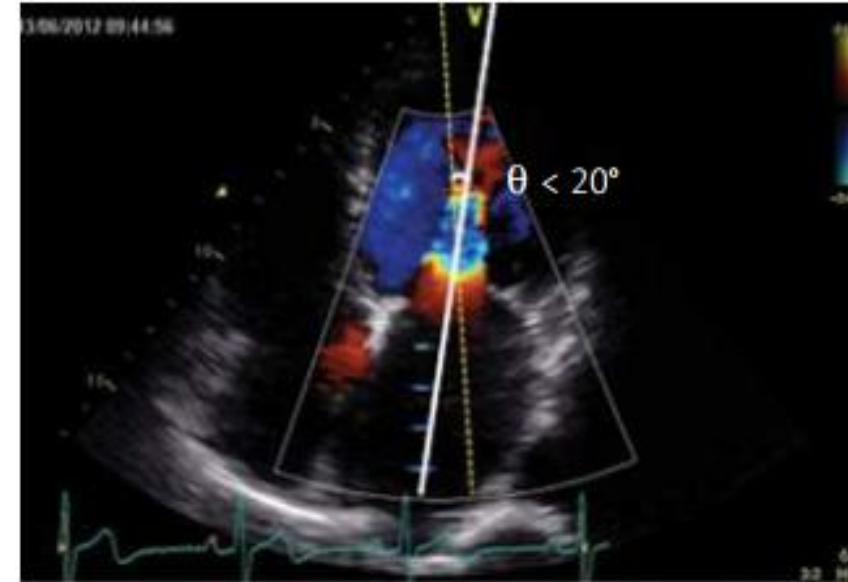
PHT < 220 msec + dubii referitoare la severitatea SM → metode complementare

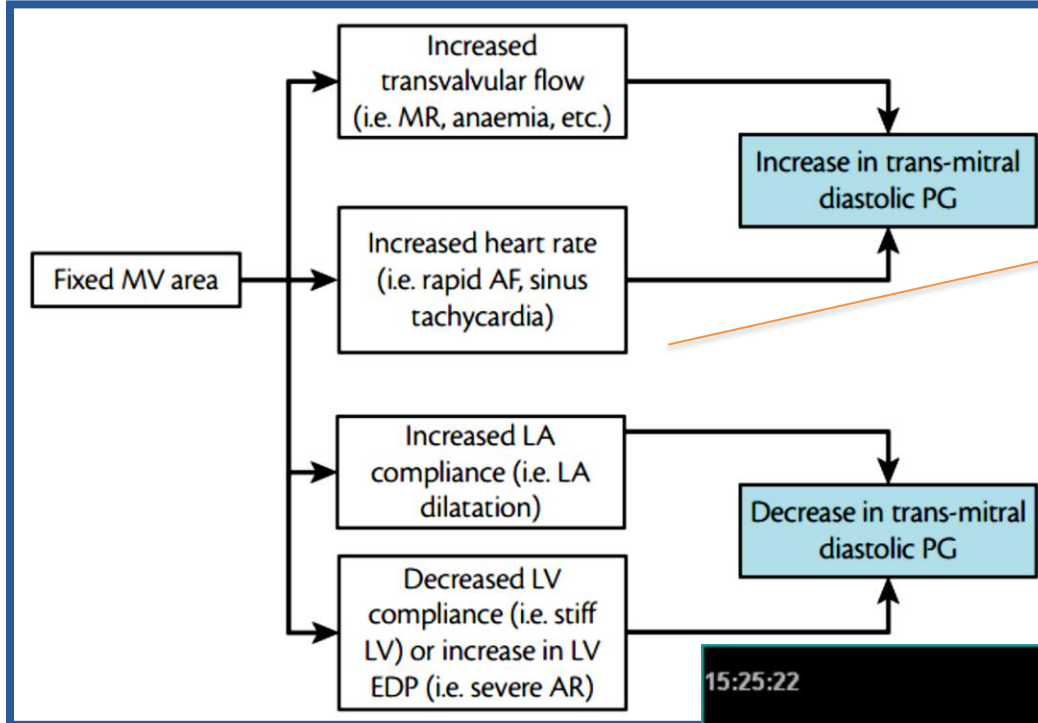
GRADIENTUL TRANSMITRAL

Trans-mitral diastolic PG image acquisition

Box 7.3.3 Trans-mitral diastolic PG image acquisition

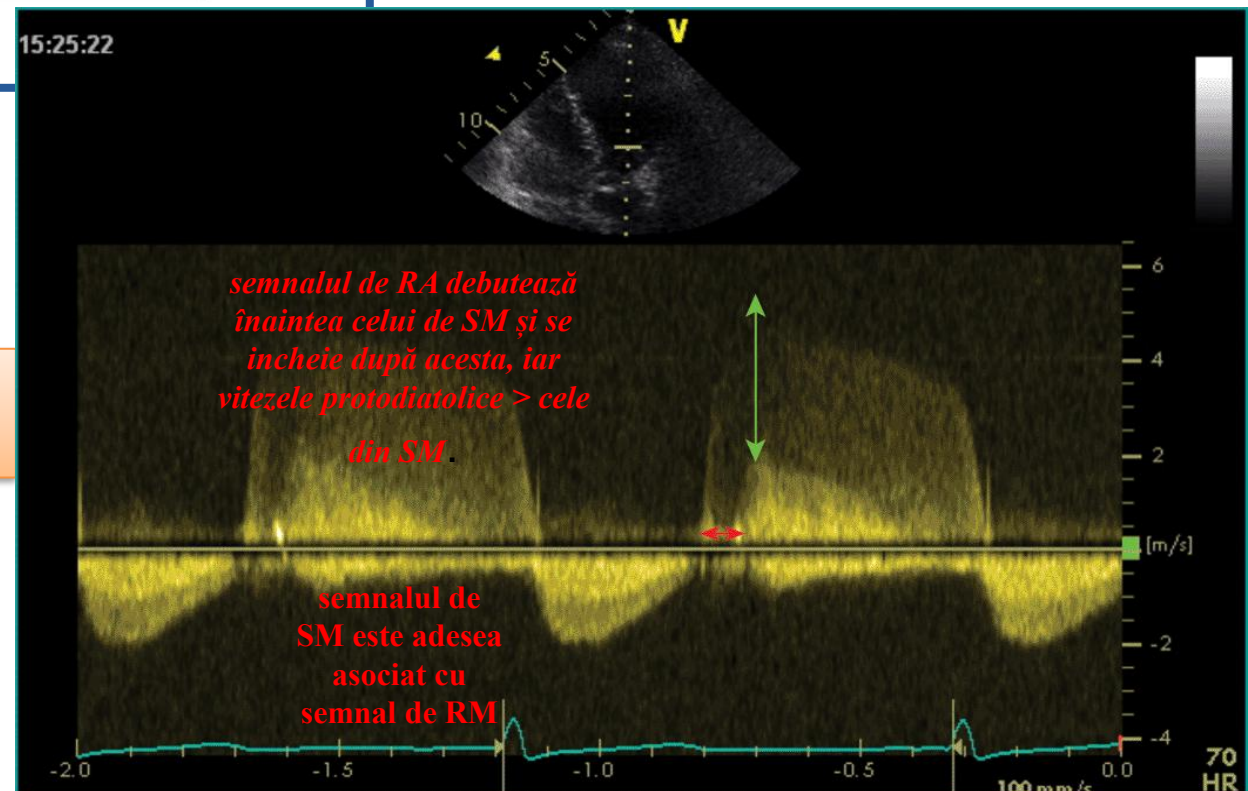
1. Apical 4CV (2CV and 3CV are also useful) the goal is to allow optimal alignment with the flow)
2. Colour Doppler-guided detection of diastolic jet direction, optimal alignment of the CW Doppler is needed. Angle (θ) between the direction of the flow and CW Doppler line $< 20^\circ$ to avoid underestimation of PG (Fig. 7.3.12A)
3. CW (preferably) or PW Doppler (PW, including HPRF to prevent signal aliasing) can be used by taking care of an adequate position the sample volume at the level of the minimal valve opening plane (into the stenotic orifice)
4. Careful tracing of the outer edge of the signal is done, avoiding the fine linear echoes at the peak of the curve—due to the transit time effect
 - ◆ Repeated measurements (three in SR or five if AF)





- *Întotdeauna se va preciza FC în raportul eco*
- *Reevaluare eco după optimizarea FC*
- *FC optim < 80/min*

Dacă există o RA cu jet spre VMA, se va realiza diferența între SM și RA





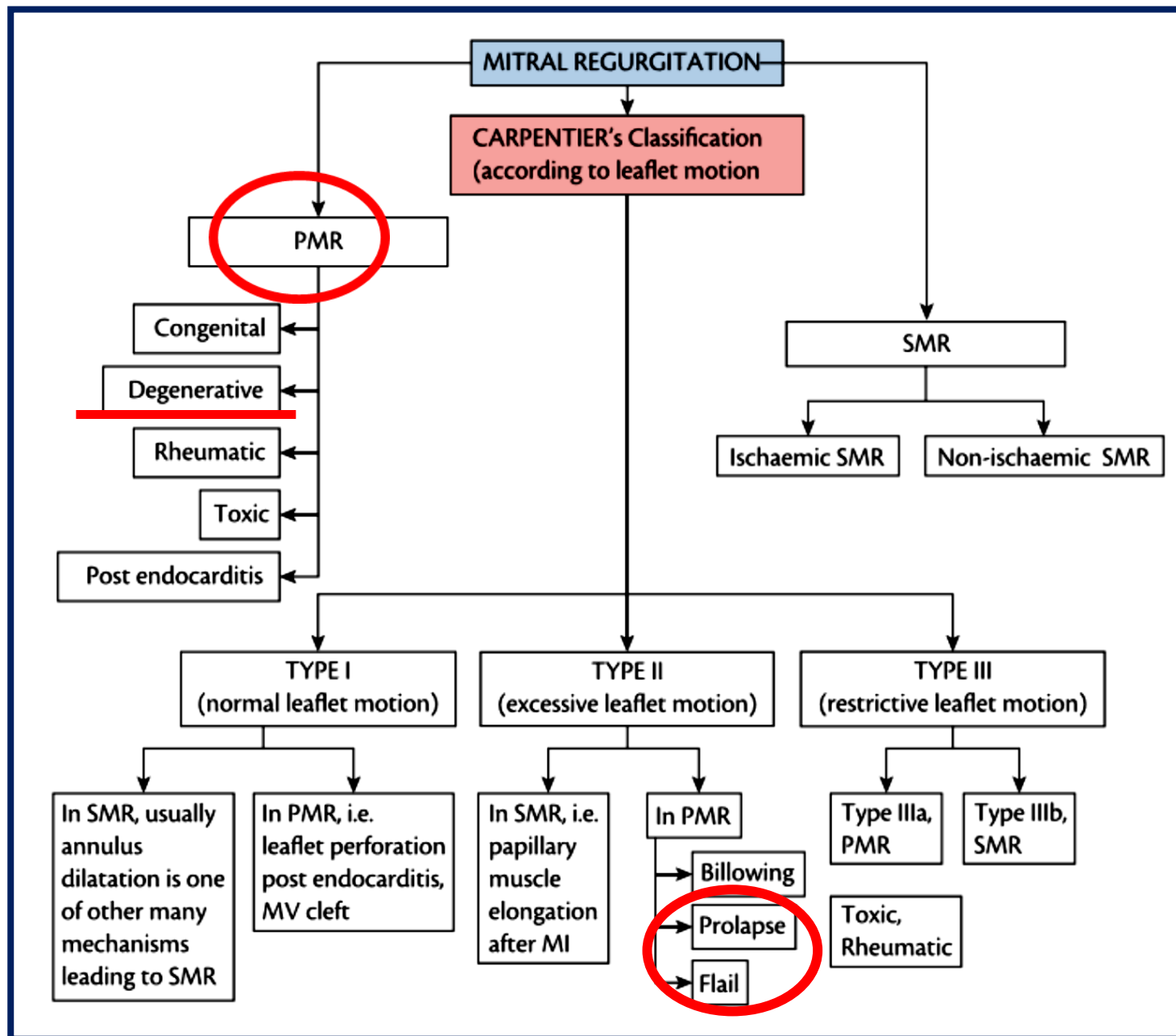
Recommendations for classification of MS according to current guidelines
(report heart rate at the time of examination)

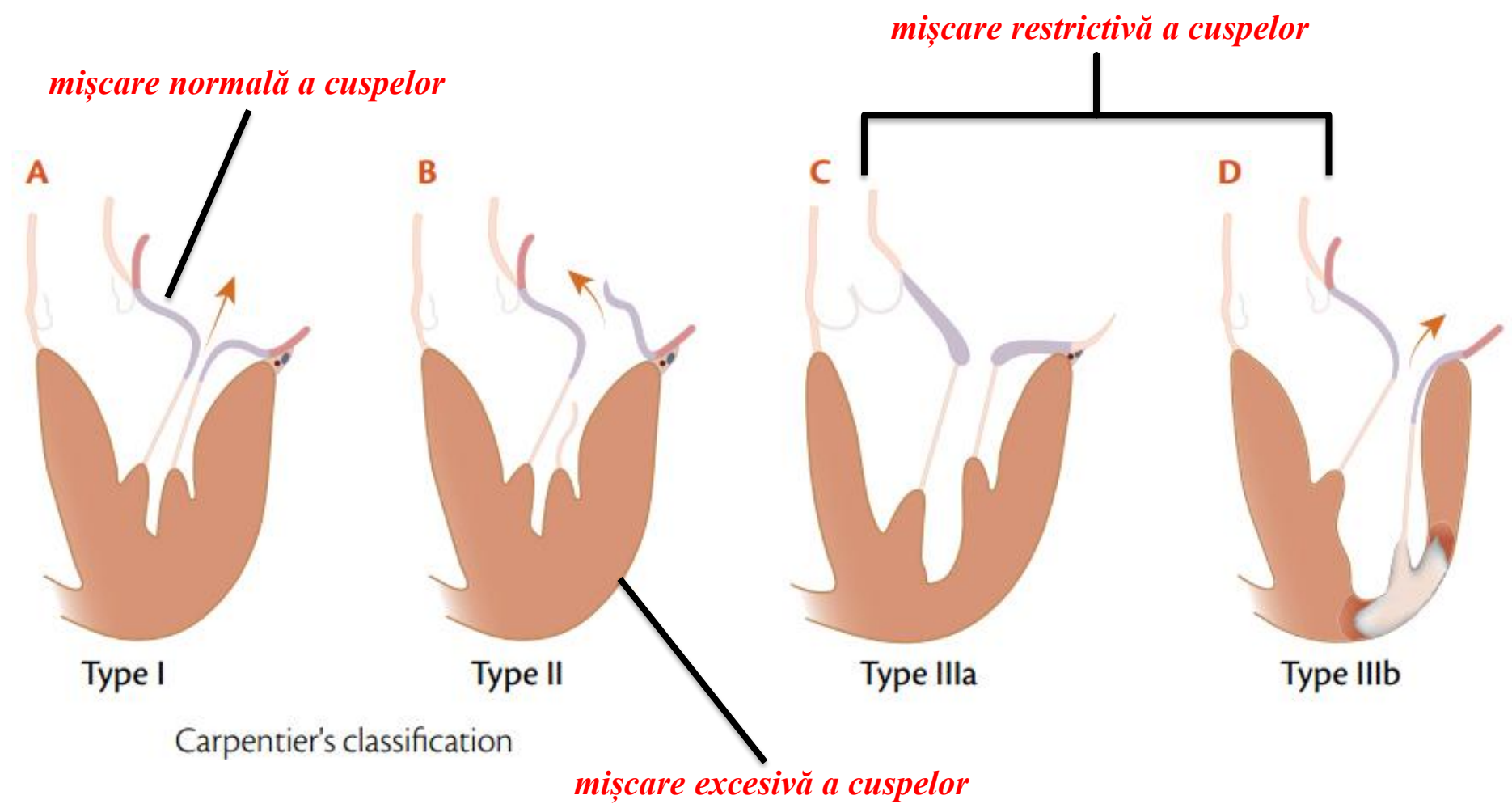
	Mild	Moderate	Severe
Direct findings			
Valve area	$> 1.5 \text{ cm}^2$	$1.5 - 1.0 \text{ cm}^2$	$< 1.0 \text{ cm}^2$
Supportive findings			
Mean pressure gradient*	$< 5 \text{ mmHg}$	$5 - 10 \text{ mmHg}$	$> 10 \text{ mmHg}$
Pulmonary artery pressure	$< 30 \text{ mmHg}$	$30 - 50 \text{ mmHg}$	$> 50 \text{ mmHg}$

* in patients in sinus rhythm and heart rate $< 80 \text{ bpm}$

MITRAL REGURGITATION









Normal mitral valve



**Degenerative MR
caused by mitral
valve prolapse**



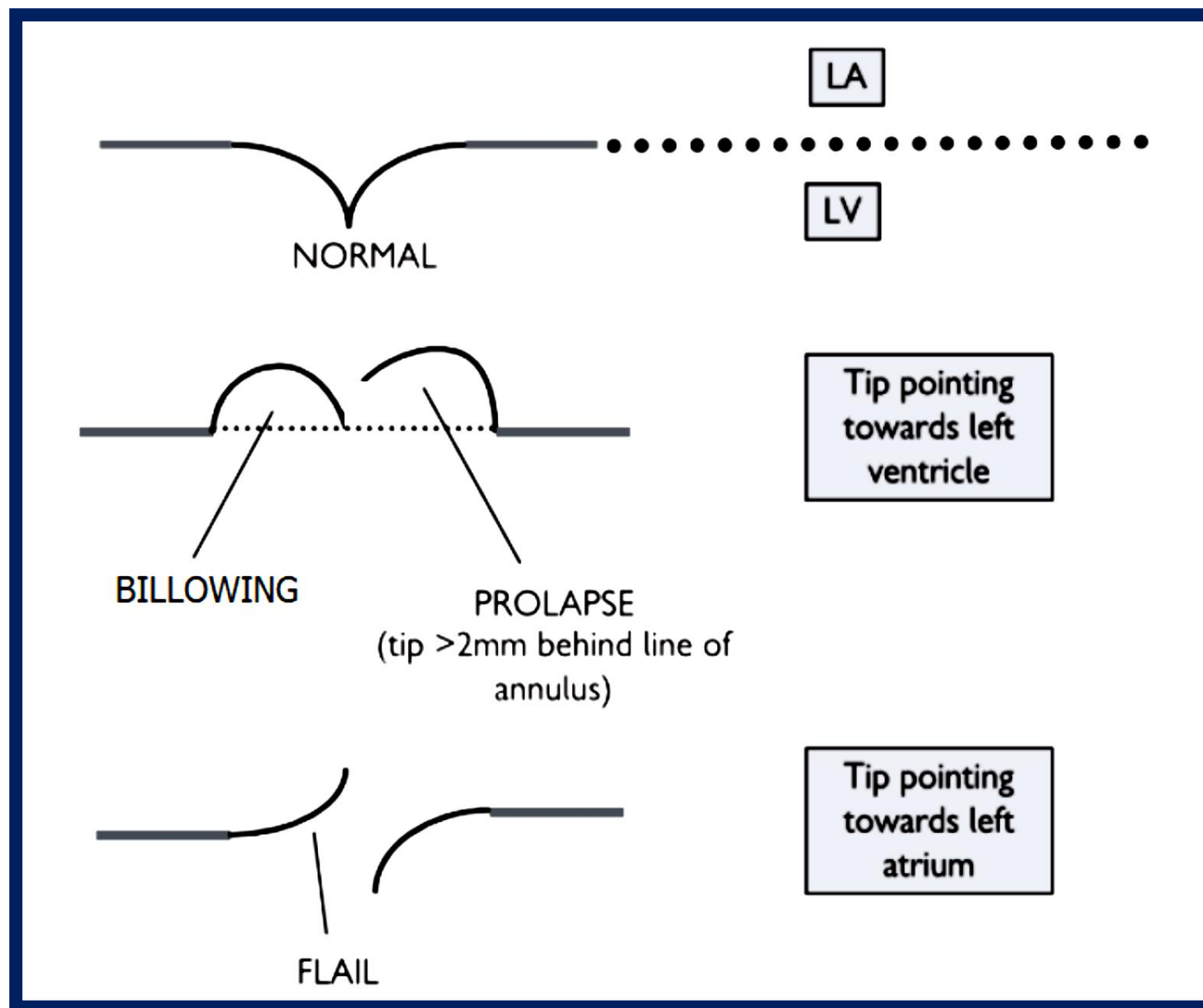
**Degenerative MR
caused by flail leaflet**

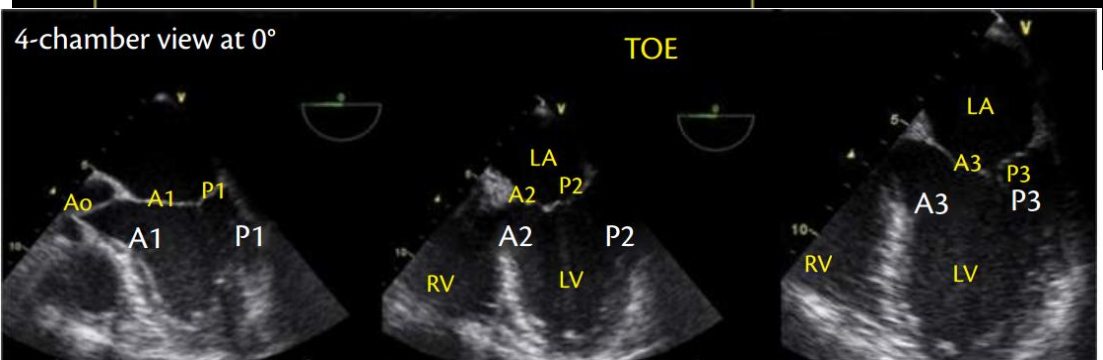
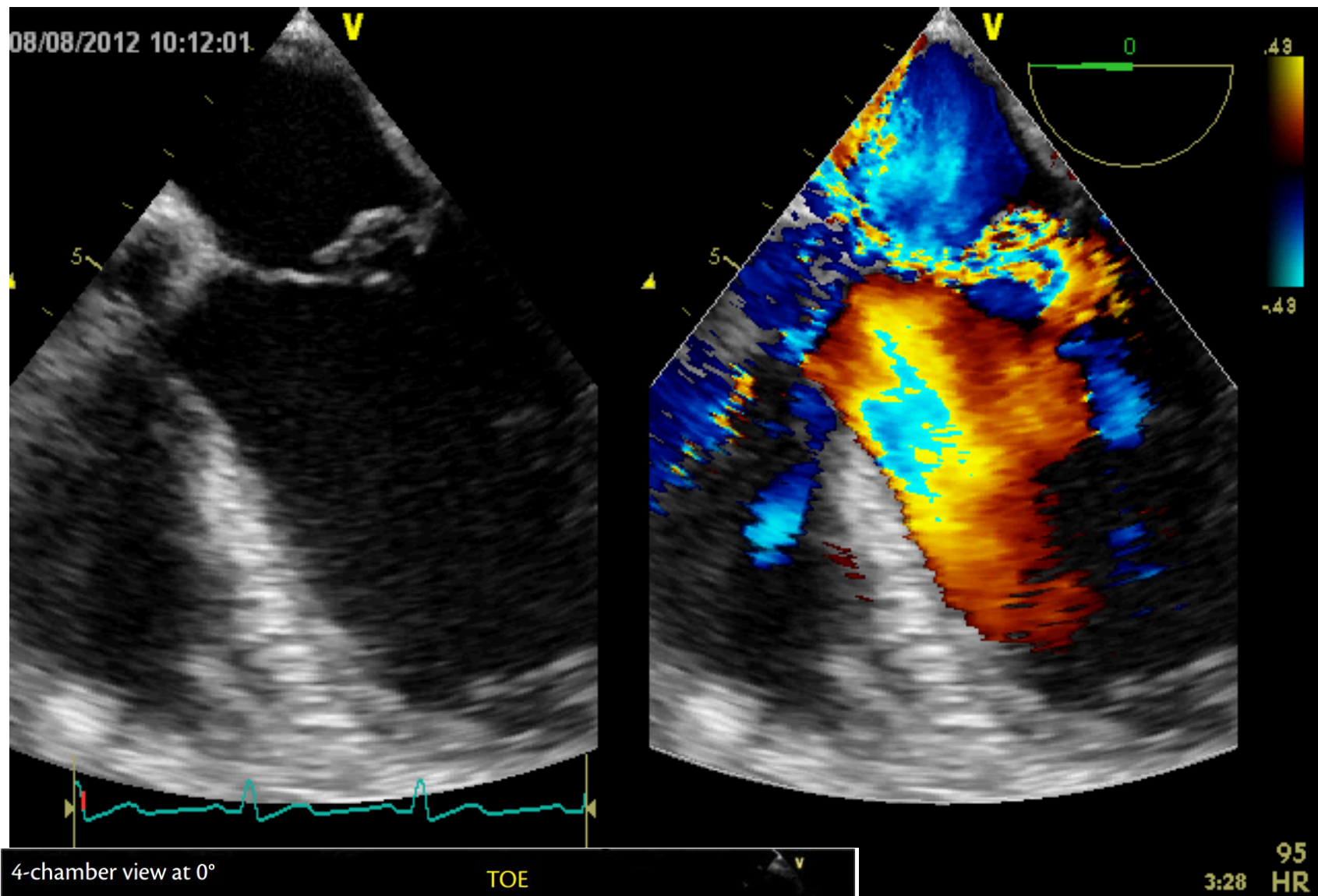


Functional MR

Tipul II de RM poate fi subdivizat în funcție de severitatea mișcării excesive a CM (evaluare în PLAX) în:

BILLOWING VM	Mișcare excesivă a cuspelor, dar linia de coaptare și vârful cuspelor rămân sub planul IM.
PROLAPS VM	Mișcare excesivă a cuspei, dar vârful cuspei depășește planul IM, în cavitatea AS și este orientat spre VS.
FLAIL VM	Miscare excesivă a cuspei, dar vârful cuspei depășește planul IM, în cavitatea AS și este orientat spre cavitate AS.





ETIOLOGIE
CLASIFICAREA CARPENTIER

PRIVEȘTE VALVA!

PLAX, A4C, A2C, PSAX la niv. VM și a m. pilieri

- *Deficit de coaptare a cuspelor*
- *Ruptura de cordaje*
- *Perforare de cuspe*



Doppler color

= **jet sistolic turbulent în cavitatea AS, ce pornește de la planul de coaptare a cuspelor**

- *Diagnostic RM*
- *Severitate RM (VC, parametri derivați din PISA)*
- *Mecanismul RM*



Doppler continuu

- *VC*
- *Parametri derivați din metoda PISA*

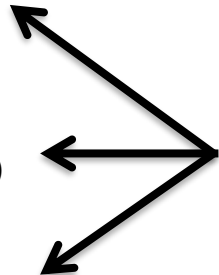


Consecințele RM

prolaps/flail VMA
(jet RM spre perete liber AS)

prolaps/flail VMP
(jet RM spre răd. Ao/SIA)

RM ischemică
(jet orientat spre valva afectată)



FR 11Hz
15cm

2D

52%

C 50

P Low

HPen

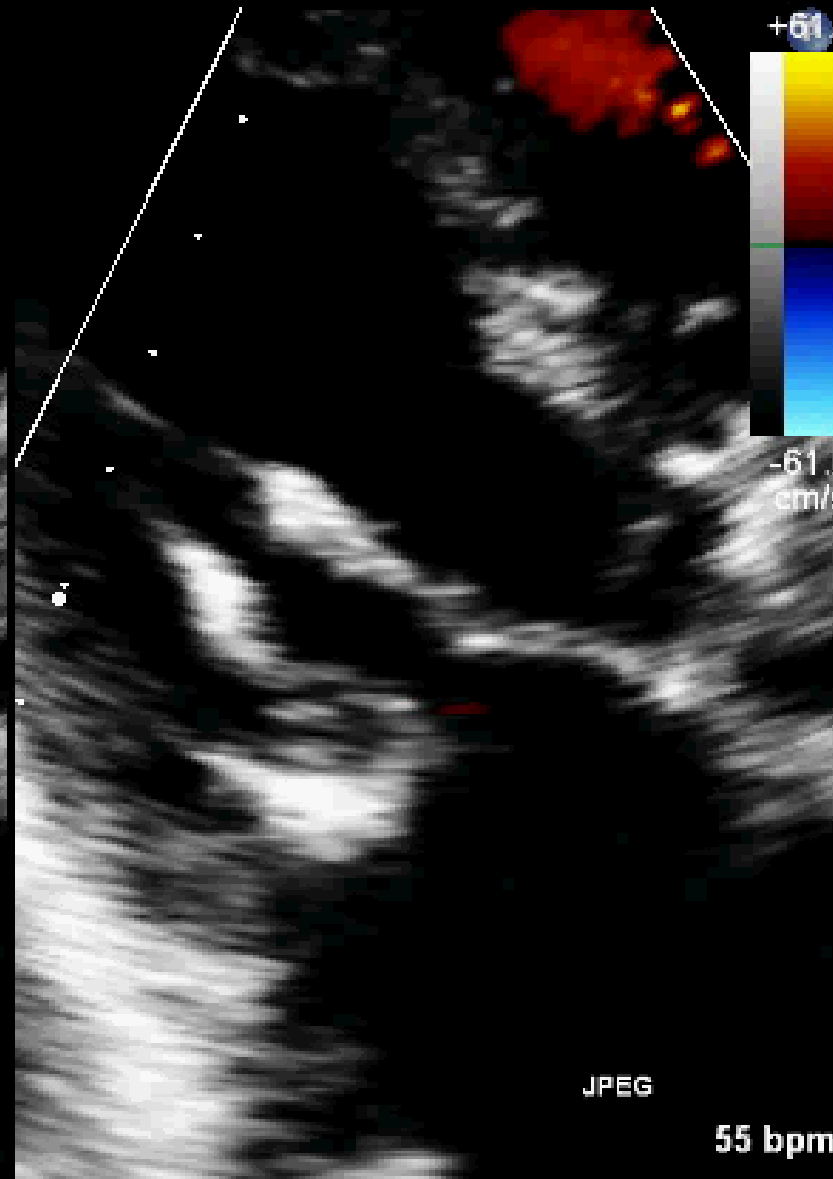
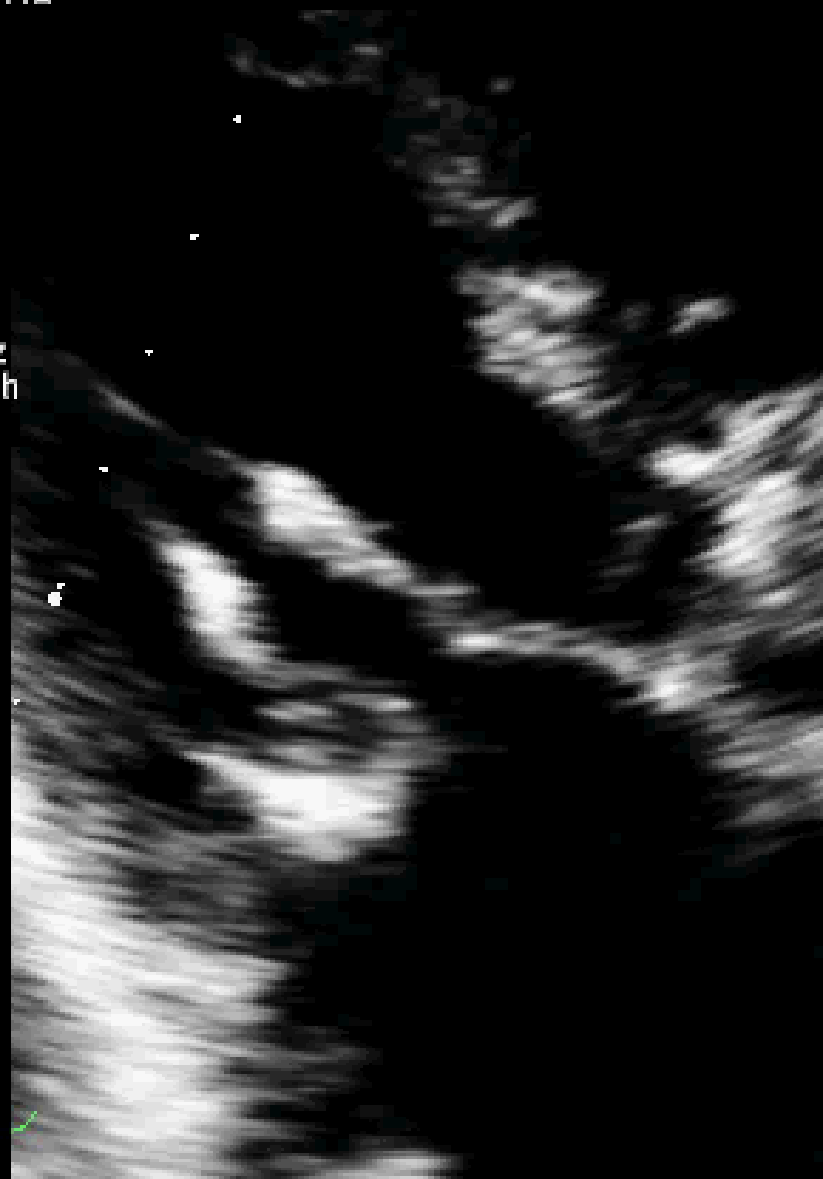
CF

66%

2.5MHz

WF High

Med



M3 M4

+61.6

-61.6

cm/s

JPEG

55 bpm

PR 8Hz
17cm

2D
52%
C 50
P Low
HPen

CF
66%
2.5MHz
WF High
Med

G
P 1.4 R 2.8

M3 M4
+61.6



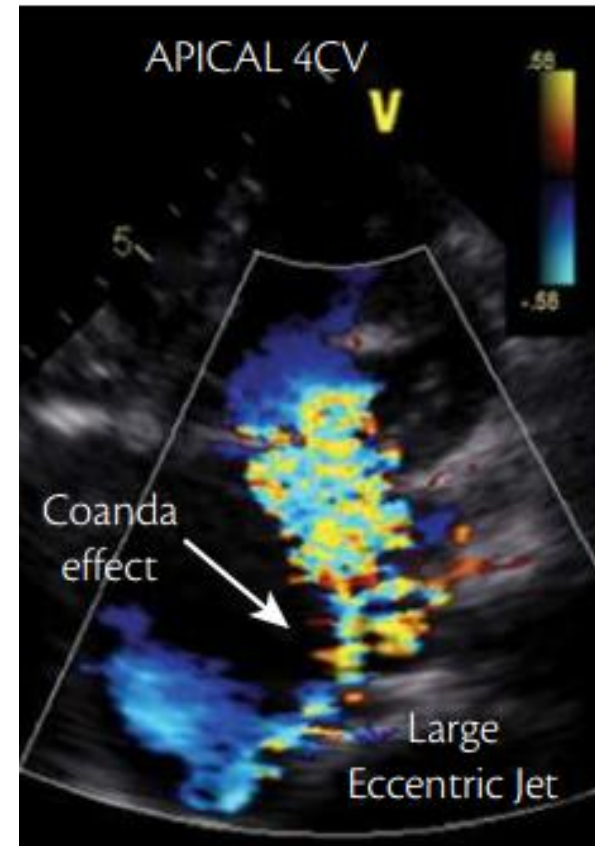
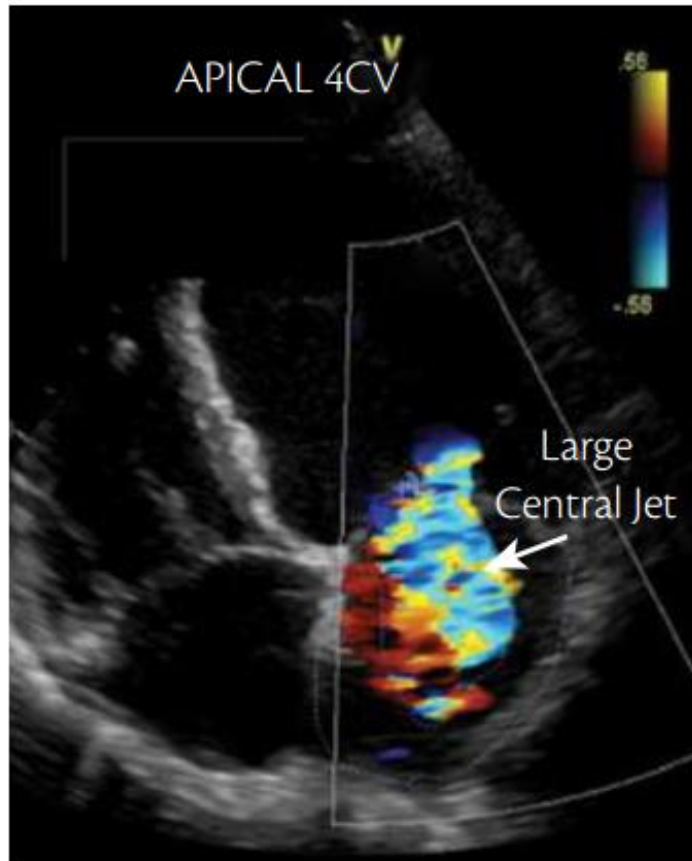
-61.6
cm/s

JPEG

66 bpm

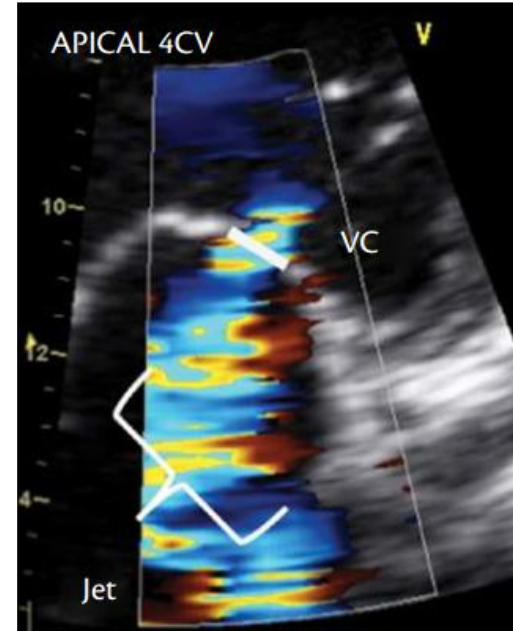
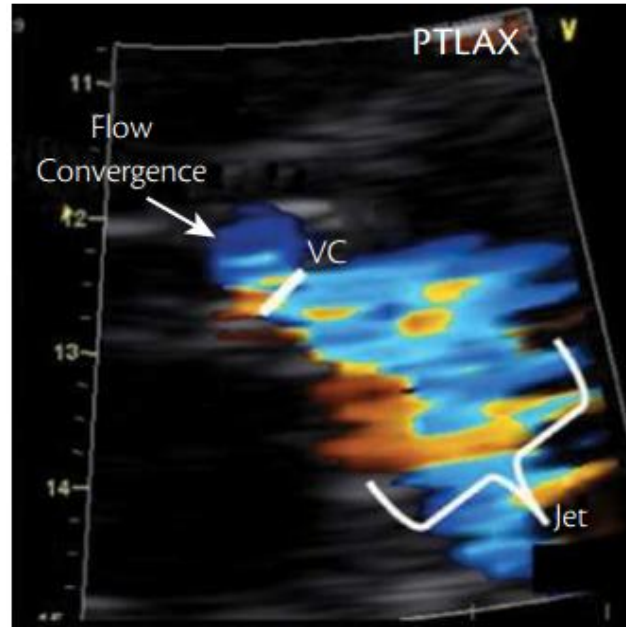
Dopplerul color

!!! Atenție la: TA, ritmul pacientului, tratamentul cu vasodilatatoare



VENA CONTRACTA

!!! Secțiuni recomandate:



Limitations

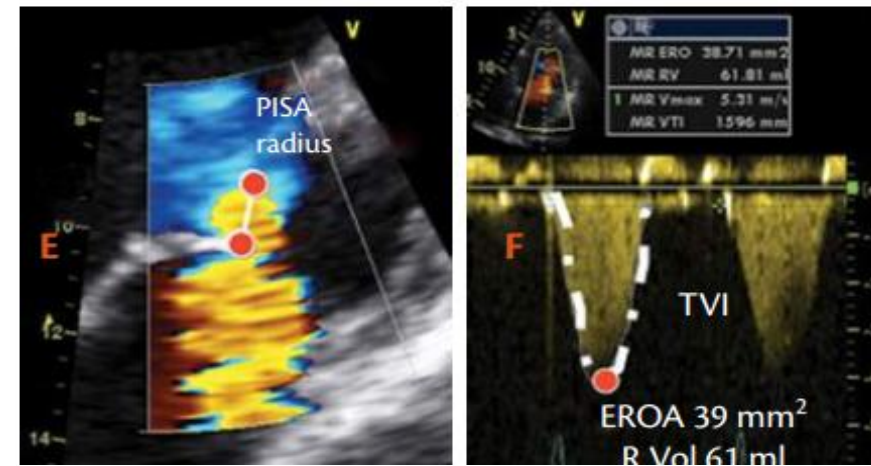
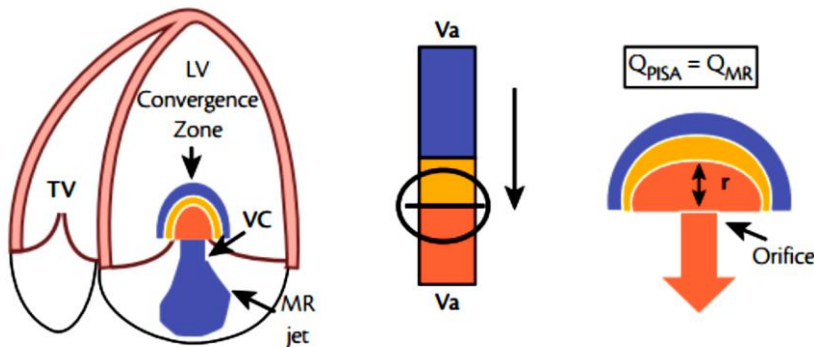
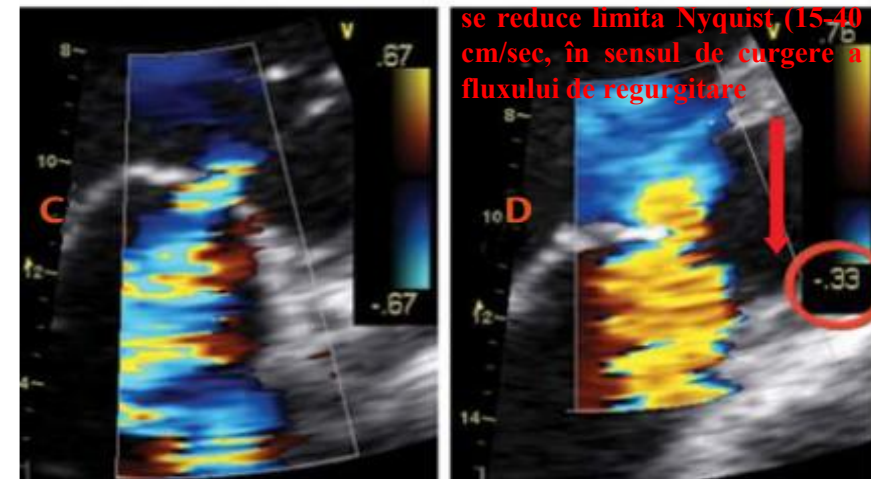
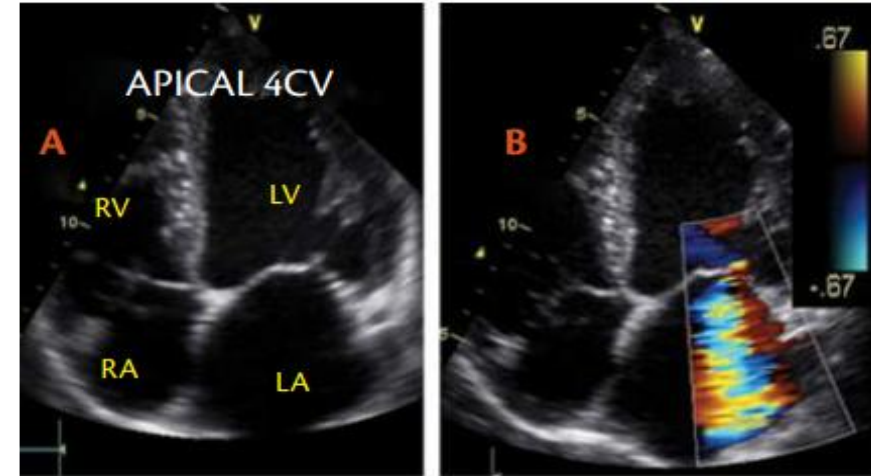
- ◆ Not valid for multiple jets
- ◆ Small values; small measurement errors leads to large % error
- ◆ Intermediate values need confirmation
- ◆ Affected by systolic changes in regurgitant flow

Interpretation

- ◆ Mild MR $VC < 3$ mm
- ◆ Severe MR $VC > 7$ mm

PISA

- Se bazează pe studiul zonei de convergență (caracterizată de viteze uniforme)
- Se calculează următorii parametri: FR, AOR, VR
- În caz de RM organică, $AOR \geq 40 \text{ mm}^2$ și $VR \geq 60 \text{ ml}$, definesc o RM severă
- Nu este validă pentru: jeturi multiple, jeturi excentrice, orificiu de regurgitare elipsoid



Complementary findings

PW mitral inflow Recordings

- ◆ Apical 4CV
- ◆ Sample volume of PW-Doppler places at mitral leaflet tips

Usefulness/Advantages

- ◆ Simple, easily available
- ◆ Dominant A-wave almost excludes severe MR

Limitations

- ◆ Affected by LA pressure, atrial fibrillation
- ◆ More applicable in patients older than 50 years old or in conditions of impaired myocardial relaxation.

CW RJ profile Recordings

- ◆ Apical 4CV

Usefulness/Advantages

- ◆ Simple, easily available

Limitations

- ◆ Qualitative
- ◆ Complete signal difficult to obtain in eccentric jet
- ◆ Peak velocity: four and six m/s
- ◆ Cutoff sign: ↗ LA pressure/severe MR

Pulmonary vein (PV) flow Recordings

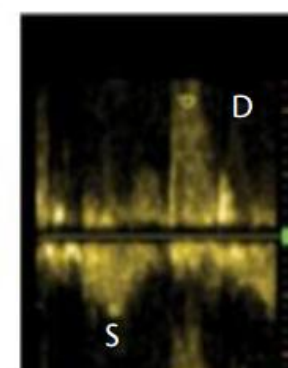
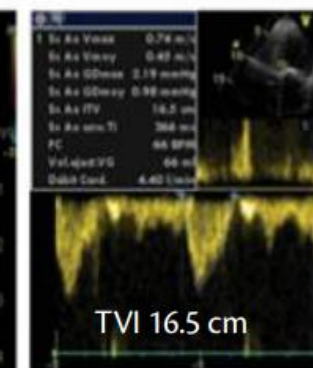
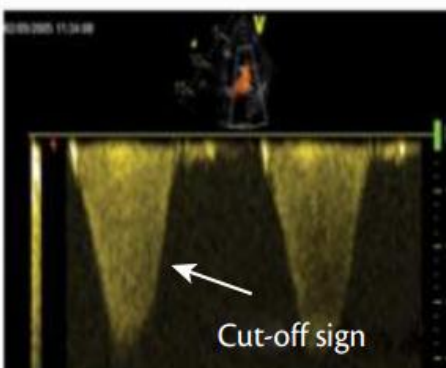
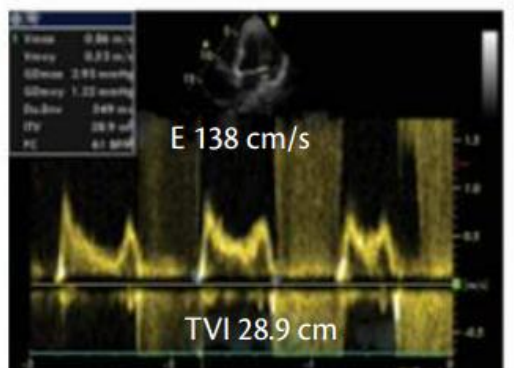
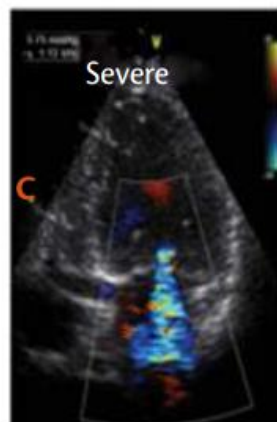
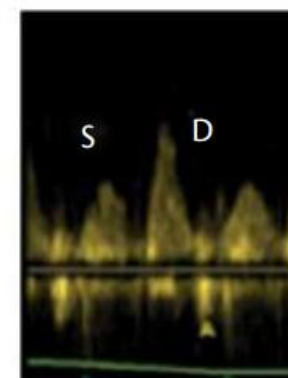
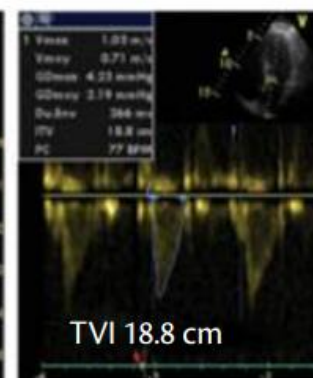
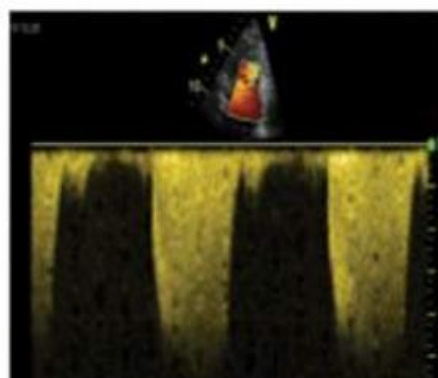
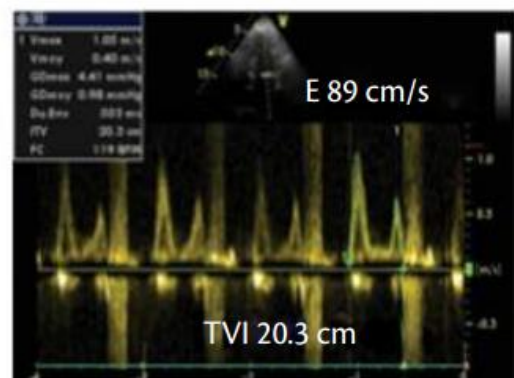
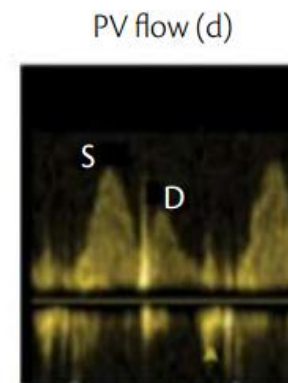
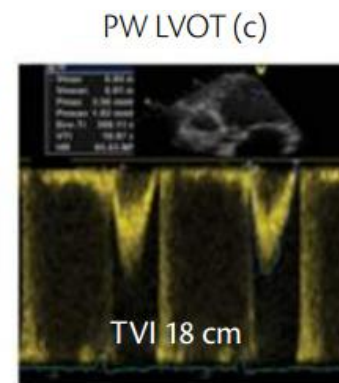
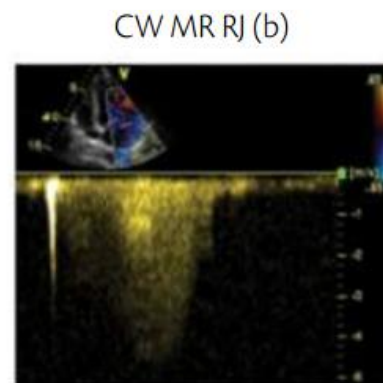
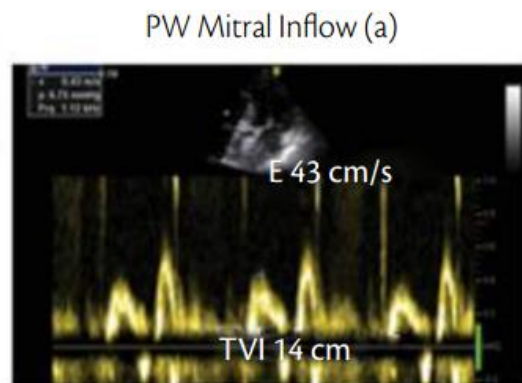
- ◆ Apical 4CV
- ◆ Sample volume of PW places into (1 cm) the PV (often right upper PV)
- ◆ Identify the PV orifice on the back flow of the LA
- ◆ Interrogate the different PVs when possible

Usefulness/Advantages

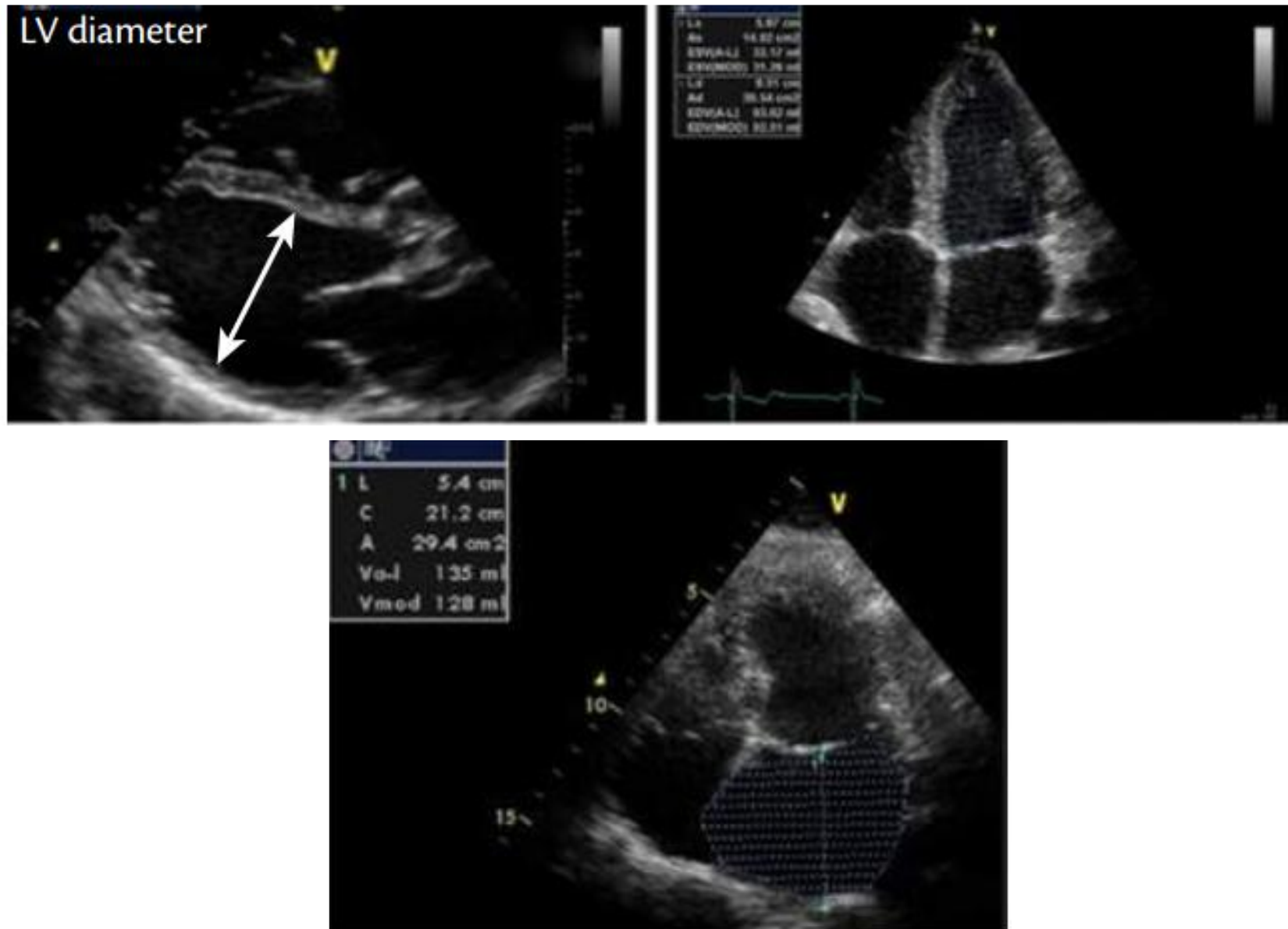
- ◆ Simple
- ◆ Systolic flow reversal is specific for severe MR

Limitations

- ◆ Affected by LA pressure, atrial fibrillation
- ◆ Not accurate if MR jet directed into sampled vein



CONSECINȚELE RM



Integrating indices of MR severity

	Mild	Moderate	Severe
Qualitative structural and Doppler parameters			
Valve morphology (2D/3D)	Normal or abnormal	Normal or abnormal	Flail/Ruptured papillary muscle
Colour-flow MR jet	Small, central jets	Intermediate	Very large central jet or eccentric jet adhering, swirling and reaching the posterior LA wall
Jet density (CW)	Faint/Parabolic	Dense/Parabolic	Dense/Triangular
Flow convergence zone	No or small	Intermediate	Large
Semi-quantitative parameters			
Vena contracta width, mm (colour flow)	< 3	Intermediate	≥ 7 (≥ 8 for biplane)
Pulmonary vein flow	Systolic dominance	Systolic blunting	Systolic flow reversal
Mitral inflow	A wave dominant	Variable	E wave dominant (> 1.5 m/s)
TVI mit/TVI Ao	< 1	Intermediate	≥ 1.4
	Mild	Moderate	Severe
Quantitative parameters			
EROA, cm ²	< 20	20–29 and 30–39	≥ 40
Regurgitant volume, ml	< 30	30–44 and 45–59	≥ 60
Regurgitant fraction, %	< 30	Intermediate	≥ 50
+ LV and LA sizes + sPAP			





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AND MAY CHRISTMAS
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