

Pitfalls and how to avoid them

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Pitfalls victims ?

WHO : all of us

WHEN : - Learning curve !
- “Don’t hurry ! “

WHICH conditions :

Poor windows

Complex diseases/procedures

Arrhythmias

Extreme ages (children , old pts.)

WHY :

I. Technical errors

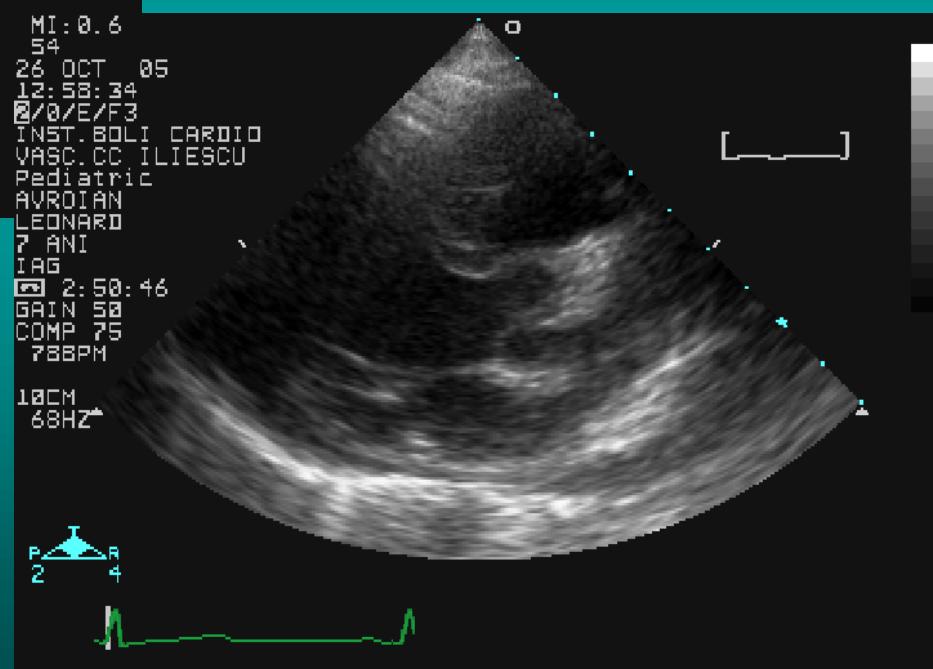
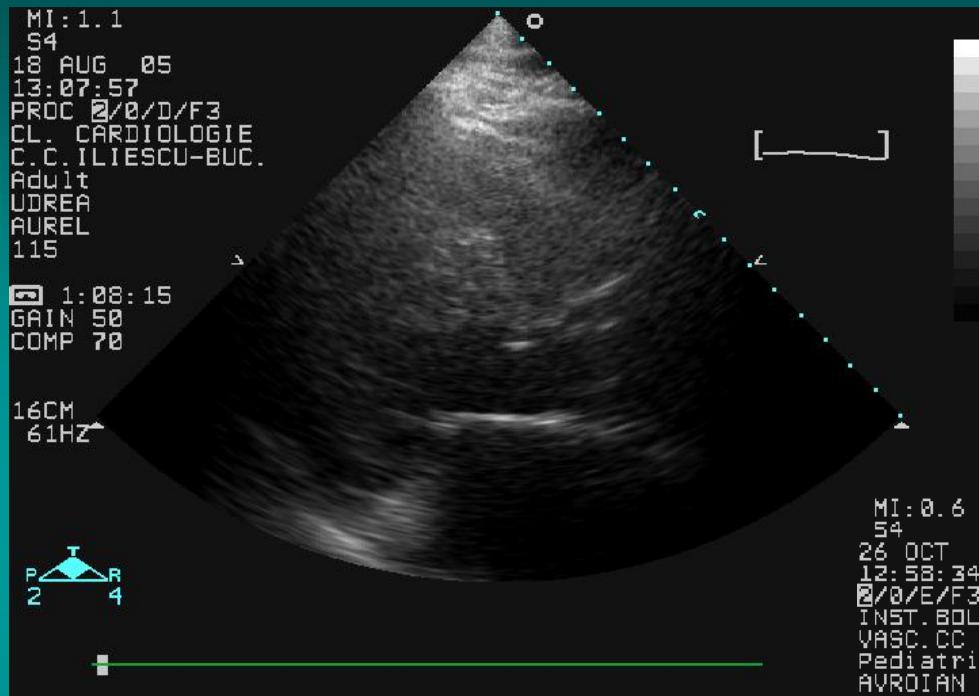
II. Choice of irrelevant parameters

III. Errors in interpreting results

EAE recommendations for training, competence, and quality improvement.

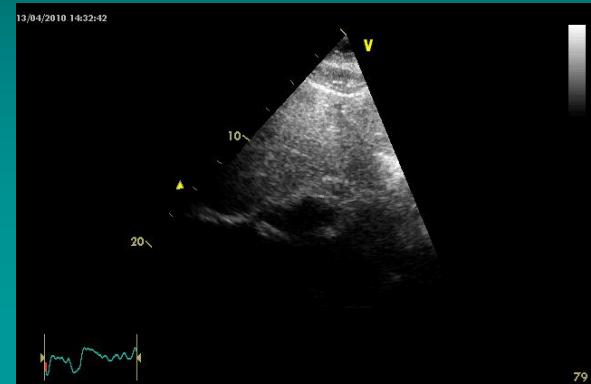
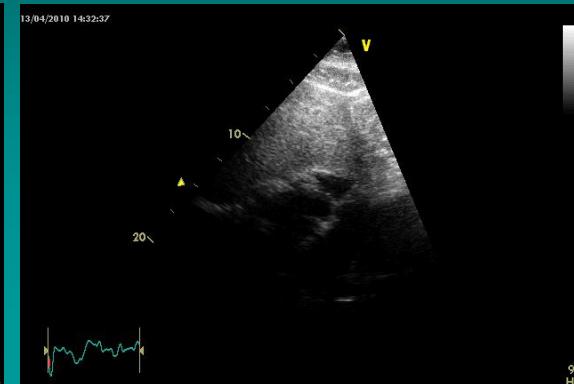
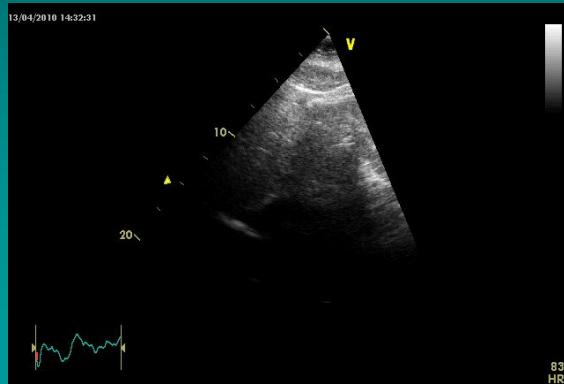
European Journal of Echocardiography (2009) 10, 893–905

A. Poor imaging

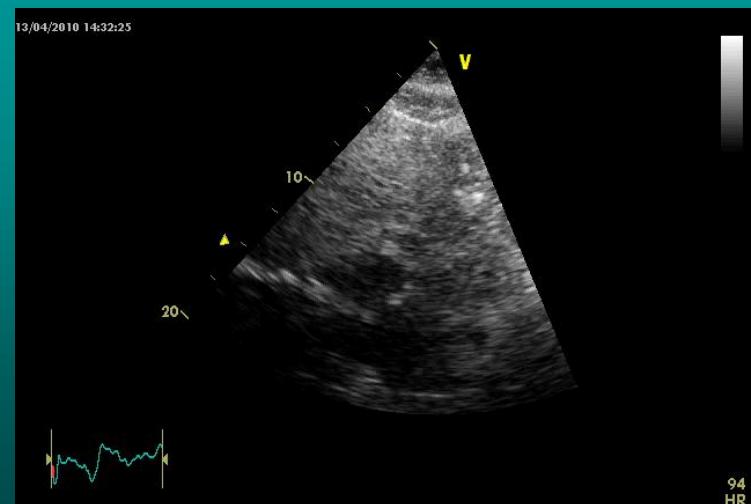
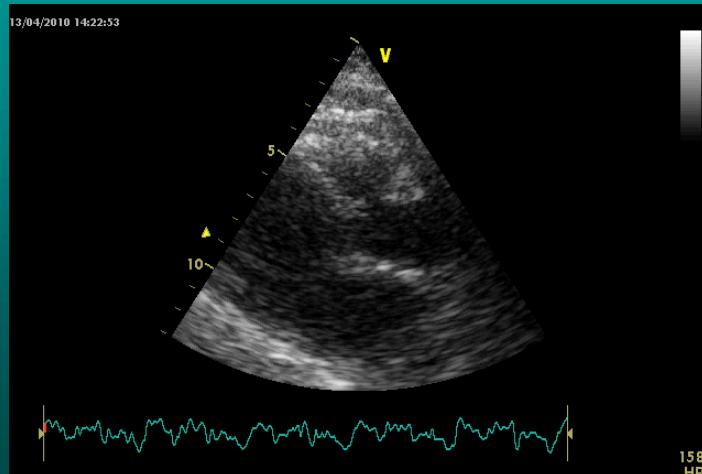


How to avoid

- Change frequency !

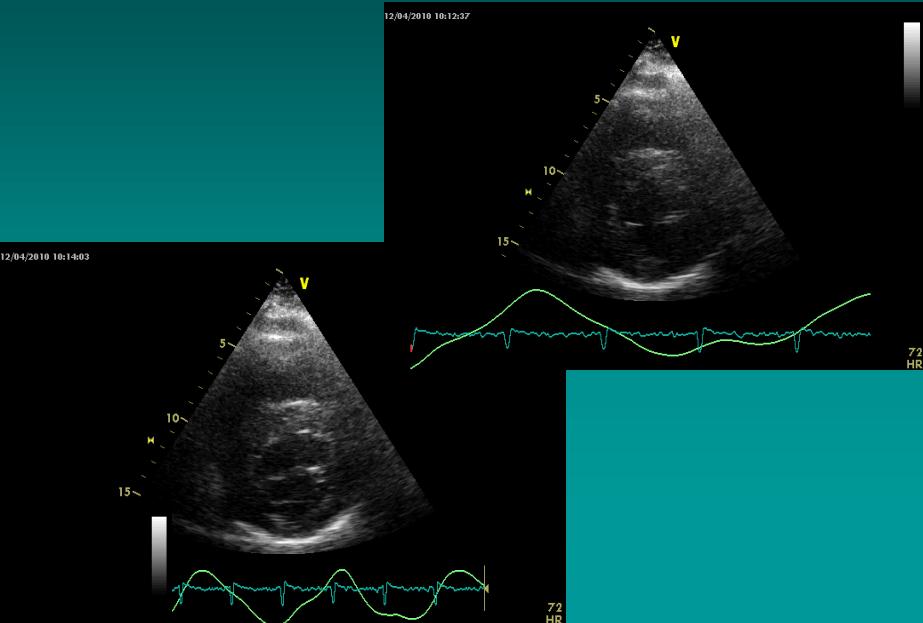
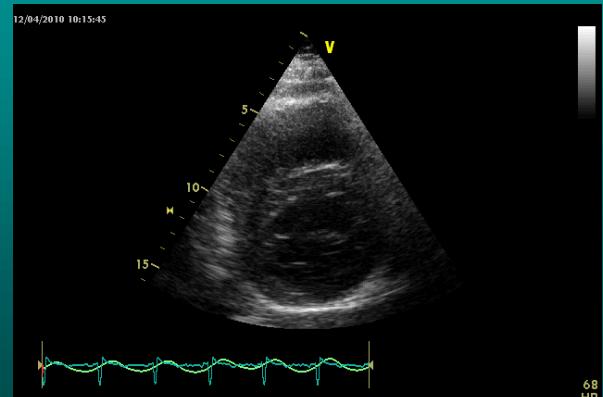
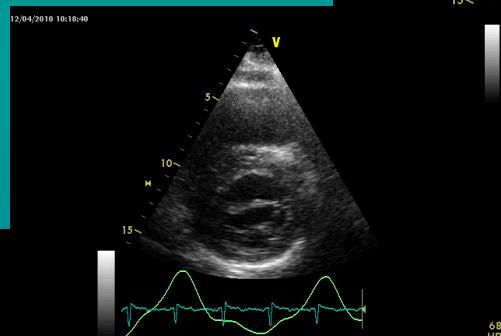
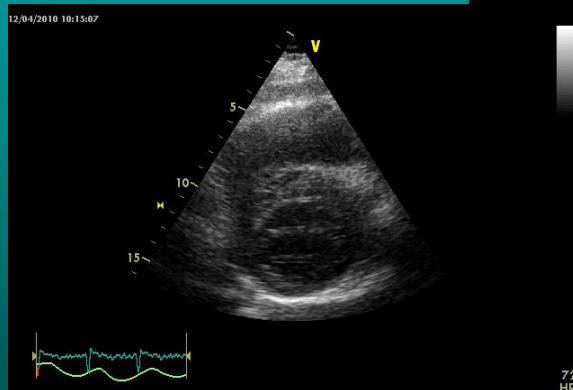


- Use harmonics !



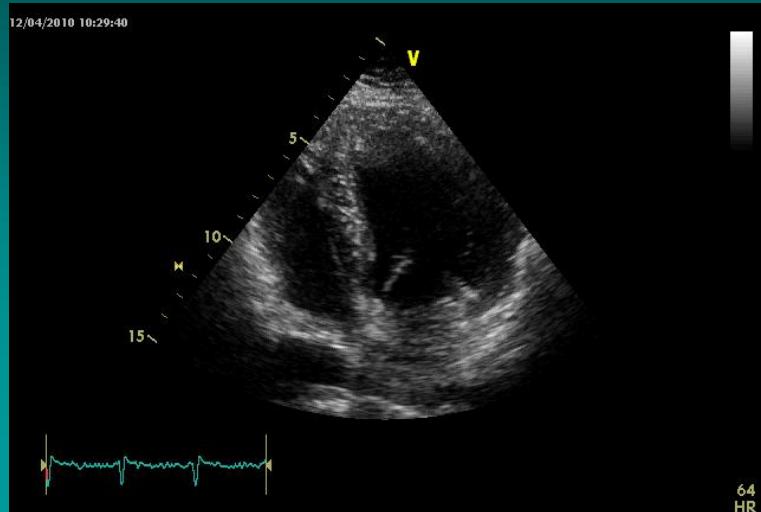
How to avoid

- Use respiratory cycle variations /apnea !
- Change patient's position !

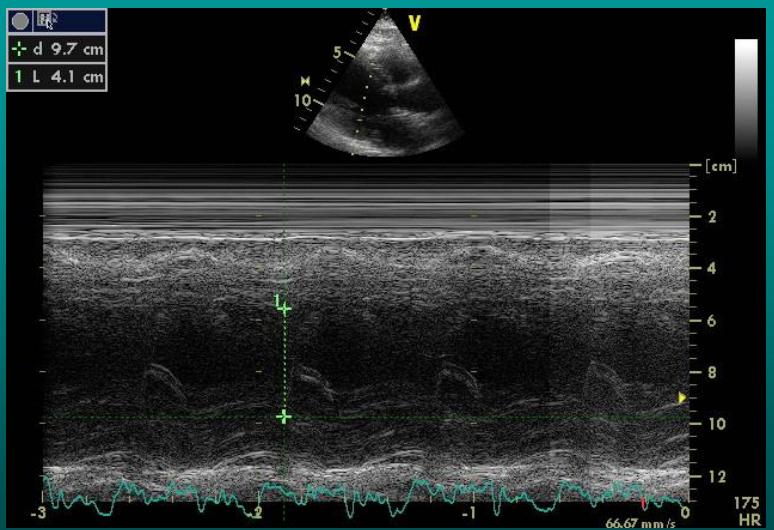


B. Inadequate imaging (2D)

A. Bad transducer position

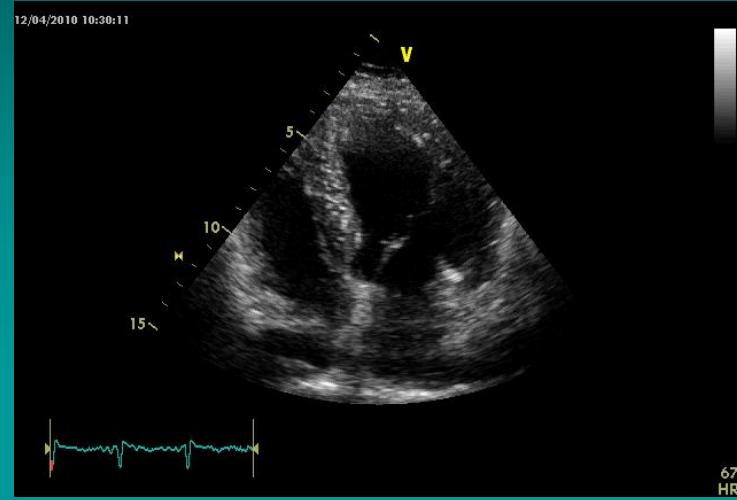
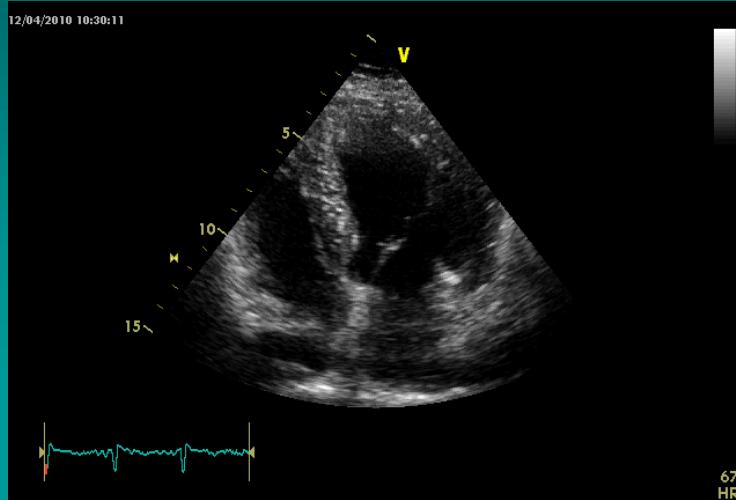


B. Wrong M-mode cut

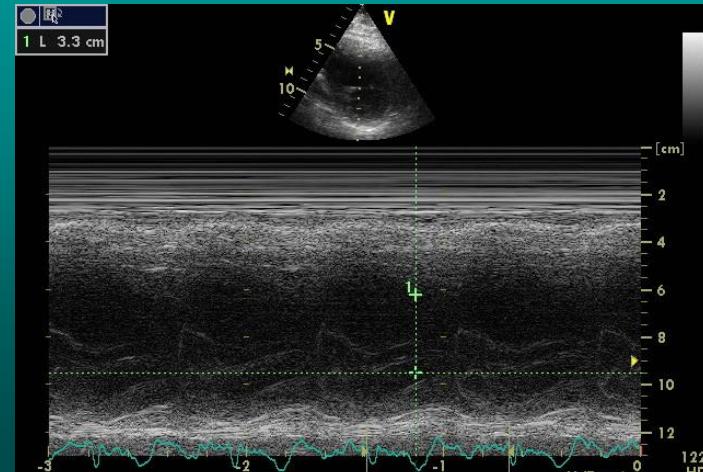
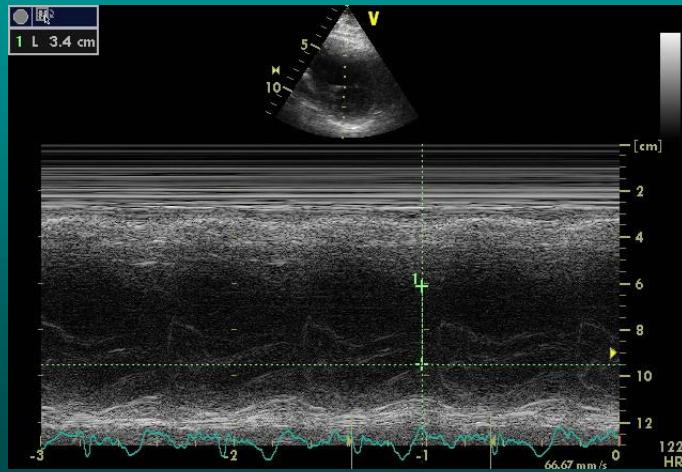


How to avoid

Go to the spine ! (“il appice di Pordenone ”)

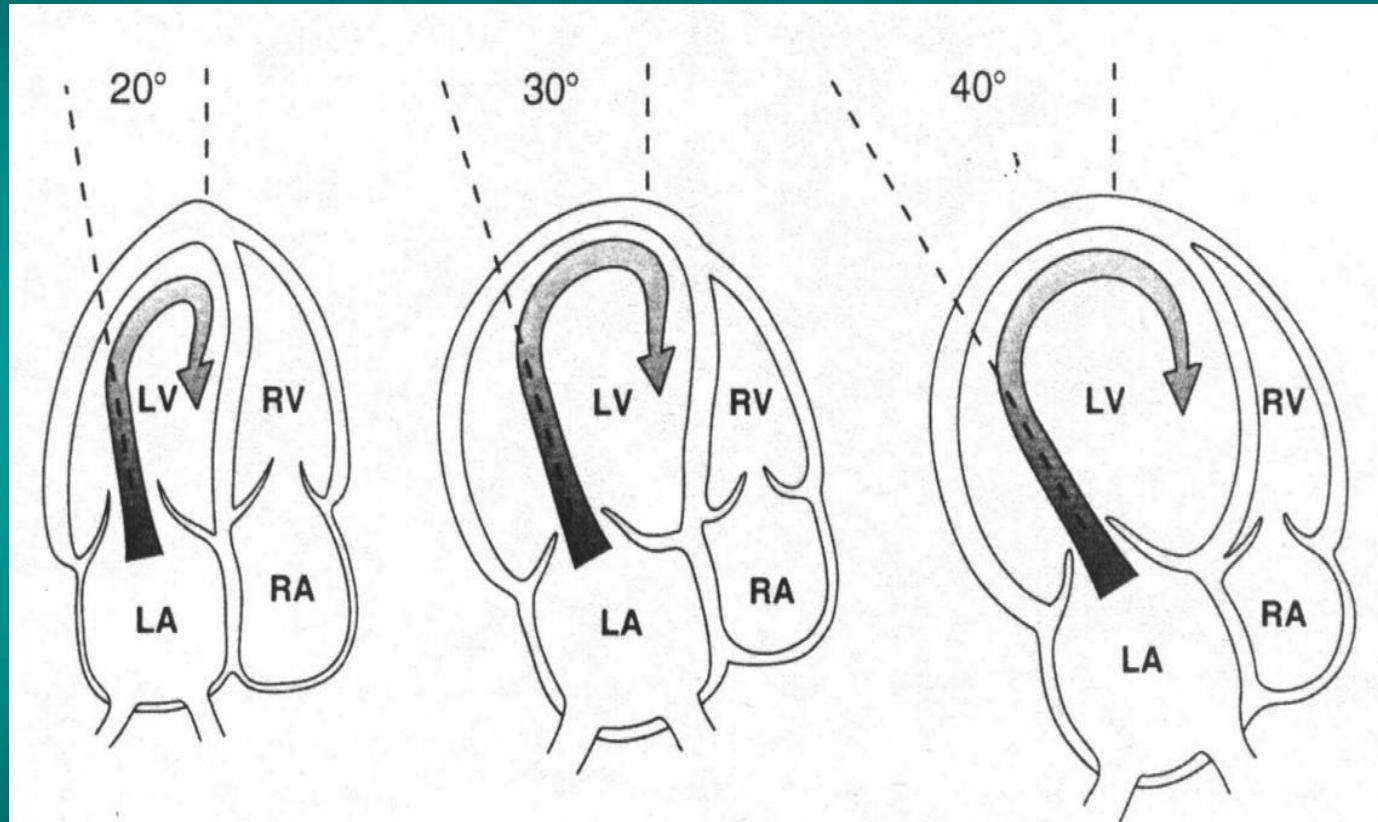


Short axis before M mode measurements !



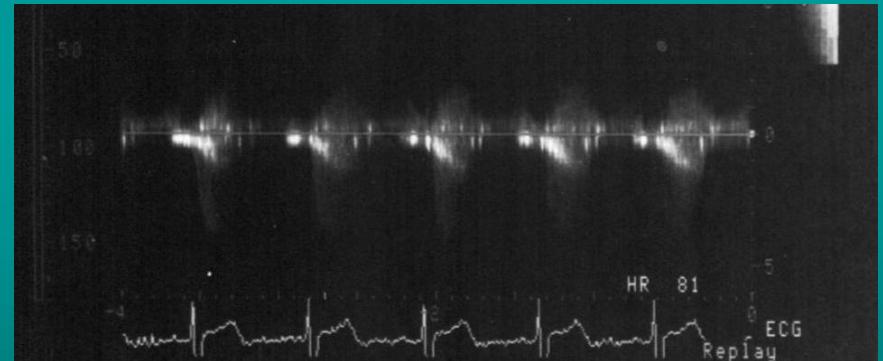
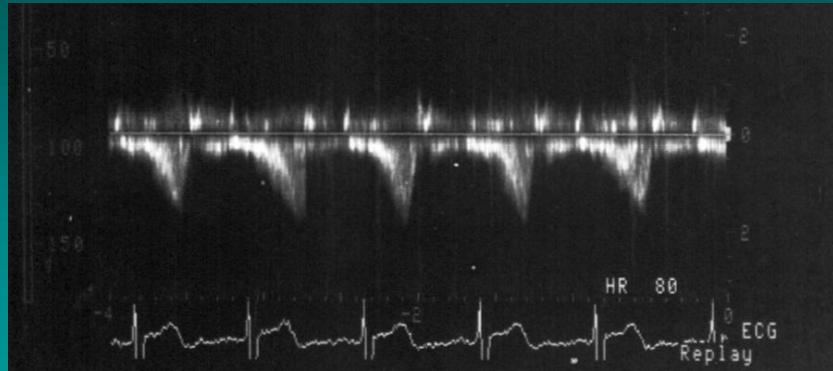
Inadequate imaging (Doppler)

Best Doppler signal ..



..NOT necessarily from the ideal 2D imaging point

The clearest signal ..



...could be not the good one..

Inadequate imaging (Doppler)

PW : mitral inflow

1. Bad sample volume position

- valve/annulus artifacts
- maximal velocity underevaluated (modified E/A)

2. Too large sample volume

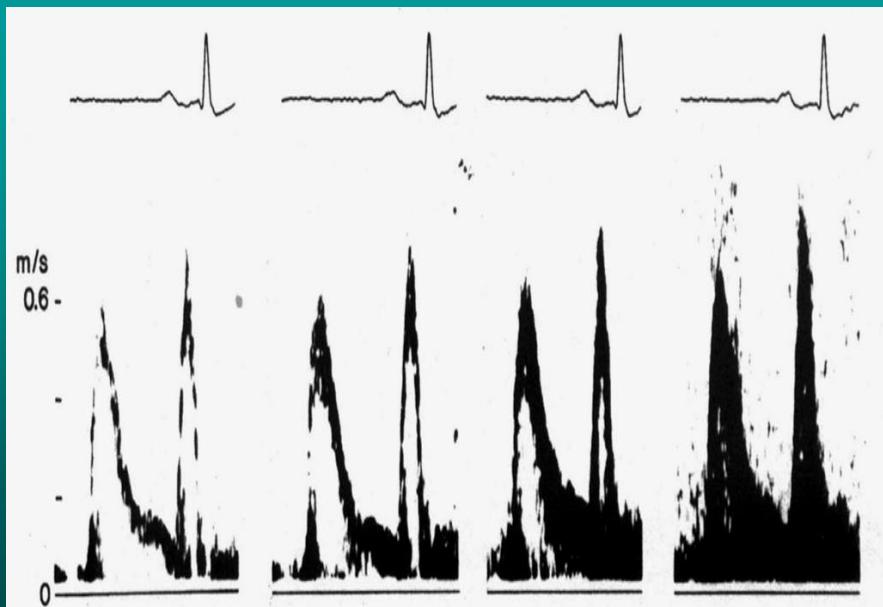
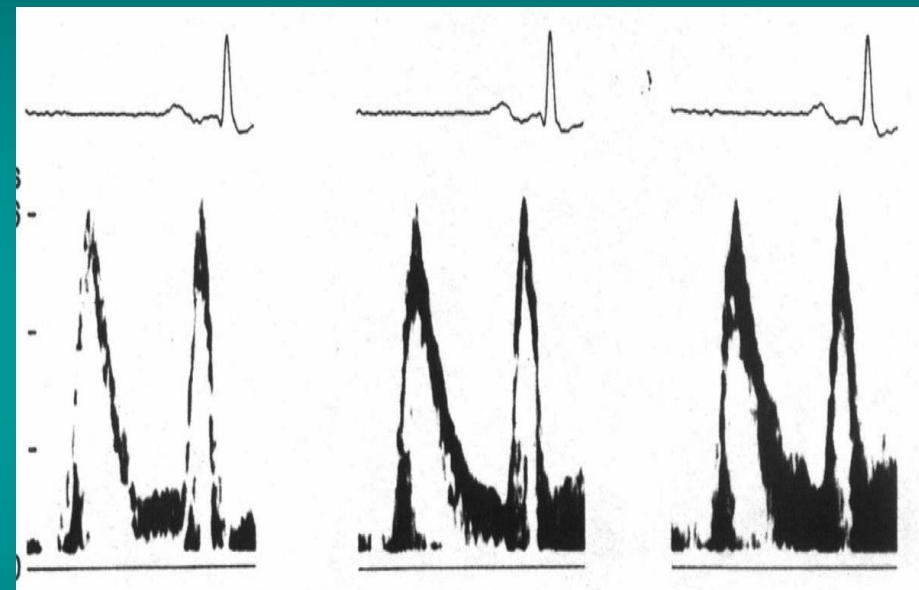
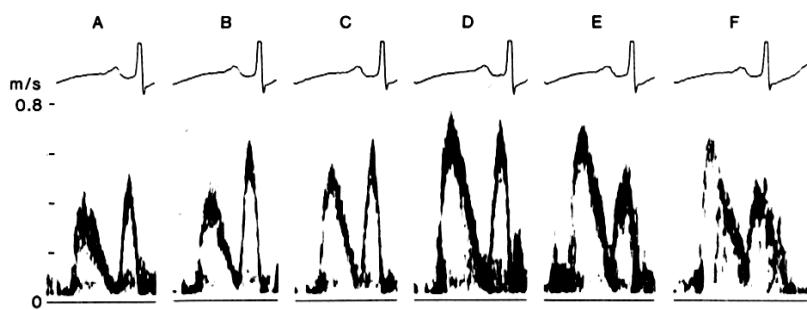
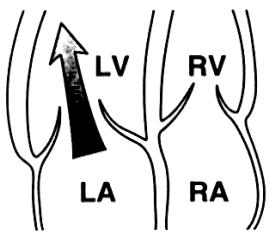
- wide velocity spectrum

3. Gain excess

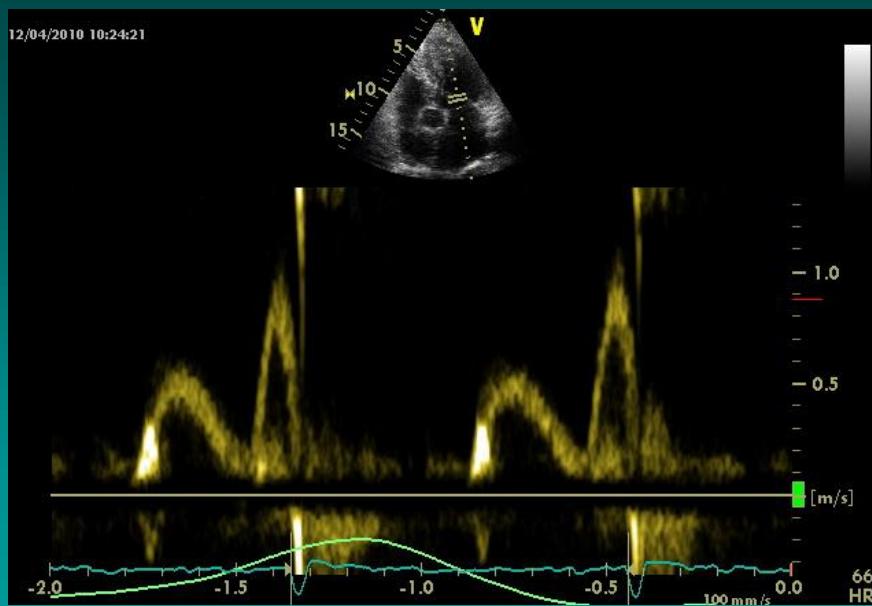
- may alter time and velocity measurements

4. Inadequate filters

- wall / valve artifacts
- falsely “reduced” durations



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Inadequate imaging (Doppler)

5. Inadequate Doppler beam direction

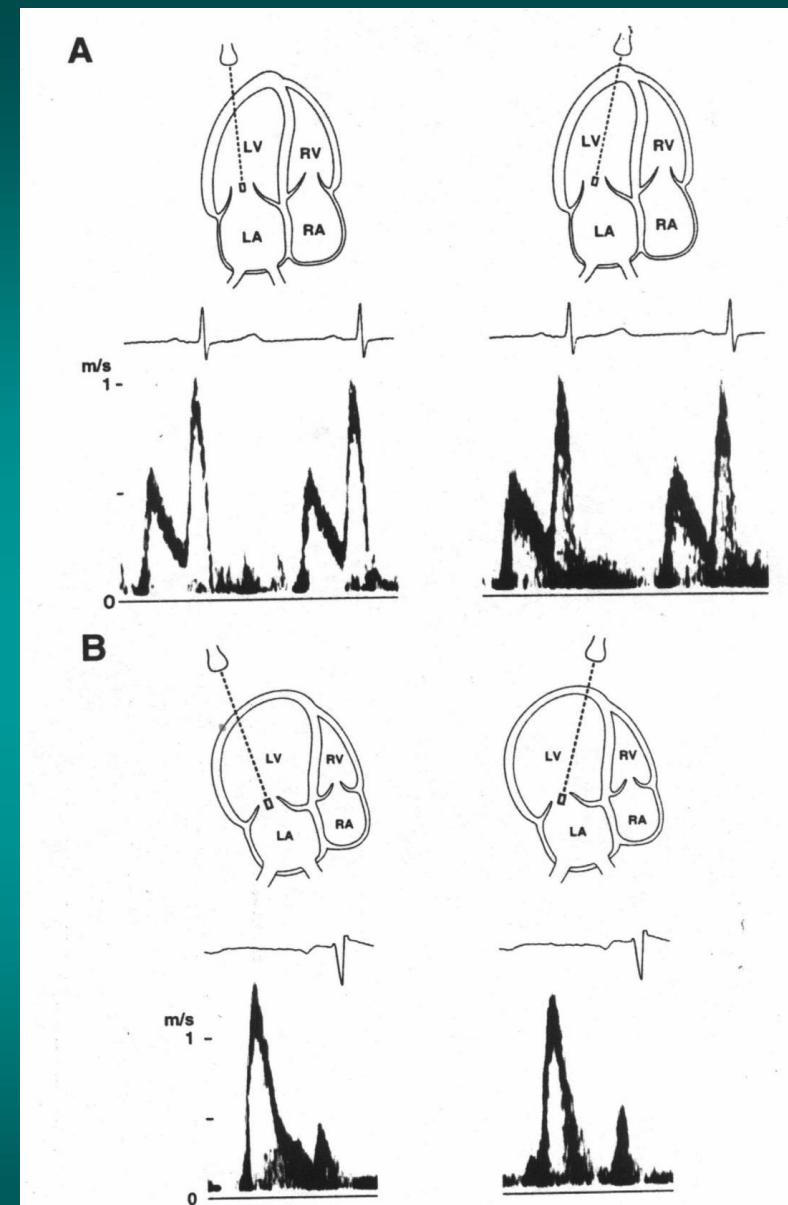
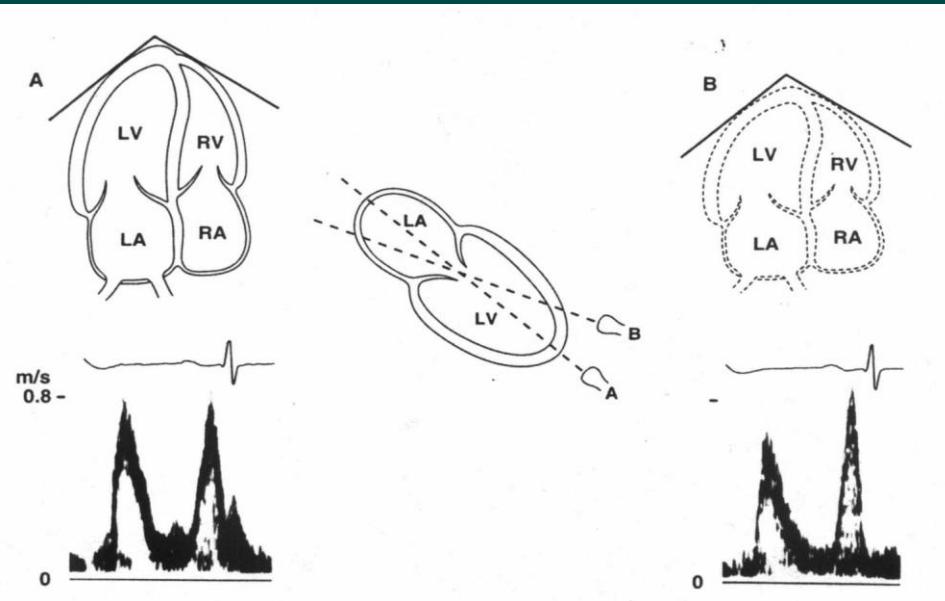
- maximal velocity underevaluated

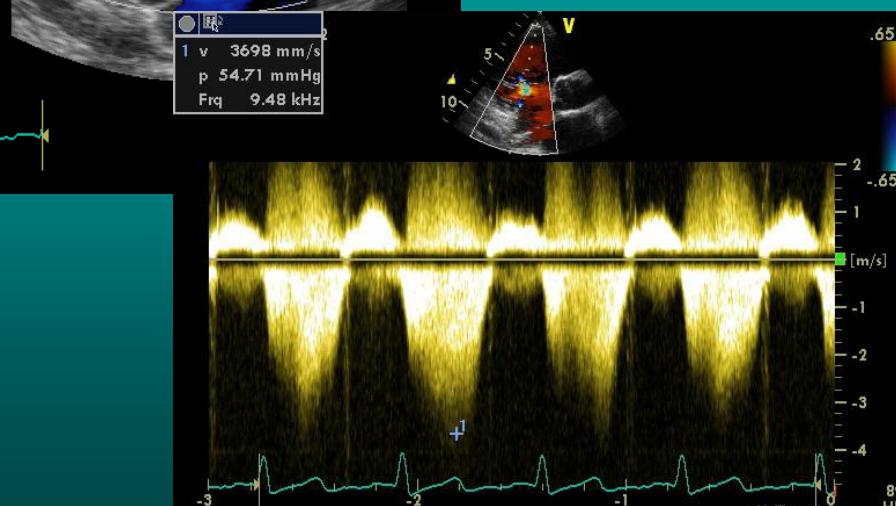
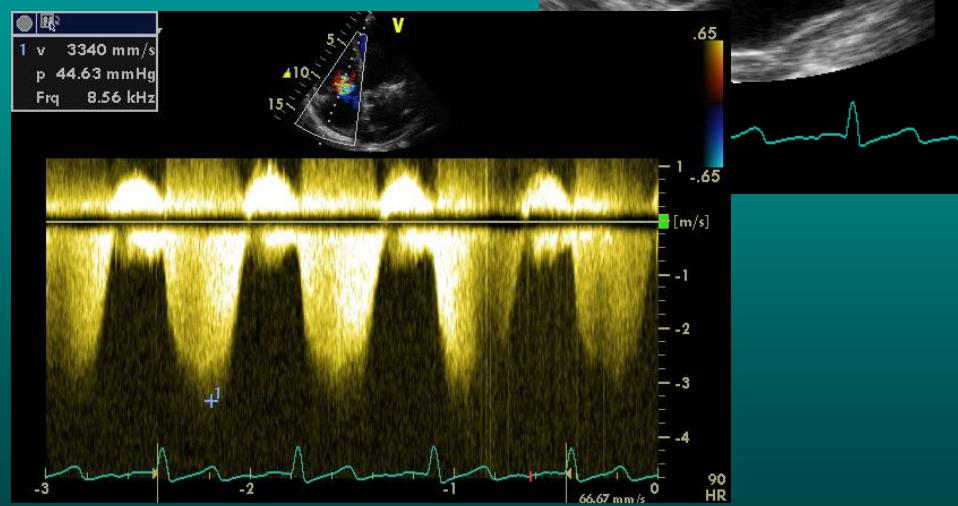
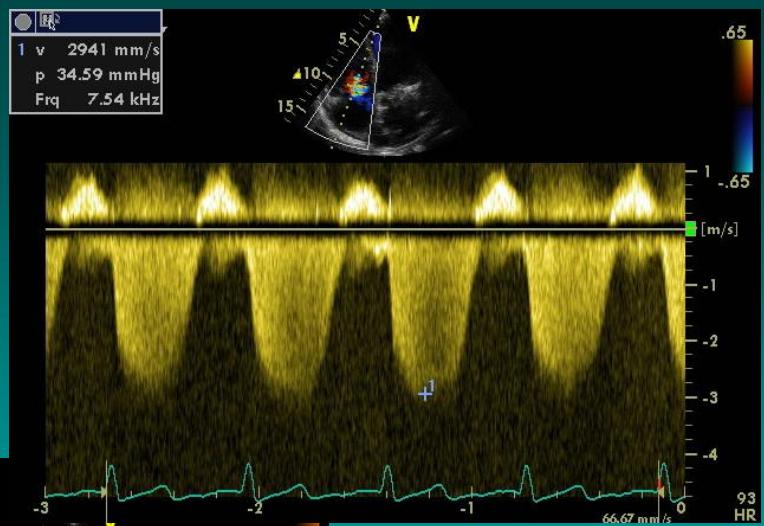
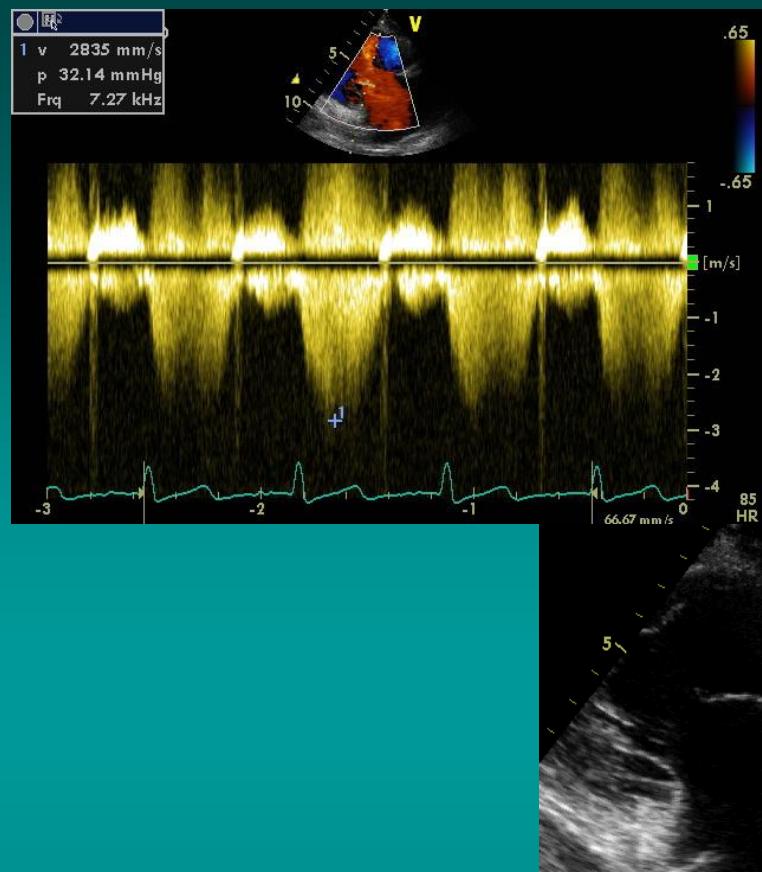
6. Sweep

- greater error probability (duration/ PHT)

7. Number of cardiac cycles measured

- > errors : pts in atrial fibrillation





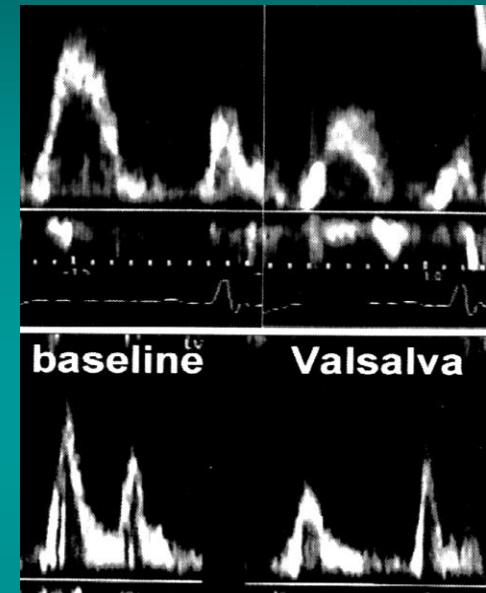
Inadequate imaging (Doppler)

8. Not using provocative maneuvers

- Valsalva
- respiratory
- contrast

9. Ignoring audio signal

10. Lack of recording measurements



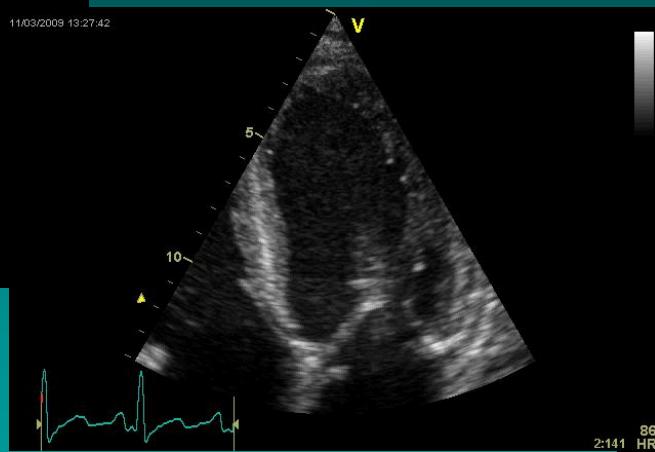
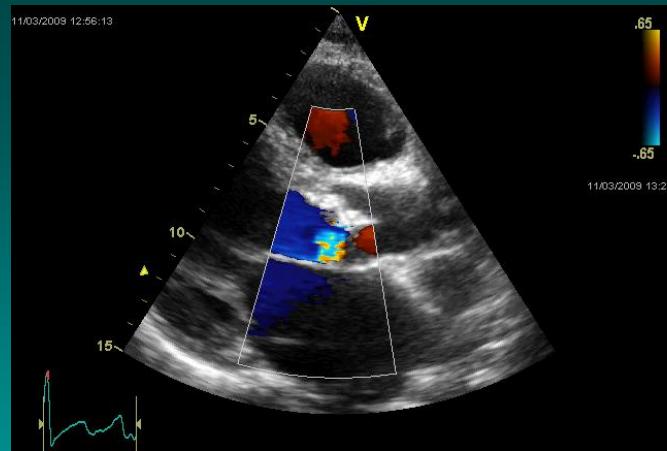
The chosen parameter - correctly calculated – does not really express , in that context , the severity of the condition

-- *transmitral gradient* to evaluate severity of mitral stenosis in
Lutembacher syndrome

-- *LV/Ao gradient* in aortic stenosis with *low LV EF*

-- *color* (semi quantitative) assessment of *AR* in *acute AR*

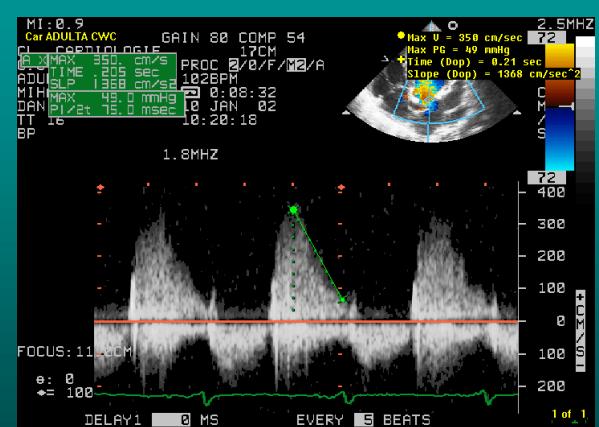
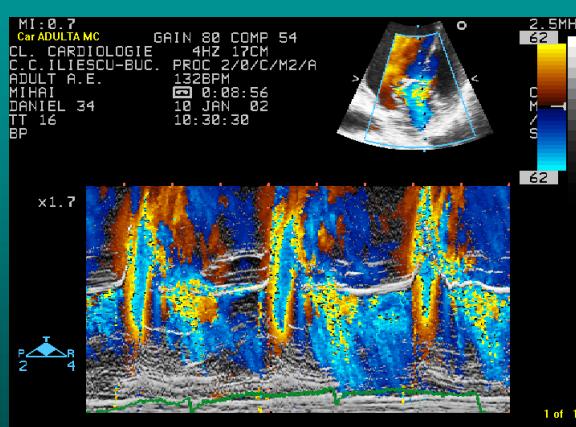
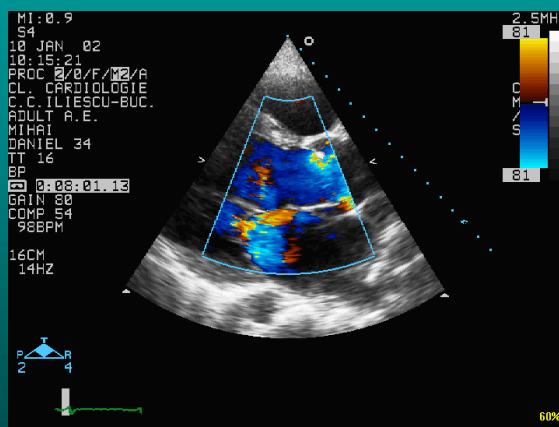
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low LV EF



No endd. aortic turbulence ..



...but diastolic mitral regurge

and brisk aortic PHT

**In spite of correctly applying the technique ,
there are major (nonavoidable) disturbing factors**

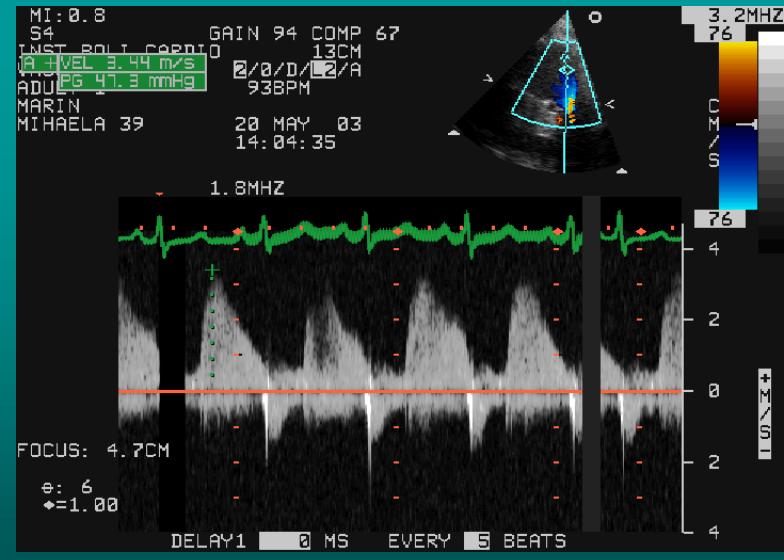
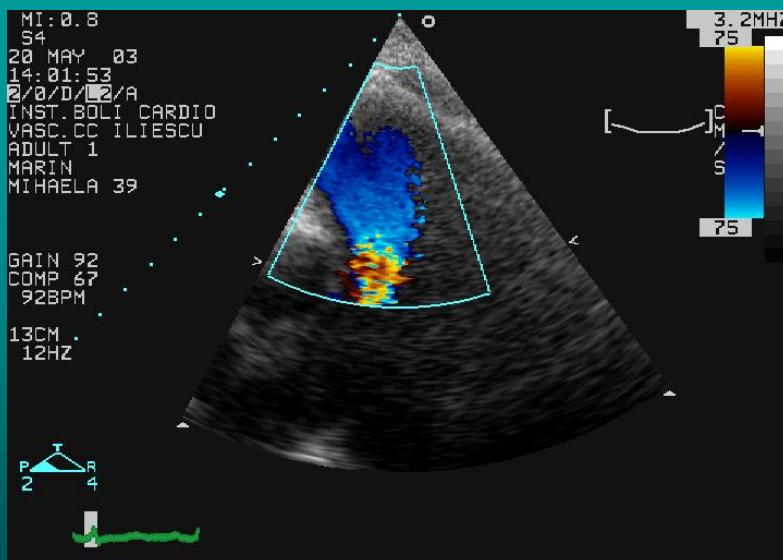
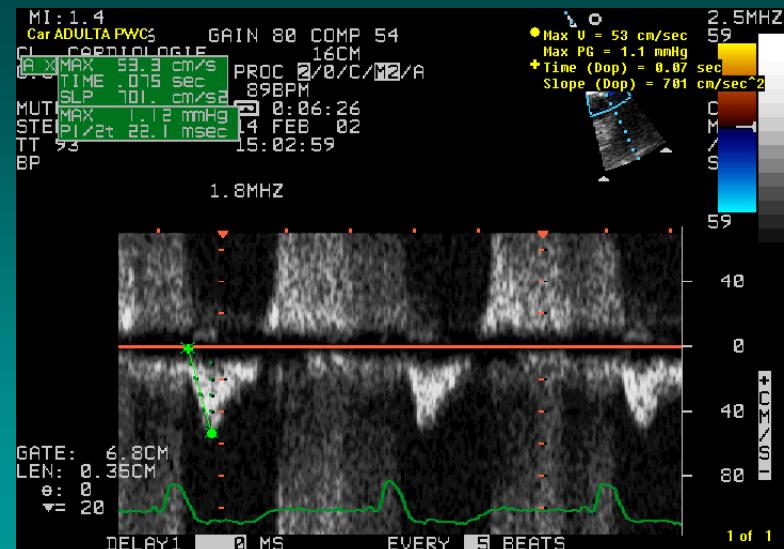
PAP calculation using Ao/PA gradient of a PDA

(wrong angle , false > PAP)

Qp/Qs assessment of shunting if significant L/R regurge

Using PAT formula for PAP assessment in very severe PHT

Presiune medie cateterism	TAP (met.A)	Gradient diastolic max AP/VD (met B.)	
40-45 mm (n:6)	- 3,6 mm (- 14 , + 8)	-12,3 mm (-21 -8)	
45-50 mm (n:10)	-4,7 mm (-16, +3)	-11,9 mm (-22 , -3)	
>50 mm (n:6)	- 9,9 mm (-21, - 5)	-16,4 mm (-29 , -8)	



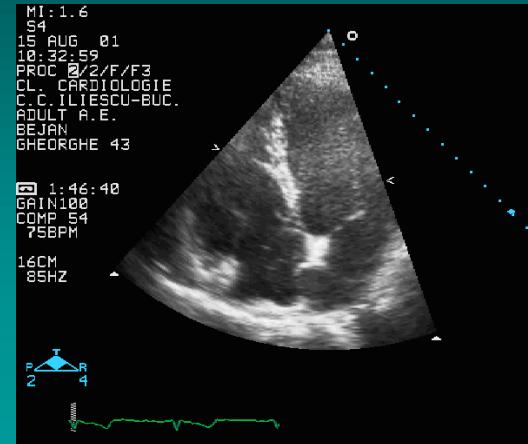
III. Errors in interpreting results



Misunderstanding results

1. Incorrect recognition of structures / waves / flows

- Chiari network
- protodiastolic gradients HCM
- RA turbulence
- paraseptal LA/RA flows versus shunting

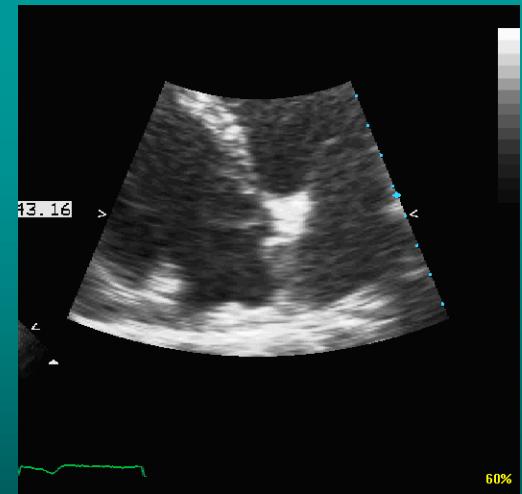


2. Ignoring normal values range

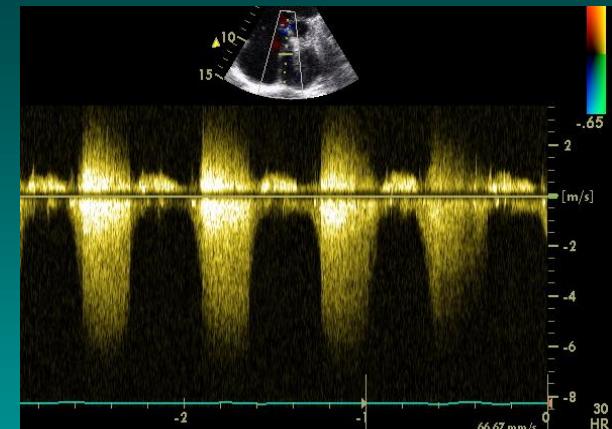
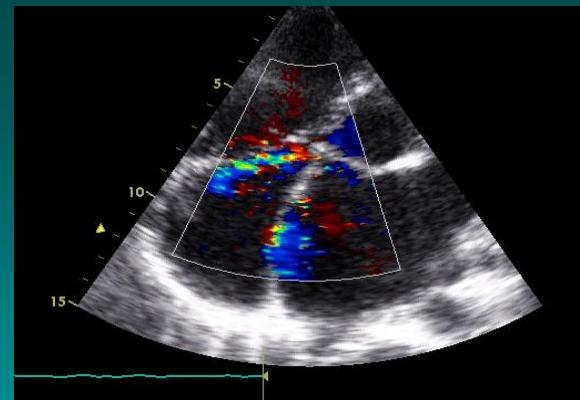
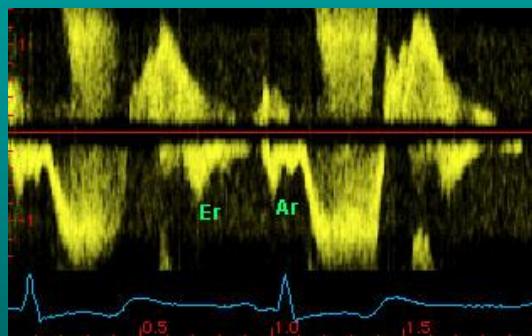
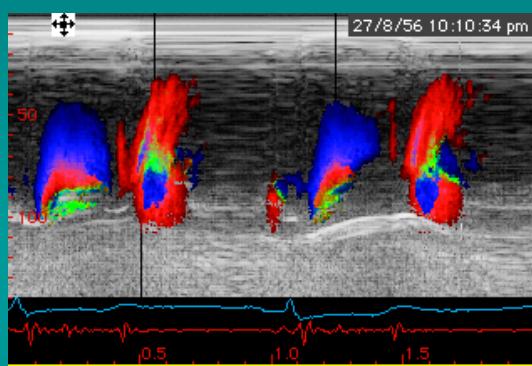
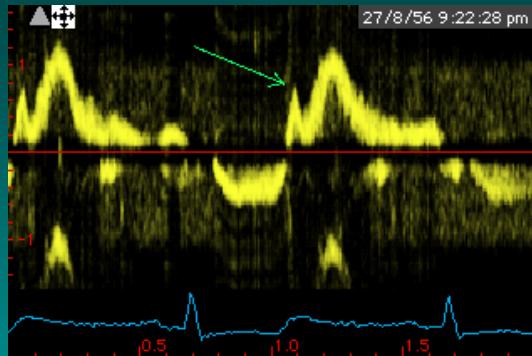
Don't be ashamed to look in a manual !

3. Not using correction for:

- BMI
- cardiac frequency
- position :
 - Coanda effect
 - tricuspid PHT : 180-190/220



ASIA and Chiari network
(no clots !)



LV-RA shunting (not tricuspid regurgitation)



**Protodiastolic gradients
Er, Ar in outflow tract**

L and R paraseptal flows –no shunting

Table 38-1. Normal Values of Doppler Parameters in Apparently Normal Prosthetic Valves

Parameter	Velocity (m/sec) V_{max}	Gradient (mm Hg) ΔP_{max}	Gradient (mm Hg) ΔP_{mean}
<i>Mitral Position</i>			
Starr-Edwards (ball-in-cage)	1.9 ± 0.4	14.6 ± 5.5	4.6 ± 2.4
St. Jude Medical (bileaflet)	1.6 ± 0.3	10.0 ± 3.6	3.5 ± 1.3
Bjork-Shiley (tilting disc)	1.6 ± 0.3	10.7 ± 2.7	2.9 ± 1.6
Carpentier-Edwards (porcine bioprosthesis)	1.8 ± 0.2	12.5 ± 3.6?	6.5 ± 2.1?
Hancock (porcine bioprosthesis)	1.5 ± 0.3	9.7 ± 3.2	4.3 ± 2.1
<i>Aortic Position</i>			
Starr-Edwards (ball-in-cage)	3.2 ± 0.6	38.6 ± 11.7	23.0 ± 8.8
St. Jude Medical (bileaflet)	2.4 ± 0.3	25.5 ± 5.1	12.5 ± 6.4
Bjork-Shiley (tilting disc)	2.5 ± 0.6	23.8 ± 8.8	14.3 ± 5.3
Carpentier-Edwards (porcine bioprosthesis)	2.5 ± 0.5	23.2 ± 8.7	14.4 ± 5.7
Hancock (porcine bioprosthesis)	2.4 ± 0.4	23.0 ± 6.7	11.0 ± 2.3
<i>Tricuspid Position (Case Reports)</i>			
Bjork-Shiley (tilting disc)	1.6	10.2	5
Porcine bioprosthetic	1.3 ± 0.3	7 ± 2	3 ± 2

(Data summarized from refs. 18, 55, 111, and 112.)

Ignoring normal values range

MI: 1.3
S4
15 FEB 05
15:06:52
2/1/0/F1
INST. BOLI CARDIO
VASC_CC ILIESCU
ADULT 1
MIHAIU
FLORENTINA
10 ANI

GAIN 43
COMP 58

13CM
95HZ

P R
2 4

[]

MI: 1.6
S4
25 JULY 01
12:25:17
PROC 2/2/F/F3
CL. CARDIOLOGIE
C.C. ILIESCU-BUC.
ADULT A.E.
RADUCANU
ELENA 62

0:02:48
GAIN 72
COMP 54
69BPM

17CM
58HZ

P R
2 4



70%

Coanda ef.: color underestimation of regurge

TIS: 0.8
PAT T: 37.8C
MI: 0.6
S4
15 FEB 05
15:07:23
2/1/0/2/A
INST. BOLI CARDIO
VASC_CC ILIESCU
ADULT 1
MIHAIU
FLORENTINA
10 ANI

GAIN 43
COMP 58

13CM
13HZ

P R
2 4

4.4MHz
2.7MHz
75

[]

MI: 0.7
Car ADULTA CWC
CL. CARDIOLOGIE
LA x MAX 129. cm/s
TIME 325 sec
ADUL SLP 235. cm/s2
RAD MAX 6.66 mmHg
ELE PI/2t 161. msec
PROC 2/0/F/H3/A
GAIN 69 COMP 54
17CM
69BPM
0:05:08
25 JULY 01
12:36:18

1.8MHz

FOCUS: 13.4CM

e: 0
v= 20

INTERVAL 3000 MS

1 of 1

Mitral PHT formula used for tricuspid area !



1.8MHz

62

160

120

80

40

0

-40

-80

-120

-160

Misunderstanding results

4. Ignoring the haemodynamic context :

Associated Lesions :

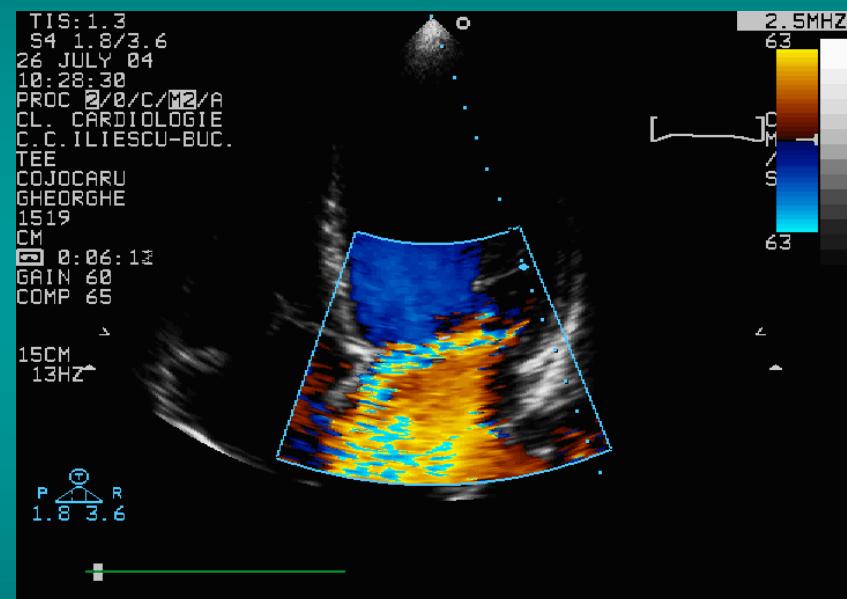
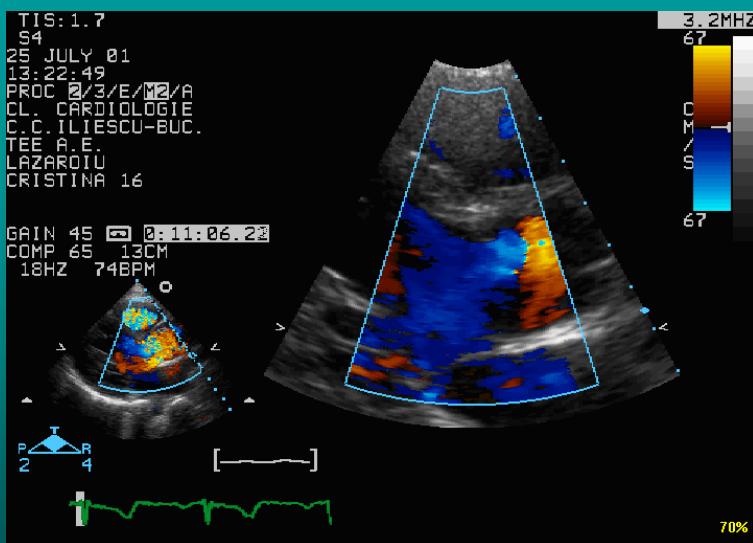
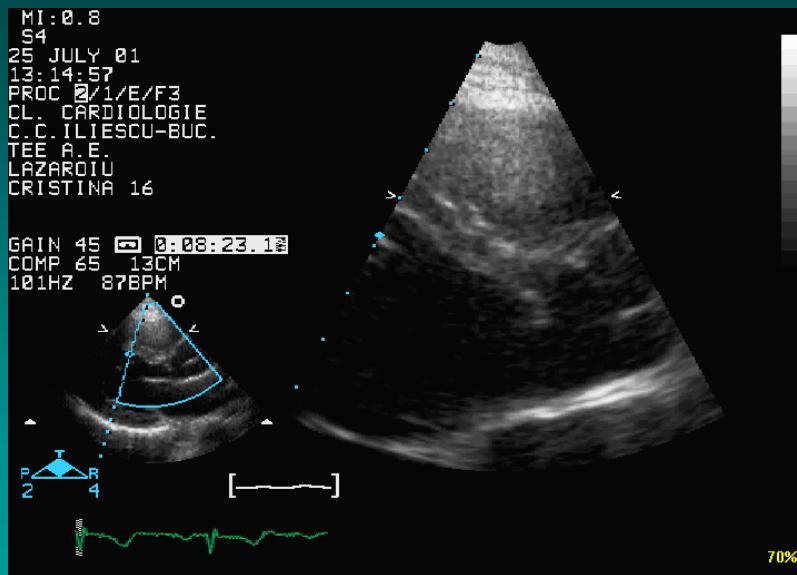
- transmитral gradient in associated regurge
- gradient in multiple stenosis (initial velocity high ! : extended Bernoulli)

LV dysfunction :

- different significance of EF in severe mitral regurge
- E/A pseudonormalisation

Intracavitory / arterial pressures

- HT : increased color area of mitral regurge
- PHT : no turbulent PDA flow



Misunderstanding results

5. Recent therapeutic procedures

- Diuretics
- SR post electric conversion : absent or < “a”
- stenting

6. Ignoring general biological context

Age Fetal Echo - physiologic shunting

- E/A < 1

Elder pts : impaired relaxation



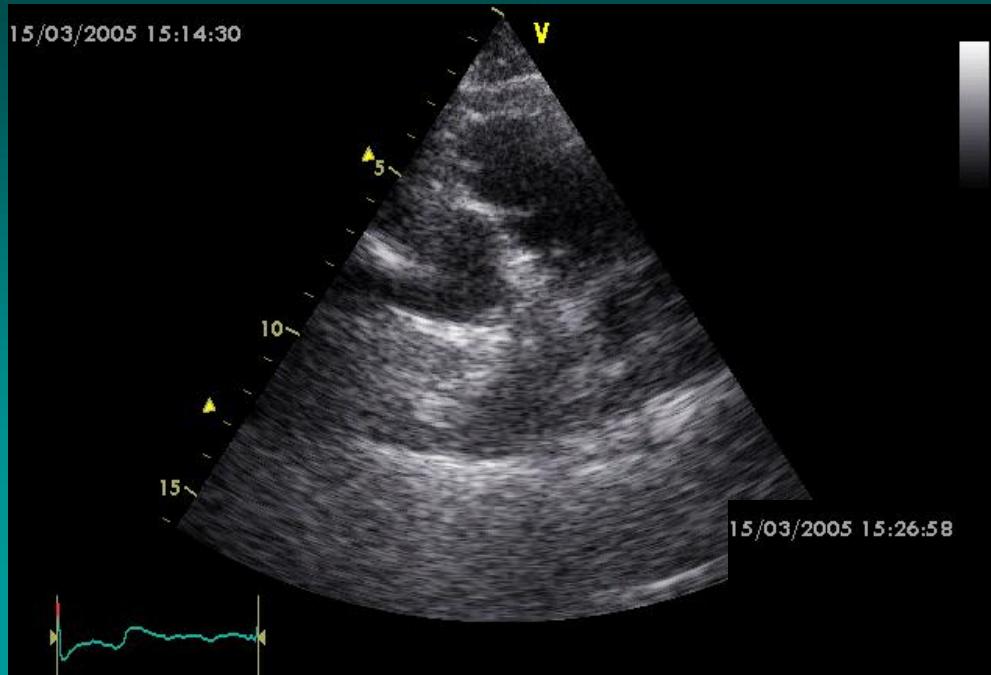
Athletic heart

Hyperkinetic Syndrome - Pregnancy

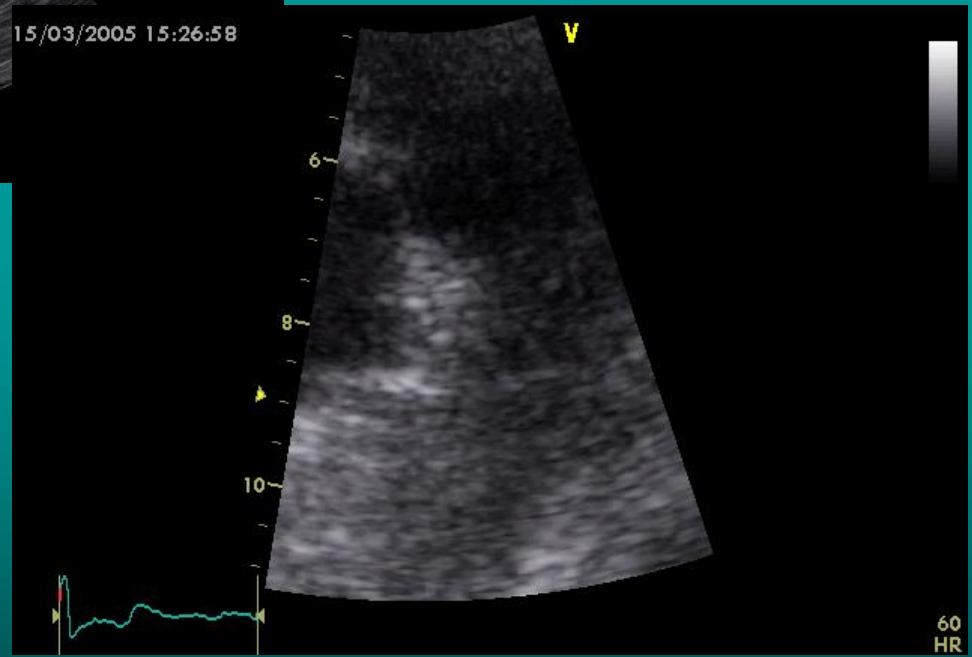
- Anemia

- Hyperthyroidia

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Left main stent



CONCLUSIONS

TO AVOID PITFALLS we need :

- Good theoretical knowledge of US physics
- Solid practical training
- Clinical integration of data
- Patience