ACC Latin America Conference 2017

MEXICO CITY

JUNE 22 – 24, 2017

GLOBAL EXPERTS, LOCAL LEARNING

ACC Latin America Conference 2017

The Inflow and Outflow of the New Diastology

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ASE/EACVI GUIDELINES AND STANDARDS

Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

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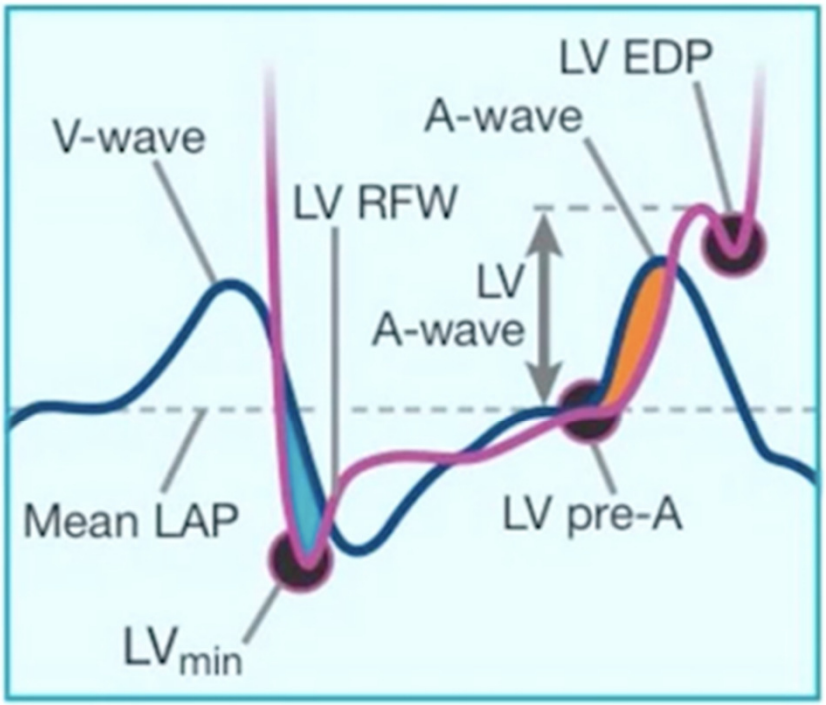
J Am Soc Echocardiogr 2016; 29: 277- 314

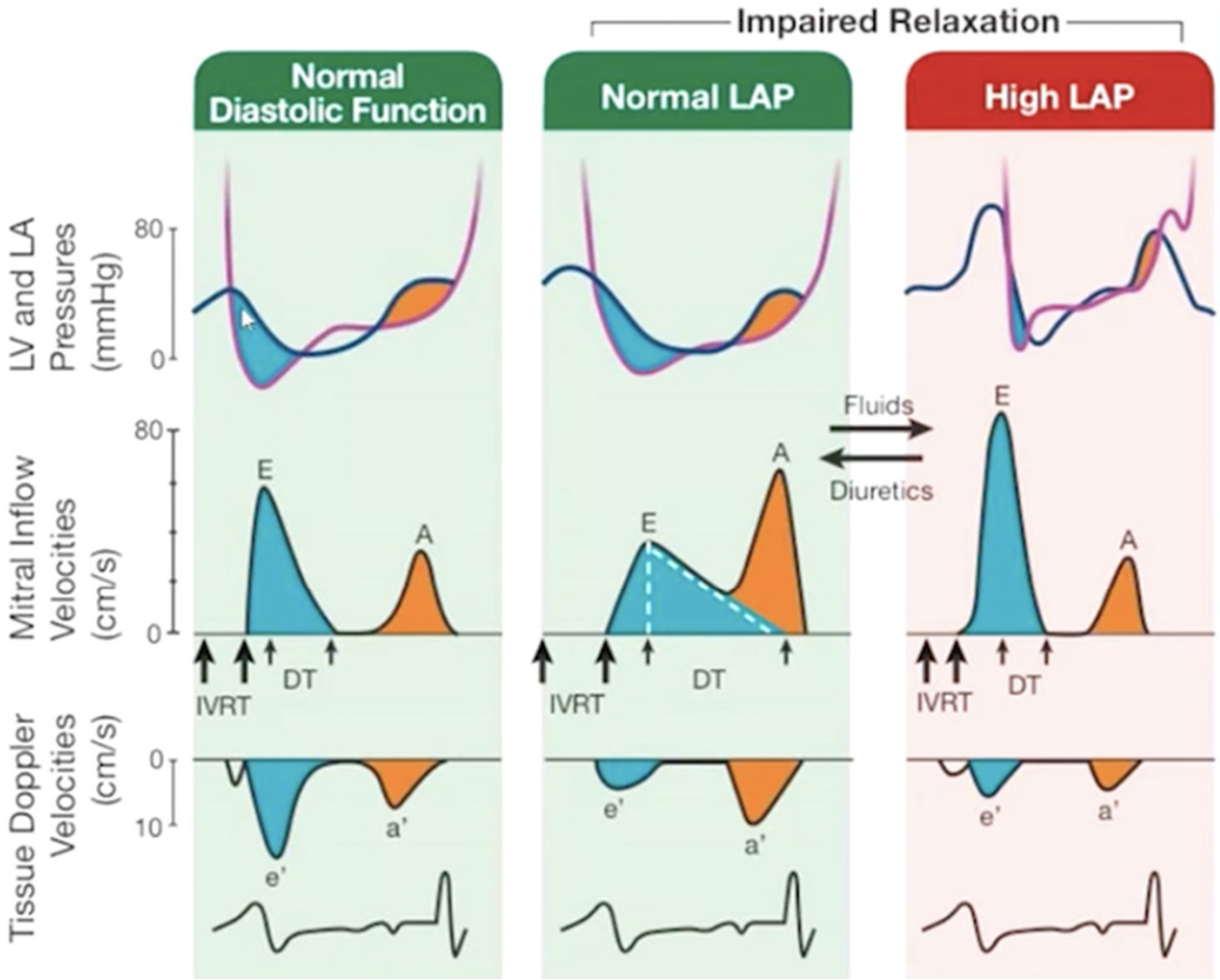
Relation of Mitral Inflow and TD Velocities with LV Filling Pressures

LA and LV Diastolic Pressures

Rapid Filling
LA Systole
LV
LA



Relation of Mitral Inflow and TD Velocities with LV Filling Pressures



Función diastólica del VI de acuerdo a relajación del VI, presiones de llenado, hallazgos 2D y Doppler

	Normal	Grado I	Grado II	Grado III
Relajación VI	Normal	Disfunción	Disfunción	Disfunción
Presión AI	Normal	Baja o normal	Elevada	Elevada
Relación E/A mitral	> = 0.8	< 0.8	> 0.8 o < 2	> 2
Promedio E/e'	< 10	< 10	10 - 14	> 14
Velocidad pico RT (m/s)	< 2.8	< 2.8	> 2.8	>2.8
Volumen indexado AI	Normal	Normal o incrementado	Incrementado	Incrementado

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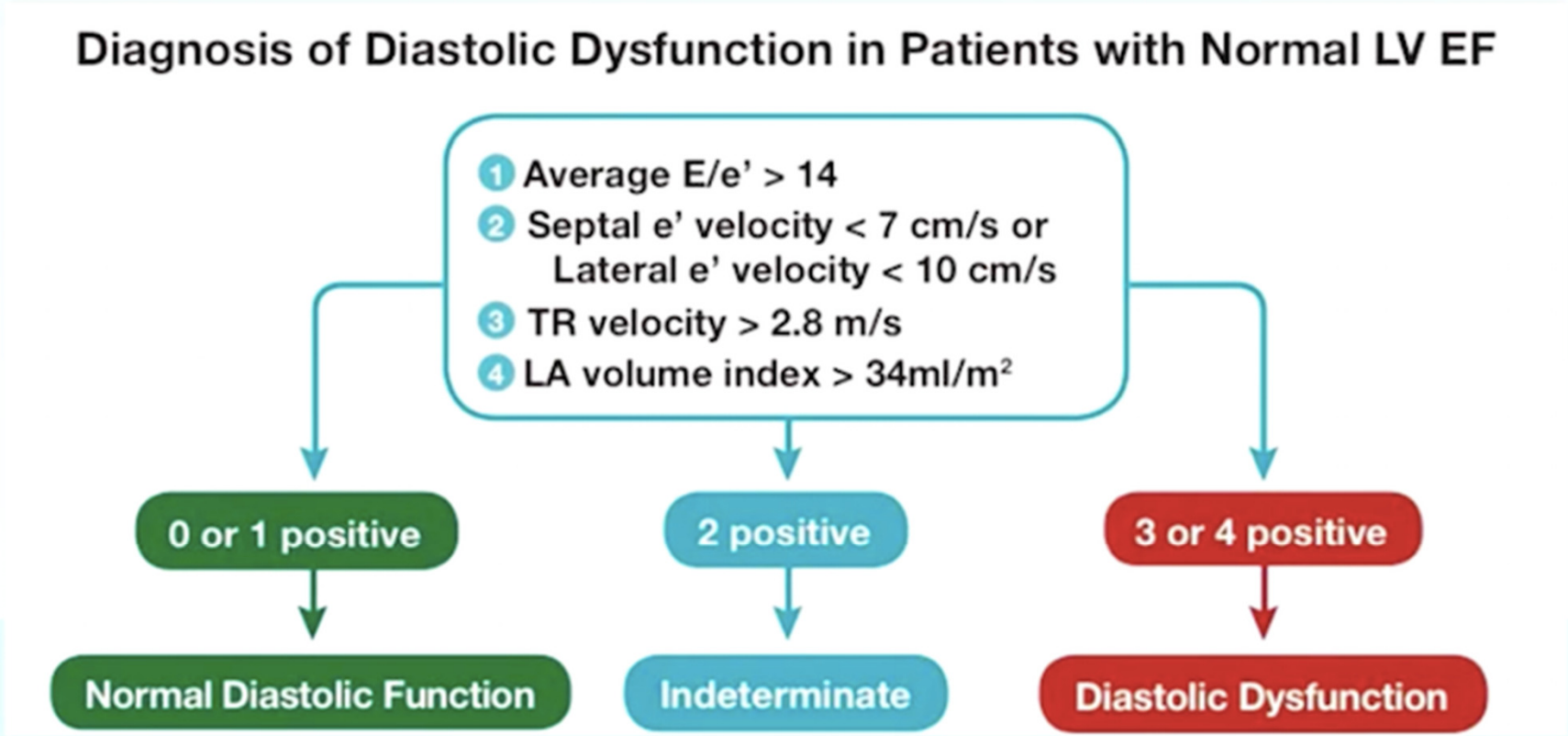
Mediciones usuales

- Geometria/morfologia del VI/VD, enf.valvular/pericardio/ritmo cardíaco, FC
- FEVI/ Strain Longitudinal Global
- Volumen AI (normal: < 34 mL/m^2)
- Velocidad Regurgitación Tricuspídea (normal: < 2,8 m/s)
- Relación onda E/A, duración onda A mitral, Tiempo de desaceleración.
- Maniobra de Valsalva
- Tiempo de relajación isovolumétrica
- Doppler tisular anillo mitral: onda e´ septal, onda e´lateral, relación E/e´promedio
- Venas pulmonares. onda S, onda D, duración A retrógrada, relación duración onda A mitral/onda A retrógrada

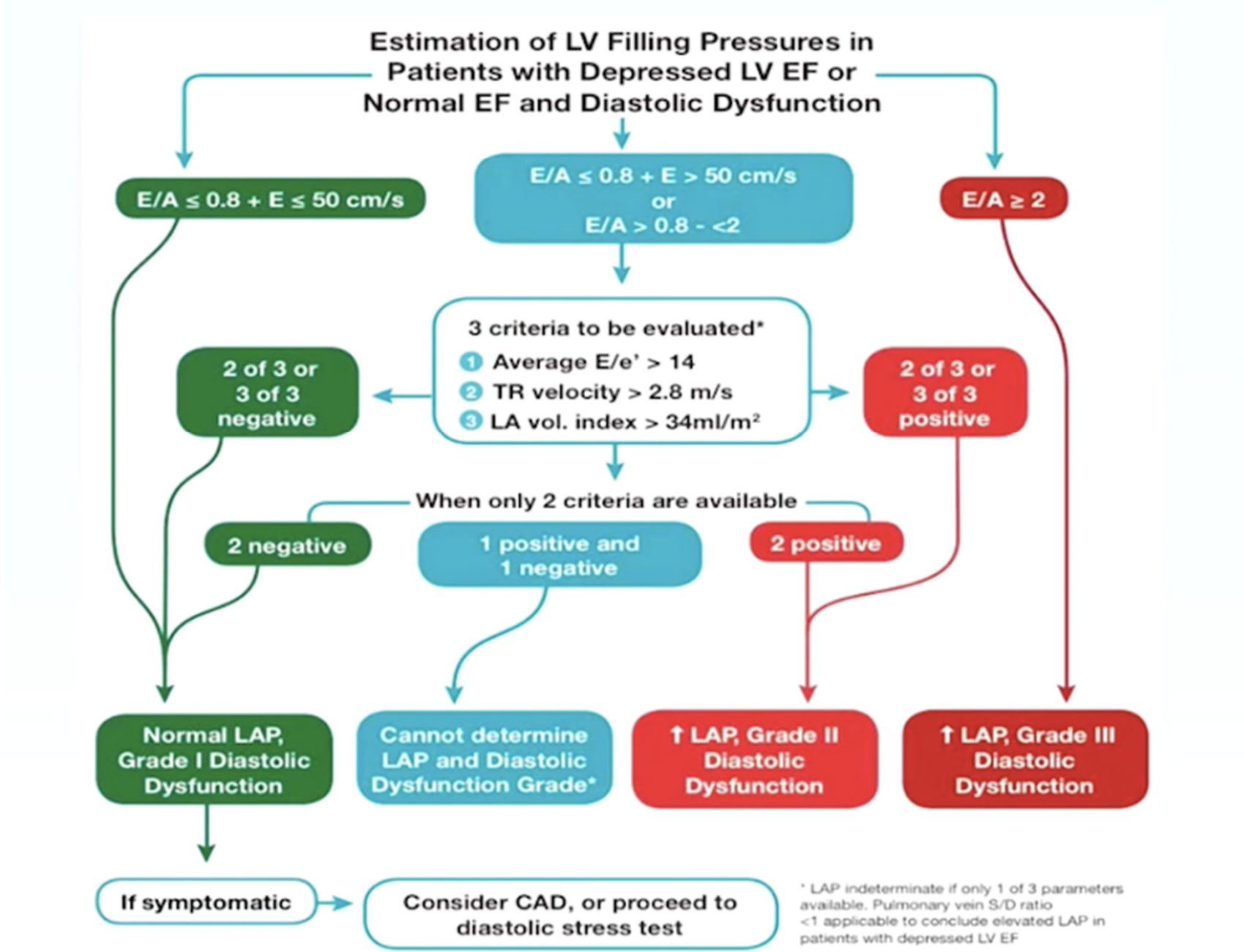
Evaluación función diastólica

- Historia clínica: Edad, enfermedad coronaria, HTA, DM, miocardiopatía (dilatada, hipertrófica, restrictiva), nefropatía, valvulopatía
- Evaluación de la geometría/morfología/función VI (Fracción de eyección del VI, Strain LG), alteraciones de la contractilidad , dilatación de la AI, enfermedad valvular/pericárdica. Función VD, Función AI, PAP

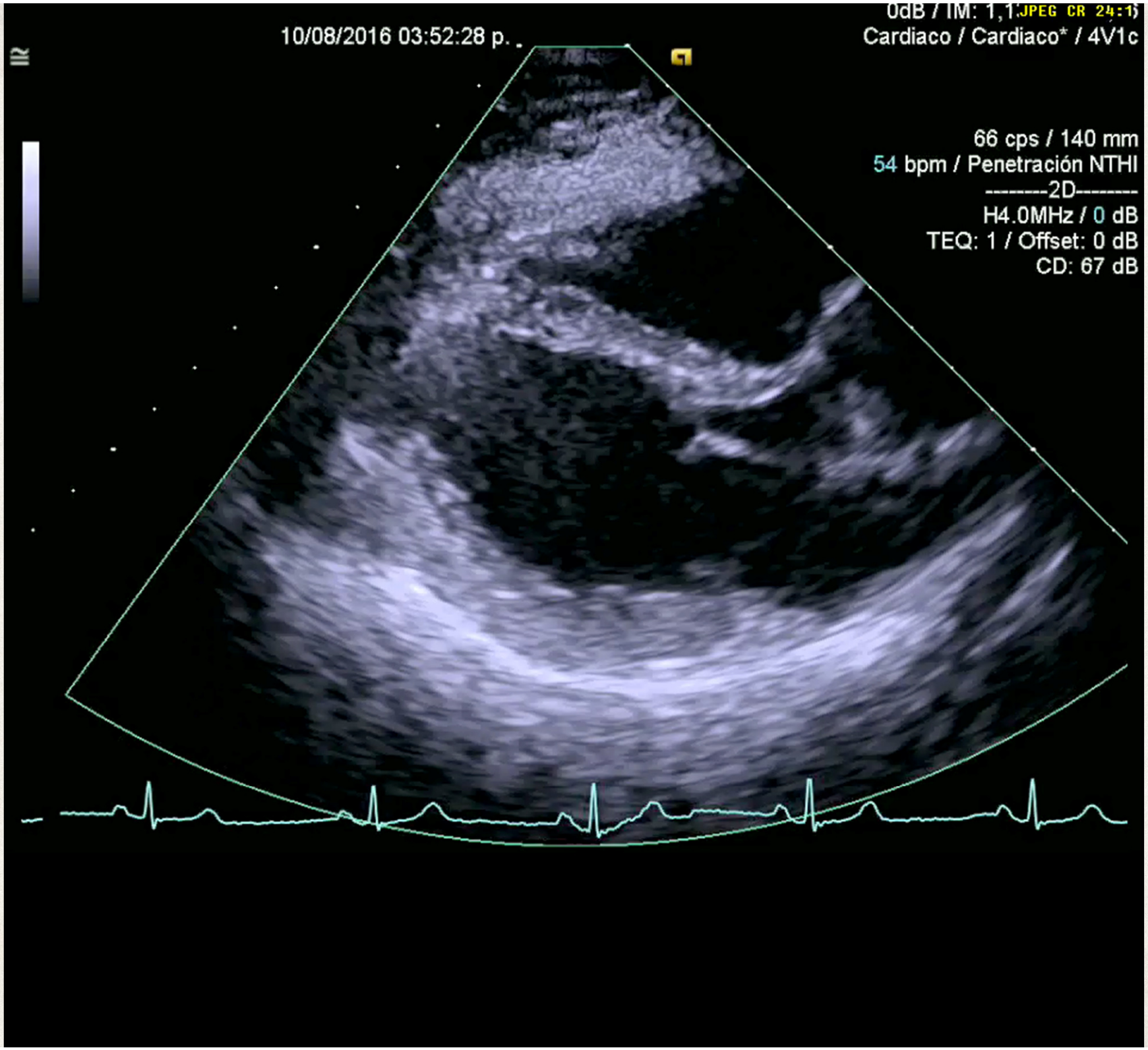
Criteria for Diagnosis of LV Diastolic Dysfunction

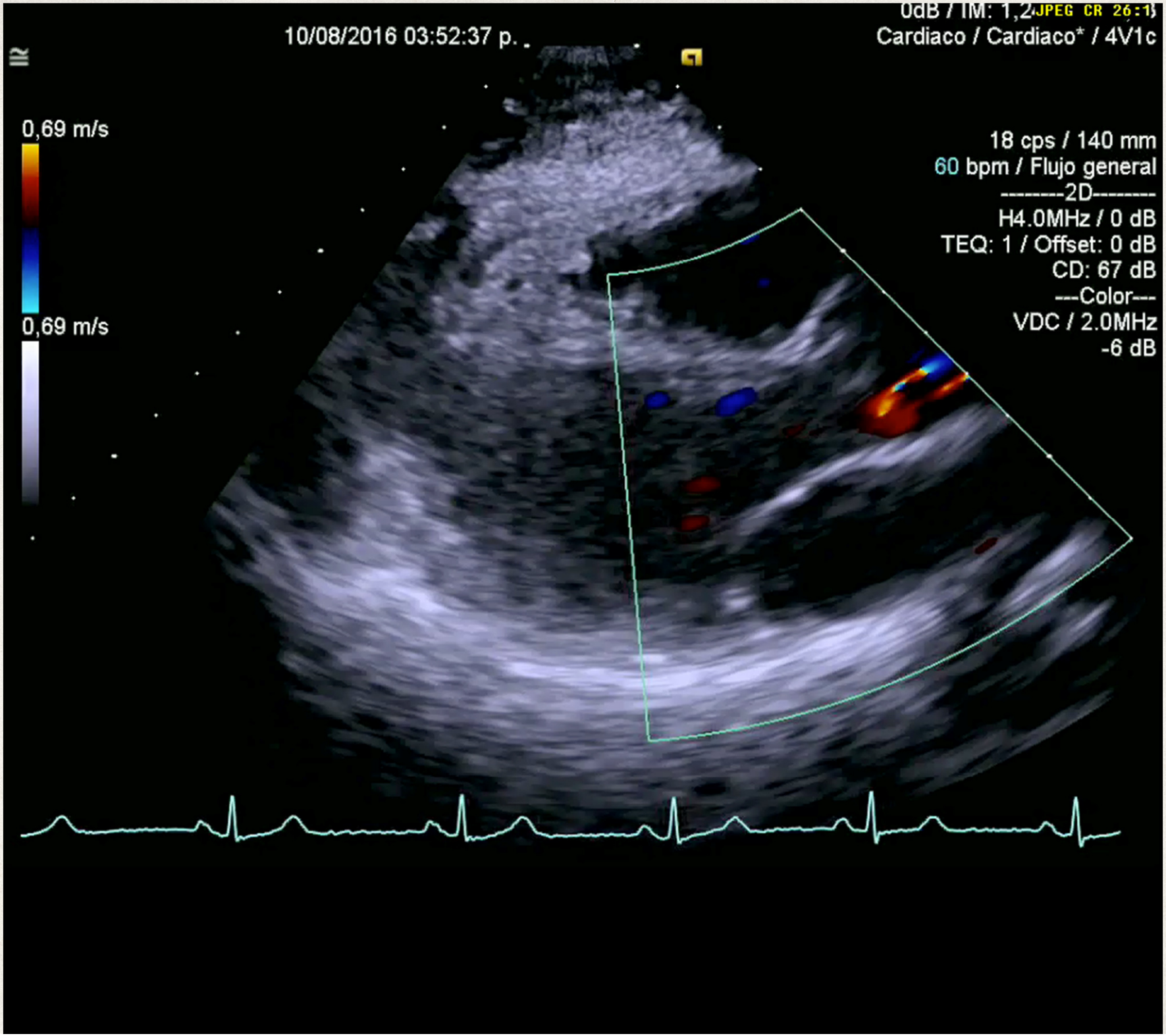


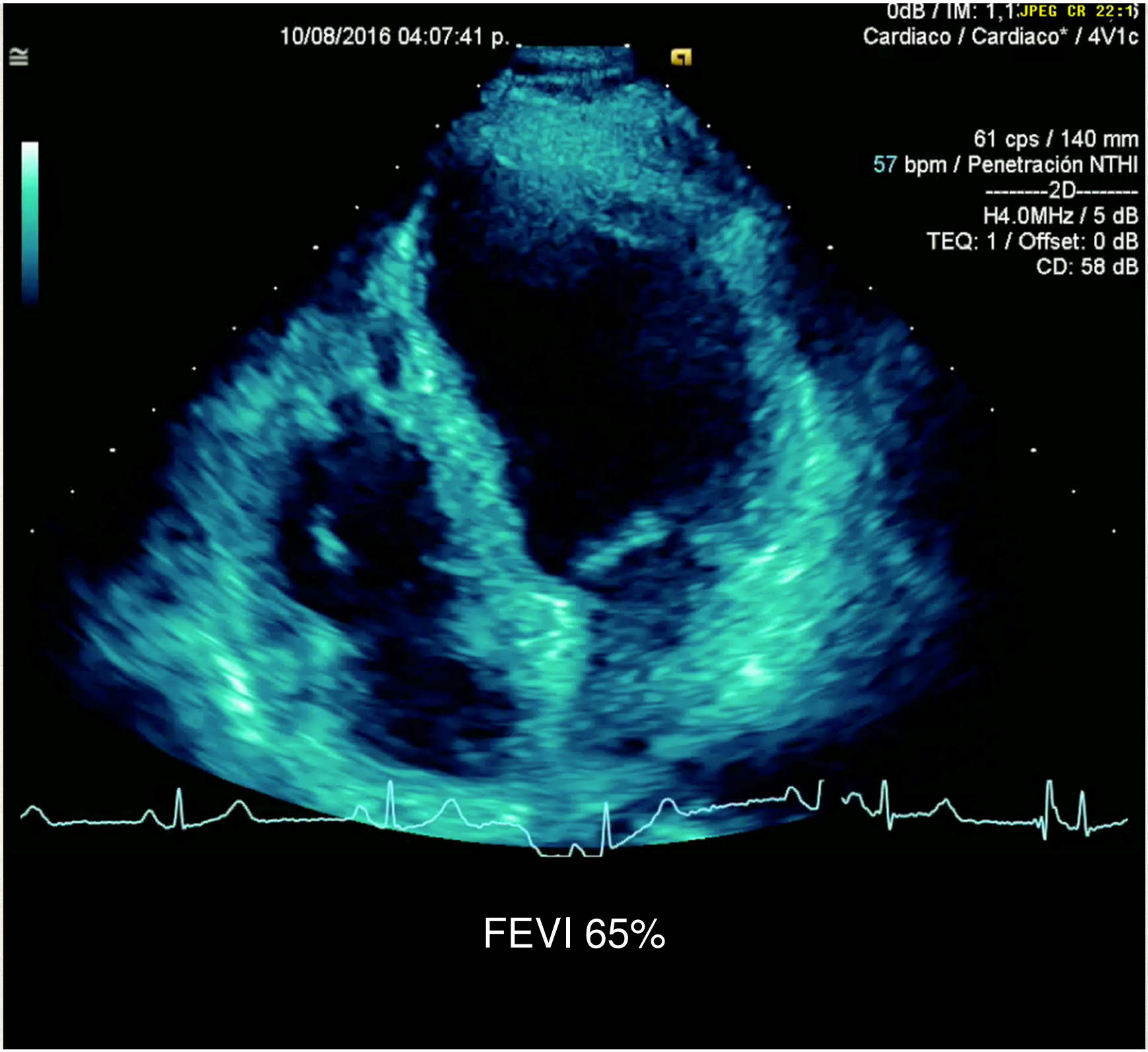
J Am Soc Echocardiogr 2016; 29: 277- 314


Estimation of LV Filling Pressures in Patients with Depressed LV EF or Normal EF and Diastolic Dysfunction
E/A ≤ 0.8 + E ≤ 50 cm/s
E/A ≤ 0.8 + E > 50 cm/s or E/A > 0.8 - <2
E/A ≥ 2
3 criteria to be evaluated*
1 Average E/e' > 14
2 TR velocity > 2.8 m/s
3 LA vol. index > 34ml/m²
2 of 3 or 3 of 3 negative
2 of 3 or 3 of 3 positive
When only 2 criteria are available
2 negative
1 positive and 1 negative
2 positive
Normal LAP, Grade I Diastolic Dysfunction
Cannot determine LAP and Diastolic Dysfunction Grade*
↑ LAP, Grade II Diastolic Dysfunction
↑ LAP, Grade III Diastolic Dysfunction
If symptomatic
Consider CAD, or proceed to diastolic stress test
* LAP indeterminate if only 1 of 3 parameters available. Pulmonary vein S/D ratio <1 applicable to conclude elevated LAP in patients with depressed LV EF

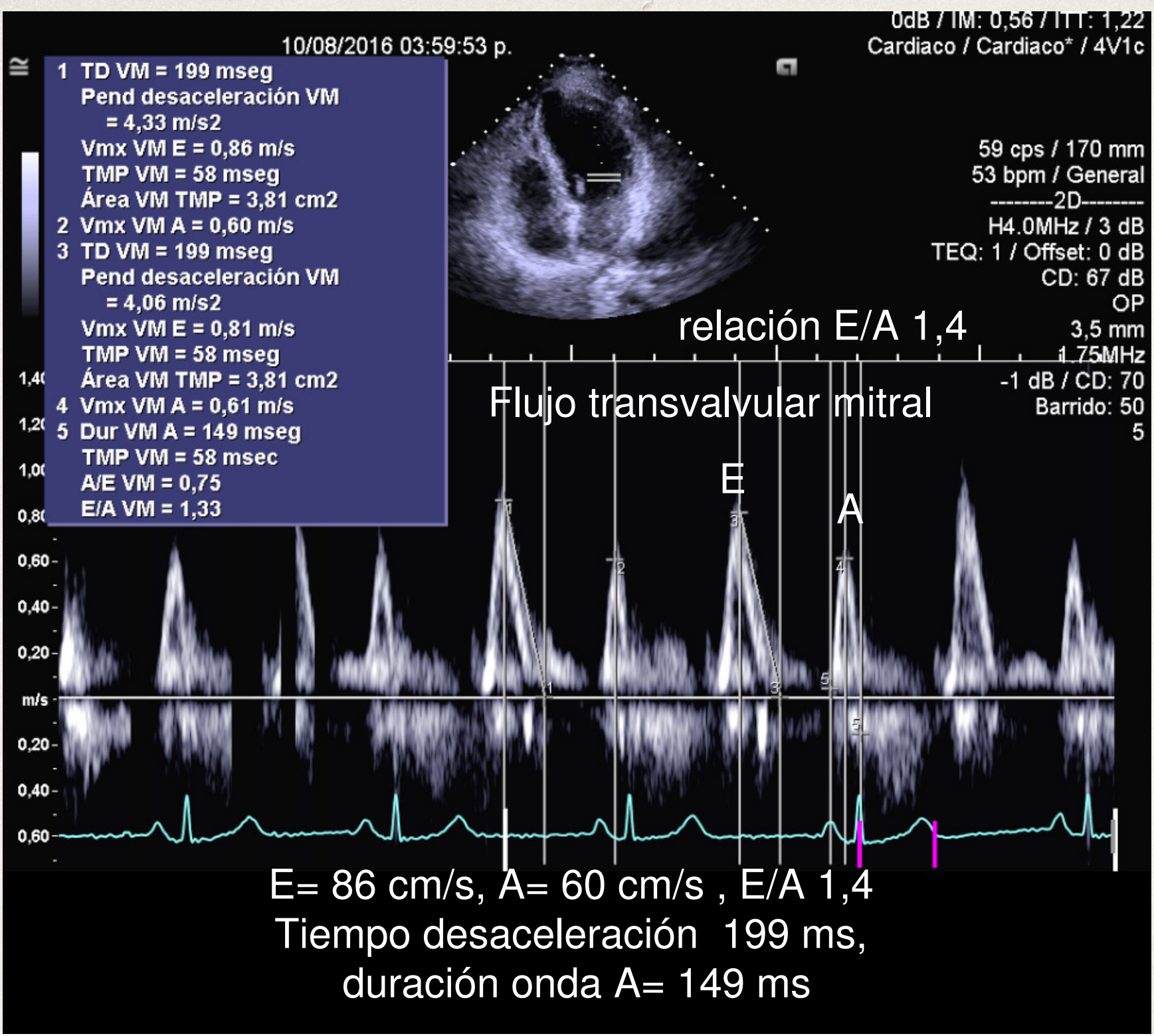
Ejemplo de Función Diastólica Normal

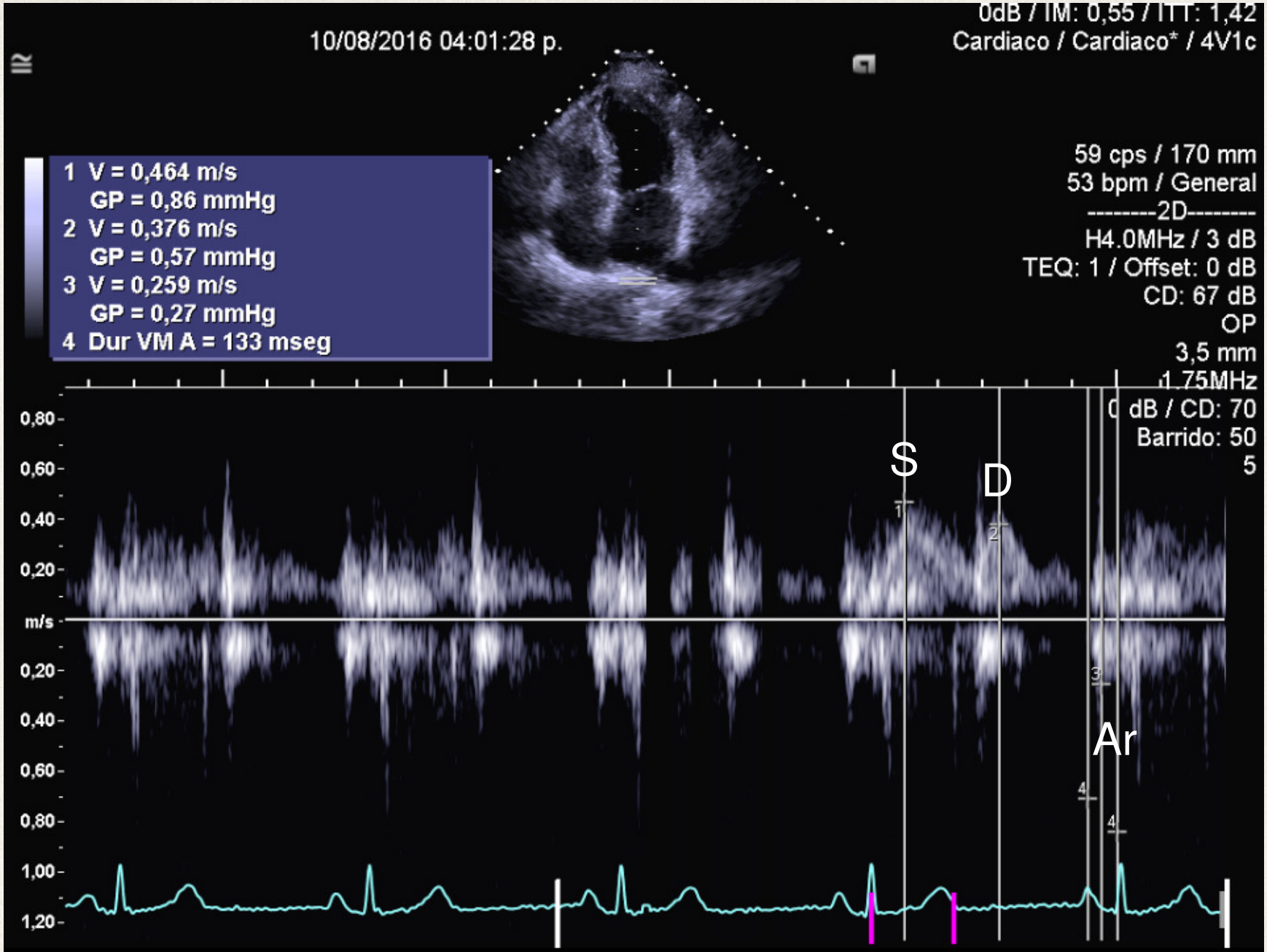

0dB / IM: 1,1
JPEG CR 24:1
10/08/2016 03:52:28 p.
Cardiaco / Cardiaco* / 4V1c
66 cps / 140 mm
54 bpm / Penetración NTHI
--------2D--------
H4.0MHz / 0 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB


0dB / IM: 1,2
JPEG CR 26:1
10/08/2016 03:52:37 p.
Cardiaco / Cardiaco* / 4V1c
0,69 m/s
0,69 m/s
18 cps / 140 mm
60 bpm / Flujo general
--------2D--------
H4.0MHz / 0 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
---Color---
VDC / 2.0MHz
-6 dB


10/08/2016 04:07:41 p.
0dB / IM: 1,1
JPEG CR 22:1
Cardiaco / Cardiaco* / 4V1c
61 cps / 140 mm
57 bpm / Penetración NTHI
--------2D--------
H4.0MHz / 5 dB
TEQ: 1 / Offset: 0 dB
CD: 58 dB

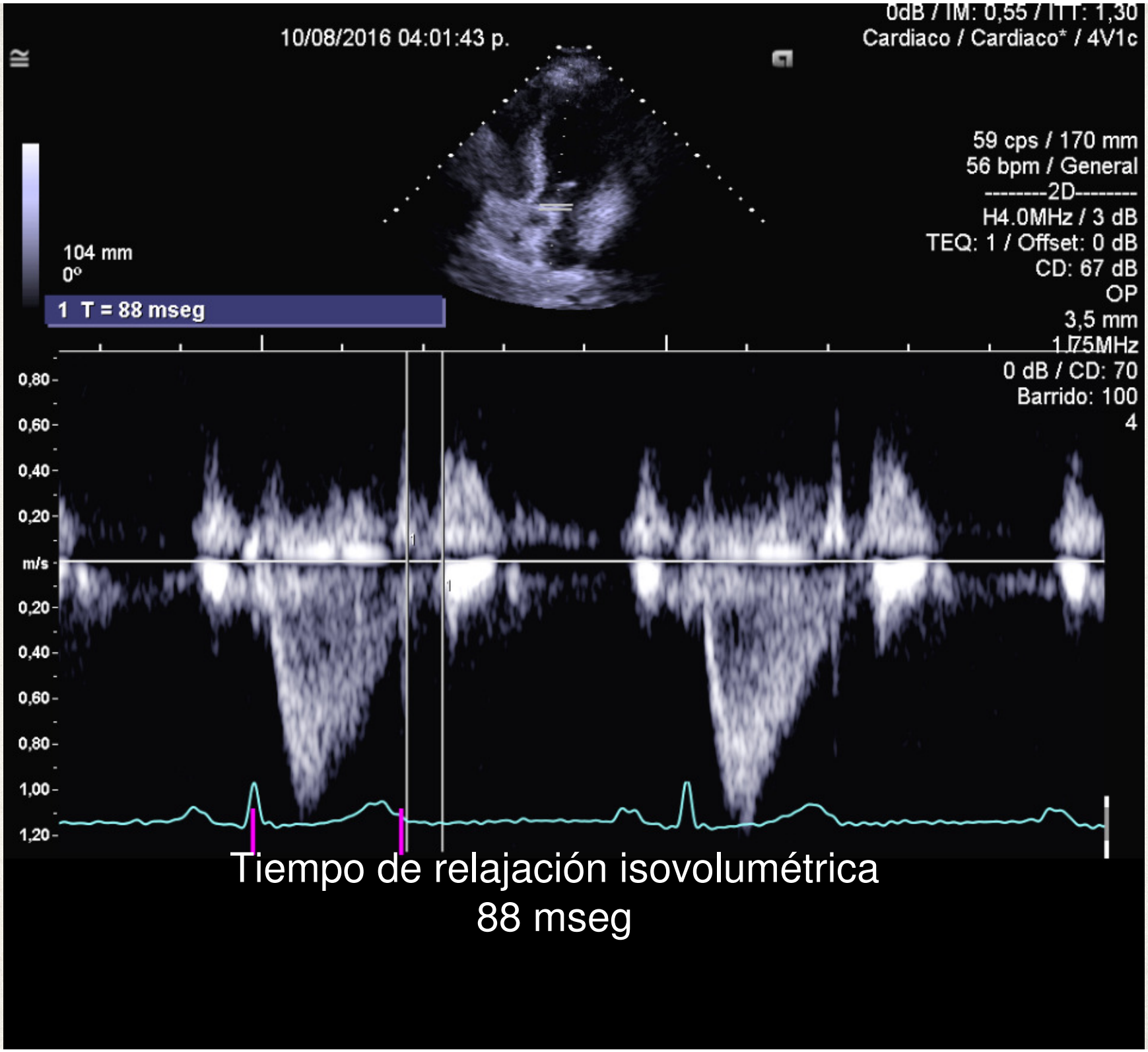
FEVI 65%


0dB / IM: 0,56 / ITT: 1,22
Cardiaco / Cardiaco* / 4V1c
10/08/2016 03:59:53 p.
1 TD VM = 199 mseg
Pend desaceleración VM
= 4,33 m/s2
Vmx VM E = 0,86 m/s
TMP VM = 58 mseg
Área VM TMP = 3,81 cm2
2 Vmx VM A = 0,60 m/s
3 TD VM = 199 mseg
Pend desaceleración VM
= 4,06 m/s2
Vmx VM E = 0,81 m/s
TMP VM = 58 mseg
Área VM TMP = 3,81 cm2
4 Vmx VM A = 0,61 m/s
5 Dur VM A = 149 mseg
TMP VM = 58 msec
A/E VM = 0,75
E/A VM = 1,33
59 cps / 170 mm
53 bpm / General
--------2D--------
H4.0MHz / 3 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
OP
3,5 mm
1.75MHz
-1 dB / CD: 70
Barrido: 50
5
relación E/A 1,4
Flujo transvalvular mitral
E
A
0,60
0,40
0,20
m/s
0,20
0,40
0,60
E= 86 cm/s, A= 60 cm/s , E/A 1,4
Tiempo desaceleración 199 ms,
duración onda A= 149 ms

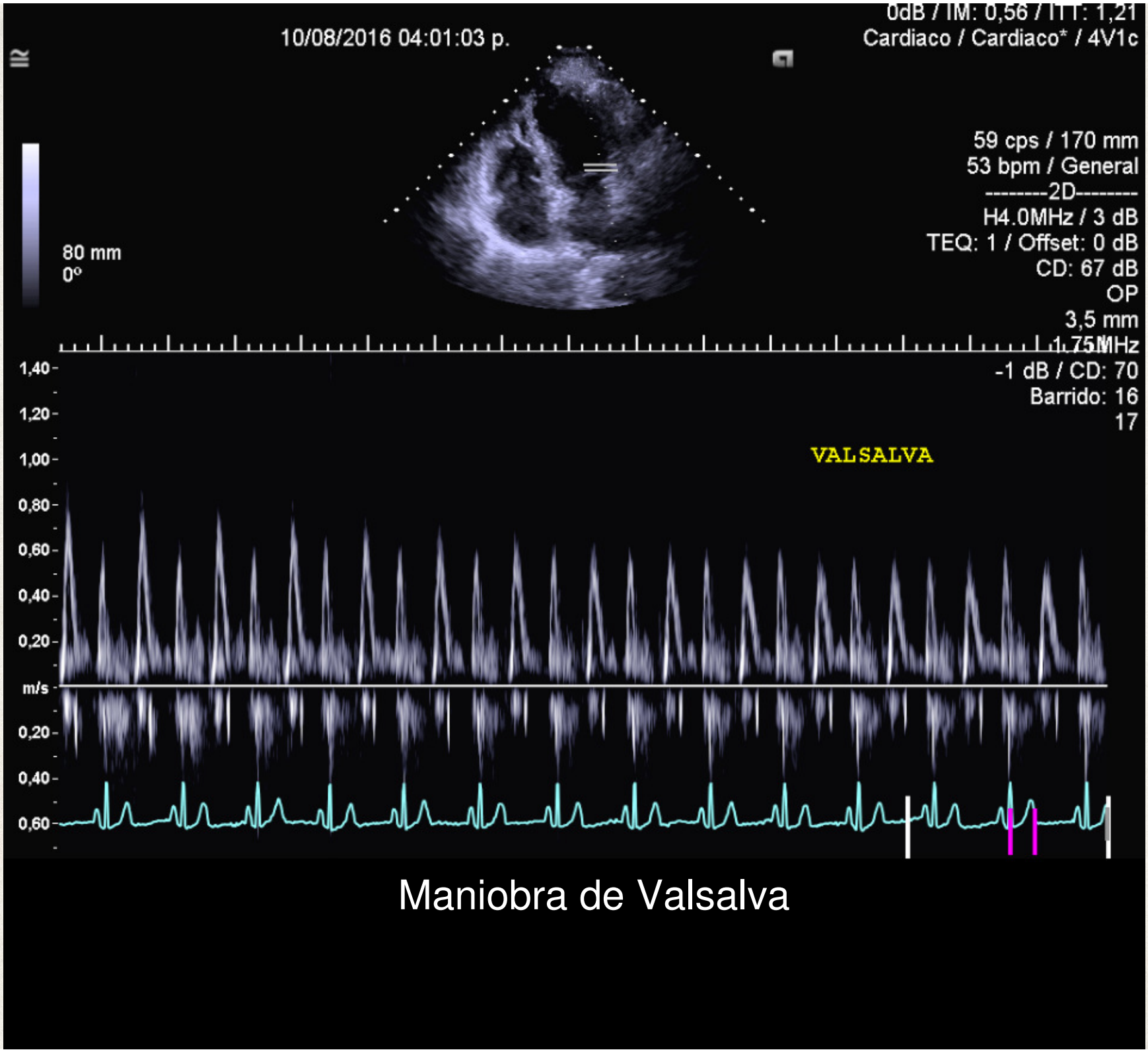


Flujo vena pulmonar

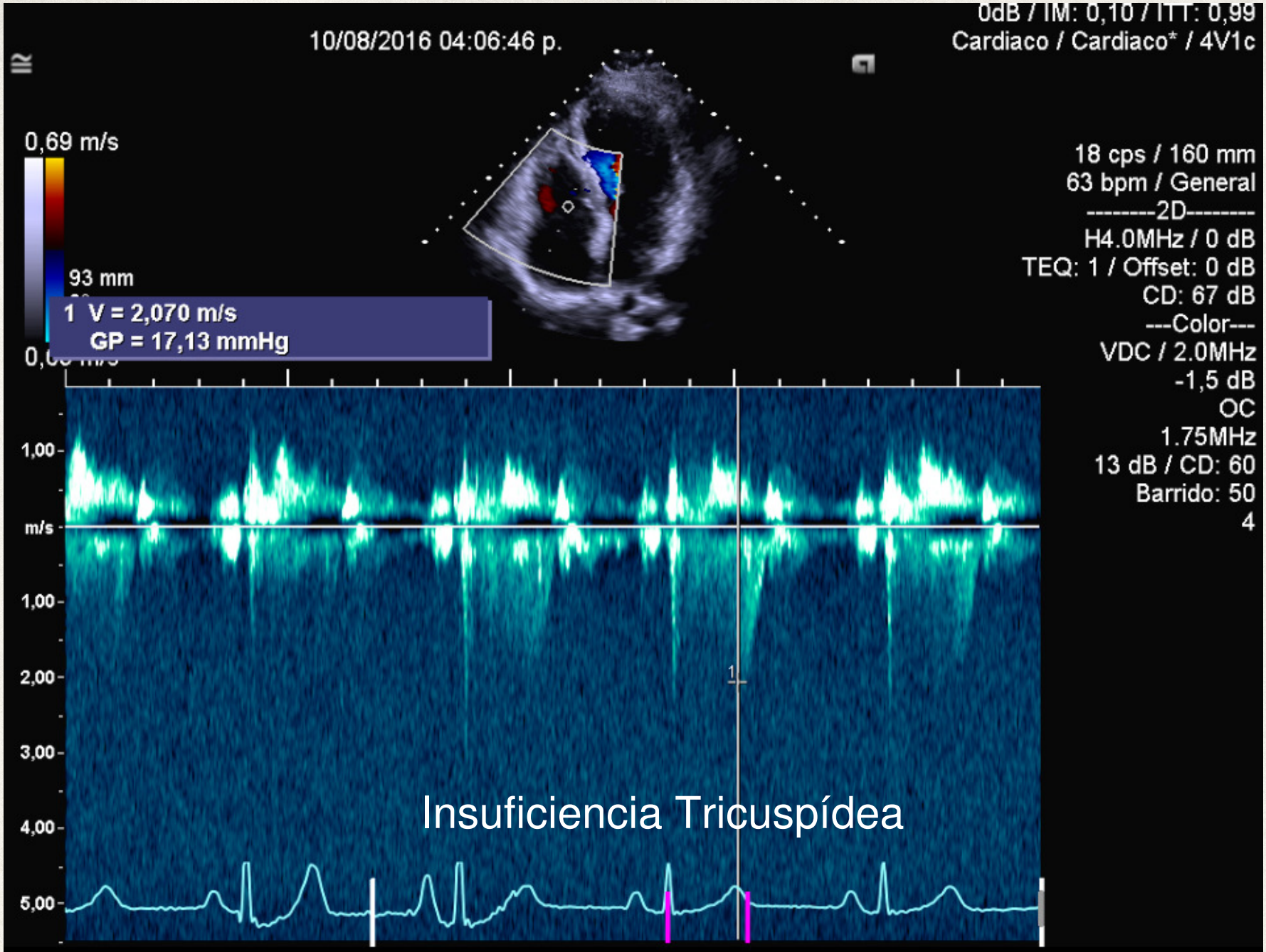
Velocidad S, velocidad D, duración Ar



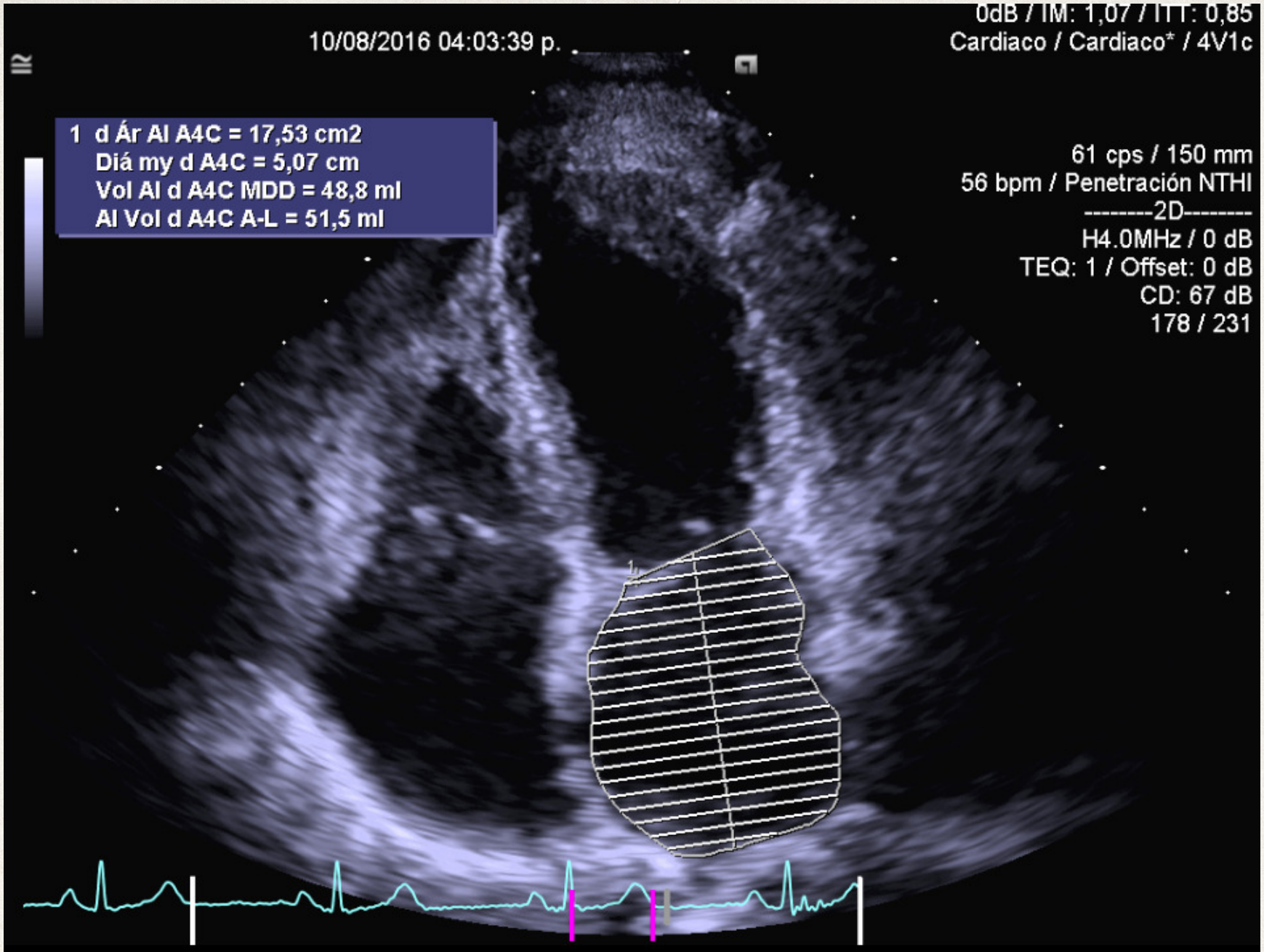
Tiempo de relajación isovolumétrica
88 mseg



Maniobra de Valsalva

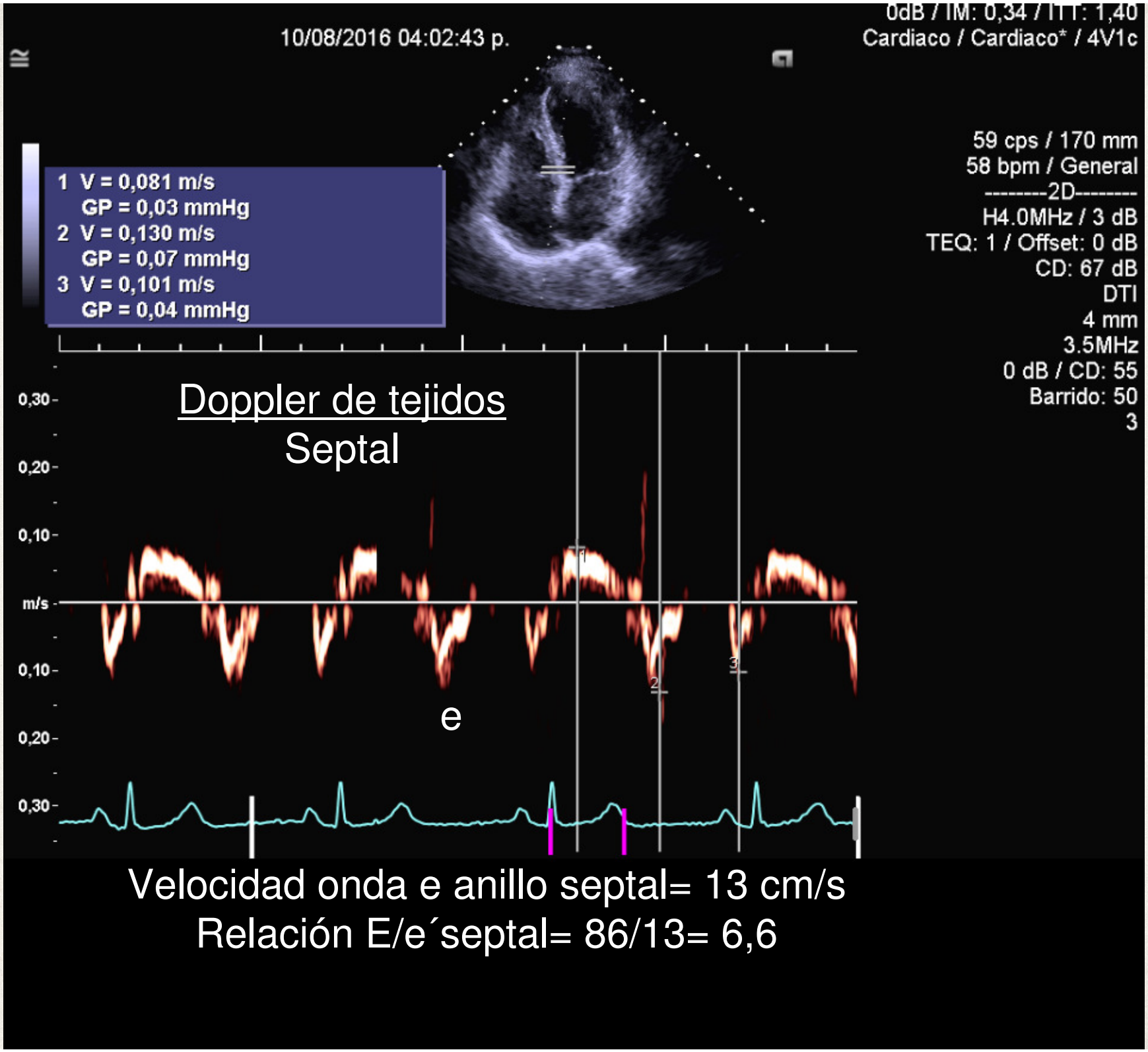


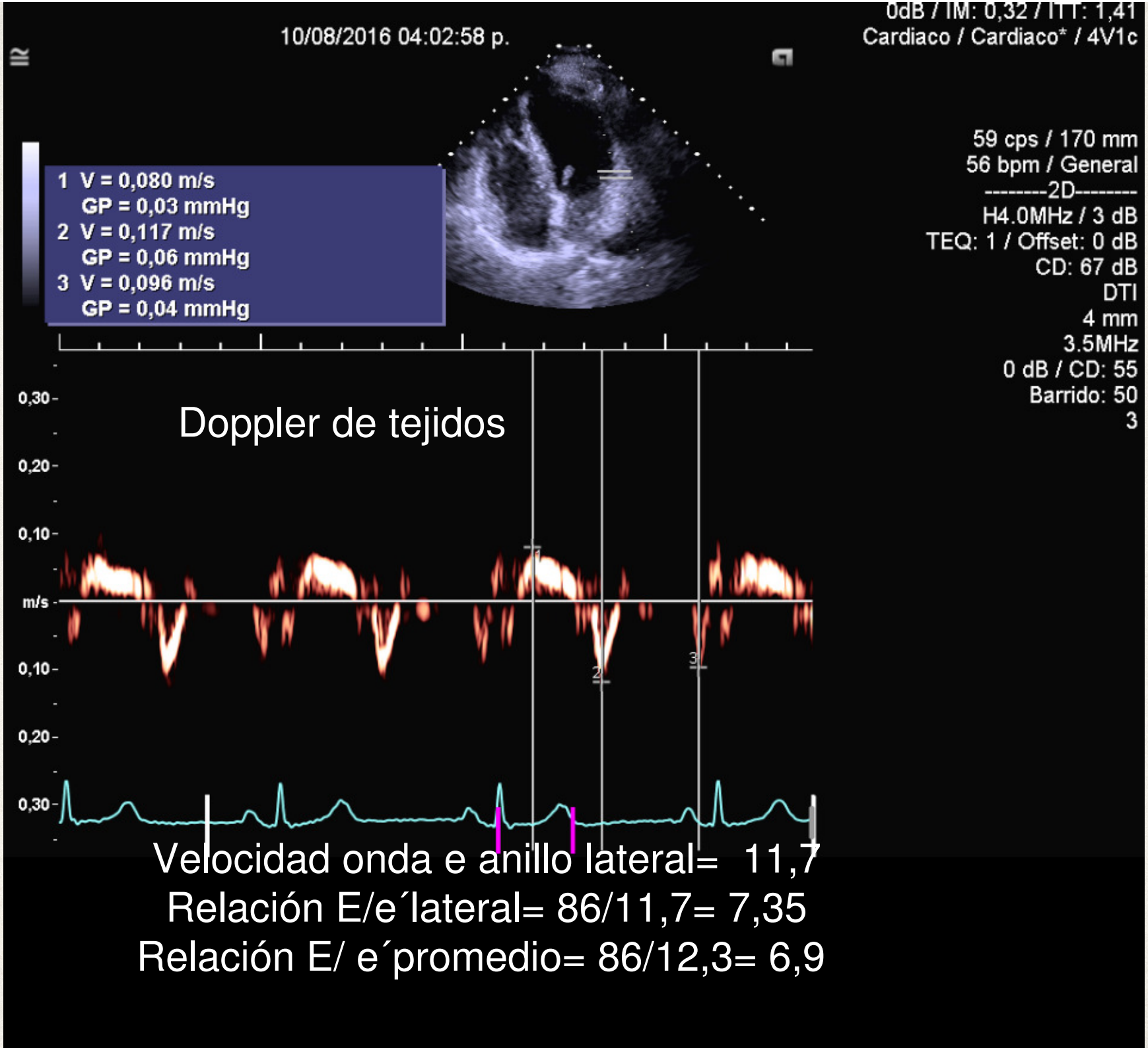
Velocidad regurgitación tricuspídea
2 m/s (17,13 mmHg)



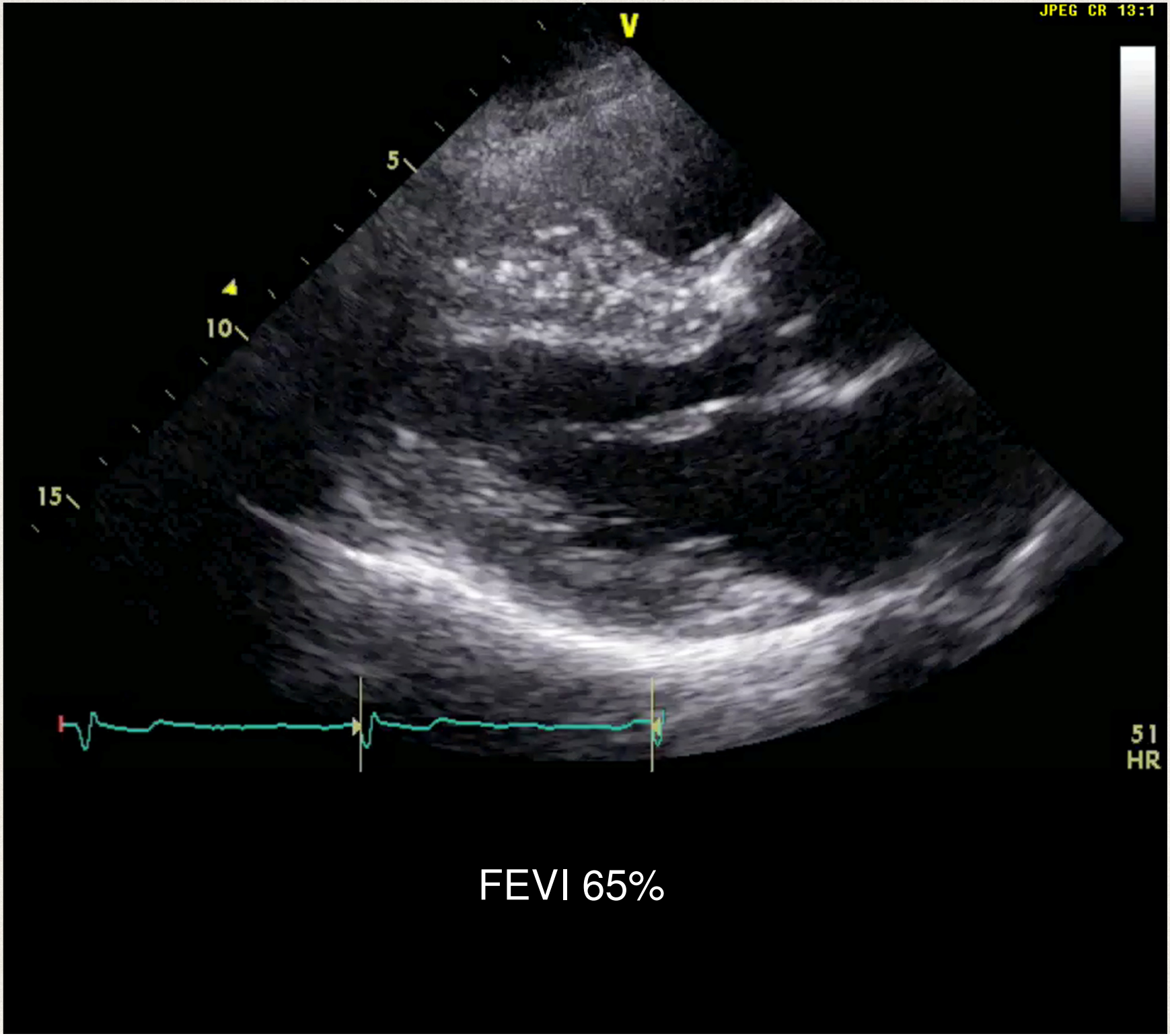
Volumen Aurícula Izquierda 4c y 2c

Indice Volumen AI: 31 mL/m^2

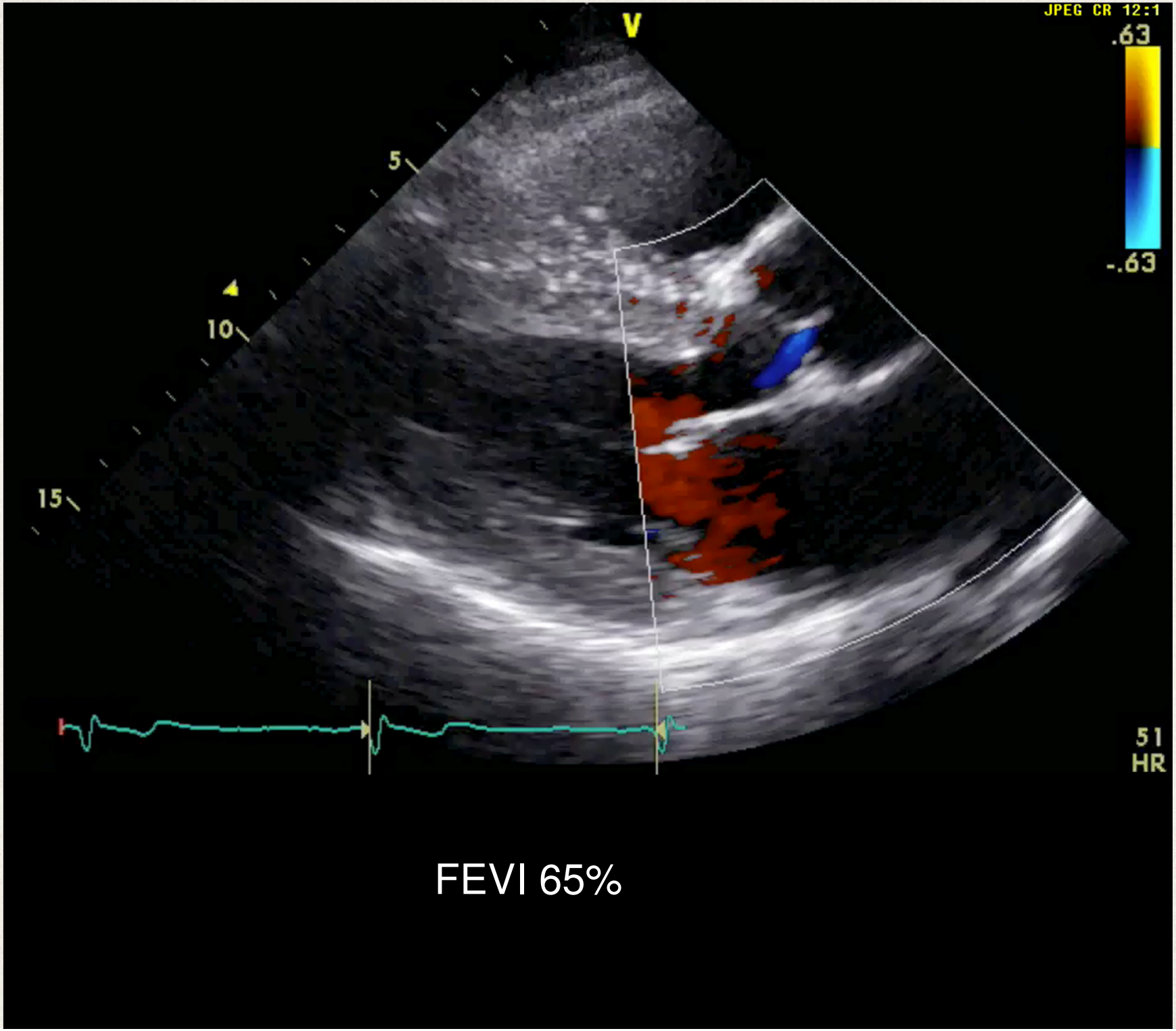

10/08/2016 04:02:43 p.
0dB / IM: 0,34 / TIT: 1,40
Cardiaco / Cardiaco* / 4V1c
1 V = 0,081 m/s
GP = 0,03 mmHg
2 V = 0,130 m/s
GP = 0,07 mmHg
3 V = 0,101 m/s
GP = 0,04 mmHg
59 cps / 170 mm
58 bpm / General
--------2D--------
H4.0MHz / 3 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
DTI
4 mm
3.5MHz
0 dB / CD: 55
Barrido: 50
3
Doppler de tejidos
Septal
0,30
0,20
0,10
m/s
0,10
0,20
0,30
e
Velocidad onda e anillo septal= 13 cm/s
Relación E/e´septal= 86/13= 6,6


10/08/2016 04:02:58 p.
0dB / IM: 0,32 / TIT: 1,41
Cardiaco / Cardiaco* / 4V1c
1 V = 0,080 m/s
GP = 0,03 mmHg
2 V = 0,117 m/s
GP = 0,06 mmHg
3 V = 0,096 m/s
GP = 0,04 mmHg
59 cps / 170 mm
56 bpm / General
--------2D--------
H4.0MHz / 3 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
DTI
4 mm
3.5MHz
0 dB / CD: 55
Barrido: 50
3
Doppler de tejidos
0,30
0,20
0,10
m/s
0,10
0,20
0,30
Velocidad onda e anillo lateral= 11,7
Relación E/e´lateral= 86/11,7= 7,35
Relación E/ e´promedio= 86/12,3= 6,9

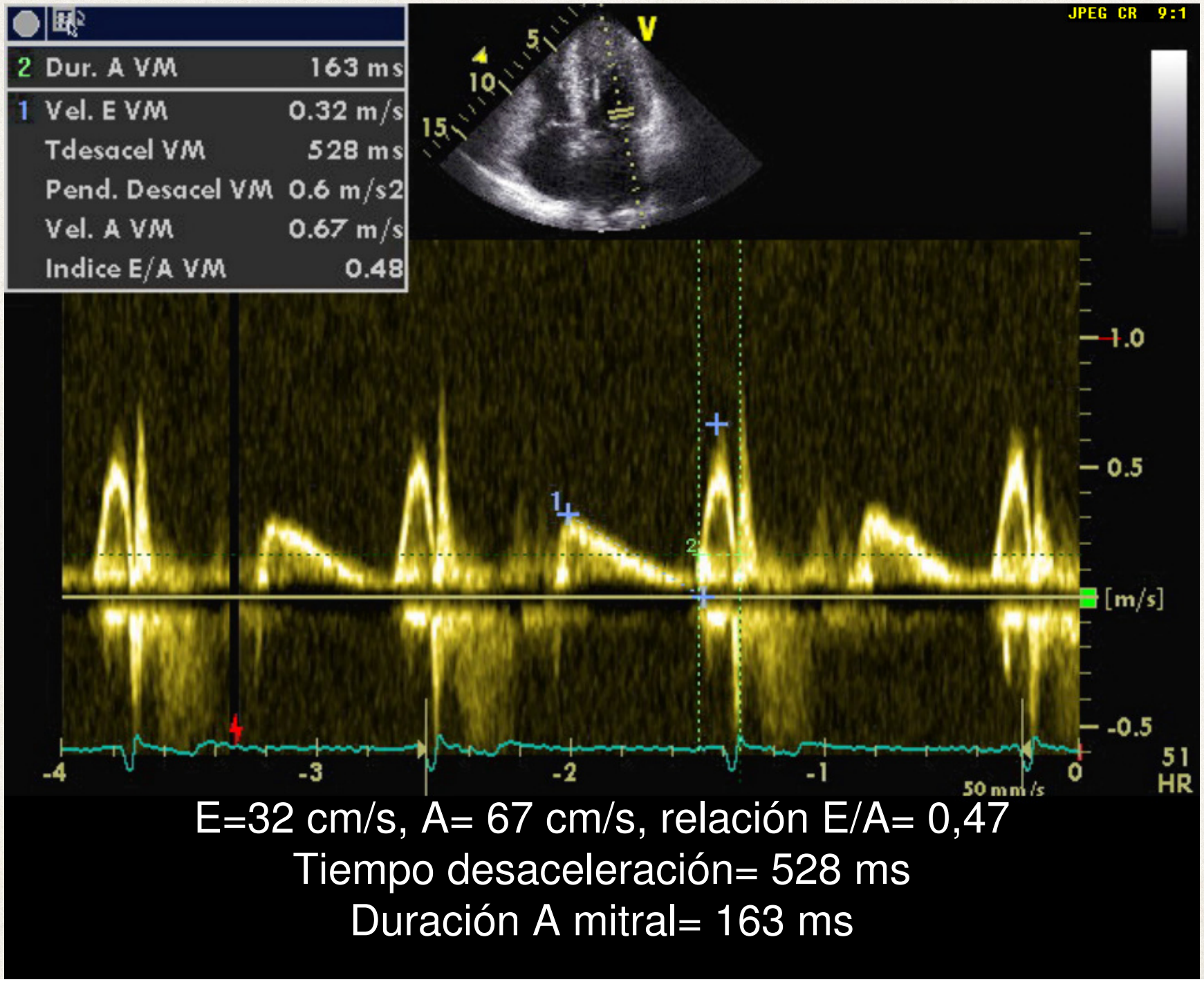
Caso clínico N. 1
(Trastorno de la relajación, Presión AI normal, DD grado I)



FEVI 65%



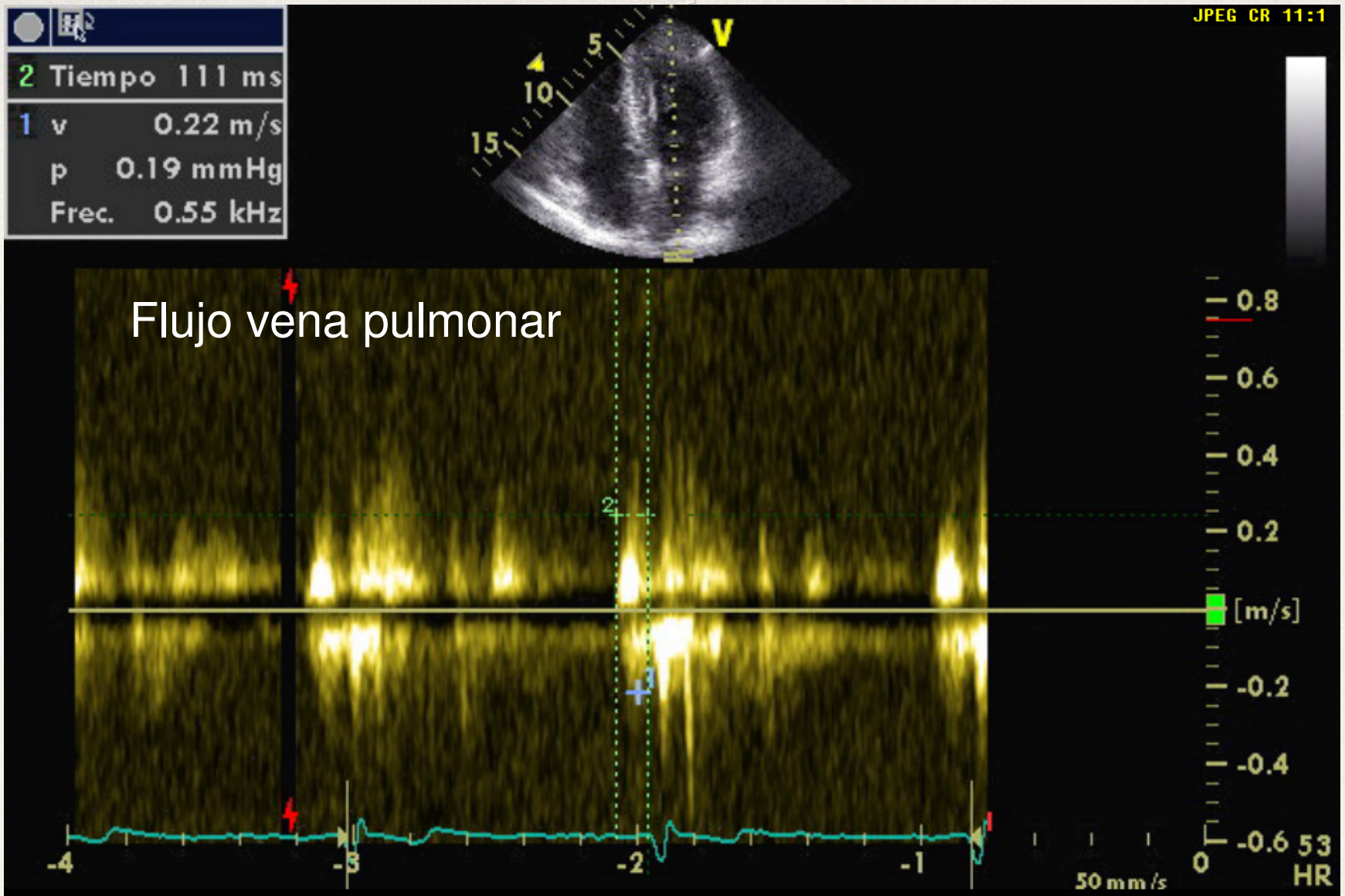
FEVI 65%



E=32 cm/s, A= 67 cm/s, relación E/A= 0,47

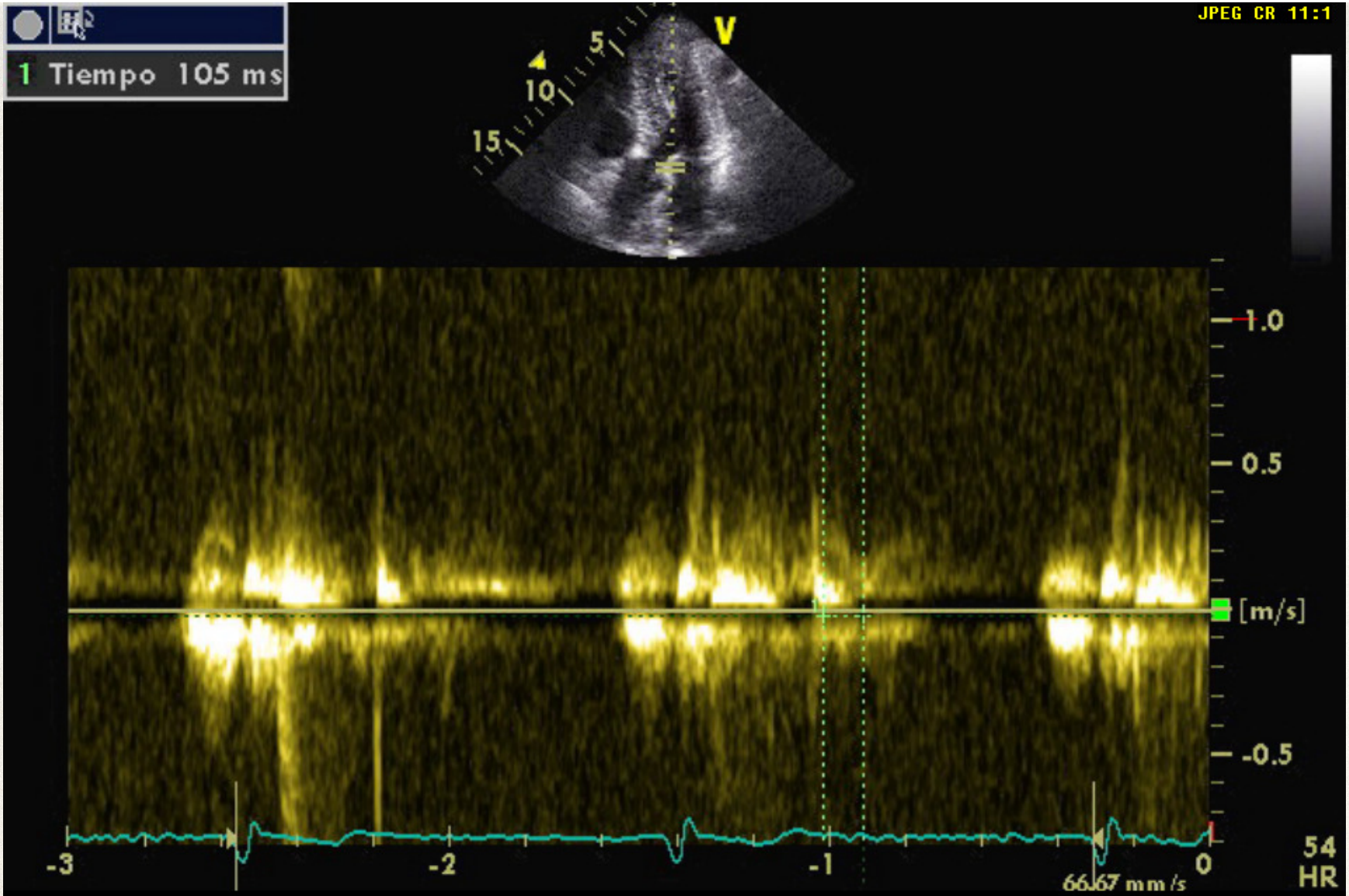
Tiempo desaceleración= 528 ms

Duración A mitral= 163 ms

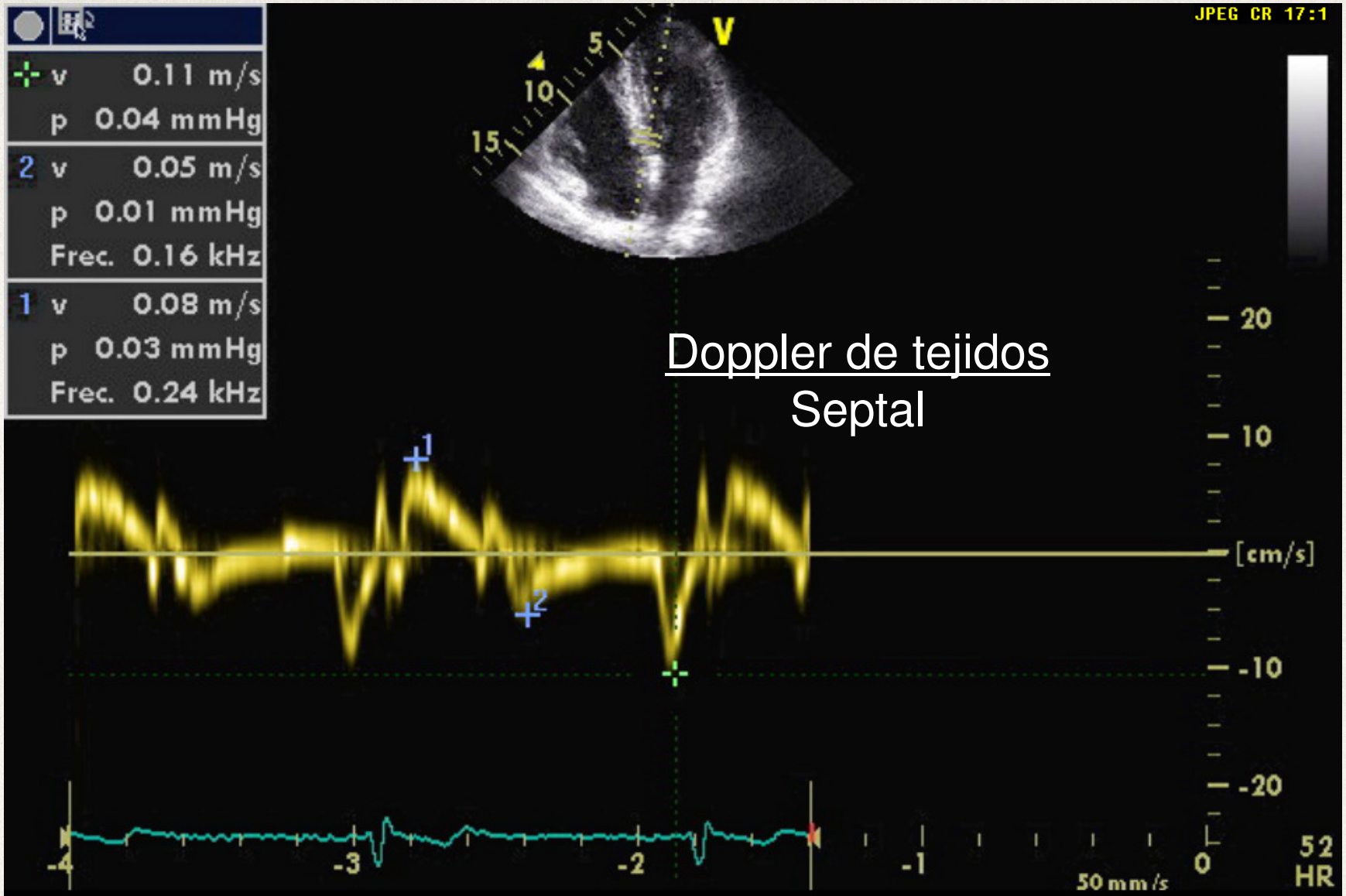


Duración onda a retrógrada 111 ms

Duración onda A mitral 163 ms



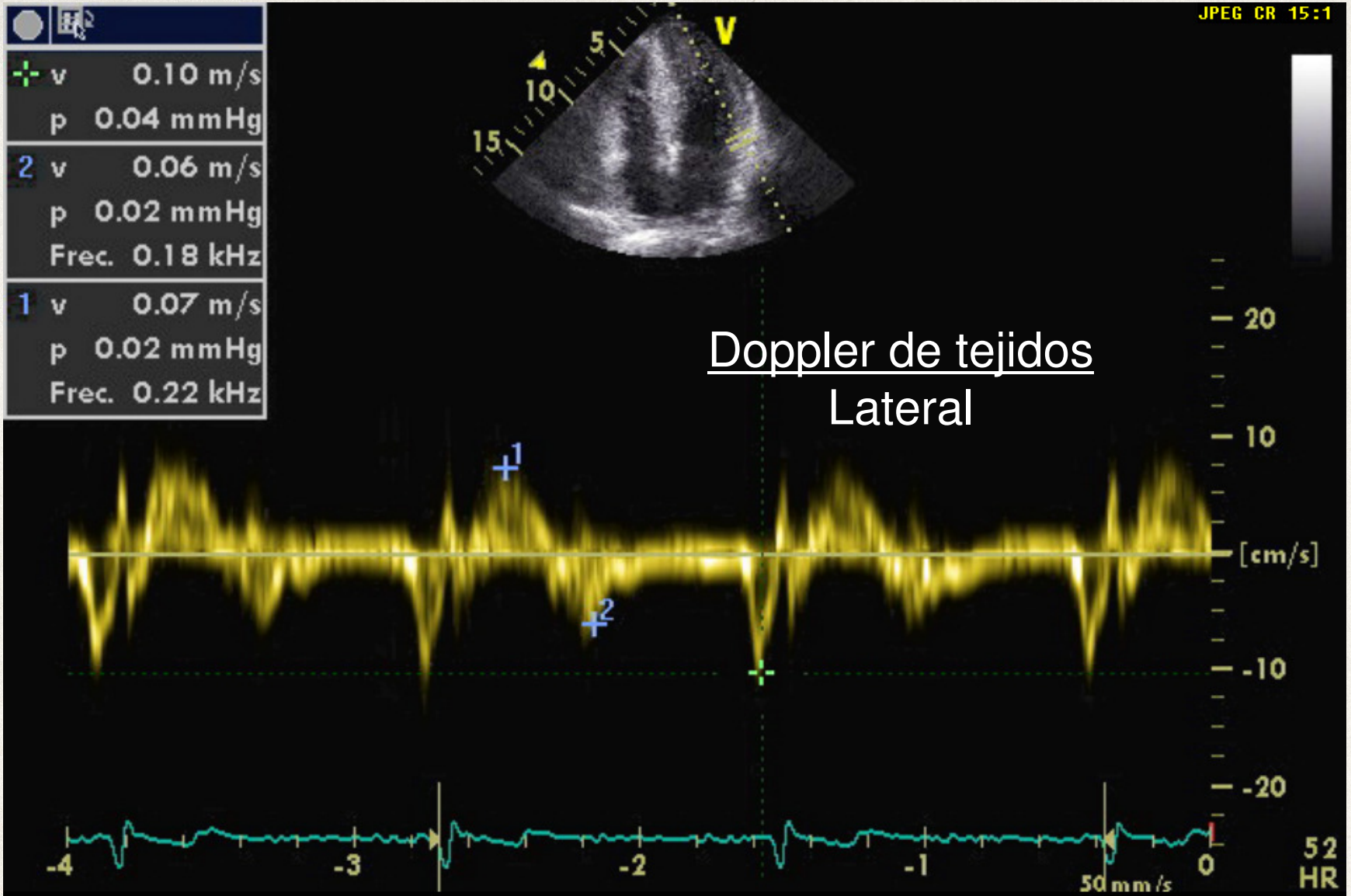
Tiempo de relajación isovolumétrica = 105 ms



e´septal= 5 cm/s

E= 32 cm/s

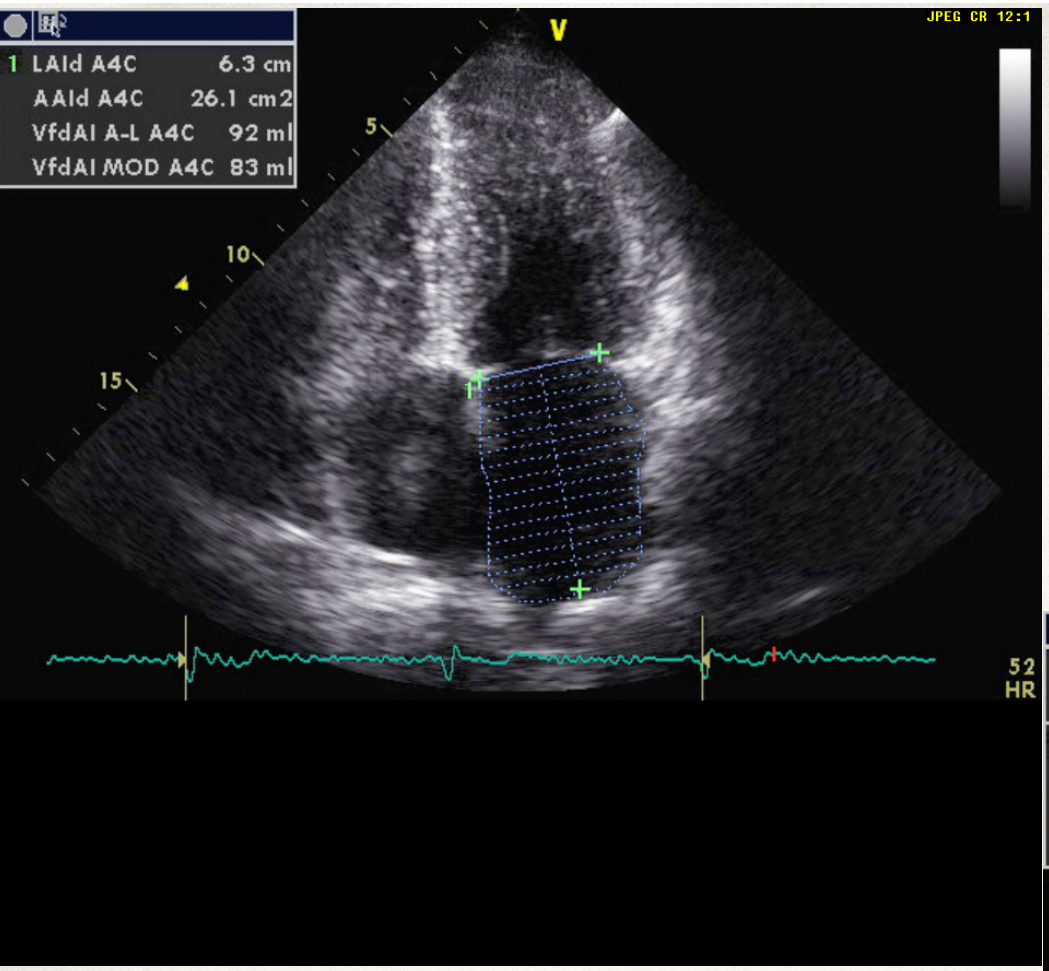
Relación E/e´septal= 32/5= 6,4

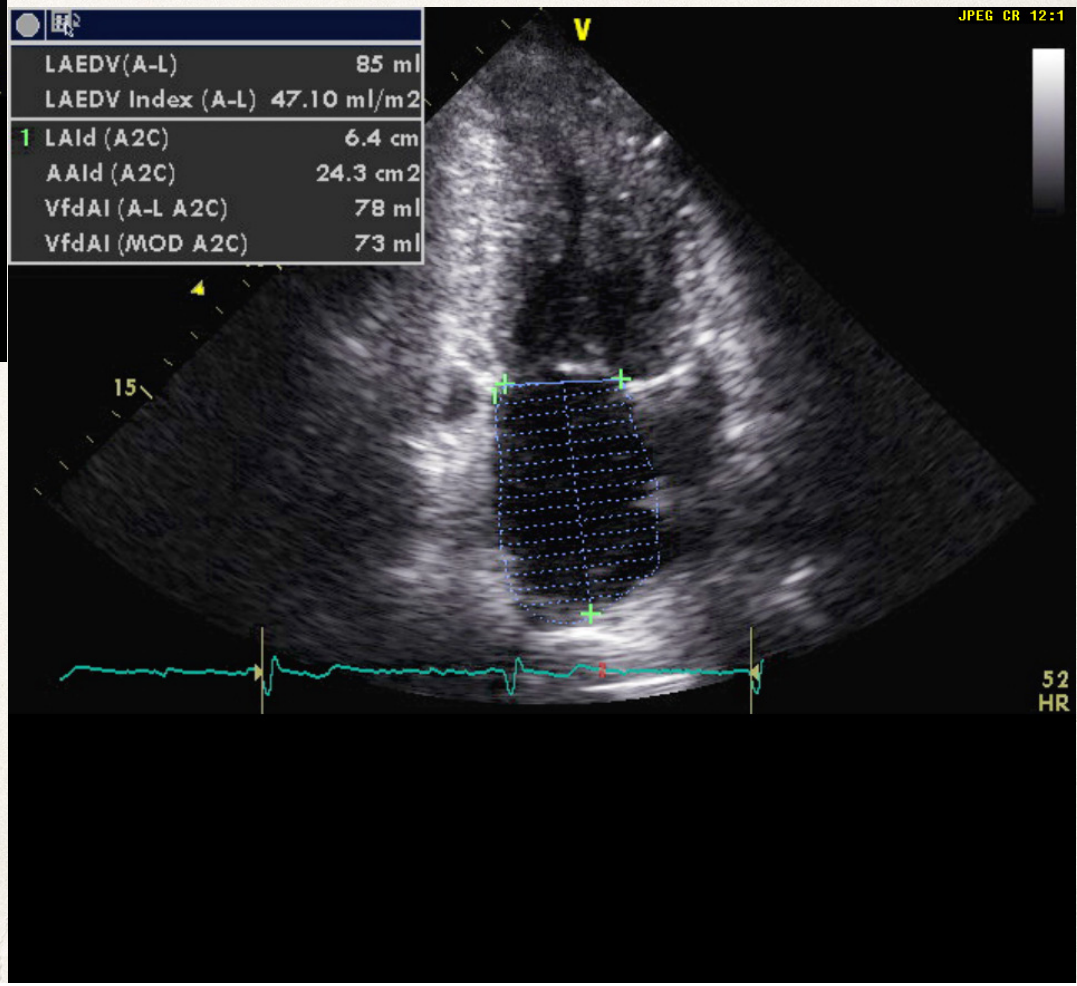


e´lateral= 6 cm/s

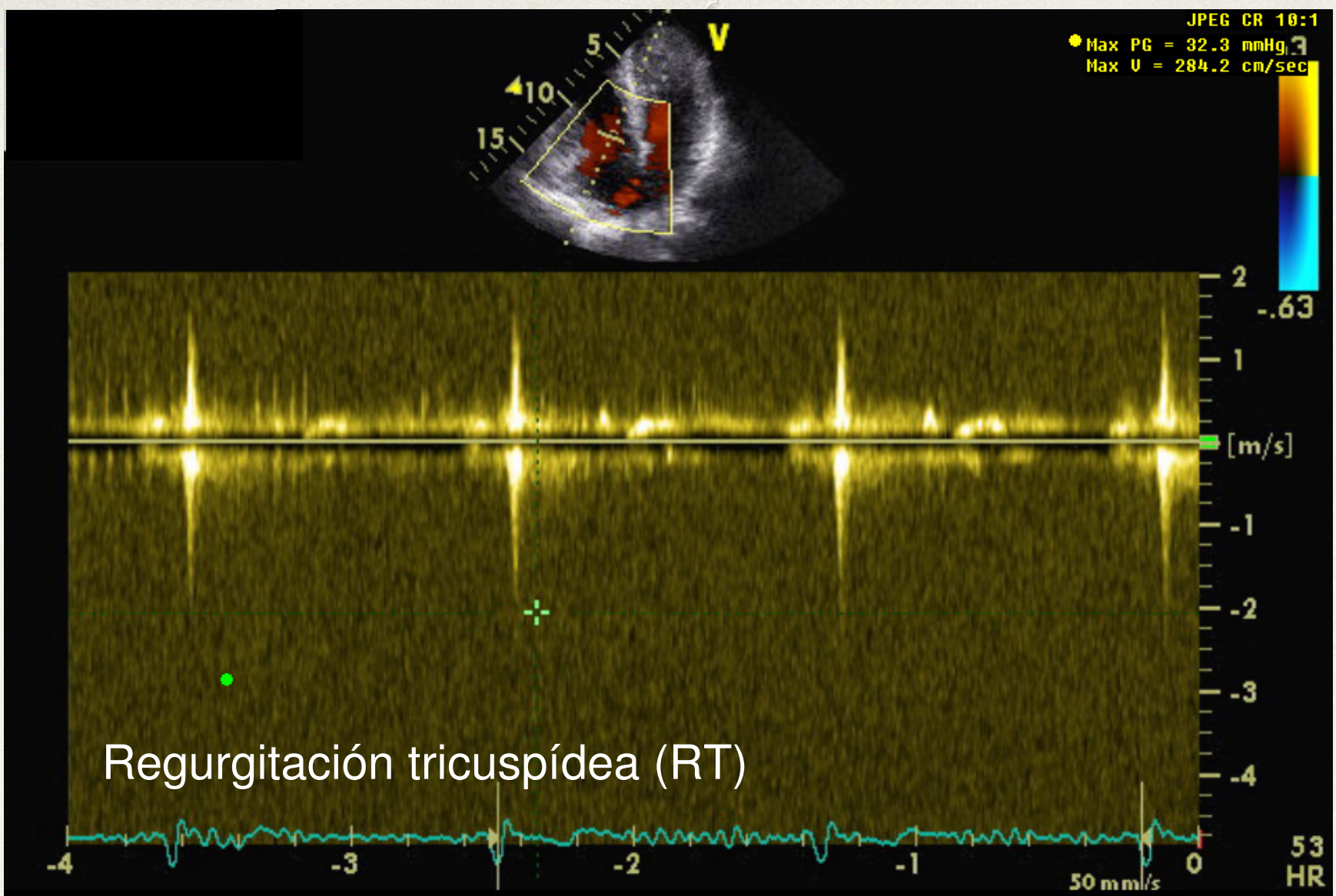
Relación E/e´ lateral= 32/6= 5,3

Relación E/e´promedio= 32/5,5=5,8





Indice volumen AI = 47 mL/m^2

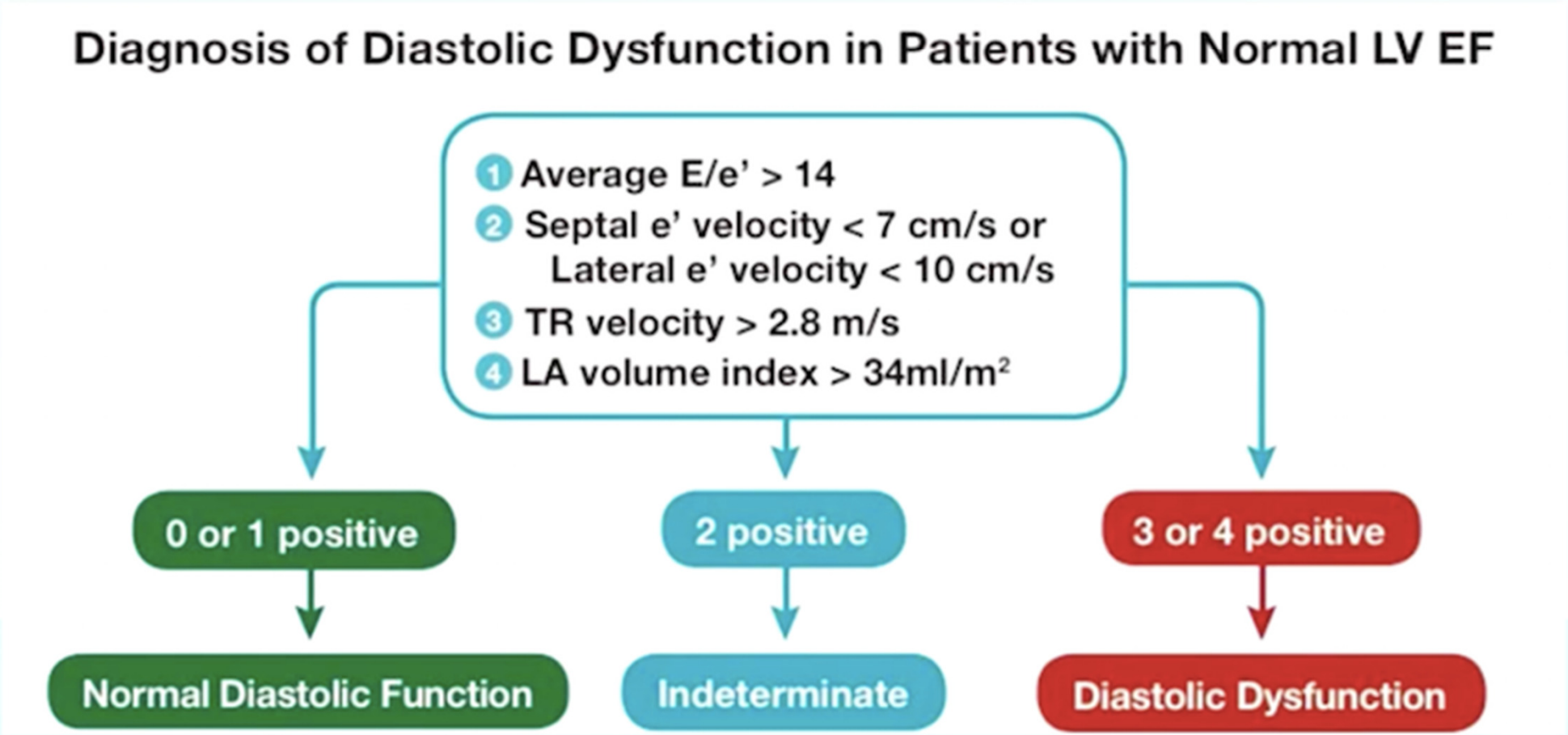


Regurgitación tricuspídea (RT)

Velocidad RT: 2.9 m/s (33 mmHg)

Criteria for Diagnosis of LV Diastolic Dysfunction

Caso clínico 1 (Presión AI normal, DD grado I)



average E/e´= 5,8
septal e´ velocity= 5
lateral e´velocity= 6
TR velocity= 2,9
LA volume index= 47

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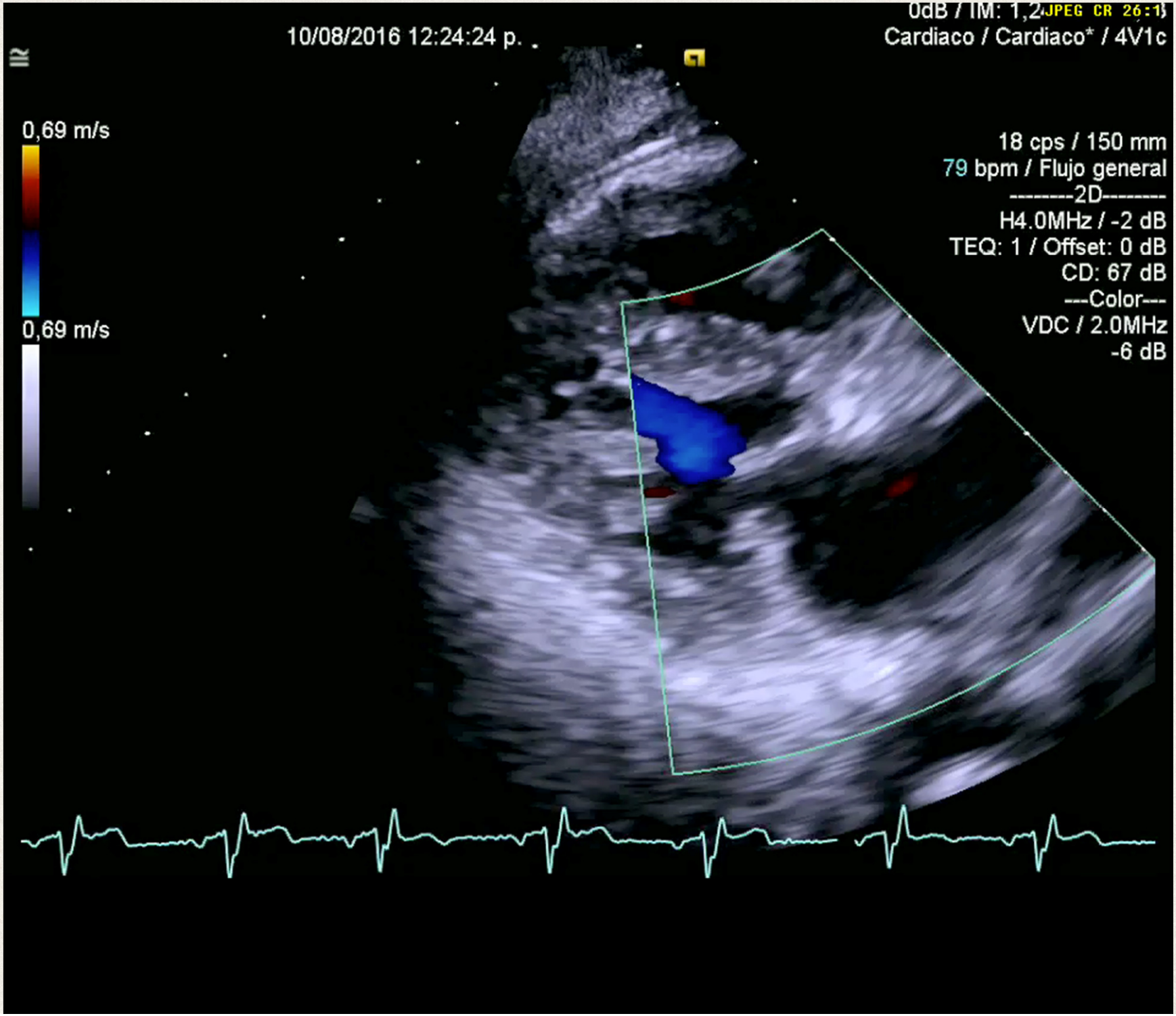
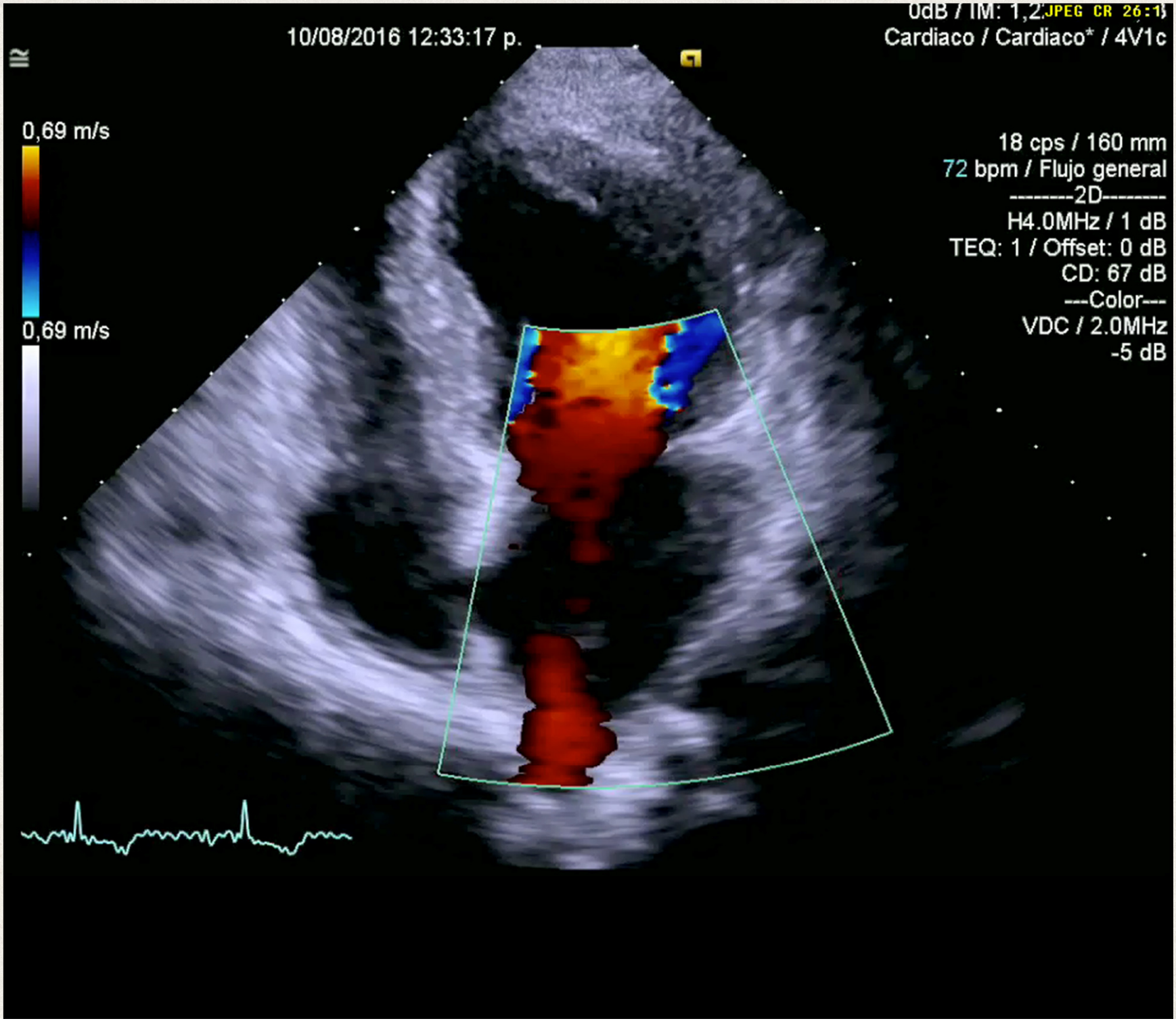
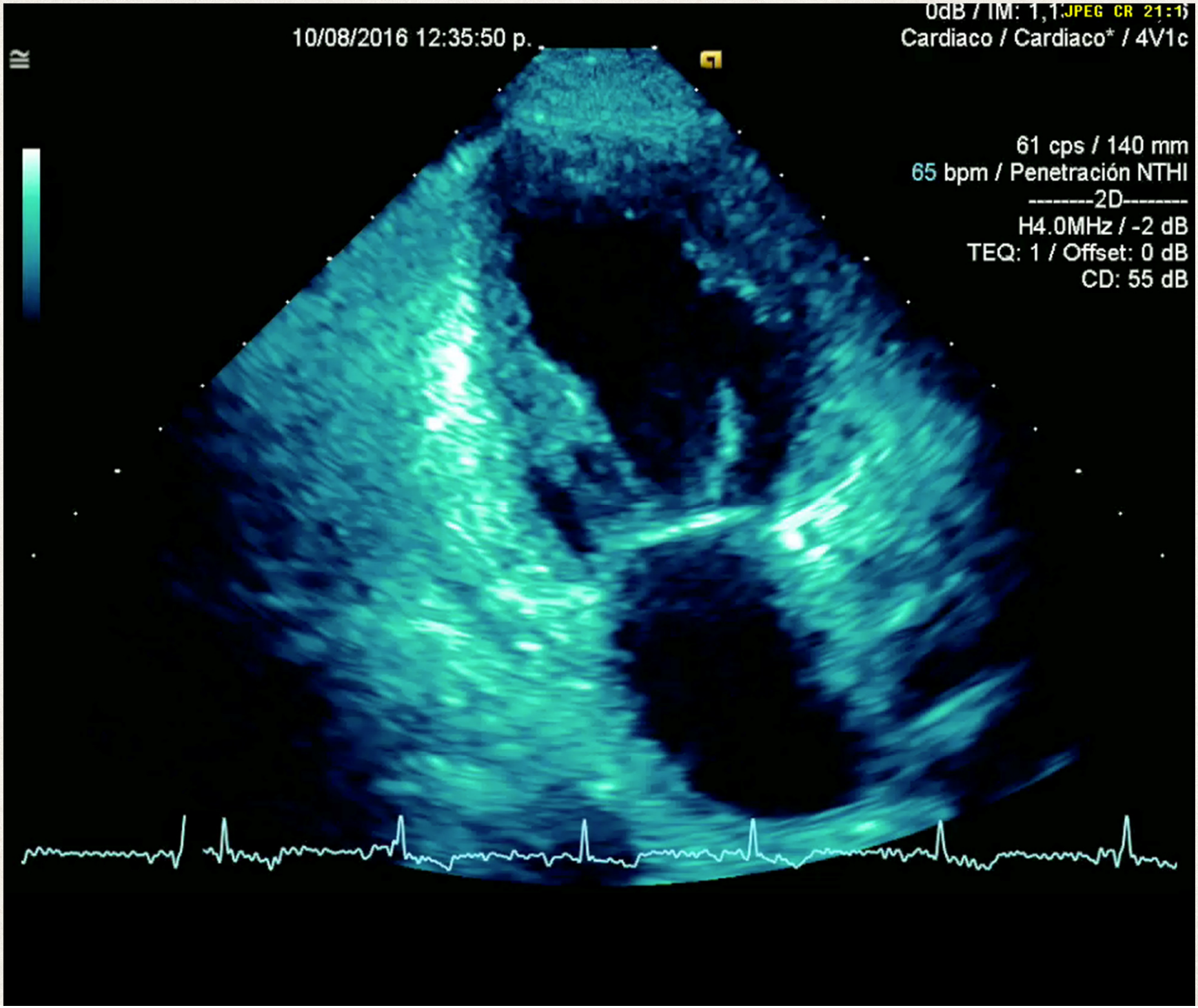
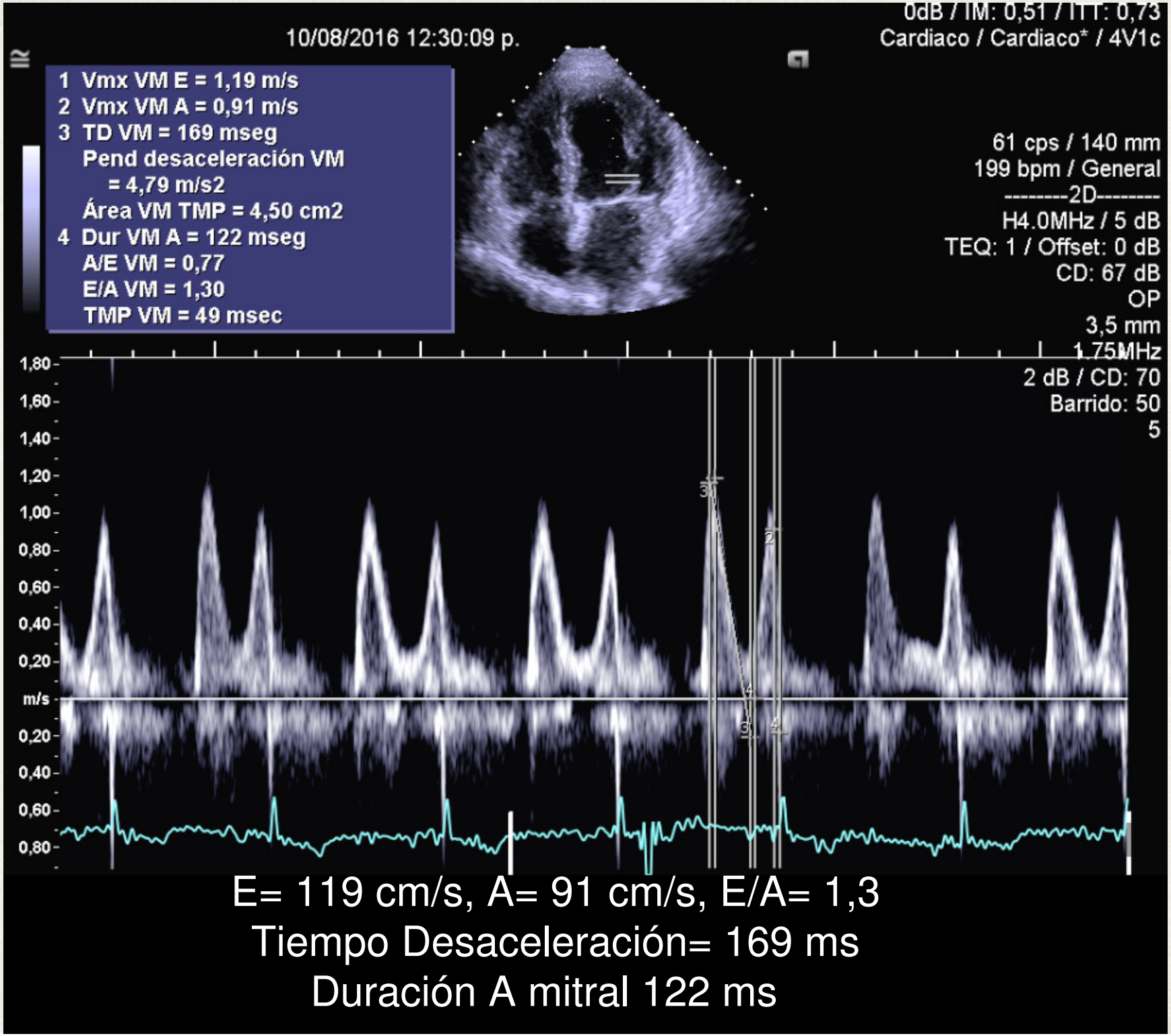
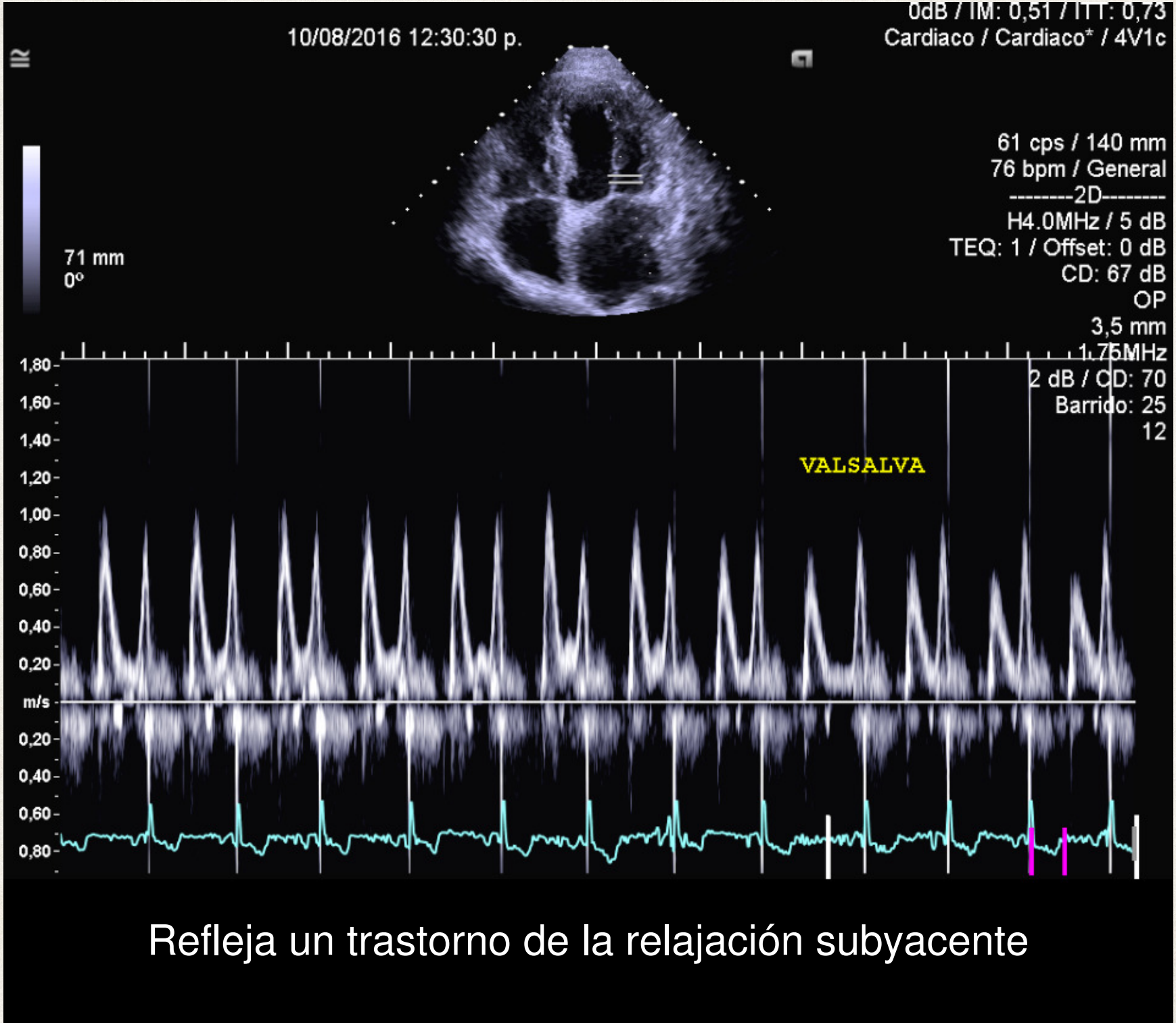
Caso clinico N. 2
Presión Al aumentada, DD II


0dB / IM: 1,2
JPEG CR 26:1
10/08/2016 12:24:24 p.
Cardiaco / Cardiaco* / 4V1c
0,69 m/s
0,69 m/s
18 cps / 150 mm
79 bpm / Flujo general
--------2D--------
H4.0MHz / -2 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
---Color---
VDC / 2.0MHz
-6 dB

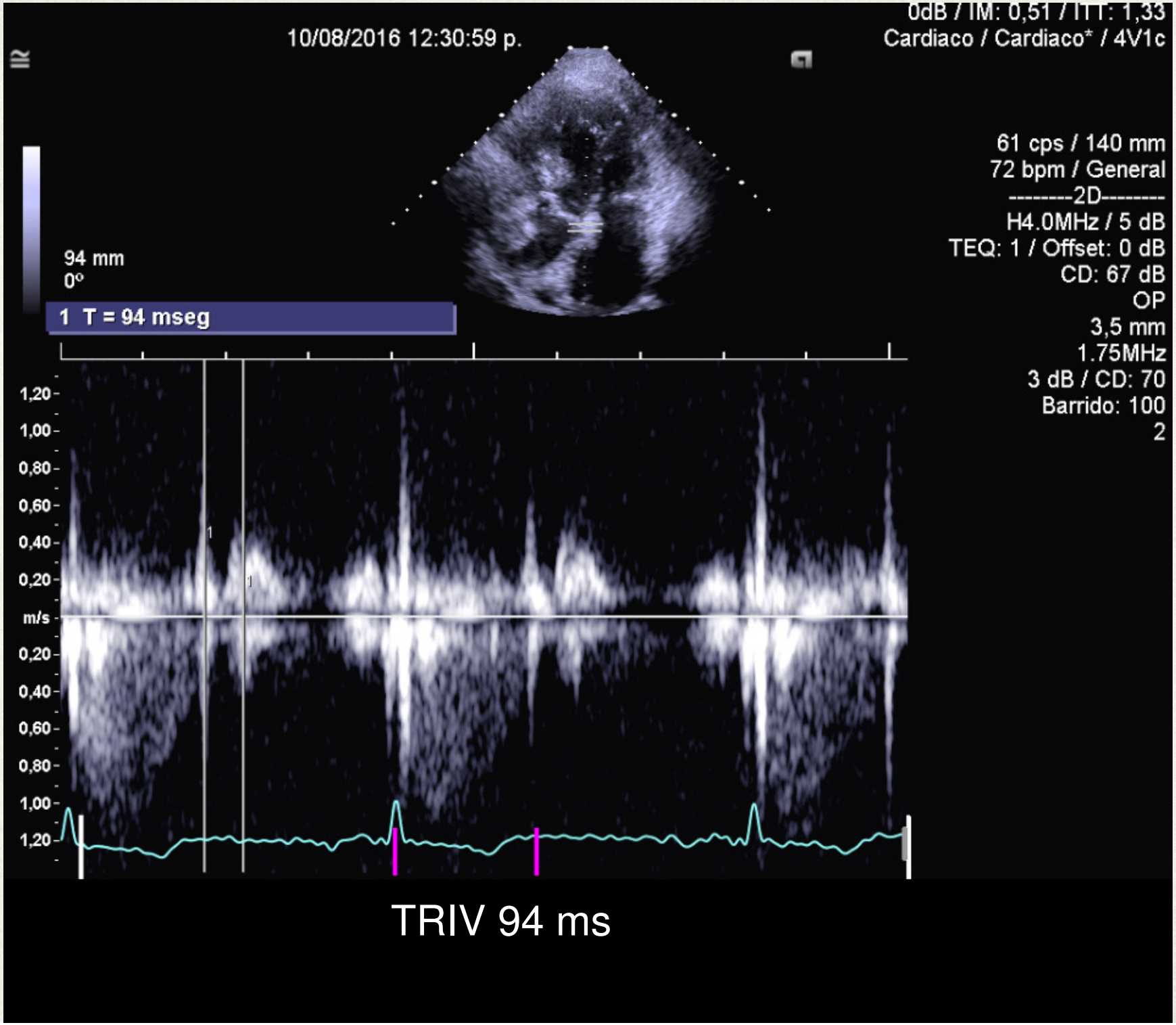

0dB / IM: 1,2 JPEG CR 26:1
10/08/2016 12:33:17 p.
Cardiaco / Cardiaco* / 4V1c
0,69 m/s
0,69 m/s
18 cps / 160 mm
72 bpm / Flujo general
-------2D-------
H4.0MHz / 1 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
---Color---
VDC / 2.0MHz
-5 dB


0dB / IM: 1,1 JPEG CR 21:1
10/08/2016 12:35:50 p.
Cardiaco / Cardiaco* / 4V1c
61 cps / 140 mm
65 bpm / Penetración NTHI
--------2D--------
H4.0MHz / -2 dB
TEQ: 1 / Offset: 0 dB
CD: 55 dB

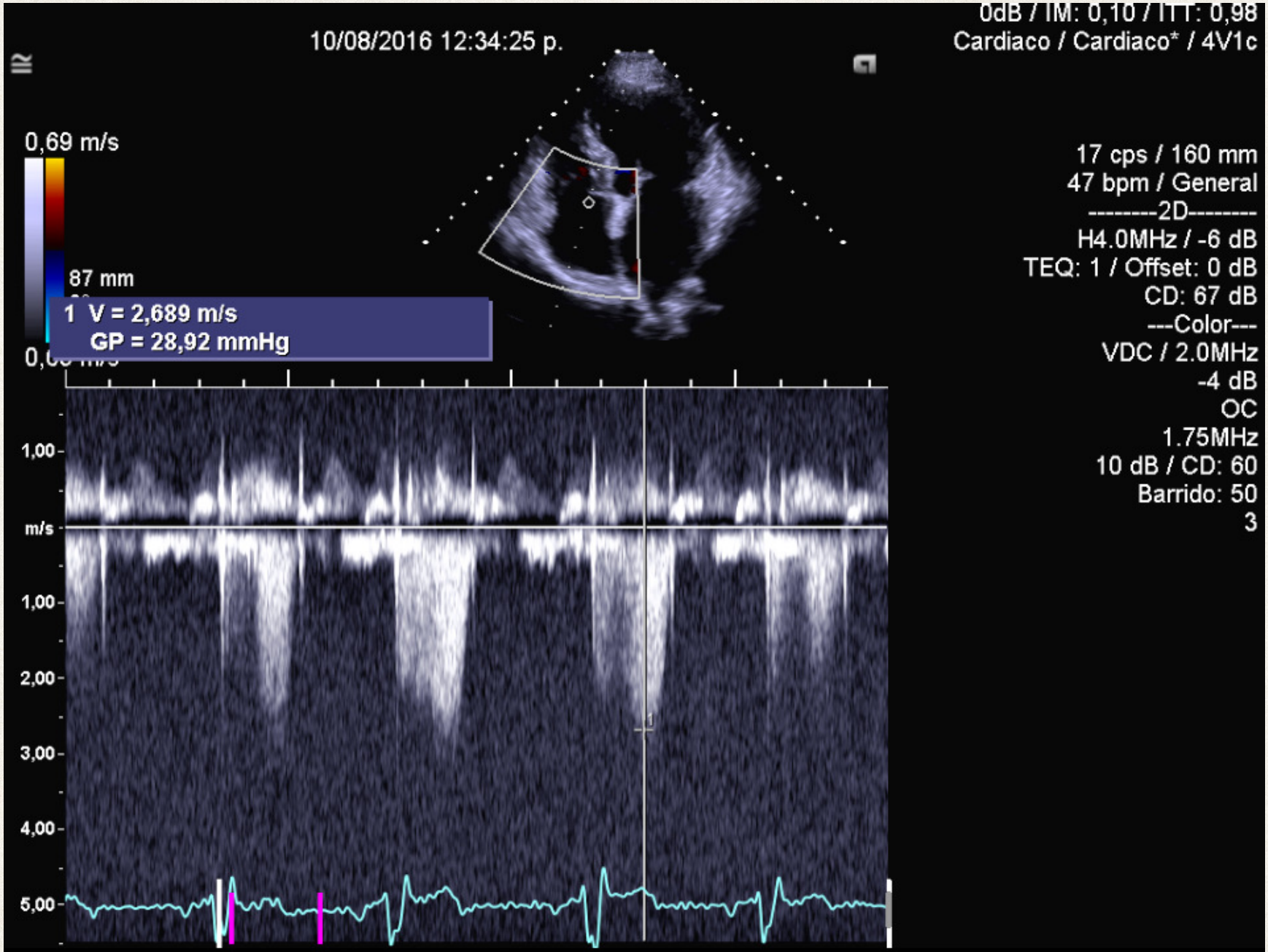

10/08/2016 12:30:09 p.
0dB / IM: 0,51 / ITT: 0,73
Cardiaco / Cardiaco* / 4V1c
1 Vmx VM E = 1,19 m/s
2 Vmx VM A = 0,91 m/s
3 TD VM = 169 mseg
Pend desaceleración VM
= 4,79 m/s2
Área VM TMP = 4,50 cm2
4 Dur VM A = 122 mseg
A/E VM = 0,77
E/A VM = 1,30
TMP VM = 49 msec
61 cps / 140 mm
199 bpm / General
--------2D--------
H4.0MHz / 5 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
OP
3,5 mm
1,75MHz
2 dB / CD: 70
Barrido: 50
5
1,80
1,60
1,40
1,20
1,00
0,80
0,60
0,40
0,20
m/s
0,20
0,40
0,60
0,80
E= 119 cm/s, A= 91 cm/s, E/A= 1,3
Tiempo Desaceleración= 169 ms
Duración A mitral 122 ms



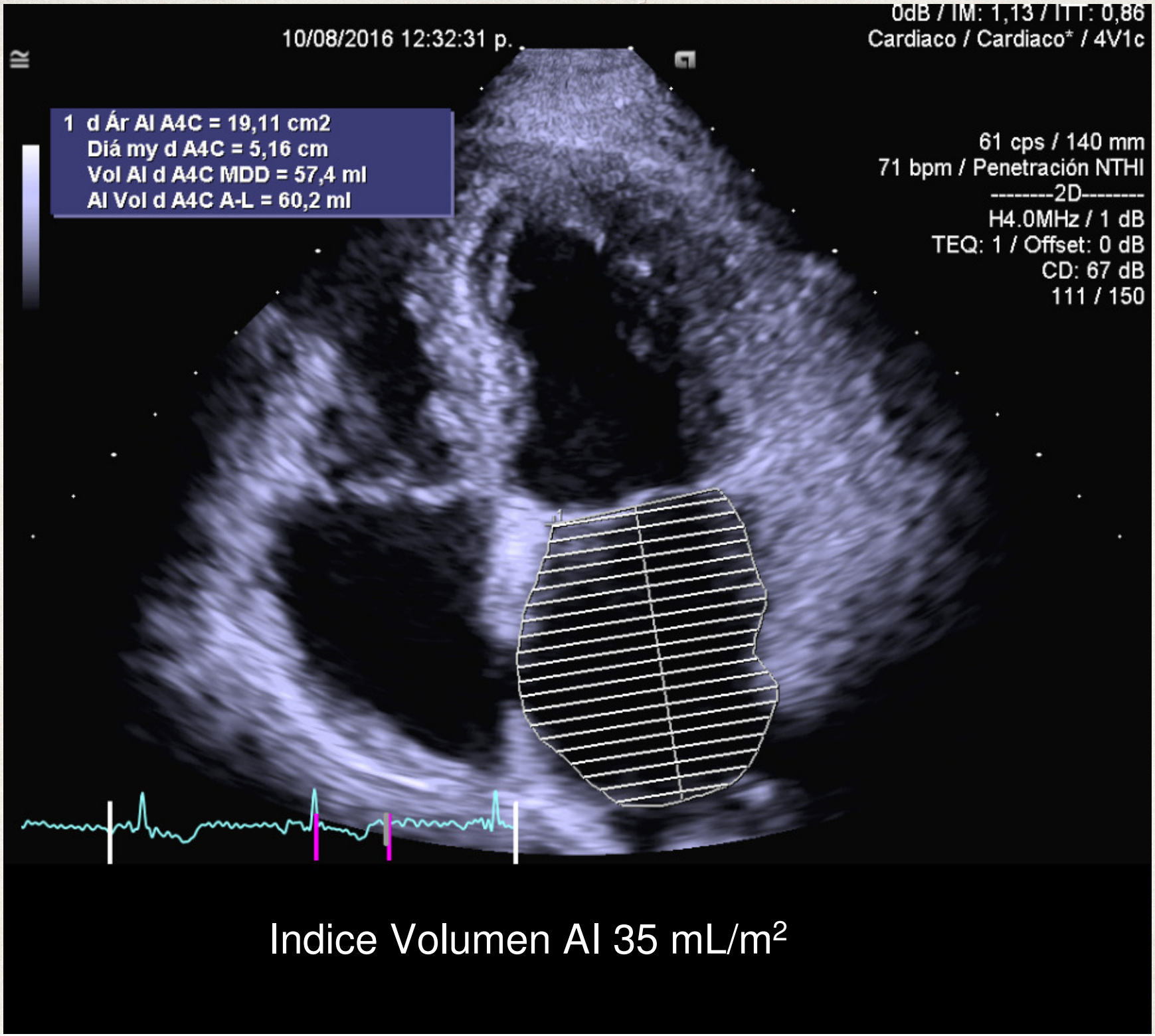
Refleja un trastorno de la relajación subyacente


10/08/2016 12:30:59 p.
0dB / IM: 0,51 / ITT: 1,33
Cardiaco / Cardiaco* / 4V1c
61 cps / 140 mm
72 bpm / General
--------2D--------
H4.0MHz / 5 dB
TEQ: 1 / Offset: 0 dB
CD: 67 dB
OP
3,5 mm
1.75MHz
3 dB / CD: 70
Barrido: 100
2
94 mm
0º
1 T = 94 mseg
1,20
1,00
0,80
0,60
0,40
0,20
m/s
0,20
0,40
0,60
0,80
1,00
1,20

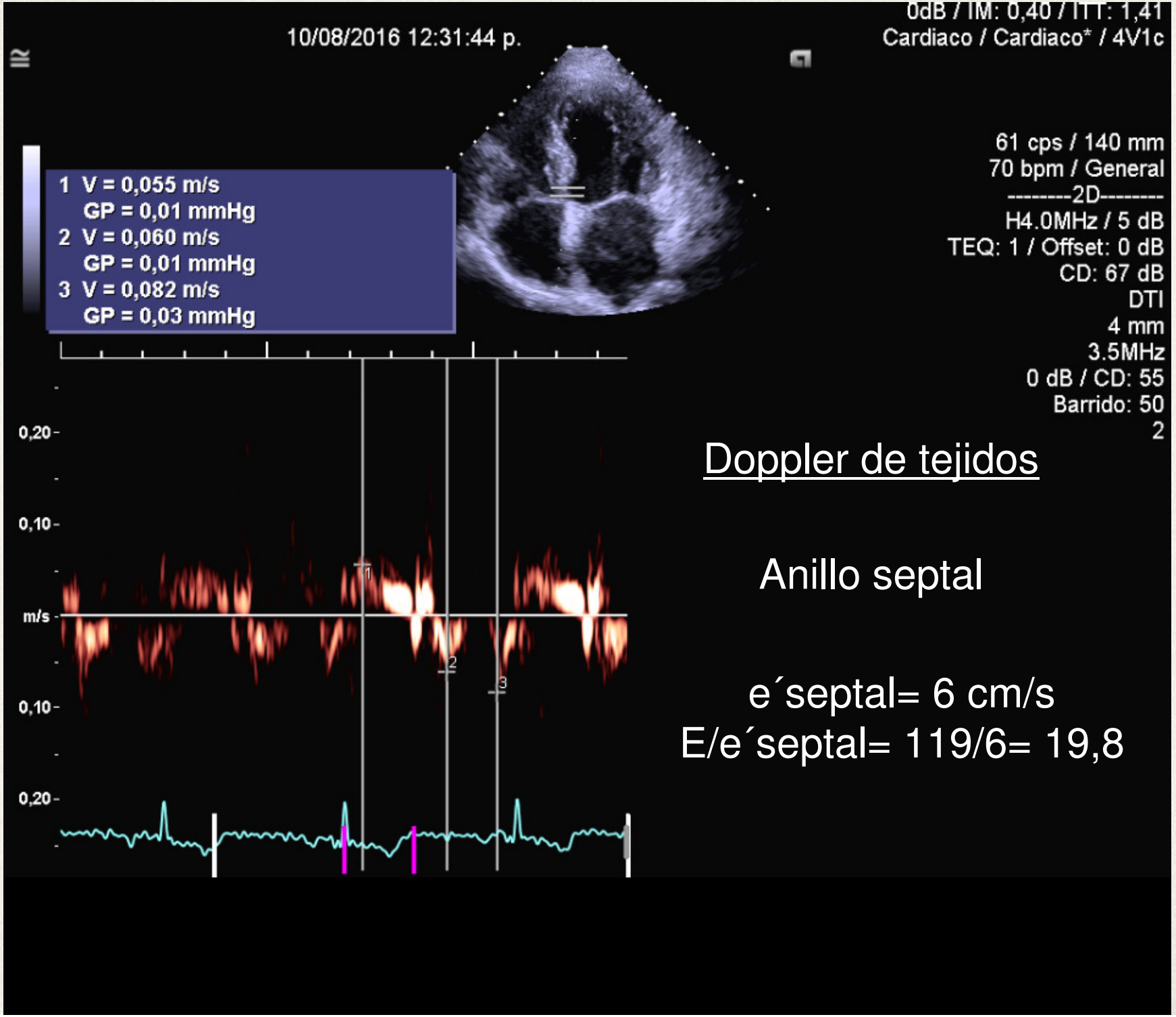
TRIV 94 ms



Velocidad RT= 2,6 m/s (28 mmHg)



Indice Volumen AI 35 mL/m^2

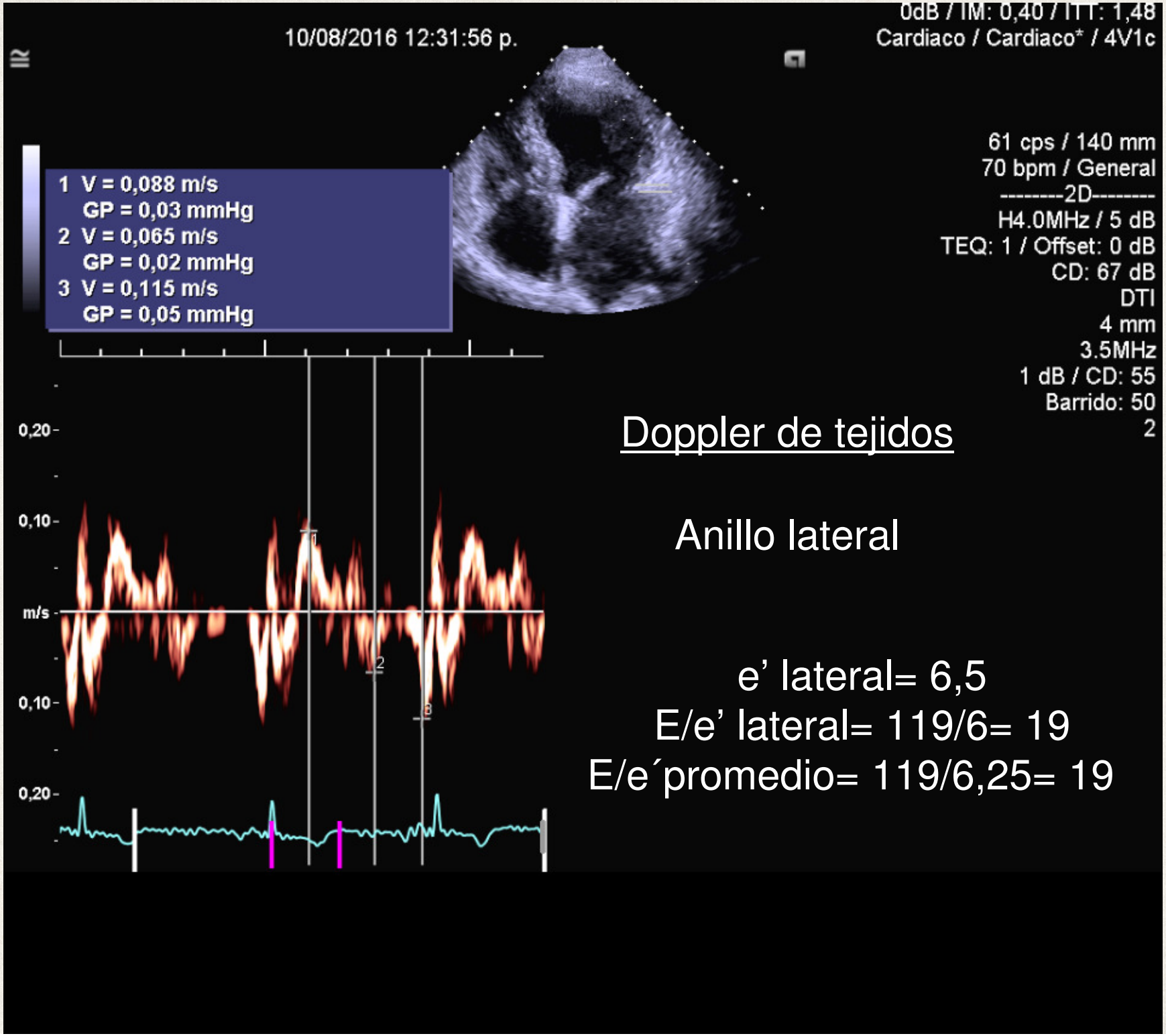


Doppler de tejidos

Anillo septal

e´septal= 6 cm/s

E/e´septal= 119/6= 19,8



Doppler de tejidos

Anillo lateral

e' lateral= 6,5

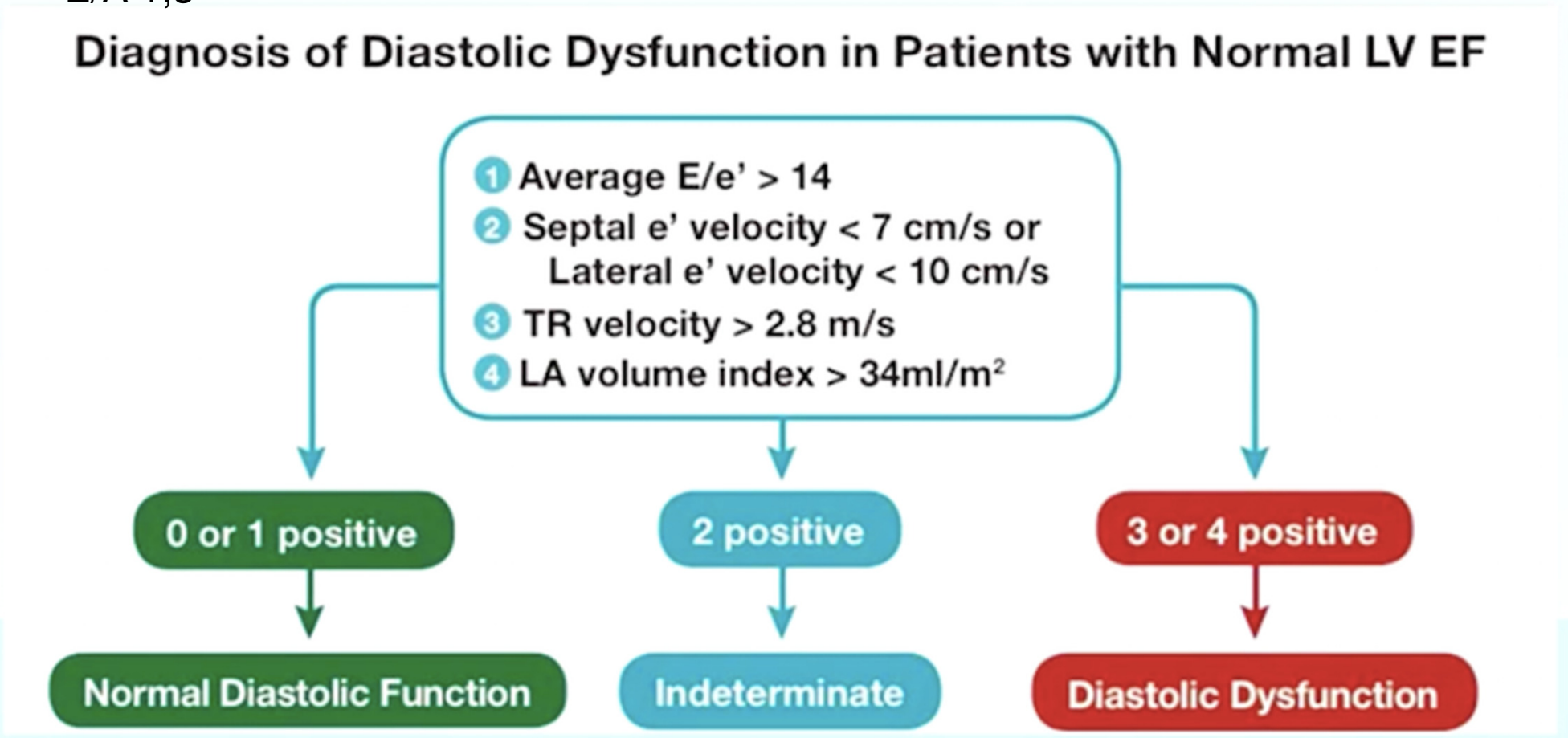
E/e' lateral= 119/6= 19

E/e´promedio= 119/6,25= 19

Criteria for Diagnosis of LV Diastolic Dysfunction

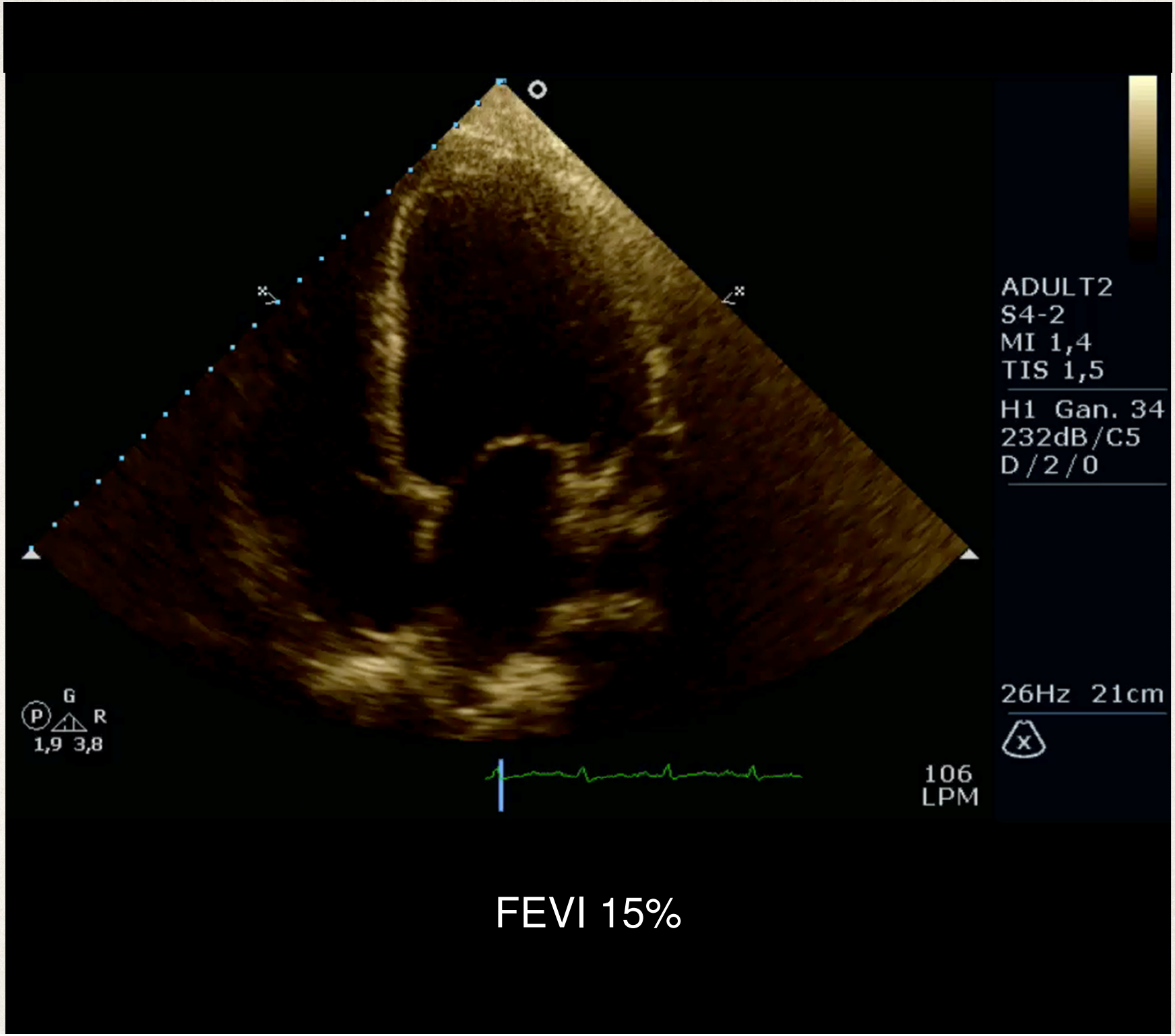
Caso clínico 2 Presión AI aumentada, DD II

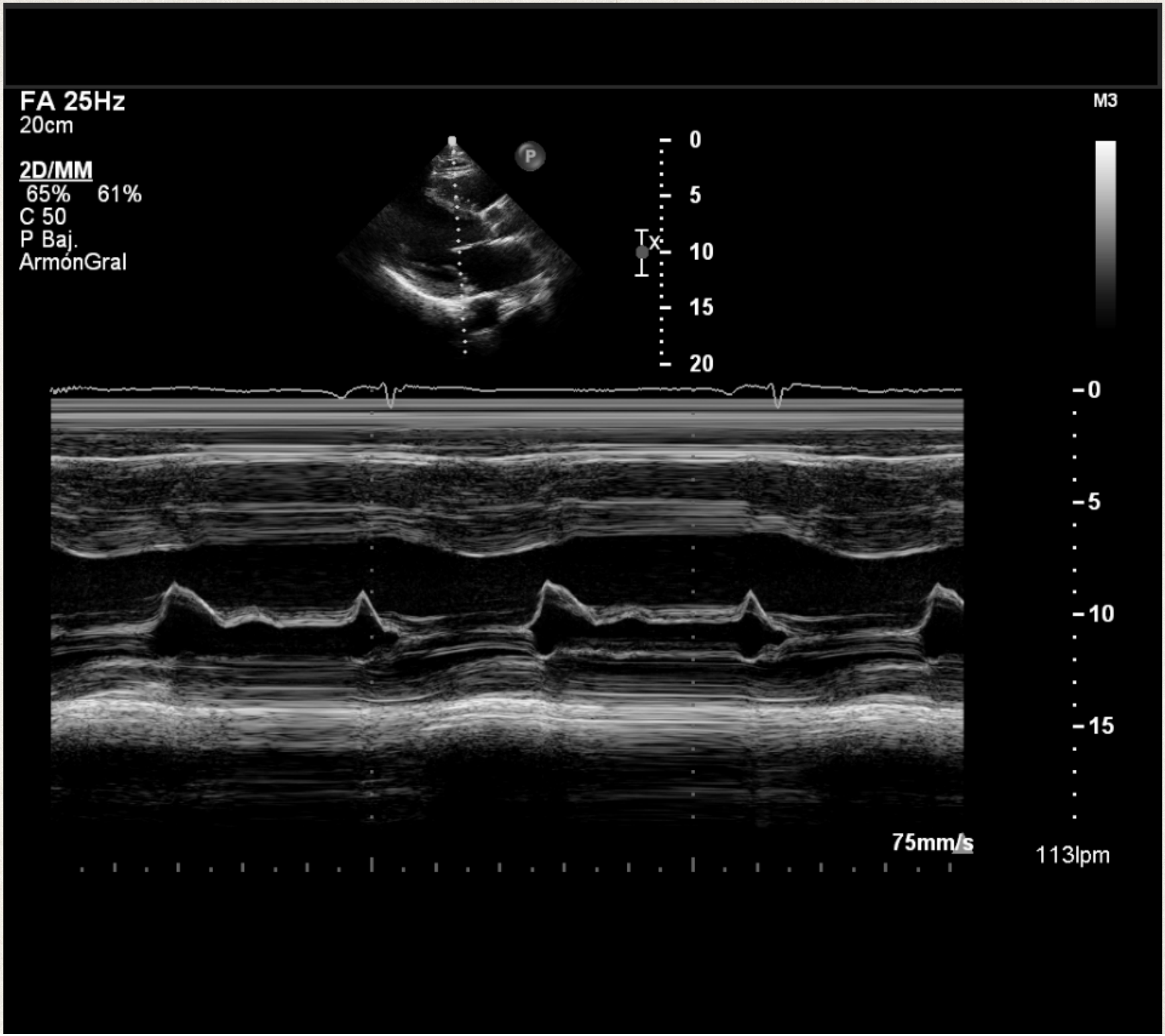
E/A 1,3

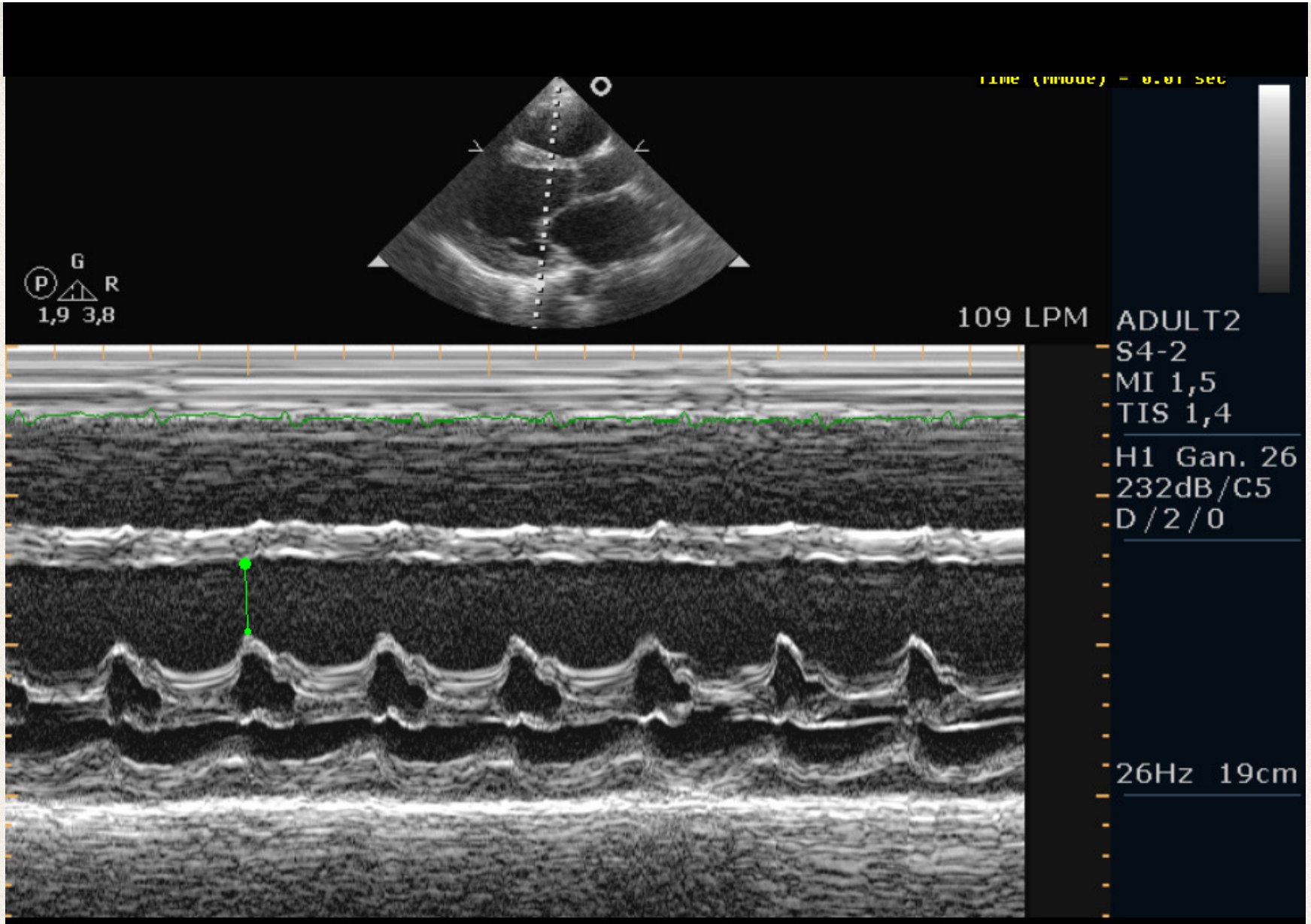


relación E/e´promedio 19
septal e´velocity 6 cm/s, e´lateral 6 cm/s
LA volume index 35 mL/m²
TR velocity 2,6

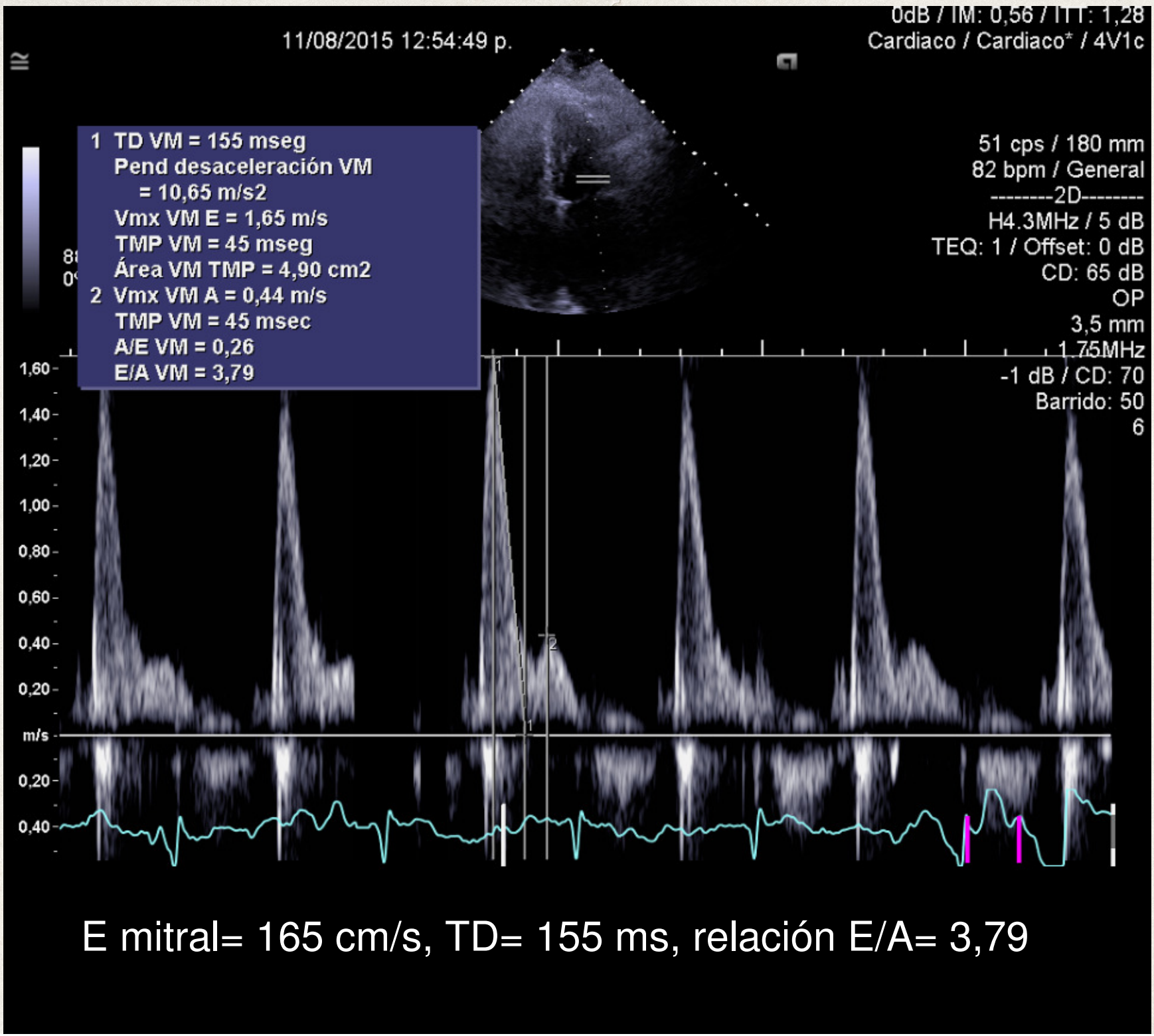
Caso clínico 3. Patrón restrictivo, Presión de AI aumentada (Disfunción diastólica grado III)


ADULT2
S4-2
MI 1,4
TIS 1,5
H1 Gan. 34
232dB/C5
D/2/0
26Hz 21cm
G
P
R
1,9 3,8
106
LPM
FEVI 15%

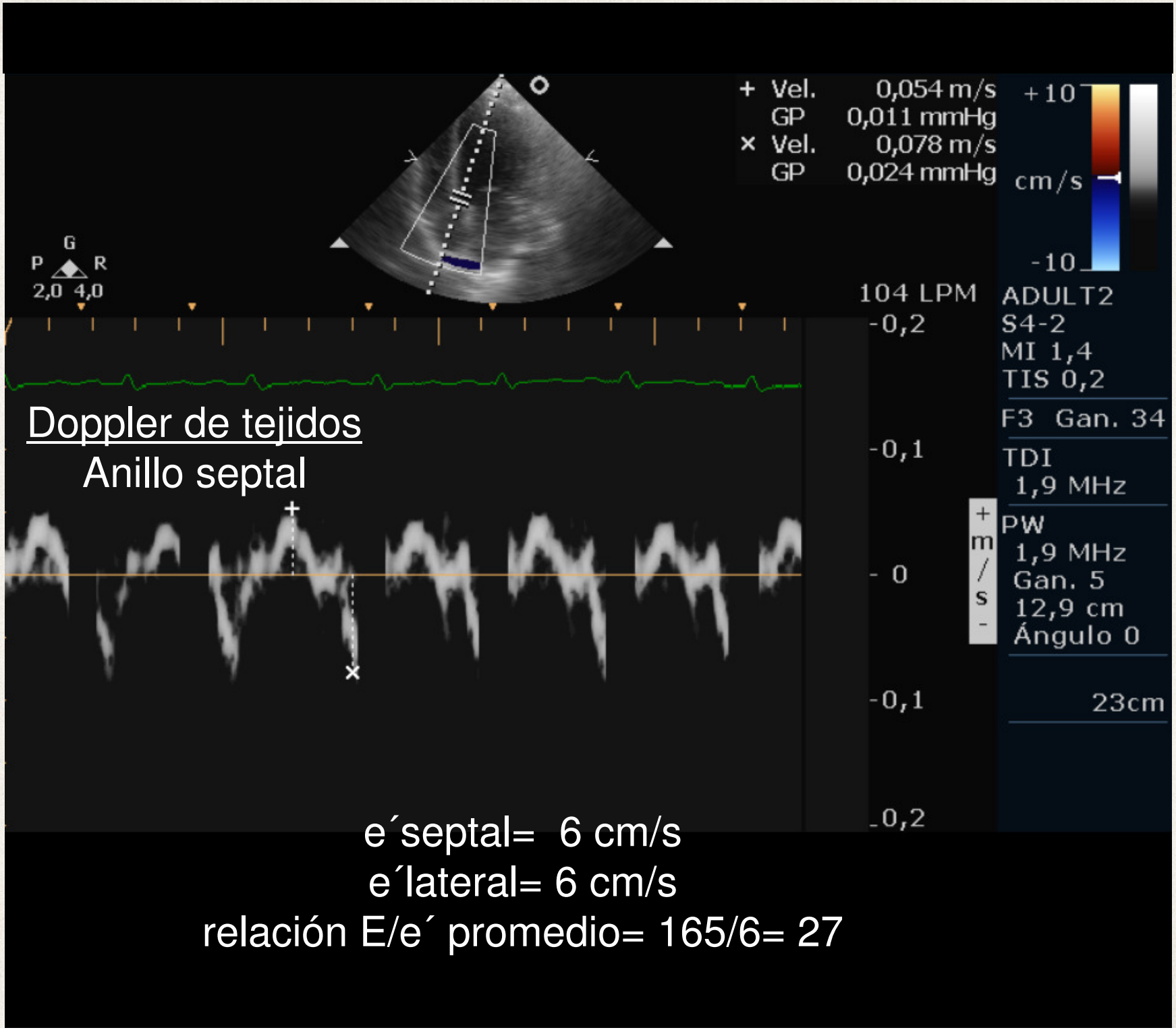

FA 25Hz
20cm
2D/MM
65% 61%
C 50
P Baj.
ArmónGral
M3
P
0
5
Tx
10
15
20
0
5
10
15
75mm/s
113lpm



Modo M válvula mitral con signo de B- Bump



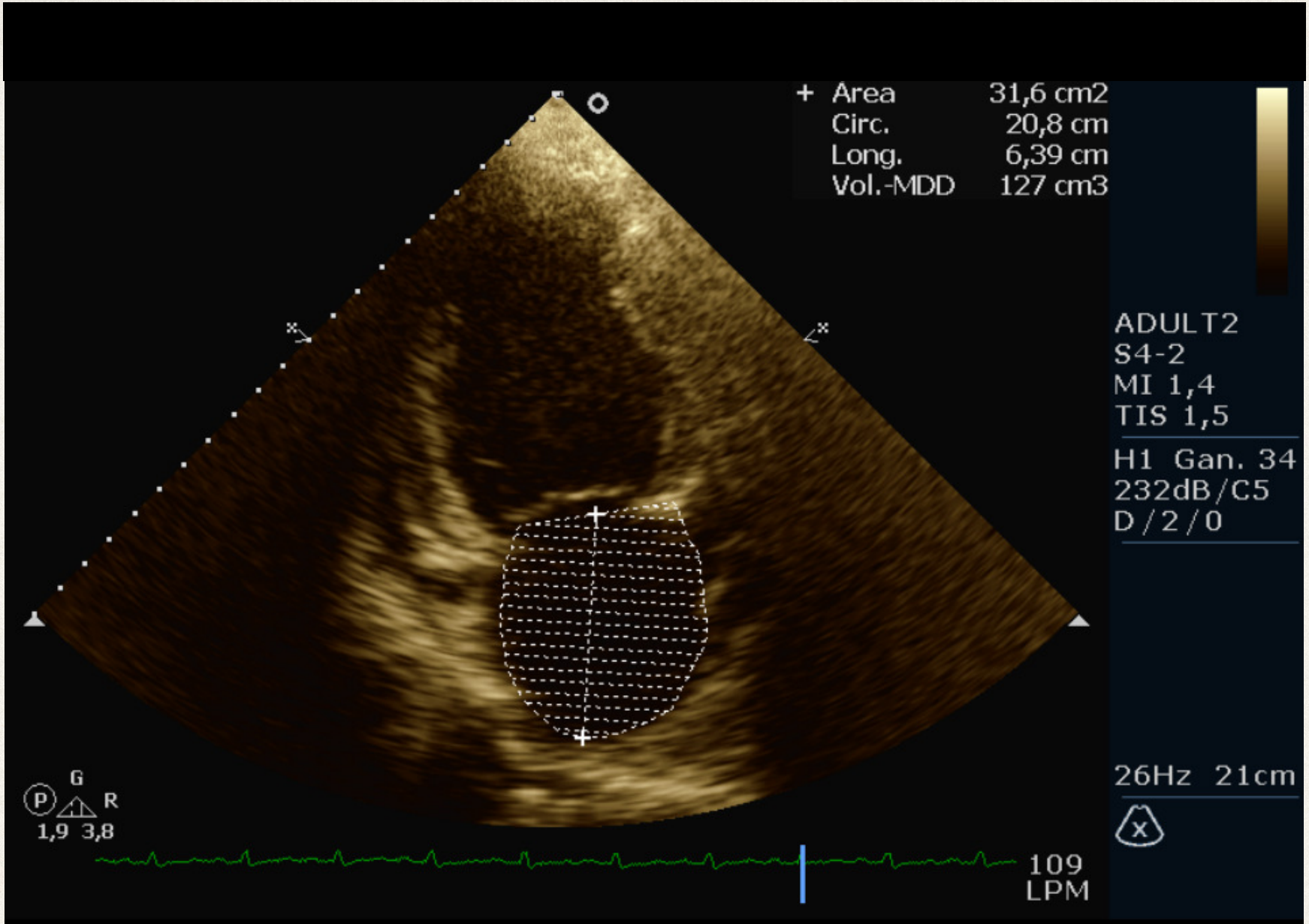
E mitral= 165 cm/s, TD= 155 ms, relación E/A= 3,79



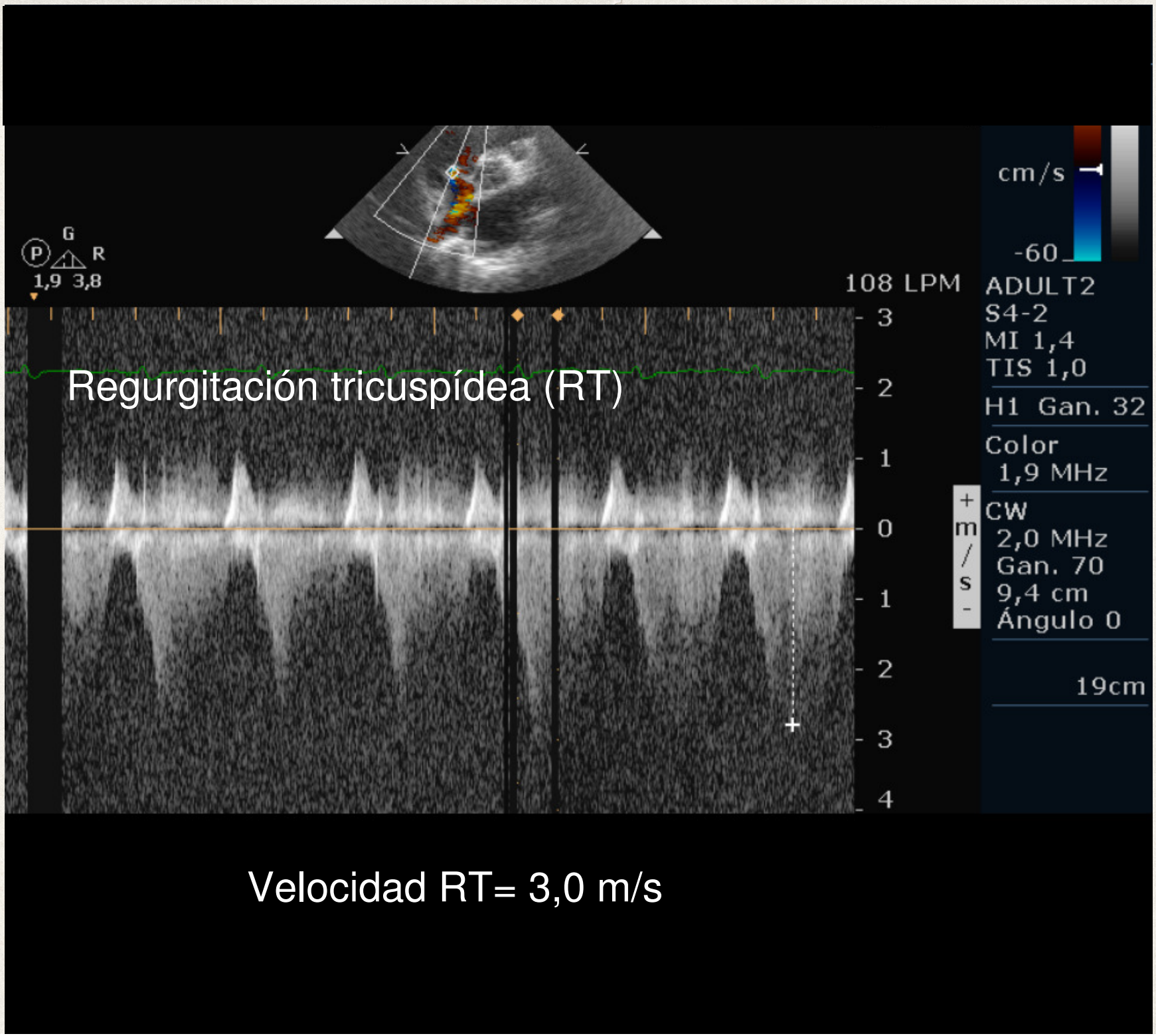
e´septal= 6 cm/s

e´lateral= 6 cm/s

relación E/e´ promedio= 165/6= 27



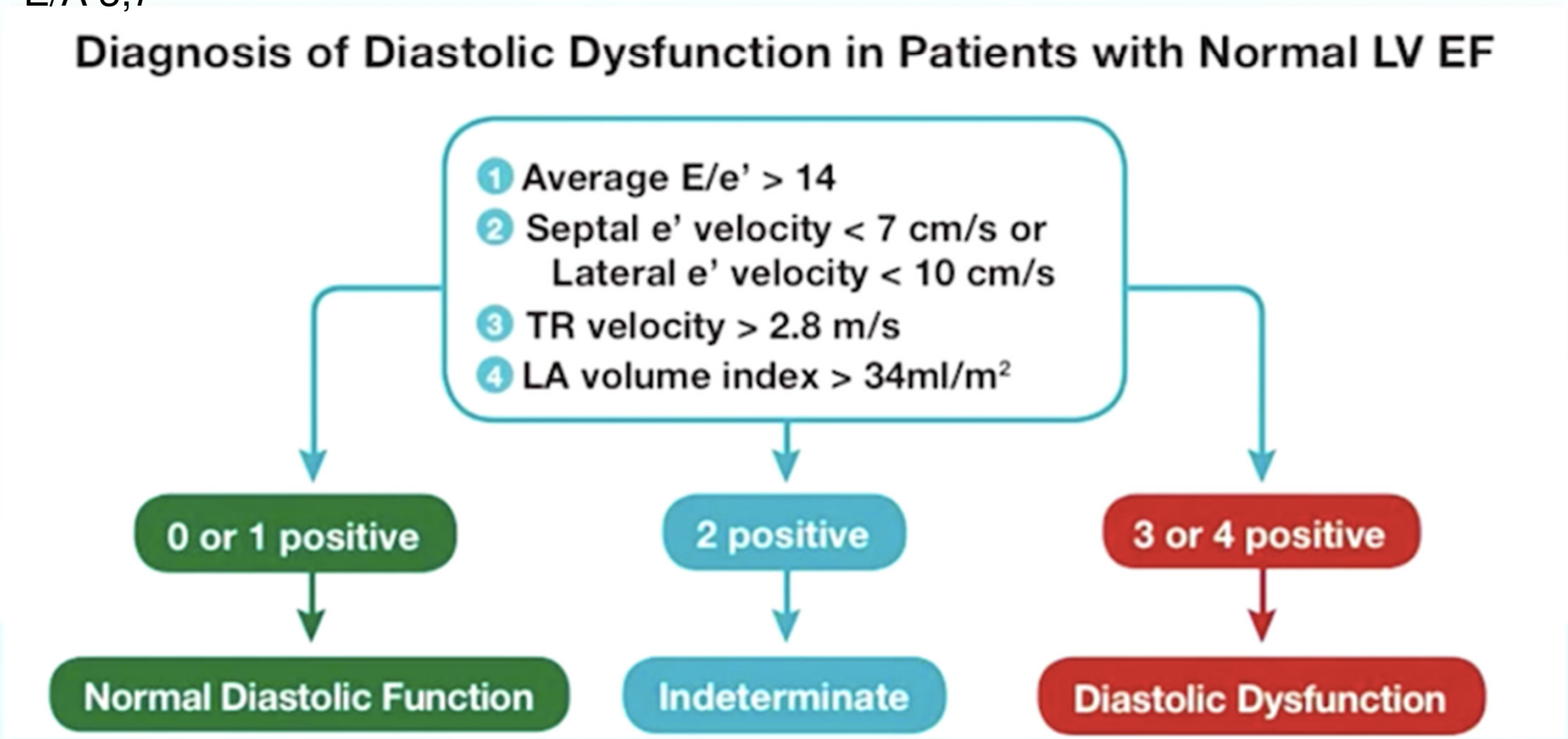
Indice Volumen AI = 74 mL/m^2


Regurgitación tricuspídea (RT)
Velocidad RT= 3,0 m/s
cm/s
-60
108 LPM
ADULT2
S4-2
MI 1,4
TIS 1,0
H1 Gan. 32
Color
1,9 MHz
CW
2,0 MHz
Gan. 70
9,4 cm
Ángulo 0
19cm
+ m/s -
3
2
1
0
1
2
3
4
G
P
R
1,9 3,8

Criteria for Diagnosis of LV Diastolic Dysfunction

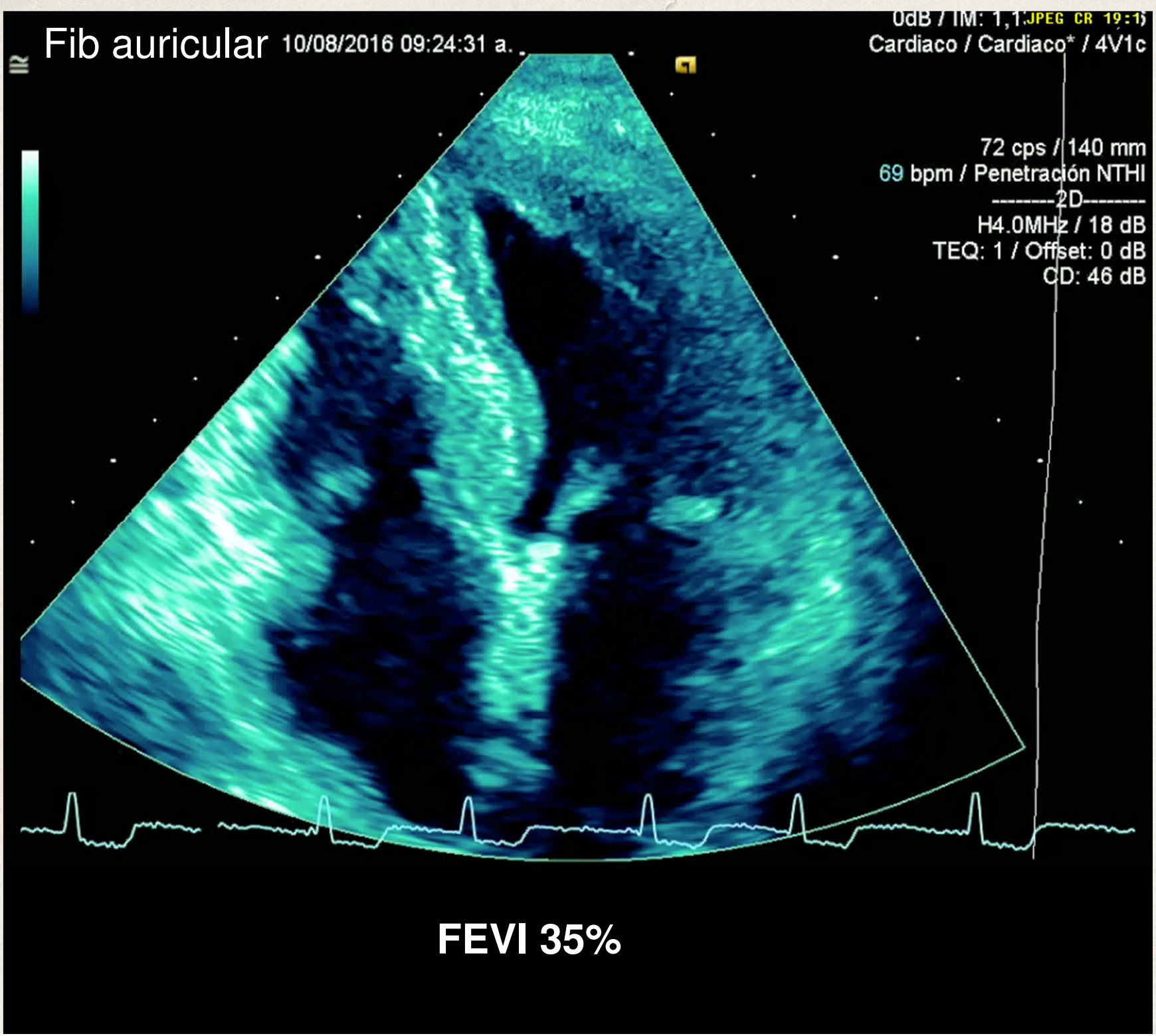
Caso clínico 3 (Patrón Restrictivo, Presión AI aumentada, DD III)

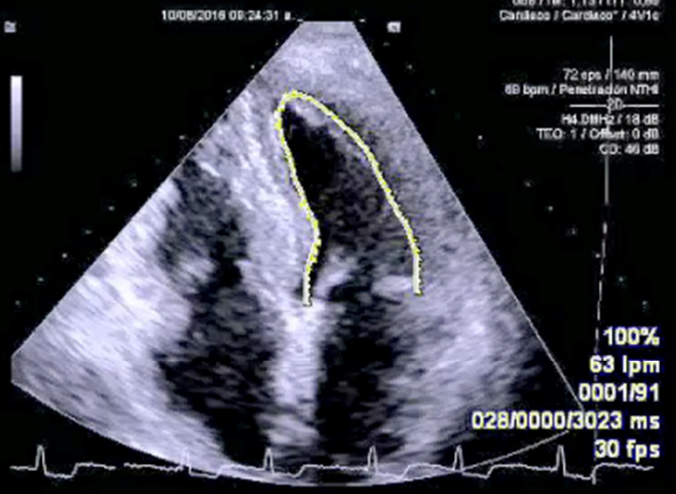
E/A 3,7



E/e´promedio 27
septal e´velocity 6 cm/s,
LA volume index 74 mL/m²
TR velocity 3,0 m/s

Caso 4. Función Diastólica en situaciones especiales:
Paciente con Fibrilación Auricular


Fib auricular
10/08/2016 09:24:31 a.
0dB / IM: 1,1
JPEG CR 19:1
Cardiaco / Cardiaco* / 4V1c
72 cps / 140 mm
69 bpm / Penetración NTHI
--------2D--------
H4.0MHz / 18 dB
TEQ: 1 / Offset: 0 dB
CD: 46 dB
FEVI 35%



JPEG CR 34:1

Vol	Latido: 1/3	
EF	35	%
Global EF	34	%
HR	40,5	bpm
EDV	37,1	ml
ESV	24,0	ml
SV	13,1	ml
CO	528,8	ml/min
Hora de cierre VA	805	ms

Fib auricular

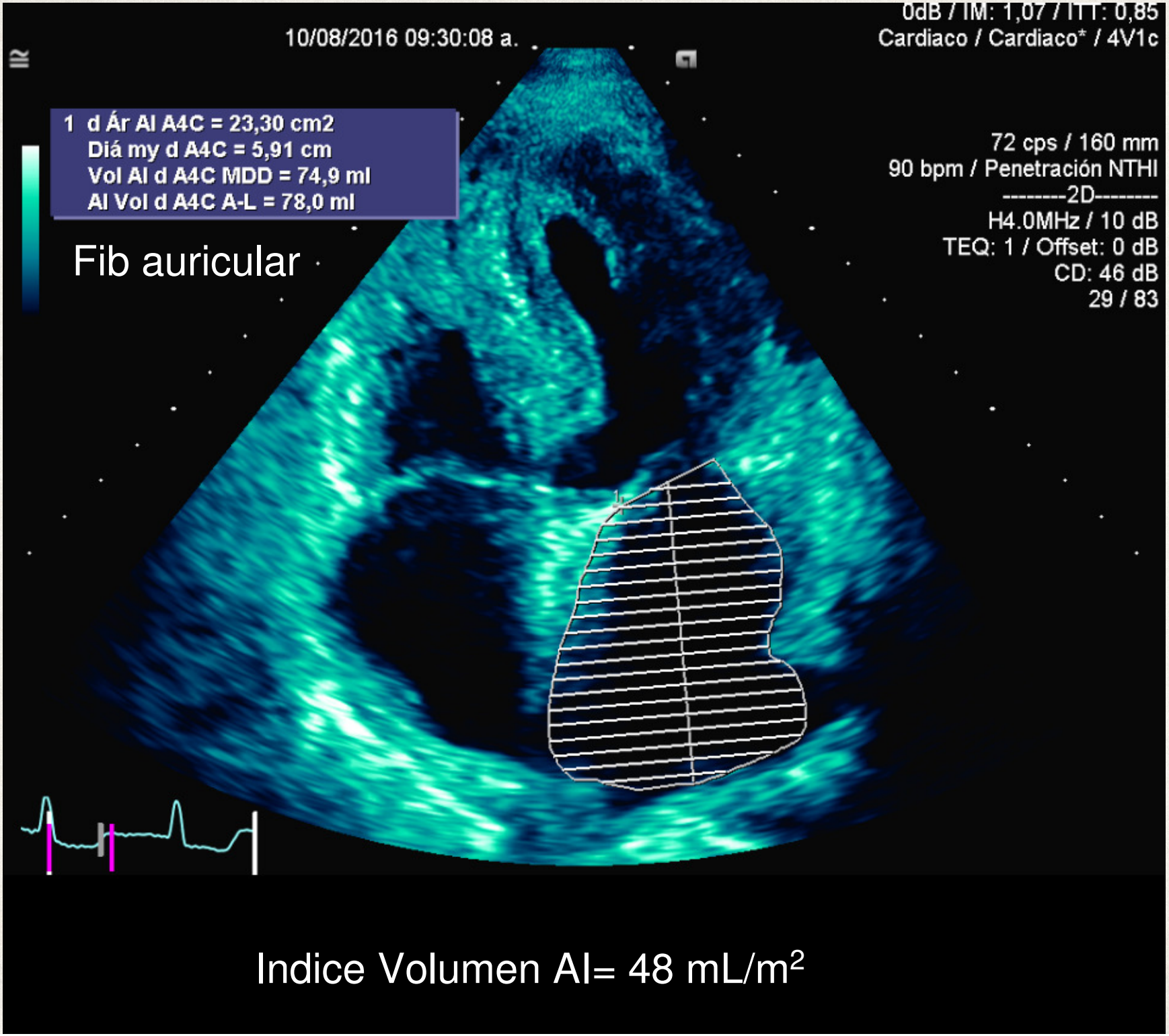
Longitudinal Tens Endo

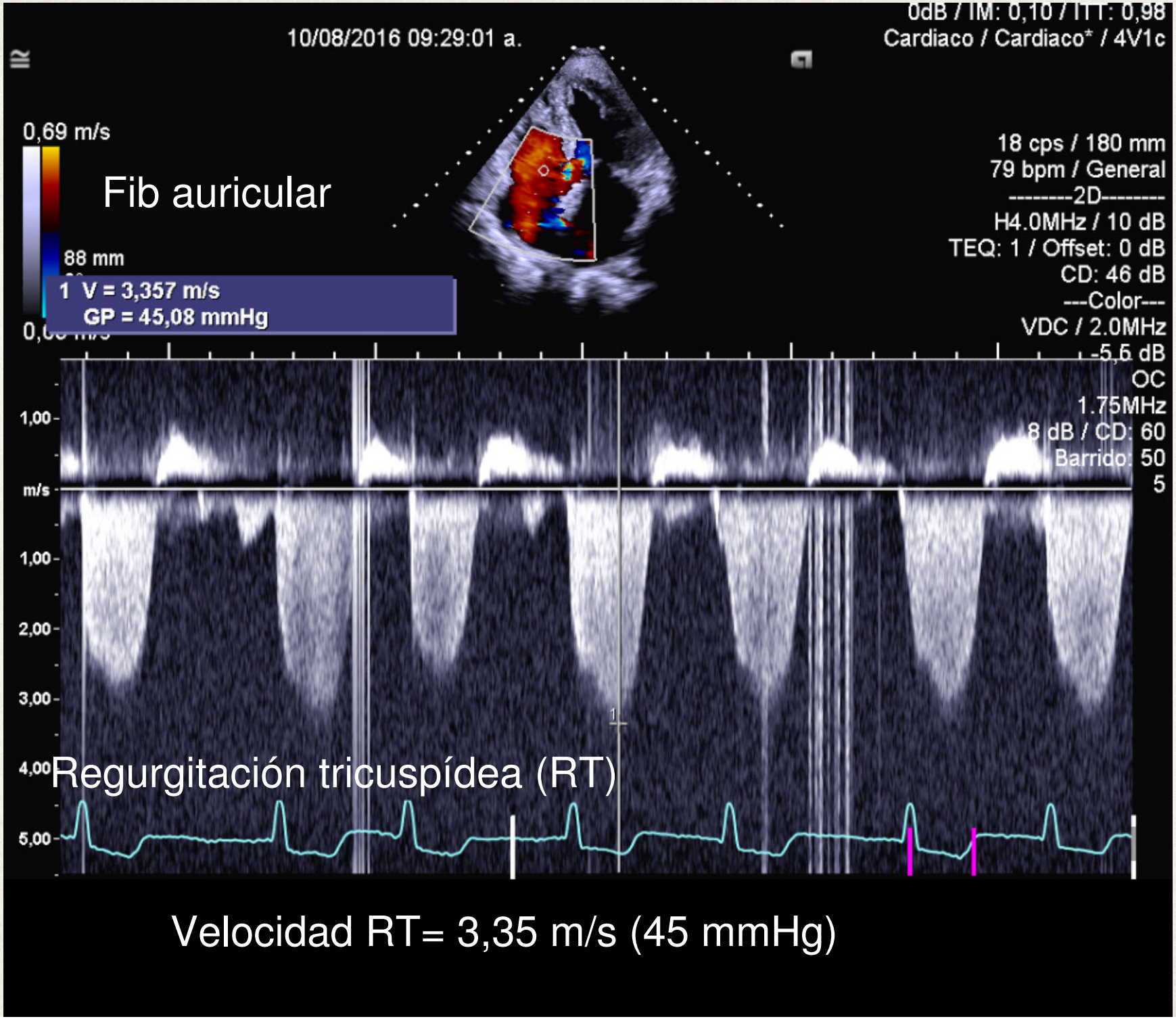
Seg	PreStr %	PkSys %	PkAll %	PSI %	TPk Ovrl ms
03-Basal septal	0,9	-6,2	-6,4	2,3	906,0
09-Septal med		-7,2	-7,2		782,0
14-Septal apical		-17,4	-17,4		782,0
16-Lateral apical	0,7	-15,6	-15,6		878,0
12-Lateral med	0,2	-2,4	-2,4		394,0
06-Basal lateral	0,3	-11,2	-11,2		726,0
Global	0,53	-10,00	-8,96	2,30	809,00
Desv est	0,3	5,8	5,8	0,0	184,3

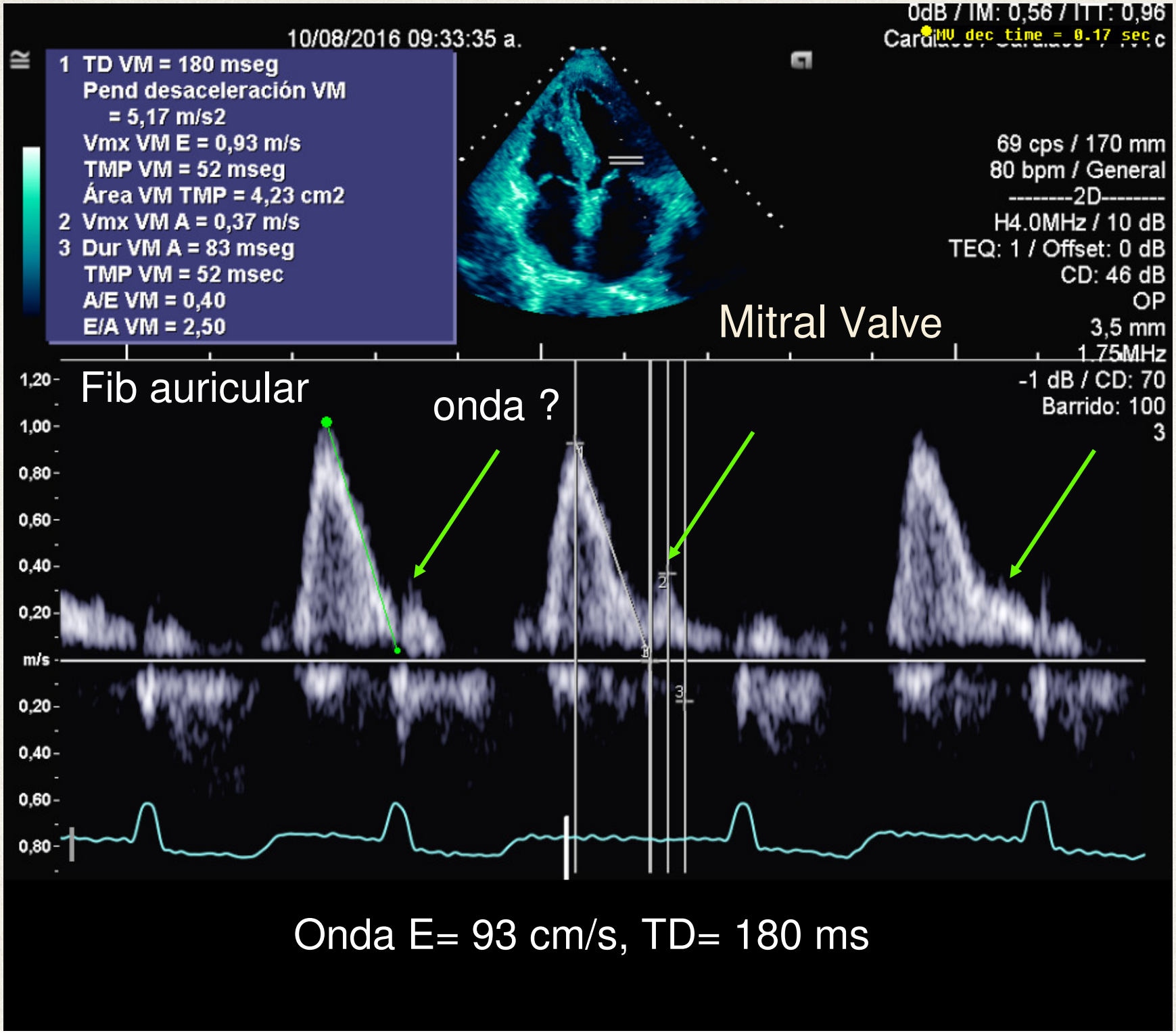
Demora de pared opuesta máxima 388,0 ms (09-12)

FEVI 35%

Strain longitudinal global - 10%


10/08/2016 09:30:08 a.
0dB / IM: 1,07 / TIT: 0,85
Cardiaco / Cardiaco* / 4V1c
1 d Ár Al A4C = 23,30 cm2
Diá my d A4C = 5,91 cm
Vol Al d A4C MDD = 74,9 ml
Al Vol d A4C A-L = 78,0 ml
Fib auricular
72 cps / 160 mm
90 bpm / Penetración NTHI
--------2D--------
H4.0MHz / 10 dB
TEQ: 1 / Offset: 0 dB
CD: 46 dB
29 / 83
Indice Volumen AI= 48 mL/m²


10/08/2016 09:29:01 a.
0dB / IM: 0,10 / TIT: 0,98
Cardiaco / Cardiaco* / 4V1c
0,69 m/s
Fib auricular
88 mm
1 V = 3,357 m/s
GP = 45,08 mmHg
18 cps / 180 mm
79 bpm / General
--------2D--------
H4.0MHz / 10 dB
TEQ: 1 / Offset: 0 dB
CD: 46 dB
---Color---
VDC / 2.0MHz
-5,5 dB
OC
1.75MHz
8 dB / CD: 60
Barrido: 50
5
1,00
m/s
1,00
2,00
3,00
4,00
5,00
Regurgitación tricuspídea (RT)
Velocidad RT= 3,35 m/s (45 mmHg)



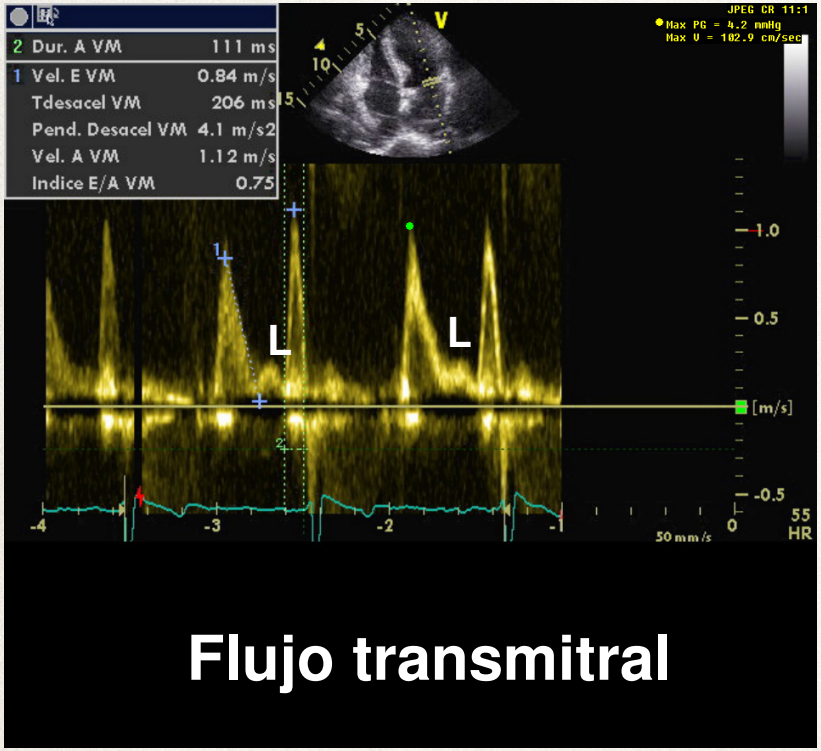
Onda E= 93 cm/s, TD= 180 ms

The Mitral L-Wave: A Relatively Common but Ignored Useful Finding

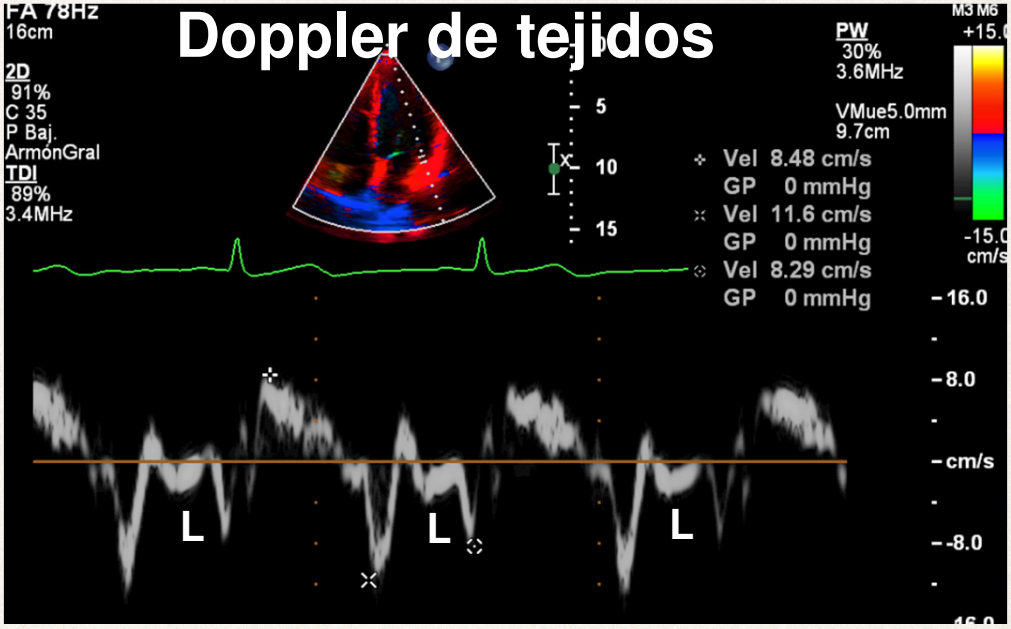
Edmund Kenneth Kerut, M.D.

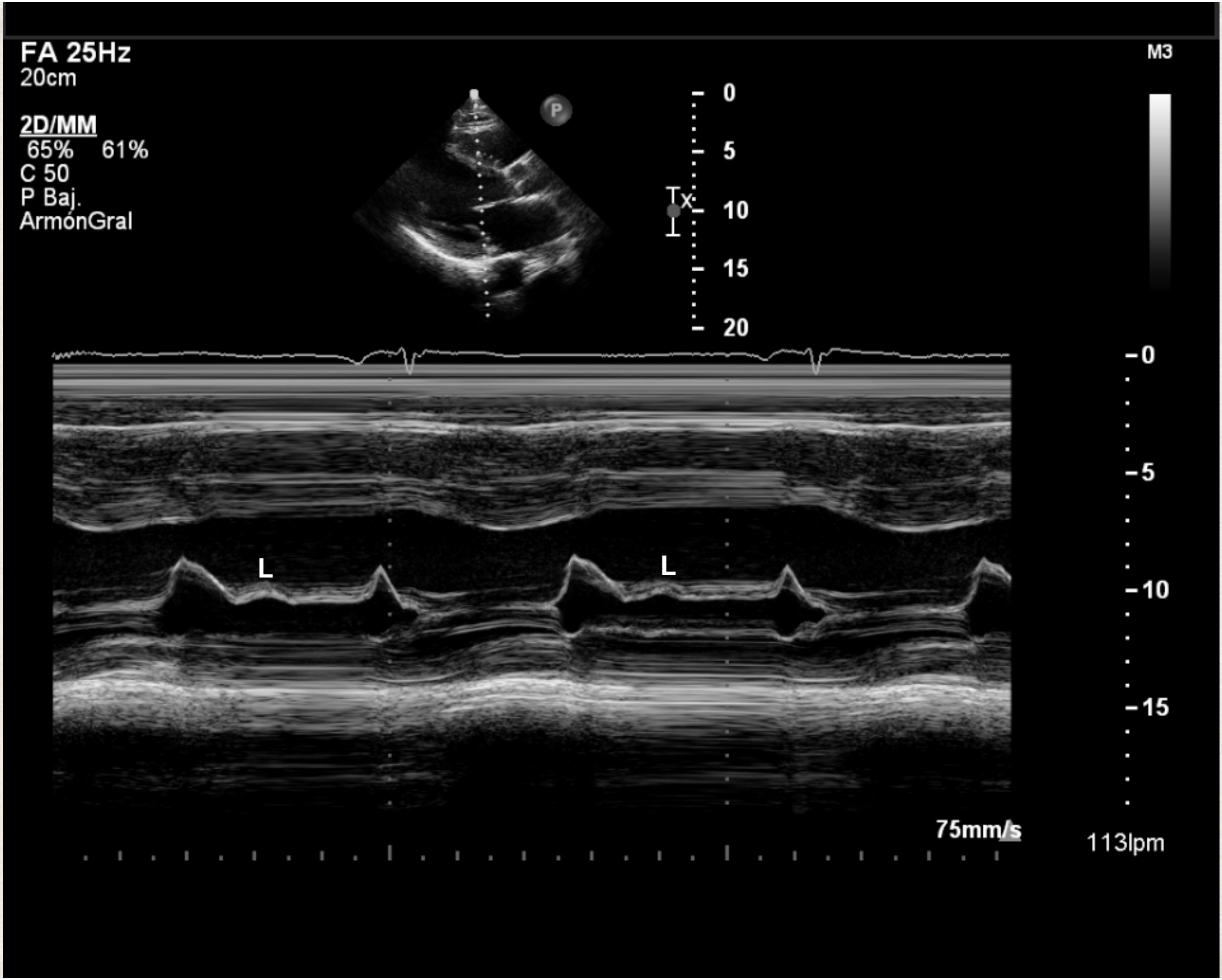
Heart Clinic of Louisiana, Marrero, Louisiana, and Departments of Physiology and Pharmacology, LSU Health Sciences Center, New Orleans, Louisiana

(ECHOCARDIOGRAPHY, Volume 25, May 2008)



Flujo transmitral



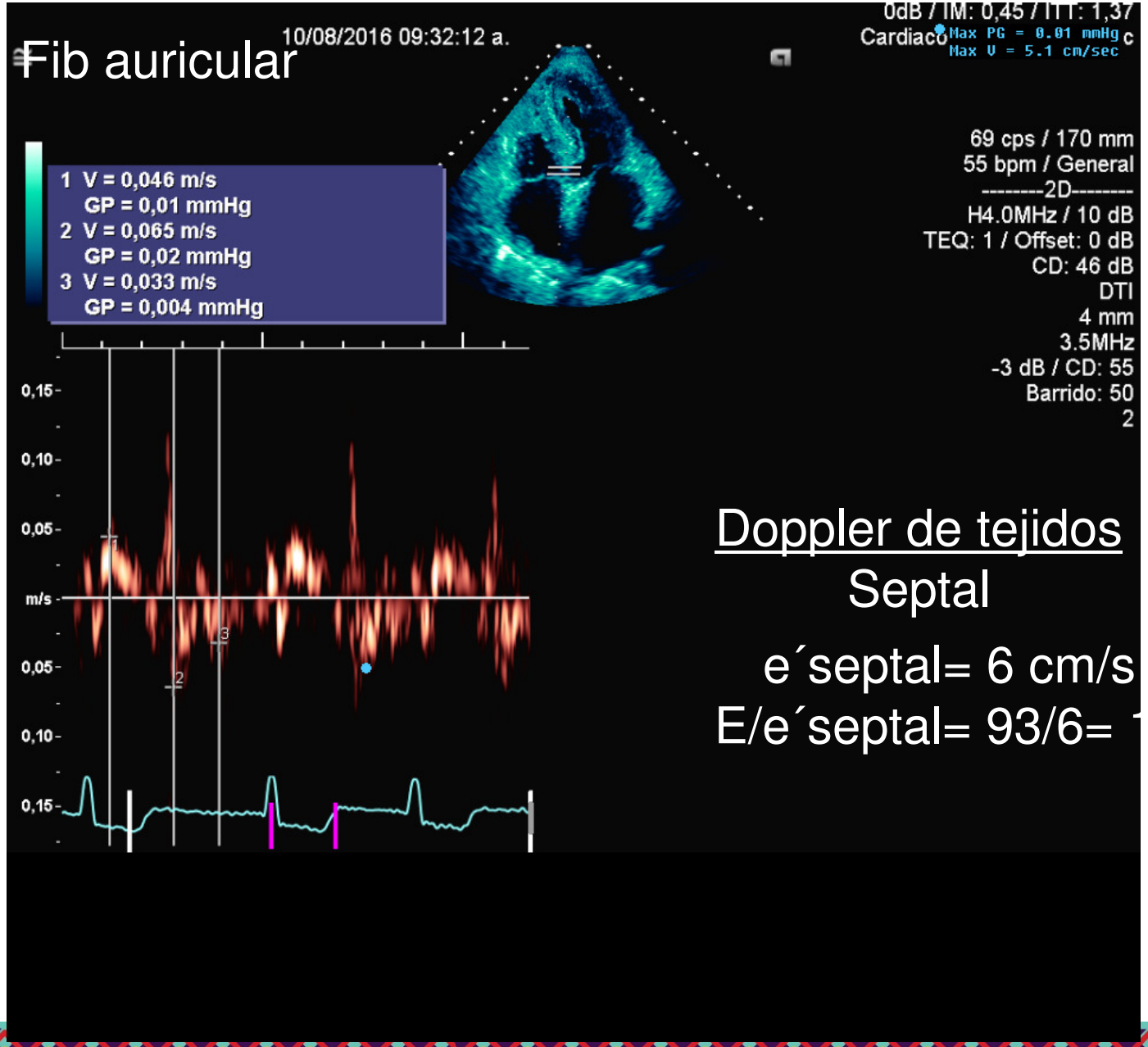

FA 25Hz
20cm
2D/MM
65% 61%
C 50
P Baj.
ArmónGral
M3
P
0
5
10
15
20
L
L
75mm/s
113lpm

Onda L mitral

Keren G. Interrelationship of mid-diastolic mitral valve motion , pulmonary venous flow, and transmittal flow. Circulation 1986; 74: 36

- Frecuentemente es un hallazgo no descrito
- Puede verse en sujetos sanos bradicárdicos
- Onda L patológica:
- Refleja precarga elevada. Es un “marcador” de pseudonormalización
- Falla cardíaca, hipertrofia VI con FEVI preservada, falla cardíaca con FEVI reducida
- Predice hospitalizaciones futuras por falla cardíaca

Septal Tissue Doppler

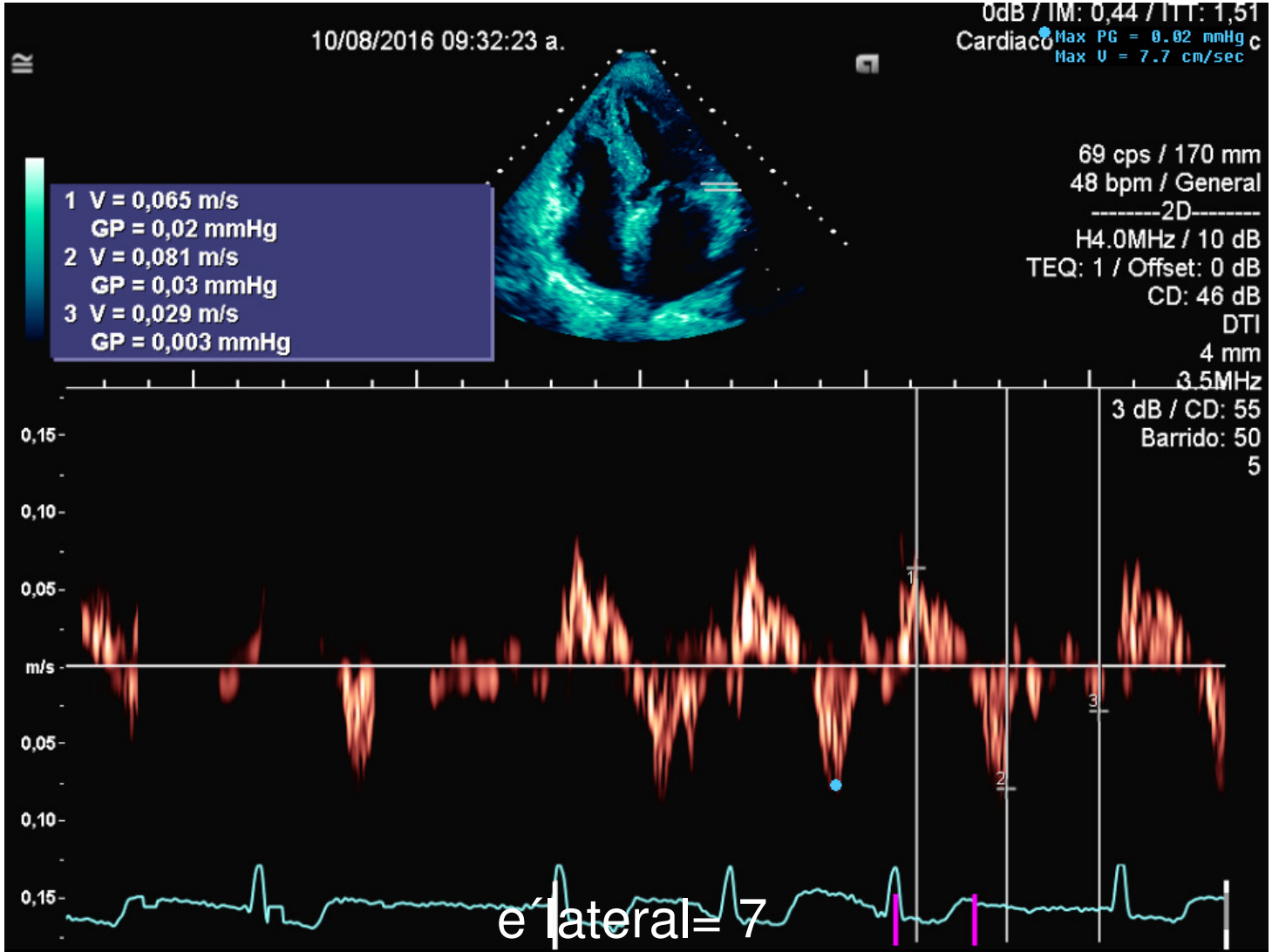


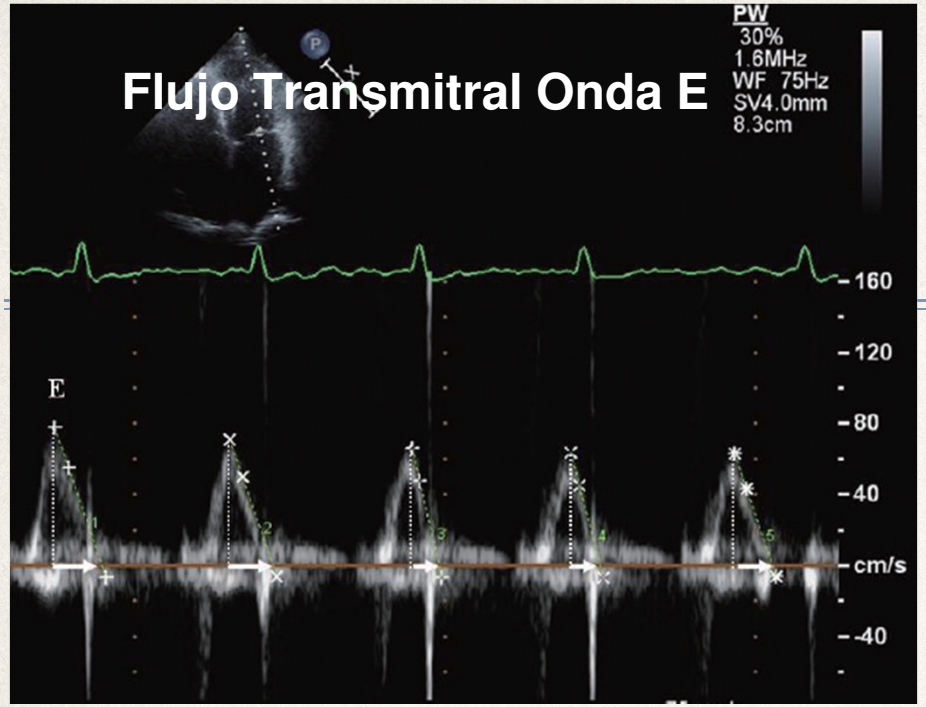
Doppler de tejidos
Septal

e´septal= 6 cm/s

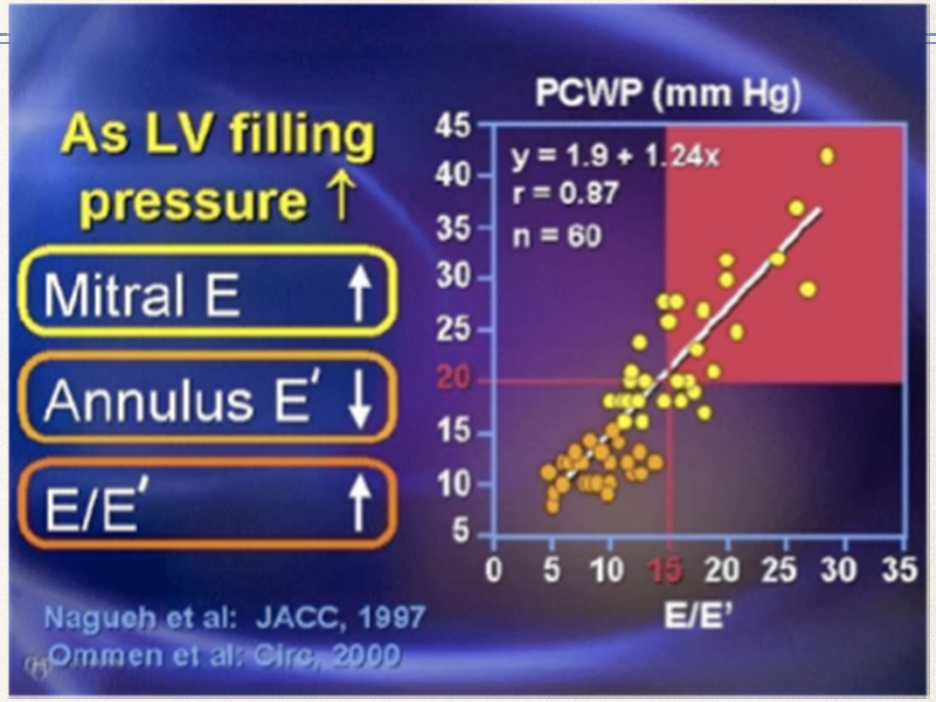
E/e´septal= 93/6= 1

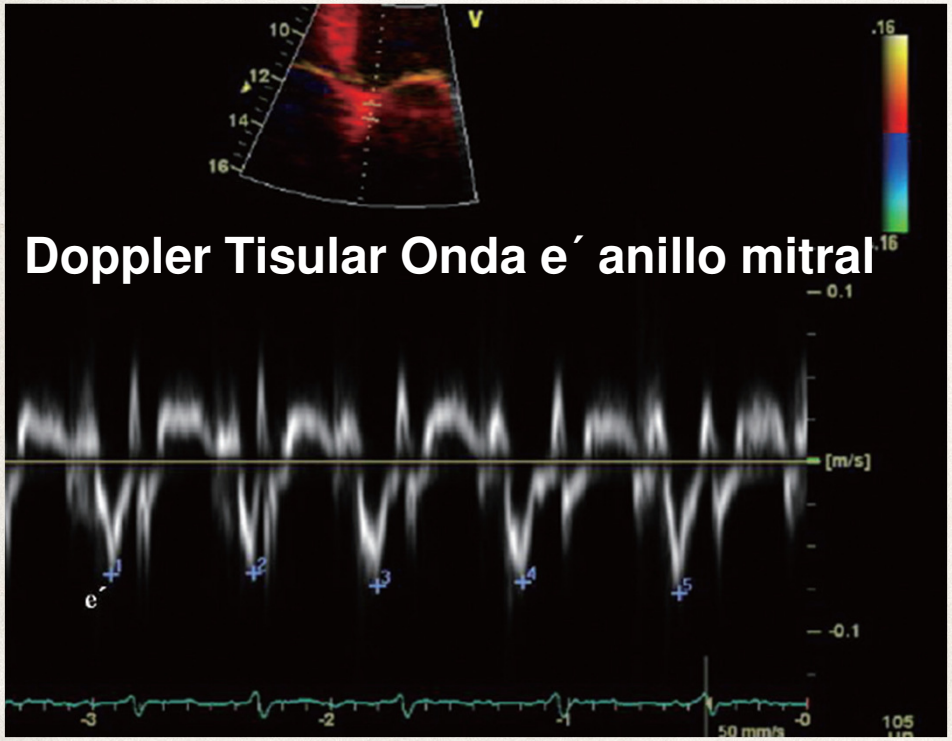
Lateral Tissue Doppler





e´anillo septal < 8 ▻ Tau ≥ 50 ms

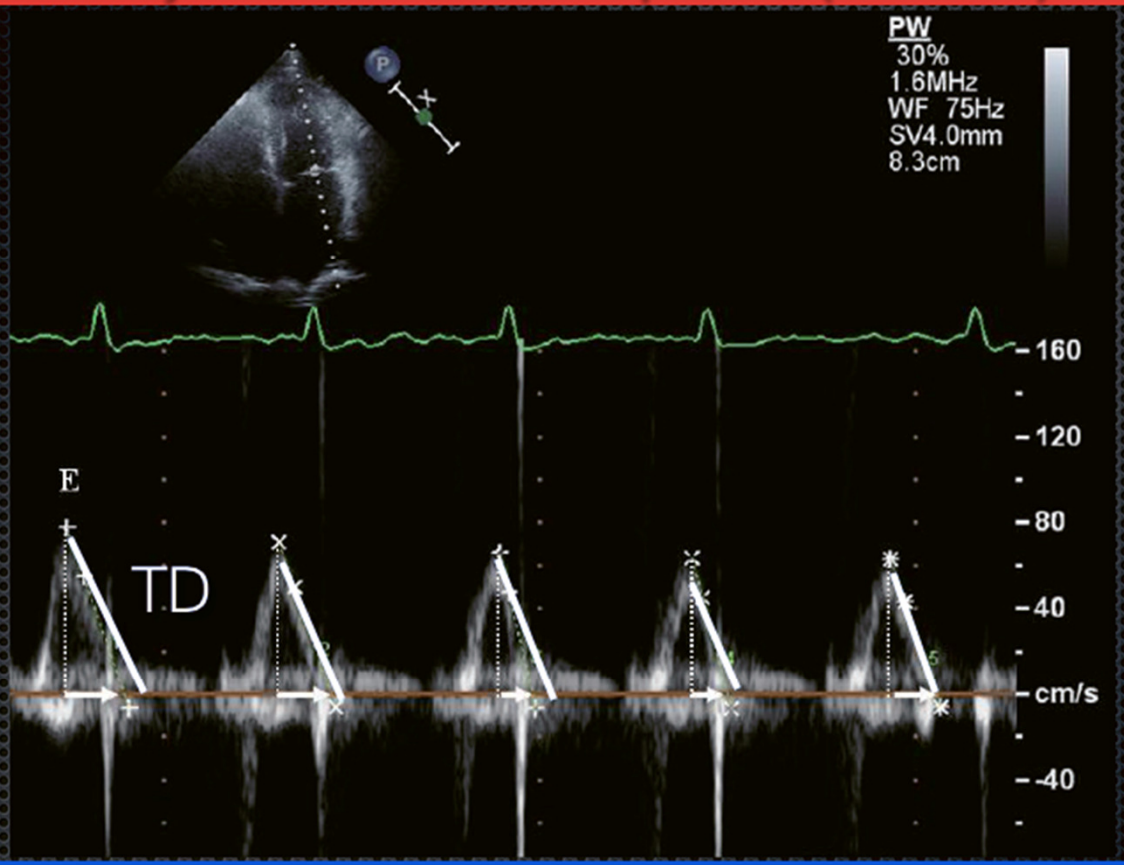




Relación E/e´ septal ≥ 11
predice
Presión llenado VI ≥ 15 mmHg
Sens 73%/Espec 100%

Sohn DW. JASE 1999;12:927

Tiempo de Desaceleración (TD) del Flujo transmitral temprano (Onda E)

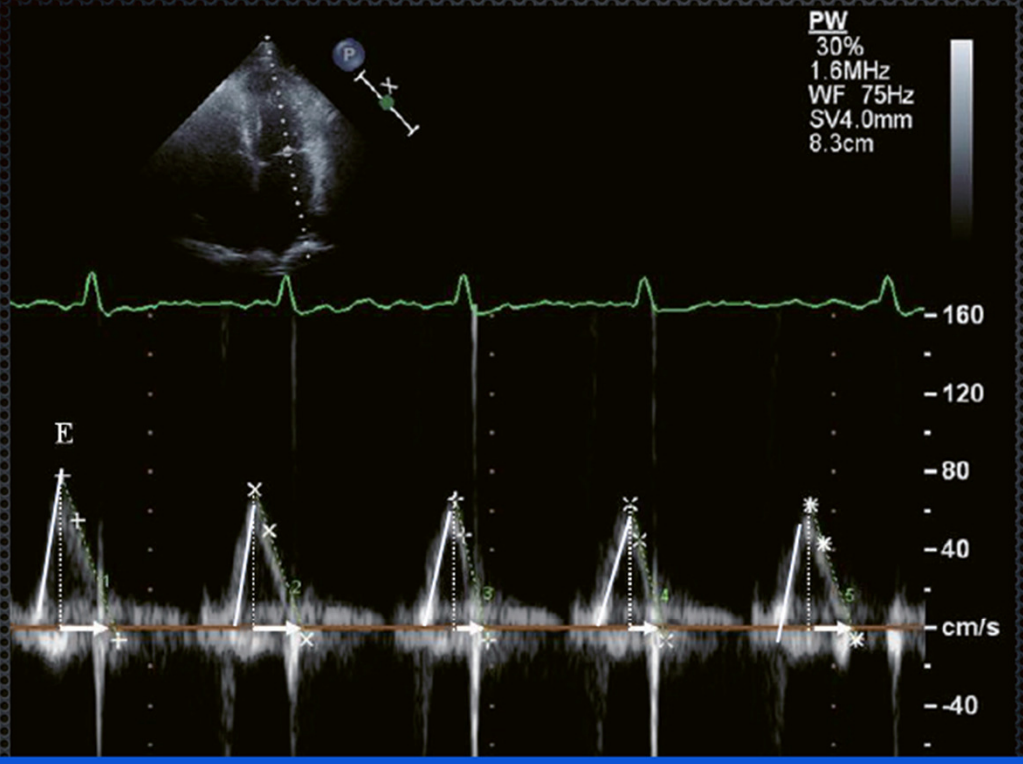


FC 60 -80 LPM

Promediar 5 a 10 ciclos cardiacos

En presencia de FE disminuida, TD ≤ 150 ms predice PLLVI elevada y mal pronóstico

Tiempo de Relajación Isovolumétrica (TRIV)

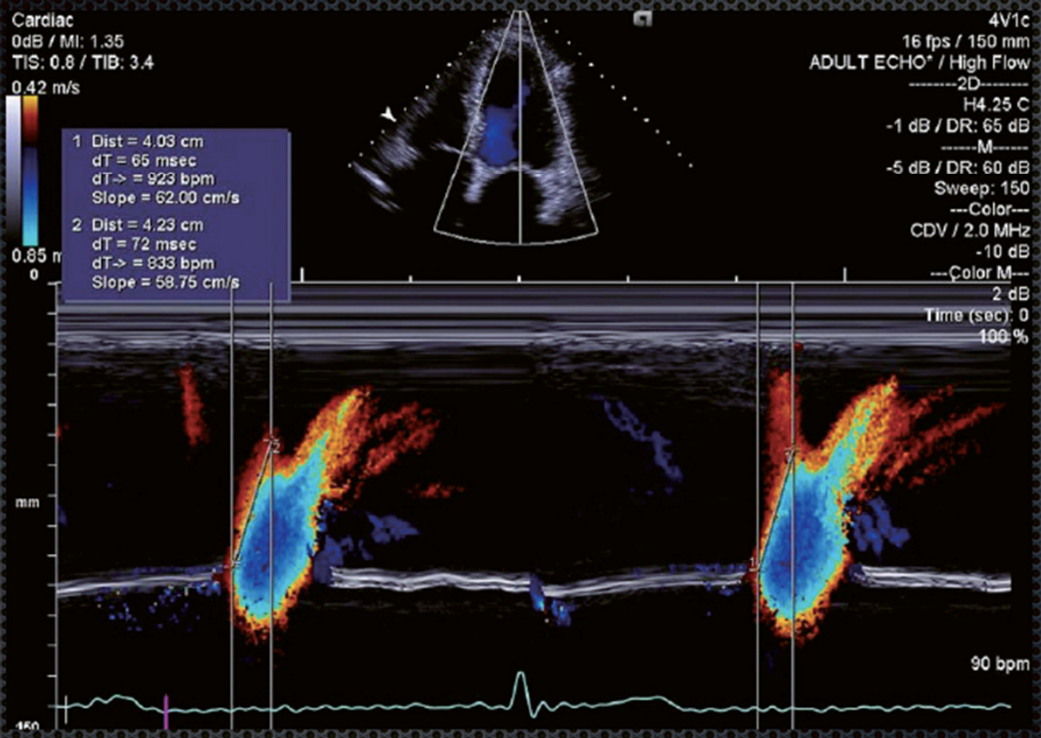


FC 60 -80 LPM

Promediar 5 a 10 ciclos cardiacos

Tiempo de relajación isovolumétrica ≤ 65 ms

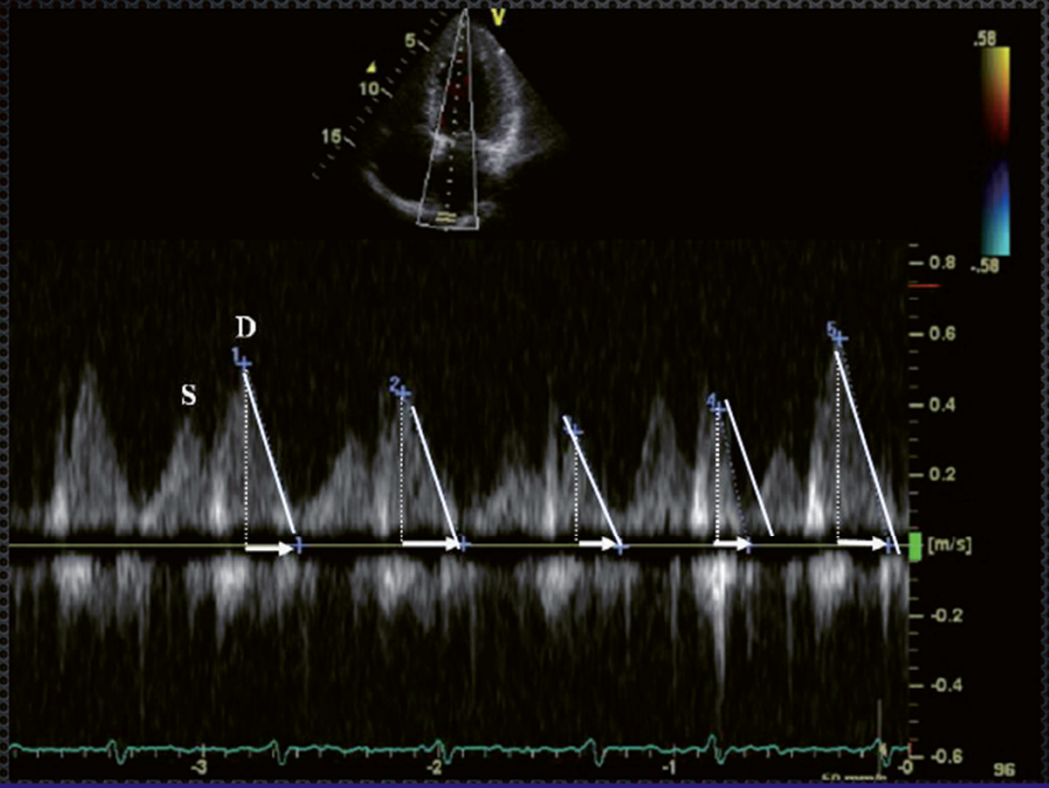
Velocidad propagación flujo Modo M color (Vp)



Vp < 45 cm/s (disfunción diastólica)

E mitral / Vp ≥1.4 (Aumento PLLVI)

Tiempo de Desaceleración (TD) del Flujo Diastólico Venoso Pulmonar



FC 60 -80 LPM

Promediar 5 a 10 ciclos cardiacos

TD ≤ 220 ms predice presión media cuña pulmonar >12 mmHg (sensibilidad/especificidad 100%) JACC 1997;30:19

JACC VOL. 69, NO. 11, 2017
MARCH 21, 2017:1451-64

A Test in Context

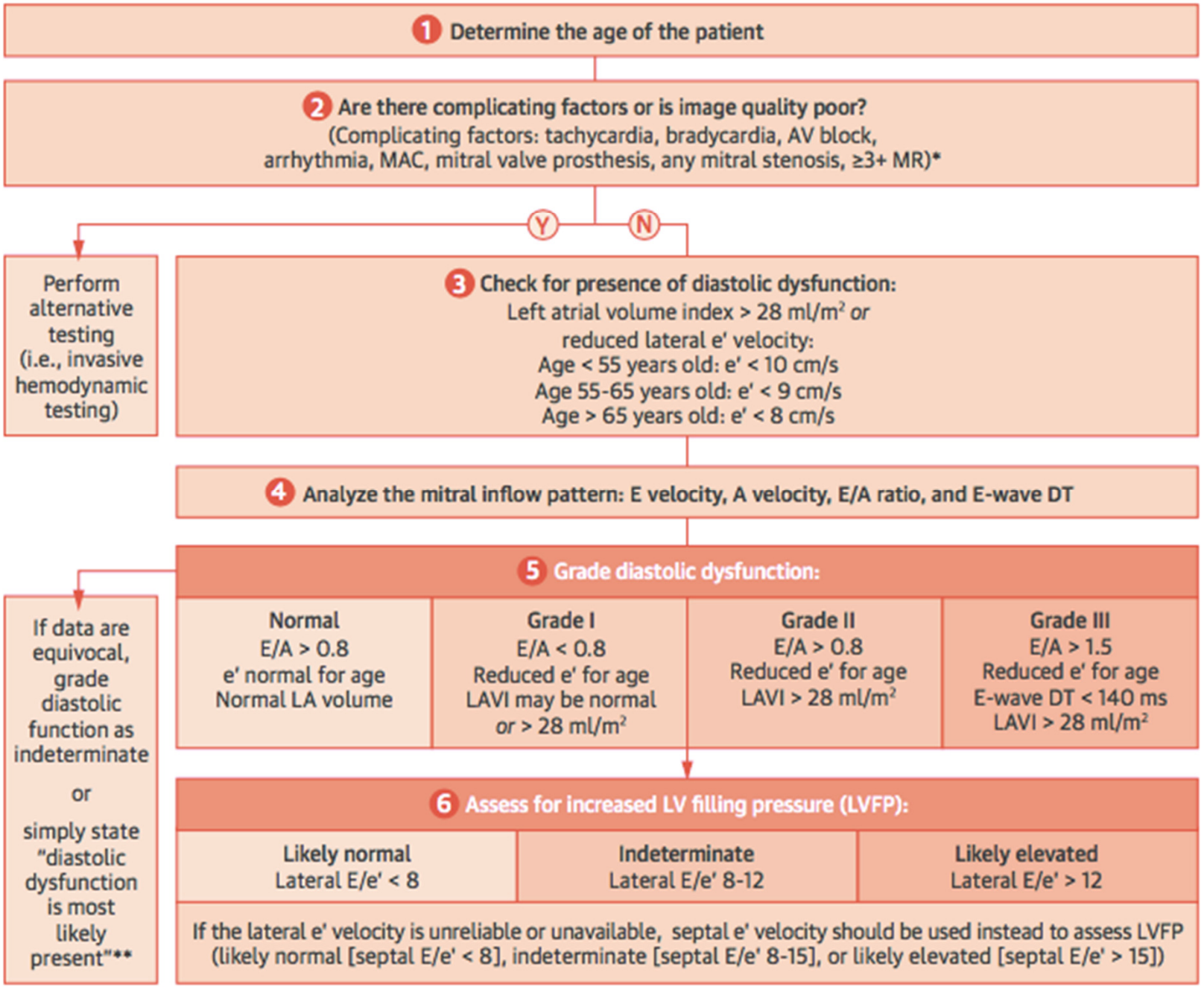
E/A and E/e′ to Assess Diastolic Dysfunction and LV Filling Pressure

Sumeet S. Mitter, MD, MSc, Sanjiv J. Shah, MD, James D. Thomas, MD

ABSTRACT

Diastolic dysfunction represents a combination of impaired left ventricular (LV) relaxation, restoration forces, myocyte lengthening load, and atrial function, culminating in increased LV filling pressures. Current Doppler echocardiography guidelines recommend using early to late diastolic transmitral flow velocity (E/A) to assess diastolic function, and E to early diastolic mitral annular tissue velocity (E/e') to estimate LV filling pressures. Although both parameters have important diagnostic and prognostic implications, they should be interpreted in the context of a patient's age and the rest of the echocardiogram to describe diastolic function and guide patient management. This review discusses: 1) the physiological basis for the E/A and E/e′ ratios; 2) their roles in diagnosing diastolic dysfunction; 3) prognostic implications of abnormalities in E/A and E/e′; 4) special scenarios of the E/A and E/e′ ratios that are either useful or challenging when evaluating diastolic function clinically; and 5) their usefulness in guiding therapeutic decision making.
(J Am Coll Cardiol 2017;69:1451-64)

CENTRAL ILLUSTRATION **Algorithm for Diagnosing Diastolic Dysfunction With Doppler Echocardiography**



Mitter, S.S. et al. J Am Coll Cardiol. 2017;69(11):1451-64.