



Ecocardiografía en el paciente crítico



Dra. Guillermina Fita
Servicio Anestesia Reanimación y
Tratamiento del Dolor
Hospital Clinic i Provincial . Barcelona





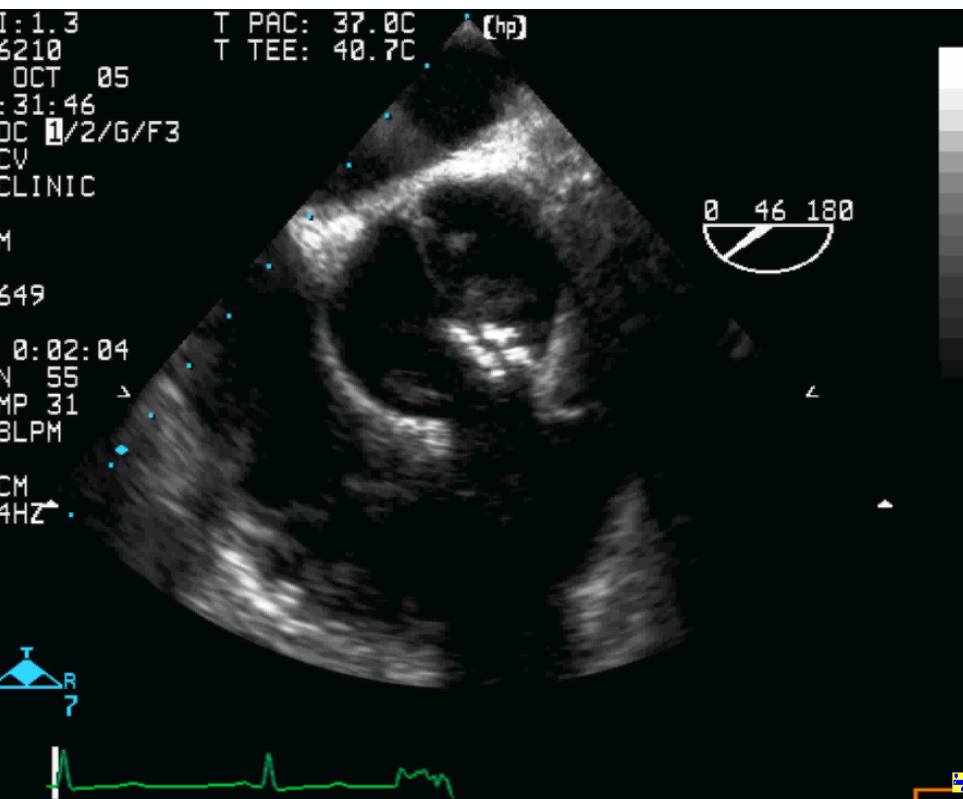
Ecocardiografía en el paciente crítico

SARTD- CHGUV - Sesión de Formación
Valencia 19 de Diciembre

La ECO permite valorar, en tiempo real,

ESTRUCTURAS

- Defectos anatómicos
- Reparaciones quirúrgicas...



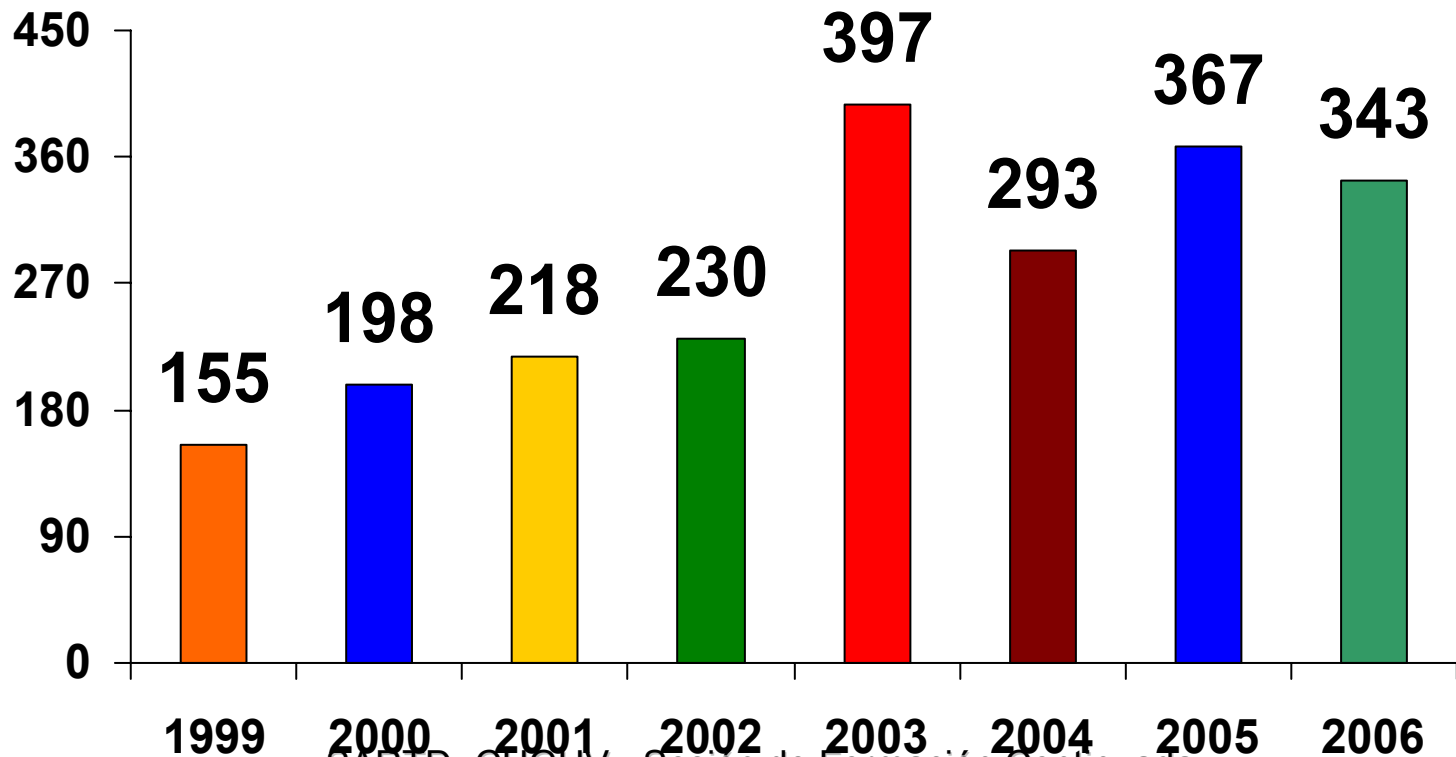
FUNCIÓN

- Contractilidad
- Función valvular
- Precarga...

Nuestra experiencia

Enero 1999 → Septiembre 2006

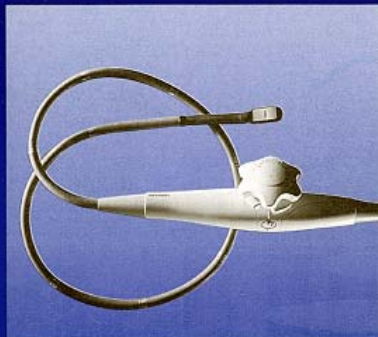
2.201 pacientes registrados



Aprendizaje

1- Laboratorio de ECO: 2 meses

2- Cursos ECO intraoperatorio:

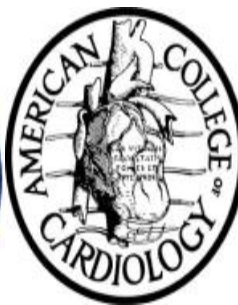
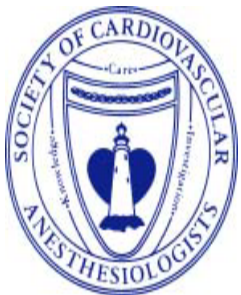


I CURSO ANUAL

DE ECOCARDIOGRAFÍA TRANSESOFÁGICA
DIRIGIDO A ANESTESIOLOGOS
Y REANIMADORES

18 de Noviembre de 1999

*5th Annual Comprehensive
Review & TEE Update:
Clinical Decision-Making in
the Cardiac Surgery Patient*
February 2002. Florida
**For Cardiologists, Cardiothoracic
Surgeons, and Cardiovascular
Anesthesiologists**



EACTA
The European Association of
Cardiothoracic Anesthesiologists

1st Annual EACTA Echocardiography Course



Uppsala Sweden
September 10th - 13th, 2002

www.eacta.org

3- Formación continuada:

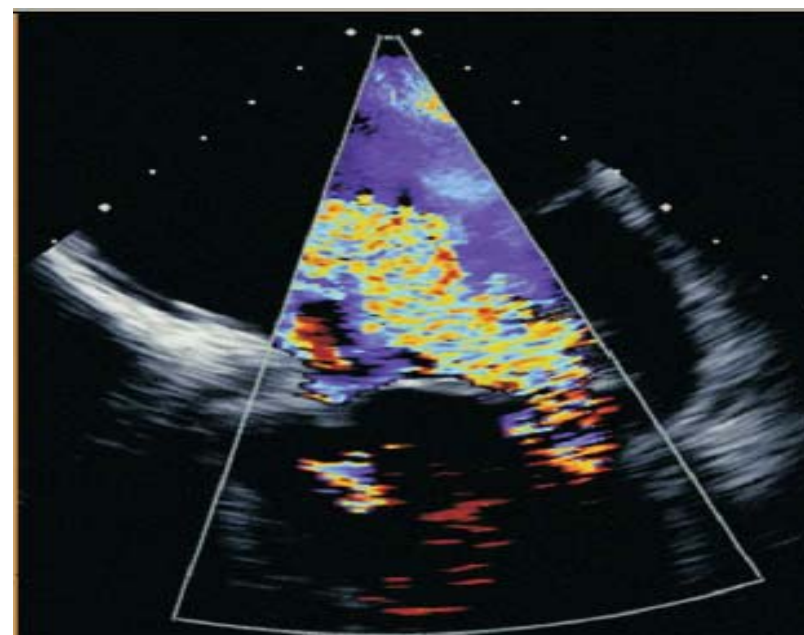


Congress Center Giovanni XXIII
Bergamo - Italy
SEPTEMBER 20th-24th, 2004

EACTA
European Association
of Cardiothoracic Anesthesiologists


ITACTA
Italian Association of Cardiothoracic
Anesthesiologists

3rd EACTA ECHO
joined with
**6th NATIONAL COURSE
ON PERIOPERATIVE TOE**

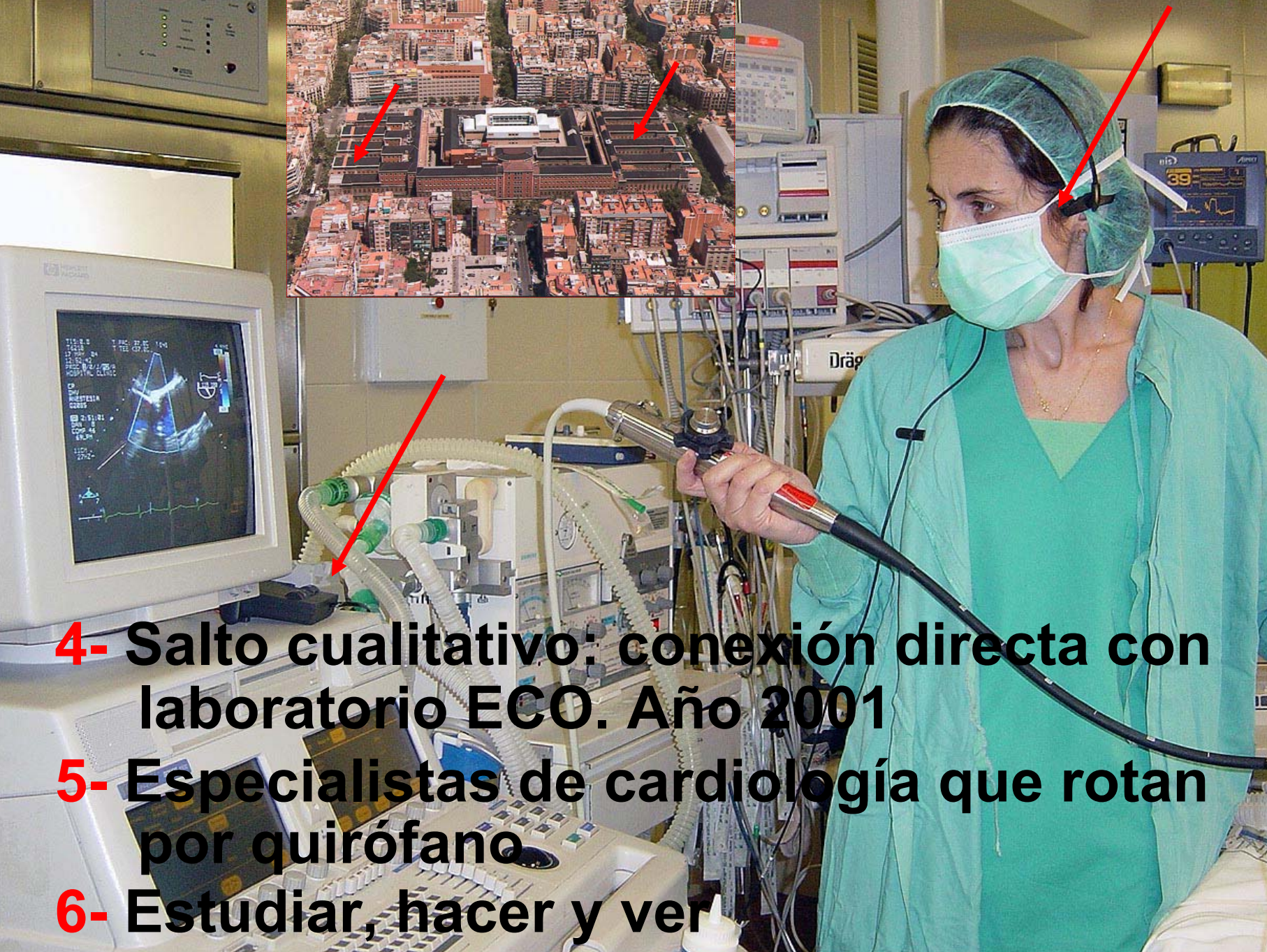


**Curso Internacional
de Ecocardiografía
para Anestesiólogos**

Pamplona 26, 27 y 28 de octubre 2006

Organiza:
 **Clínica Universitaria
Universidad de Navarra**

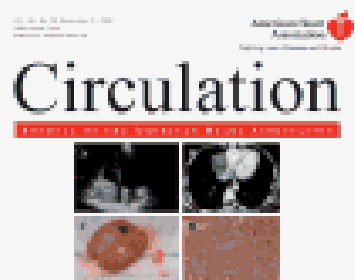
Participan:
The Cleveland Clinic Foundation, Johns Hopkins Hospital,
Hospital Clínic, Hospital Gregorio Marañón, Hospital Sant Pau



4- Salto cualitativo: conexión directa con laboratorio ECO. Año 2001

5- Especialistas de cardiología que rotan por quirófano

6- Estudiar, hacer y ver



Circulation. 1997;95:1686-1744



ACC/AHA Guidelines for the Clinical Application of Echocardiography. A Report of the **American College of Cardiology / American Heart Association** Task Force on Practice Guidelines for Clinical Application of Echocardiography. Developed in Collaboration With the **American Society of Echocardiography**



J Am Coll Cardiol. 2000;36:1441-53

ACC/AHA/Am Society Echocardiography

- **Revisan las guías de 1997**
- **Sección de ecocardioperioperatorio y en el paciente crítico**

- Reparaciones valvulares
- Reparación cardiomiopatía hipertrófica obstructiva
- Patología de la aorta torácica
- Cirugía cardíaca endovascular mínimamente invasiva o cirugía vascular de endoprótesis
- Alteración hemodinámica grave
- Cardiopatías congénitas

Clase I

- Riesgo elevado isquemia coronaria
- Cuerpos extraños
- Embolectomía pulmonar
- Embolismo aéreo neurocirugía
- Trasplante pulmonar

Clase II

- Embolismo aéreo cirugía ortopédica

Clase III



2003;108; 1146-62

ACC/AHA/Am Society Echocardiography

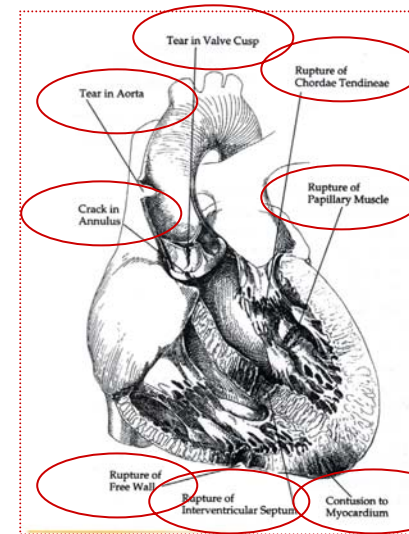
• Revisan las guías del 2000 y amplían indicaciones para el paciente crítico y traumático

Paciente crítico:

- Inestabilidad hemodinámica
- Sospecha de disección de aorta

Politraumático inestable:

- Sospecha de valvulopatía o coronariopatía previa en paciente politraumático
- Paciente con trauma torácico inestable por mecanismo potencial de lesión cardíaca o aórtica. Sospecha de:
 - lesión cardíaca
 - derrame pericárdico, taponamiento...
- Lesión potencial durante pericardiocentesis, marcapasos, catéteres con o sin signos de taponamiento



Razones más frecuentes para solicitar ECO en Reanimación o en Urgencias

- **Hipotensión que no responde a líquidos/vasopresores:**
 - valorar el volumen intravascular
 - valorar función cardíaca derecha e izquierda
- **Trauma torácico conocido o sospechado**
- **Sospecha embolismo pulmonar**
- **Sospecha disfunción valvular: nativa/protésica**
- **Sospecha endocarditis**
- **Sospecha de lesión pericárdica**
- **Hipoxemia con sospecha "shunt" intracardiaco**
- **Dolor torácico**
- **Complicaciones IAM**

Feasibility and Potential Clinical Utility of Goal-Directed Transthoracic Echocardiography Performed by Noncardiologist Intensivists Using a Small Hand-Carried Device (SonoHeart) in Critically Ill Patients

Journal of Cardiothoracic and Vascular Anesthesia, Vol 19, No 2 (April), 2005; pp 155-159

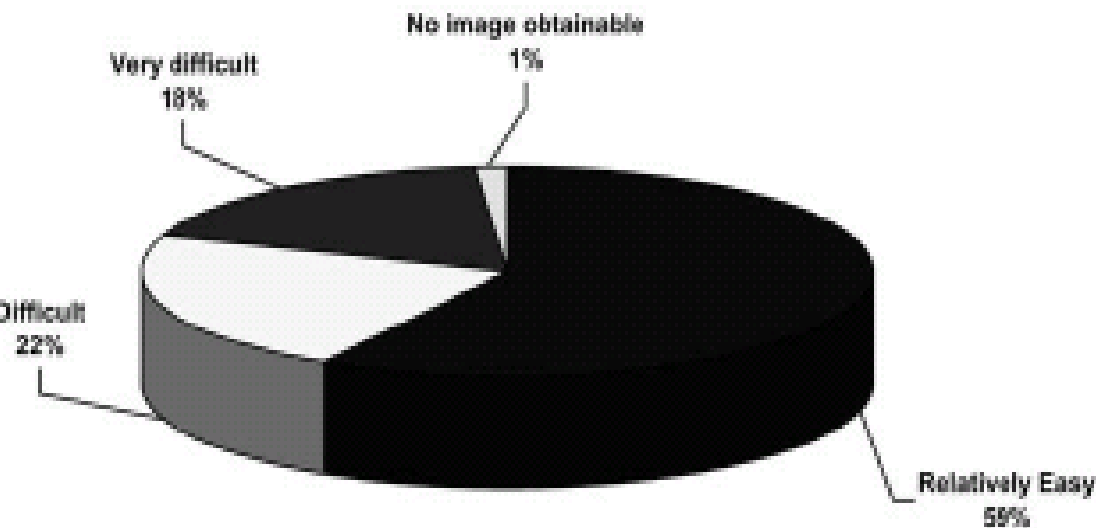
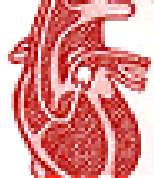


Fig 3. How intensivists rated ease of image acquisition.





Impact of Intraoperative Transesophageal Echocardiography During Noncardiac Surgery

Journal of Cardiothoracic and Vascular Anesthesia, Vol 20, No 6 (December), 2006: pp 768-771

Objective: The purpose of this study was to test if parameters measured by intraoperative transesophageal echocardiography (TEE) could be useful to evaluate the hemodynamic status of high-risk cardiovascular patients and if this information was sufficient to make changes in intraoperative management.

Design: Prospective clinical study.

Setting: Single-university hospital.

Participants: Ninety-eight patients undergoing noncardiac surgery.

Interventions: Every patient was assessed with a baseline examination of 2-dimensional, color, pulsed, and continuous Doppler images. Intraoperative changes in any of the evaluated and measured parameters led to a specific change according to the protocol.

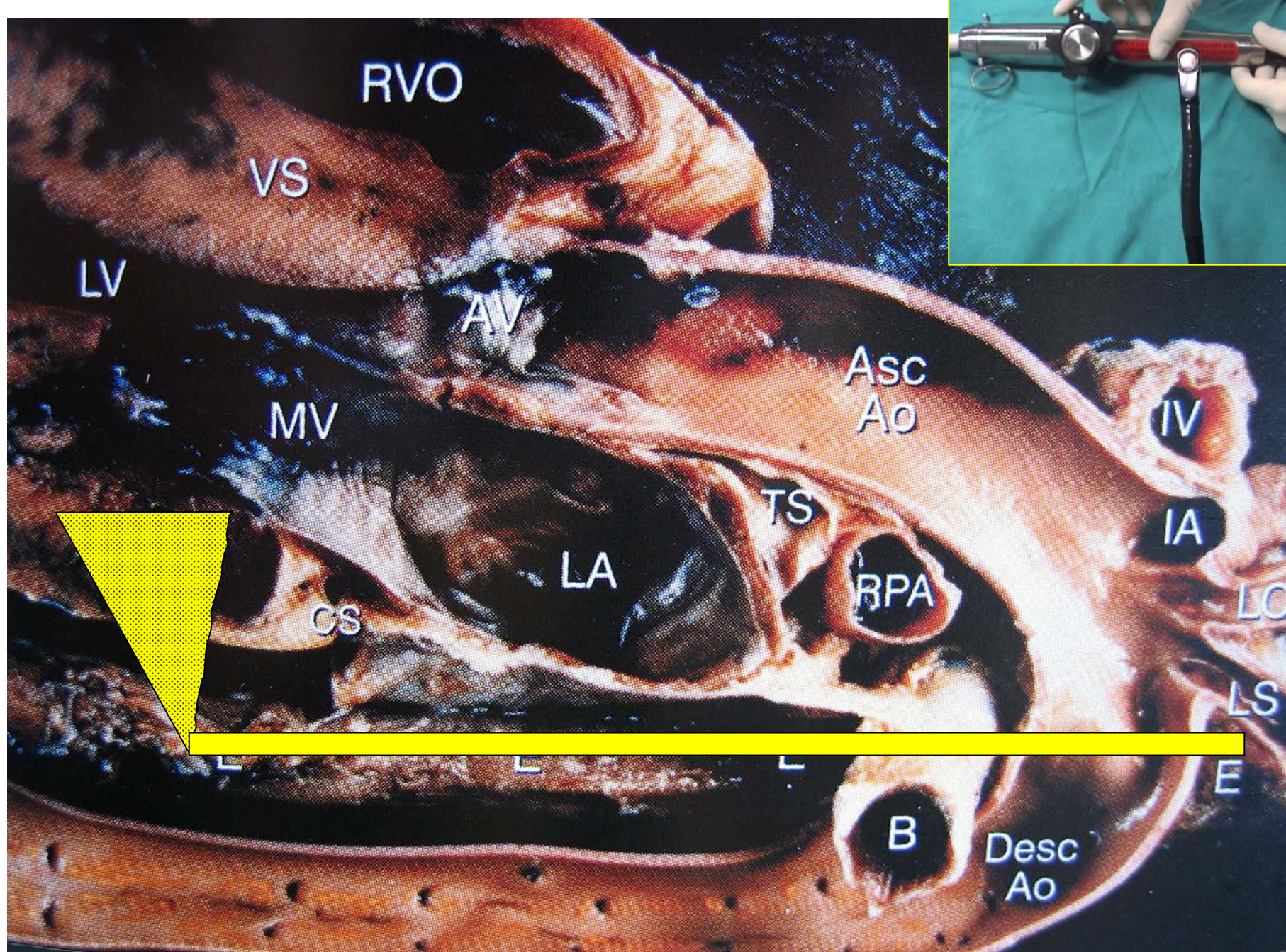
Measurements and Main Results: After continuous monitoring with TEE during surgery, all patients were assigned to one of the following groups: (1) TEE was of no use, (2) TEE-

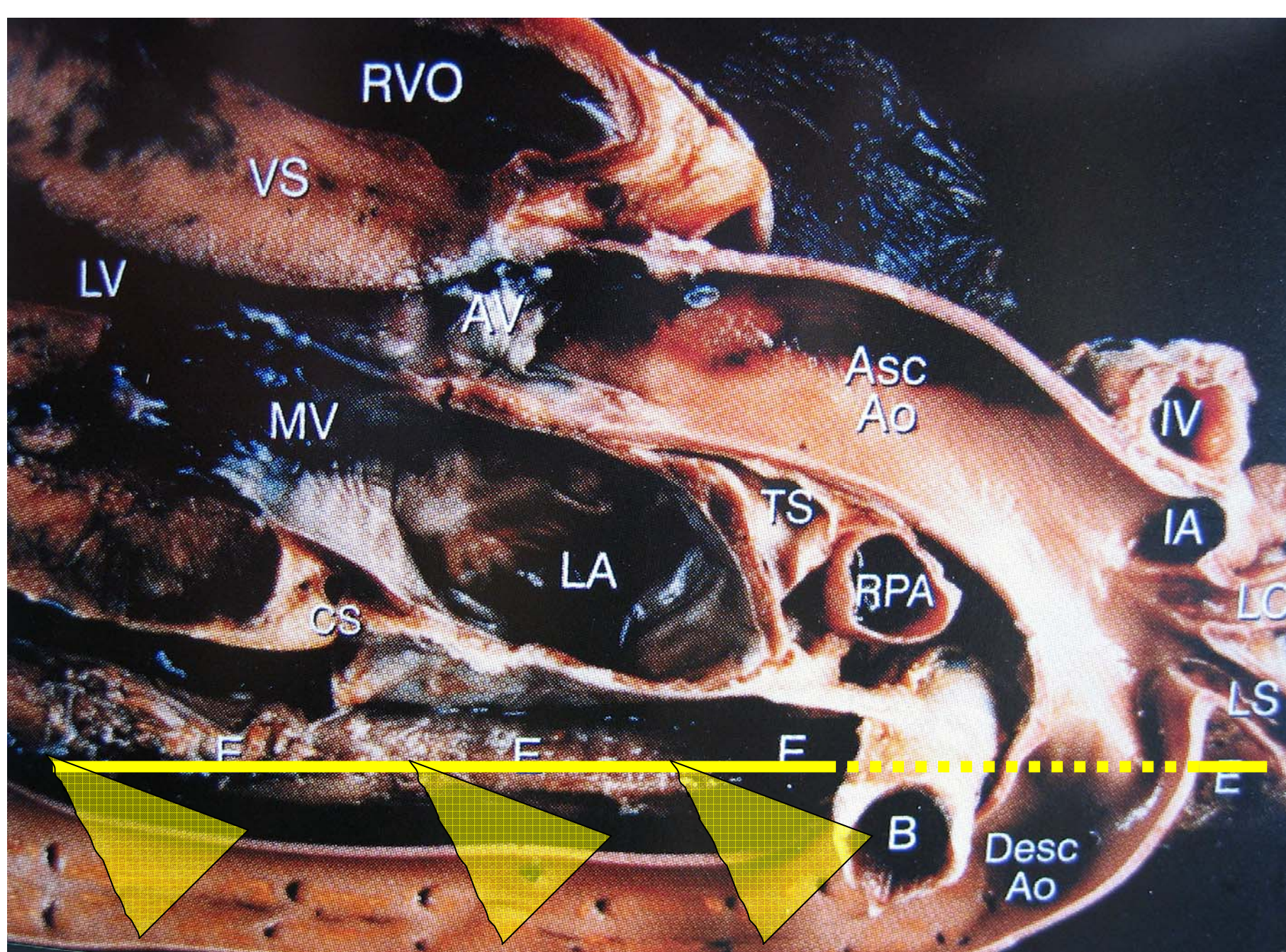
directed intraoperative management changes, (3) intraoperative TEE-directed changes in postoperative management, and (4) TEE successfully used as a substitute for pulmonary artery catheter monitoring. Two patients (2%) were assigned to group 1, 47 (48%) patients to group 2, 25 (25%) patients to group 3, and 24 (24%) patients to group 4. The most frequent modifications in intraoperative management were changes in drug therapy and fluid administration. Postoperative management changes were mostly made because of new diagnosis (14%) and new left ventricular wall motion abnormalities (9%).

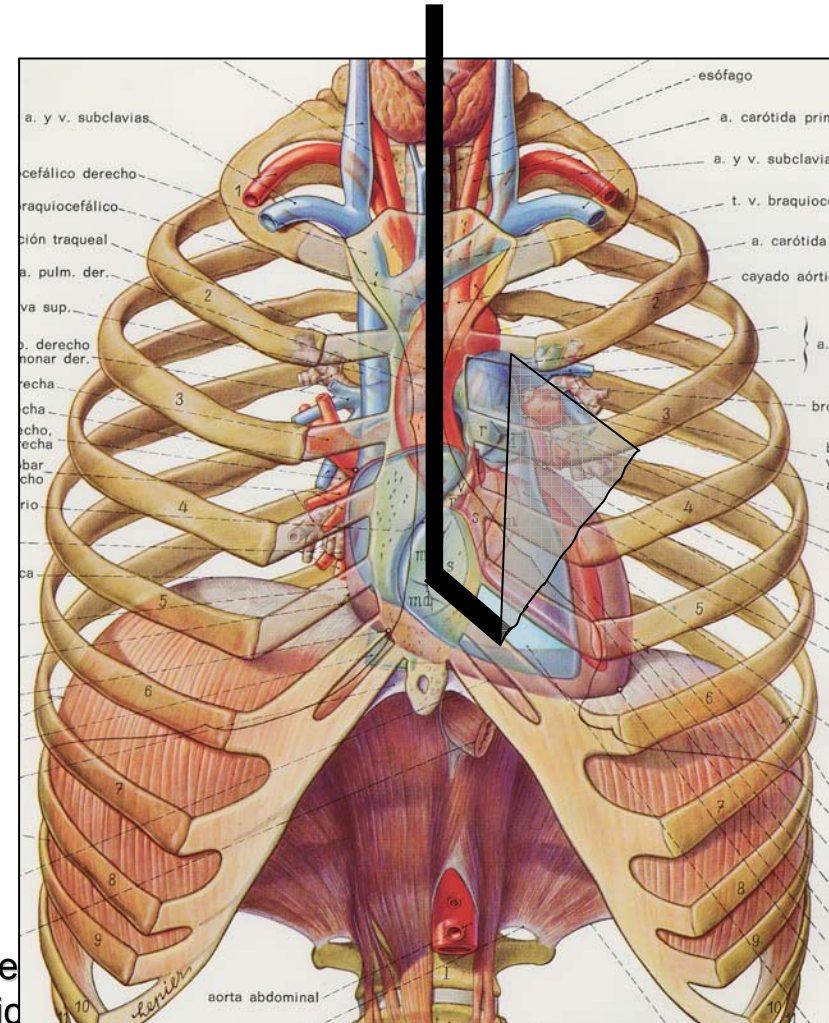
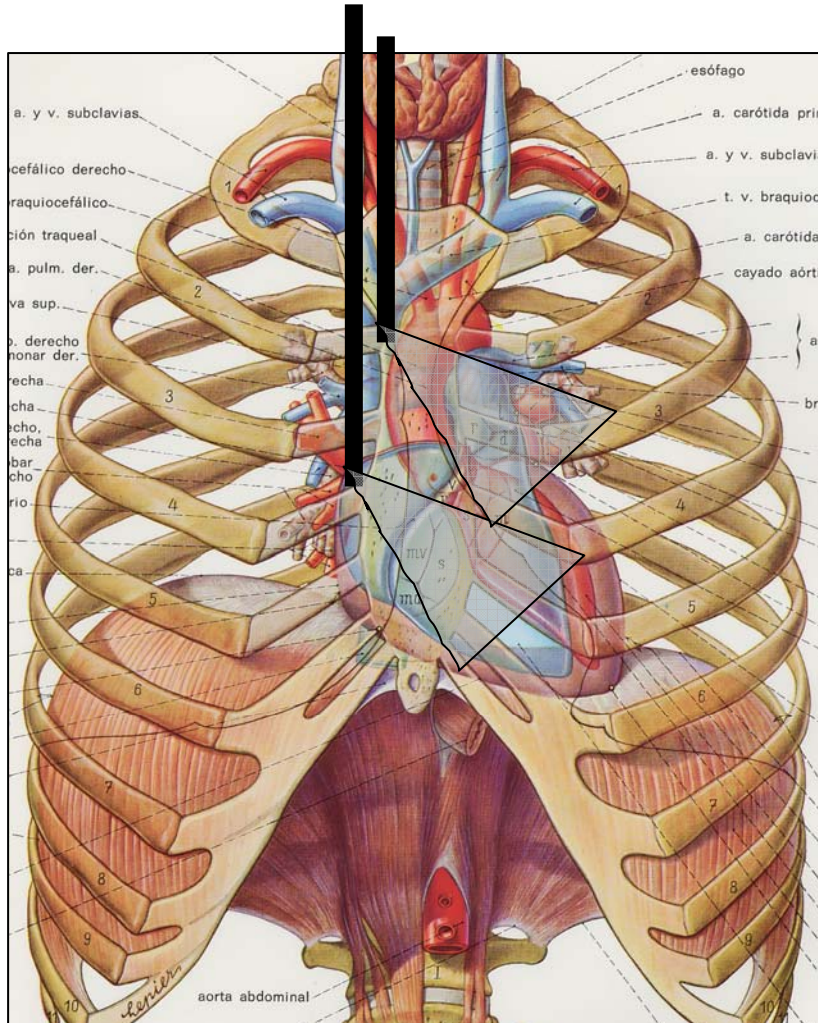
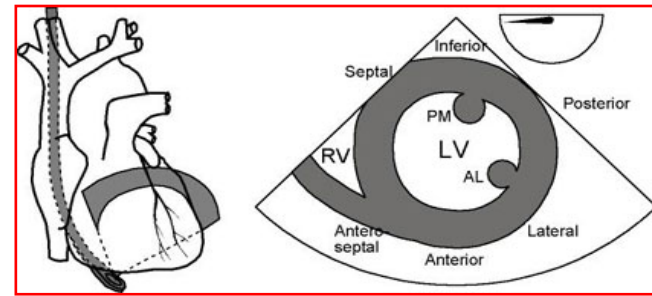
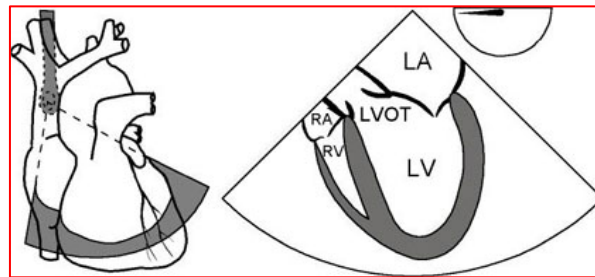
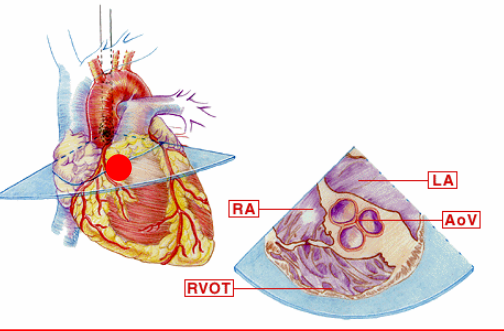
Conclusion: These results strongly suggest that objective measurements made by intraoperative TEE are effective in unveiling relevant clinical findings and useful information in high-risk patients undergoing noncardiac surgery.

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KEY WORDS: *intraoperative transesophageal echocardiography, monitoring, noncardiac surgery, hemodynamic*







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 de Dic

VALORACIÓN HEMODINÁMICA

Determinar si la causa de la inestabilidad es de origen cardíaco

En el paciente hipotenso e inestable la ECO permite hacer diagnóstico diferencial entre diferentes patologías:

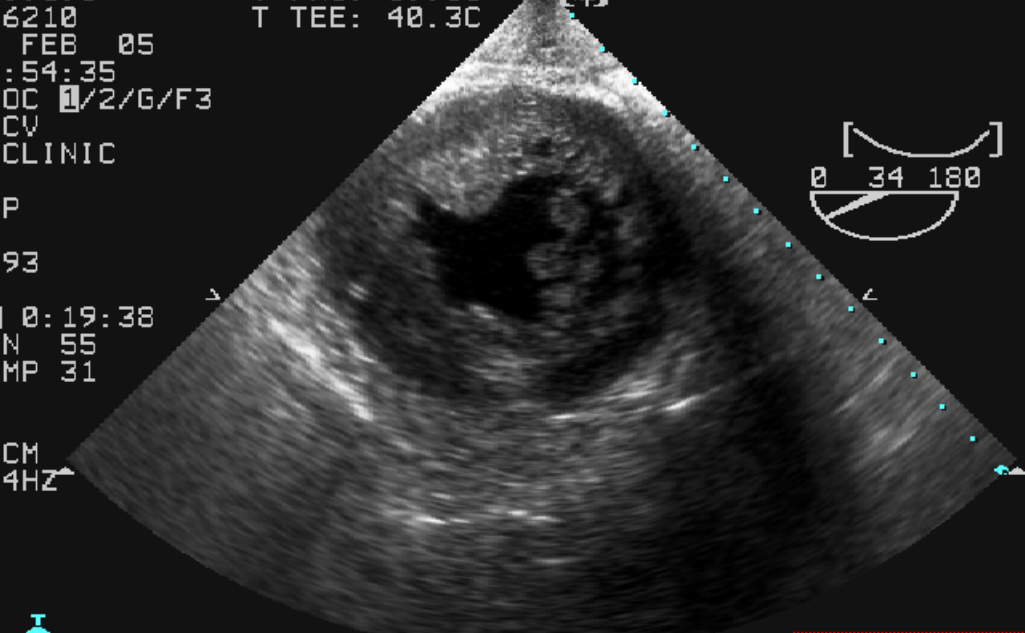
- fallo contractilidad VI o VD
- disfunción diastólica
- hipovolemia
- taponamiento
- embolismo pulmonar

Precarga

**"Use of echocardiography for hemodynamic monitoring". Crit Care Med 2002;30:1361-4
Brown JM. Australia**

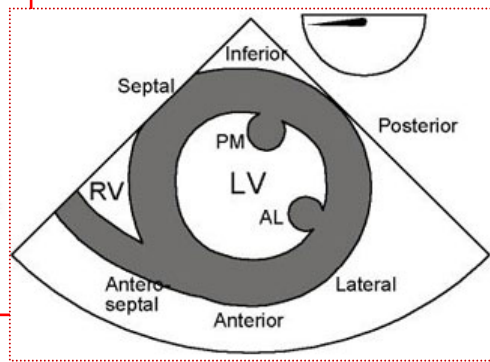
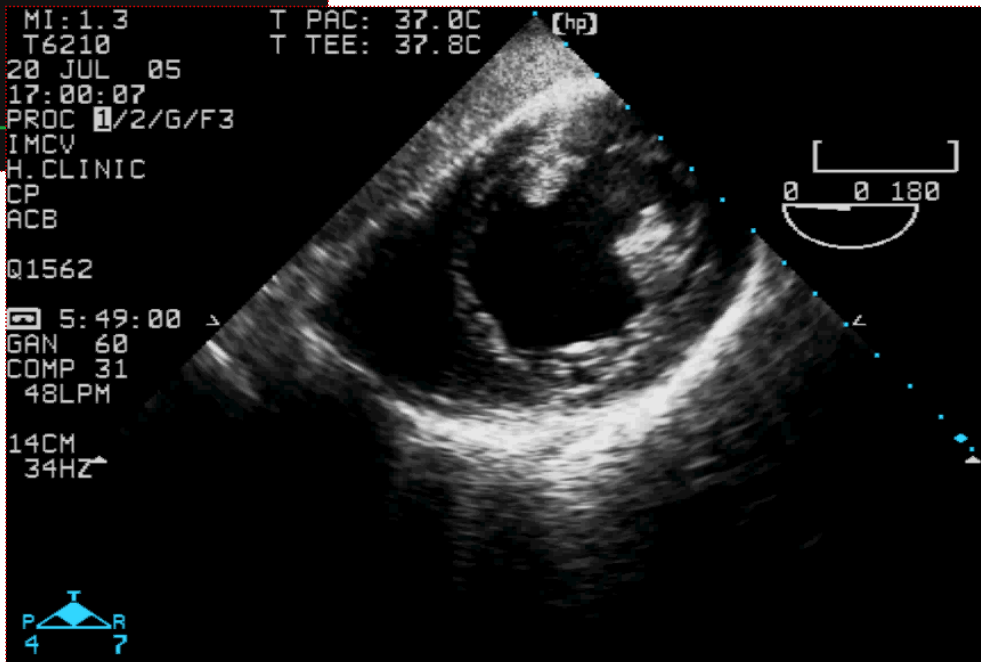
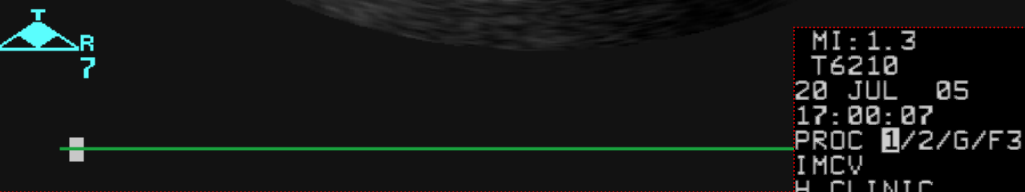
Efectividad y precisión de diferentes técnicas para medir la precarga

- **Método Doppler:**
 - mitral, vvpp
 - vena cava
- **Medida de volumen:**
 - modo M; 2D
- **Desplazamientos del tabique**



**Medida de volumen
 visión transgástrica
 eje corto:**

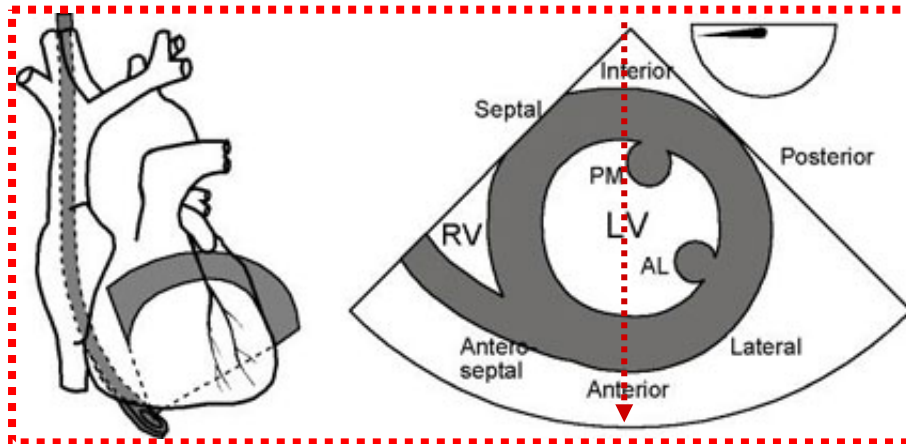
- 2D
- cualitativa



SARTD- CHGUV
 Valenc

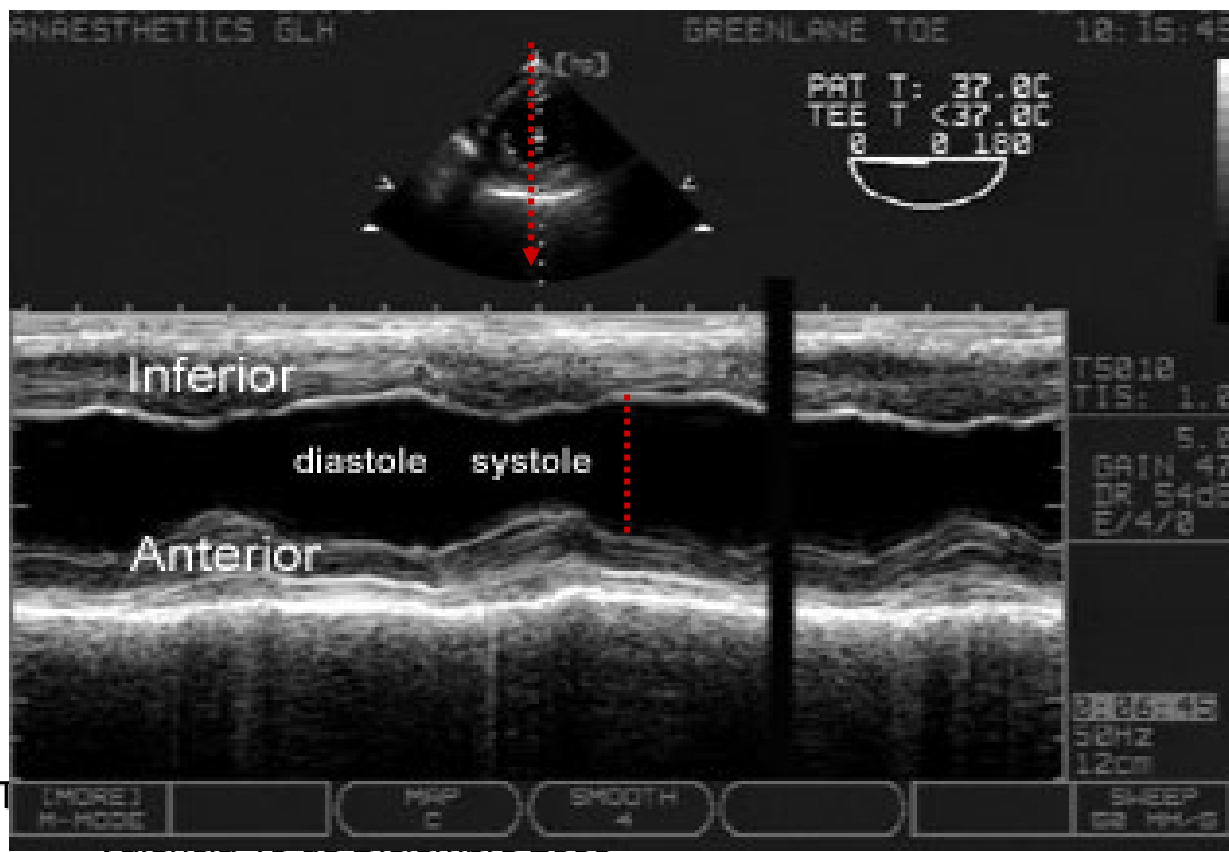
Medida de volumen:

- **dimensión VITD**



Modo M

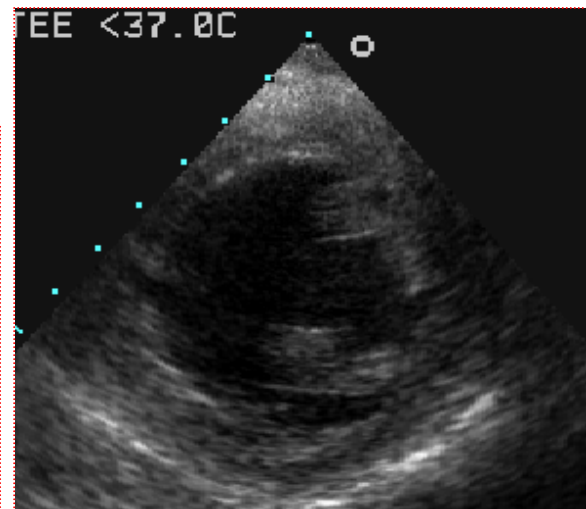
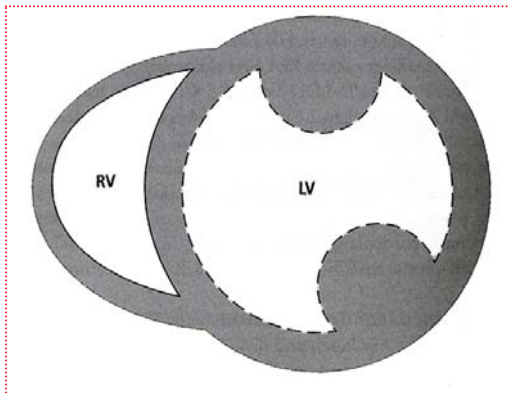
- 4-5,5 cm
- Errores:
 - 2D
 - 3D



Medida de volumen:

- Área diastólica final

2 D



Hypovolaemia



<8 cm²

Normal



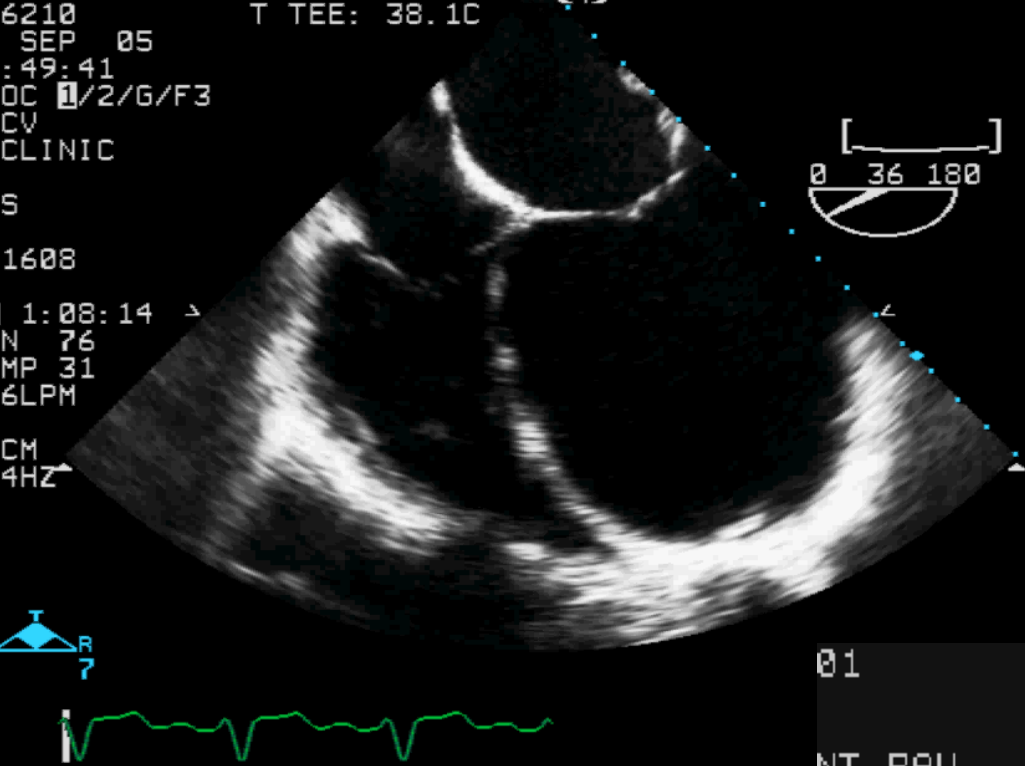
8-14 cm²

Dilated



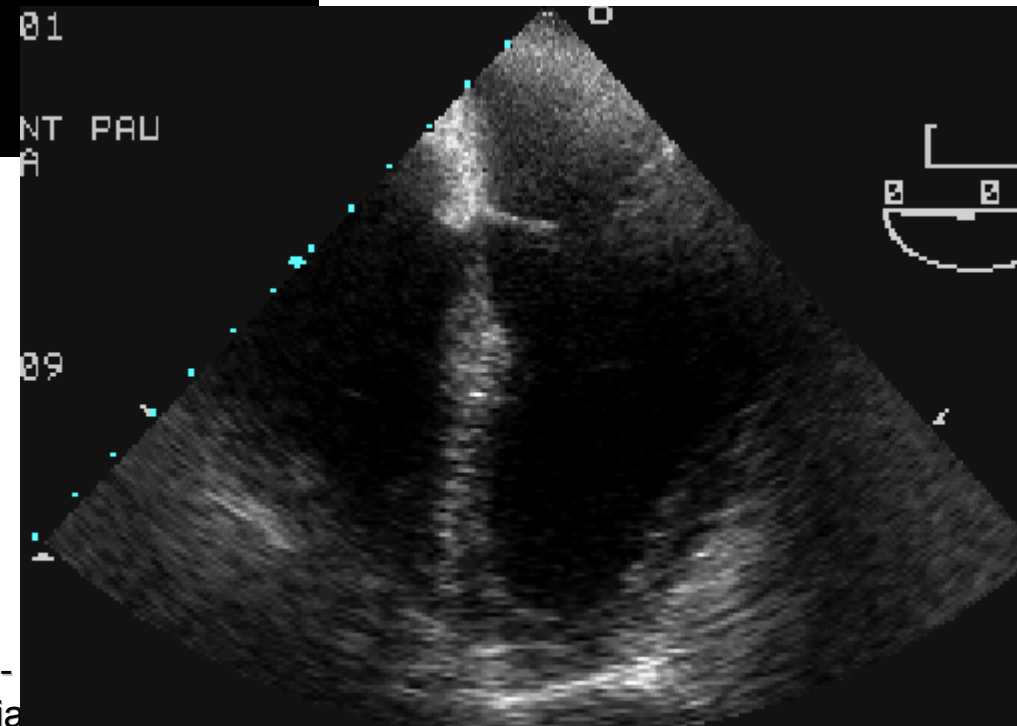
>14 cm²

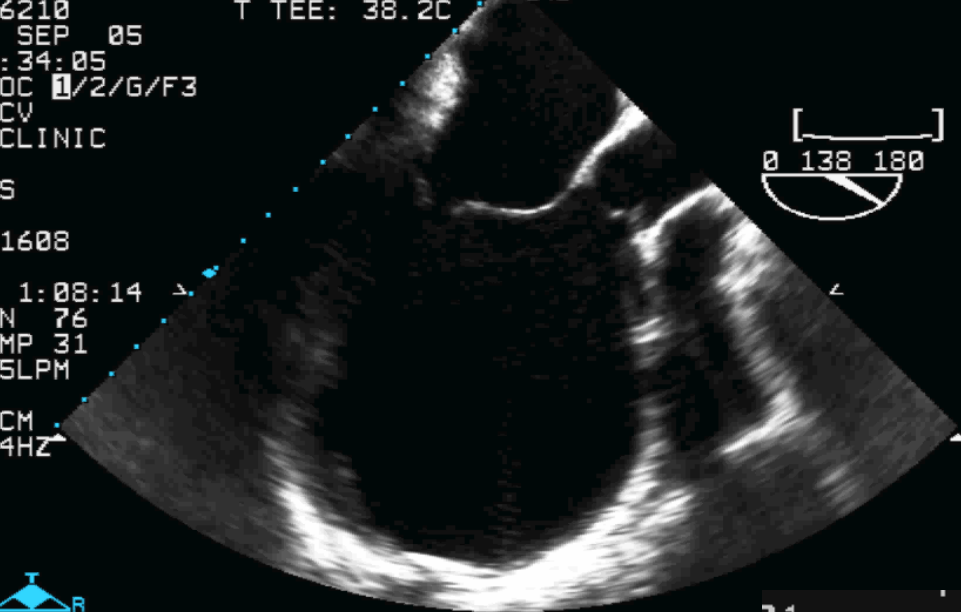
- hipovolemia: <8 cm²
- normal: 8-14 cm²
- dilatado: >14 cm²



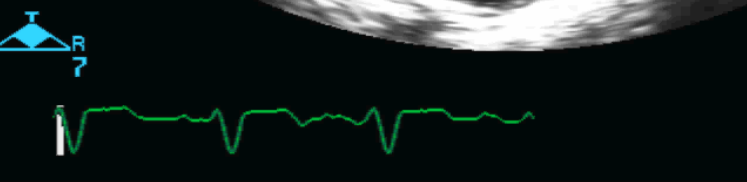
**Contractilidad
global normal**

**Contractilidad
global
patológica**

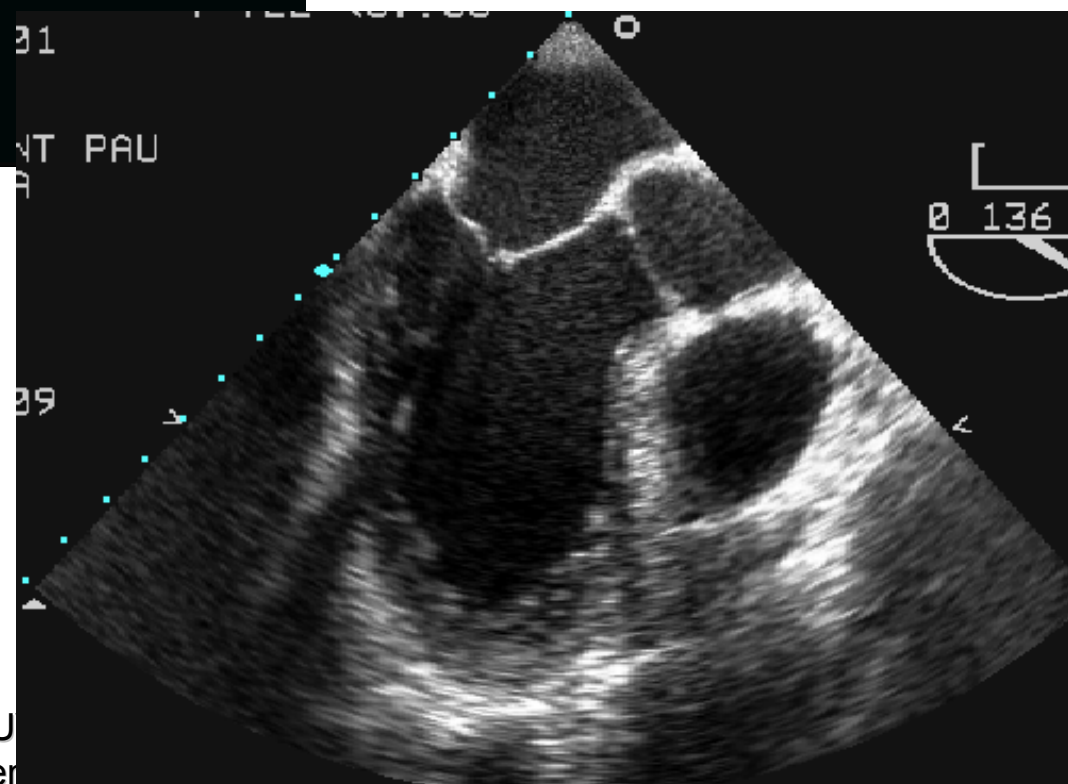


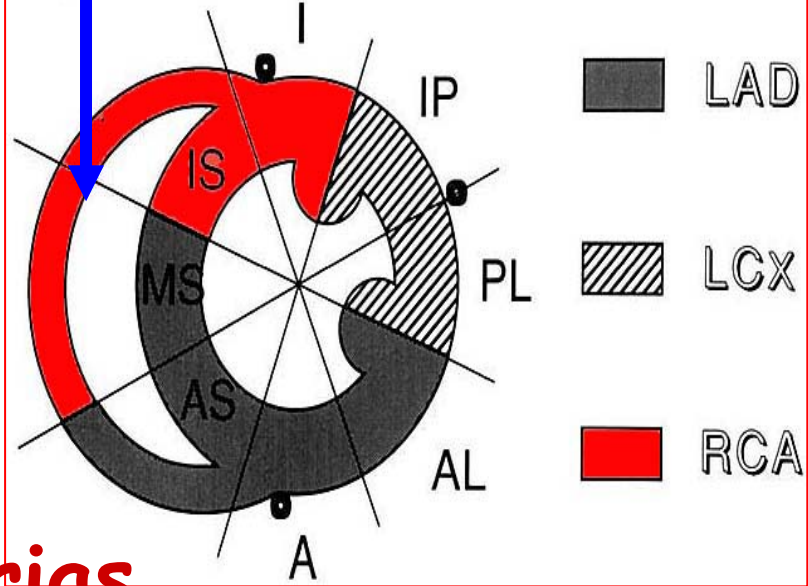
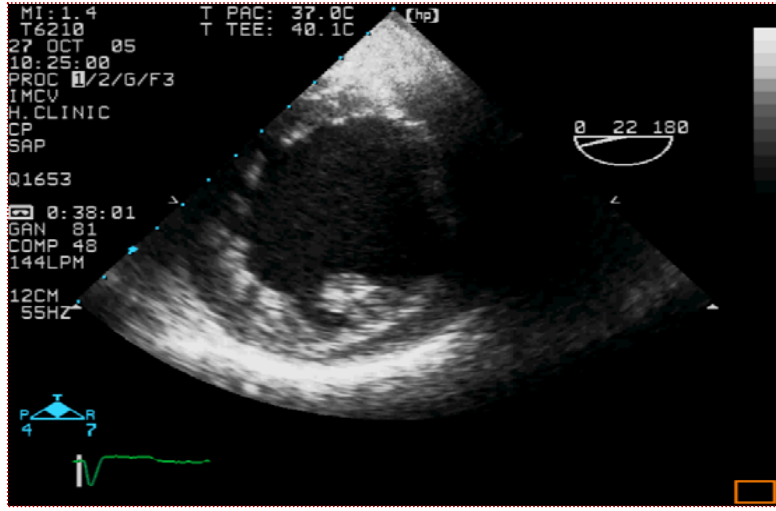


Contractilidad normal

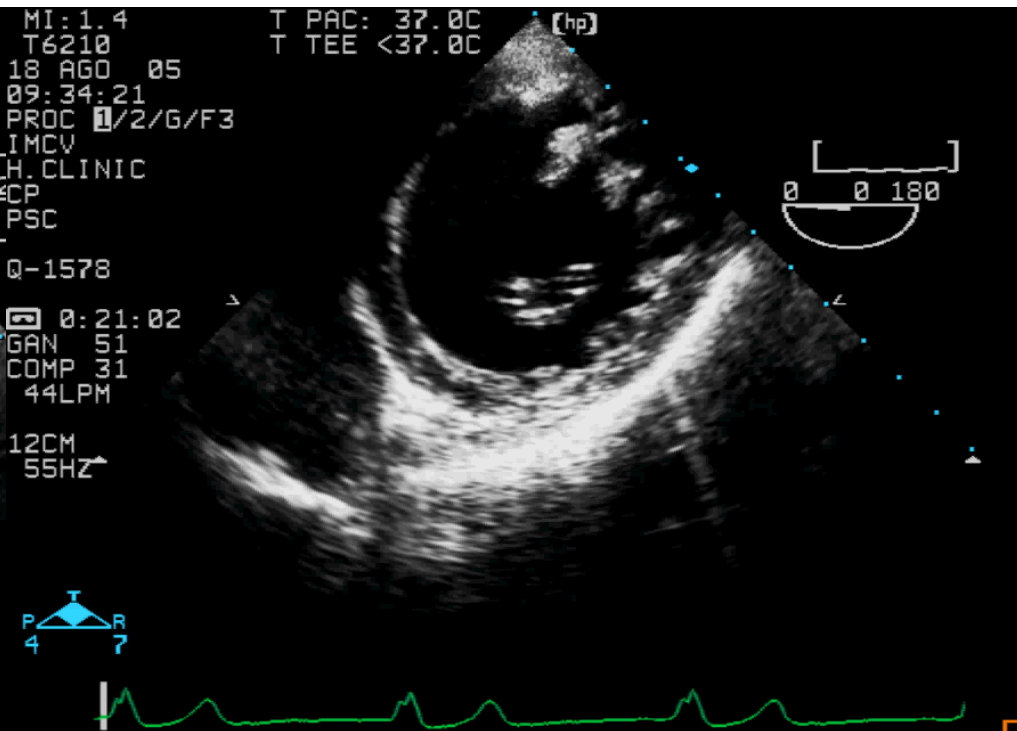
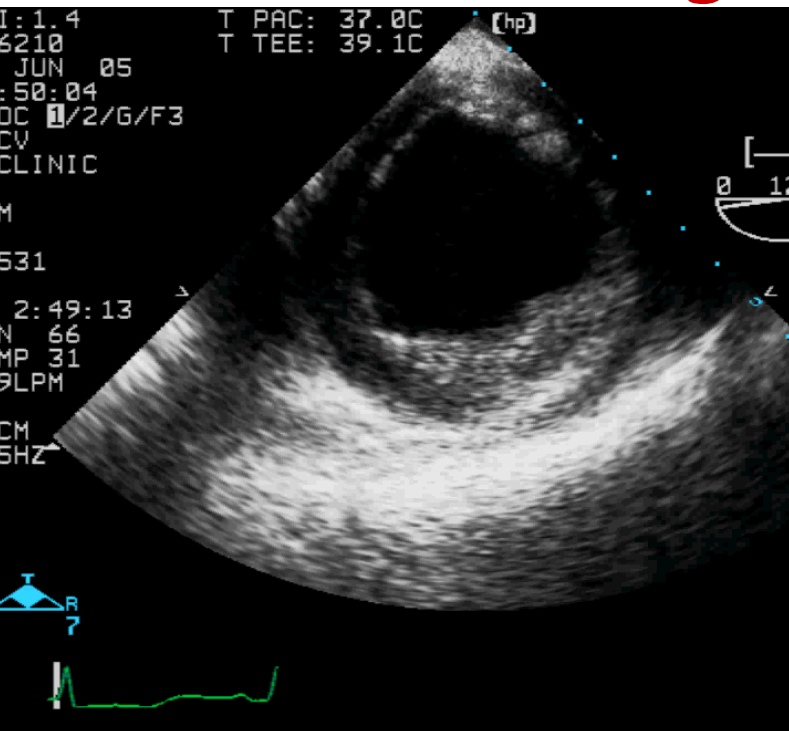


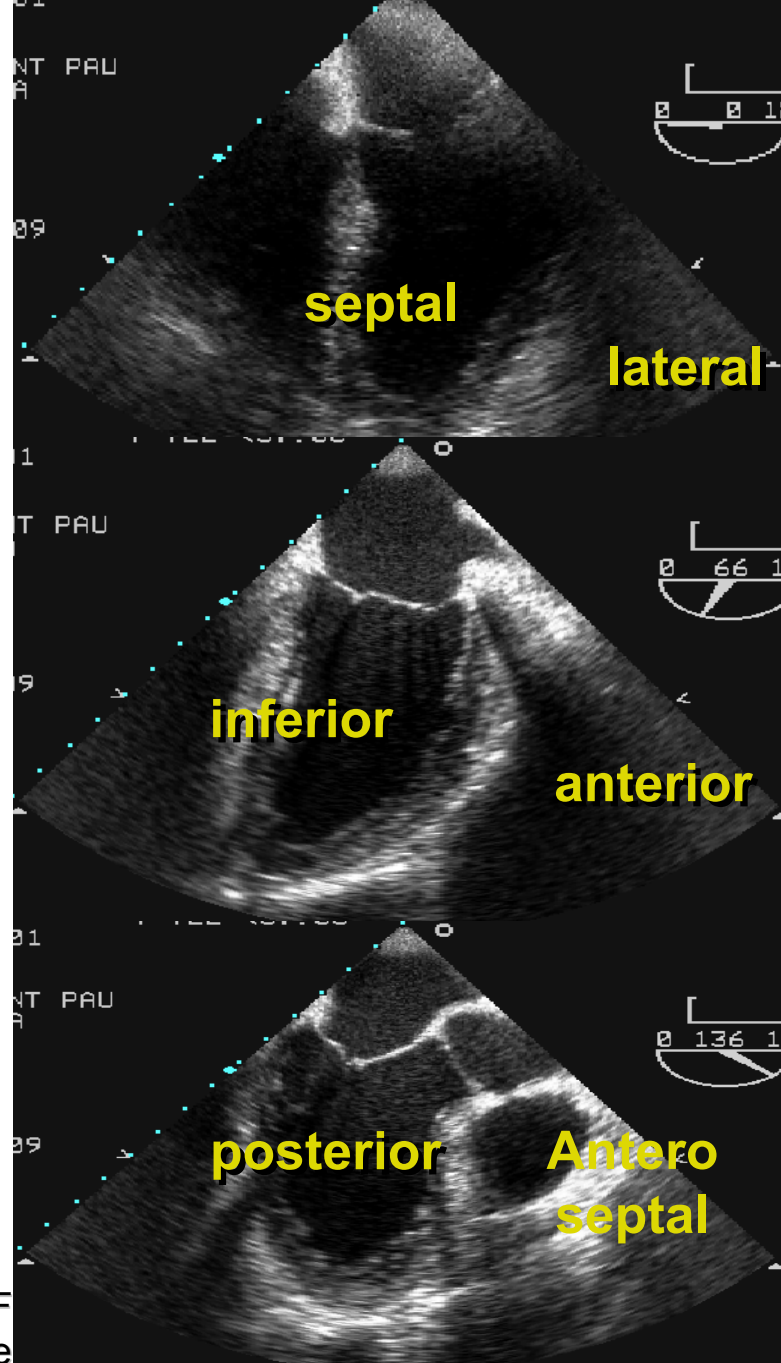
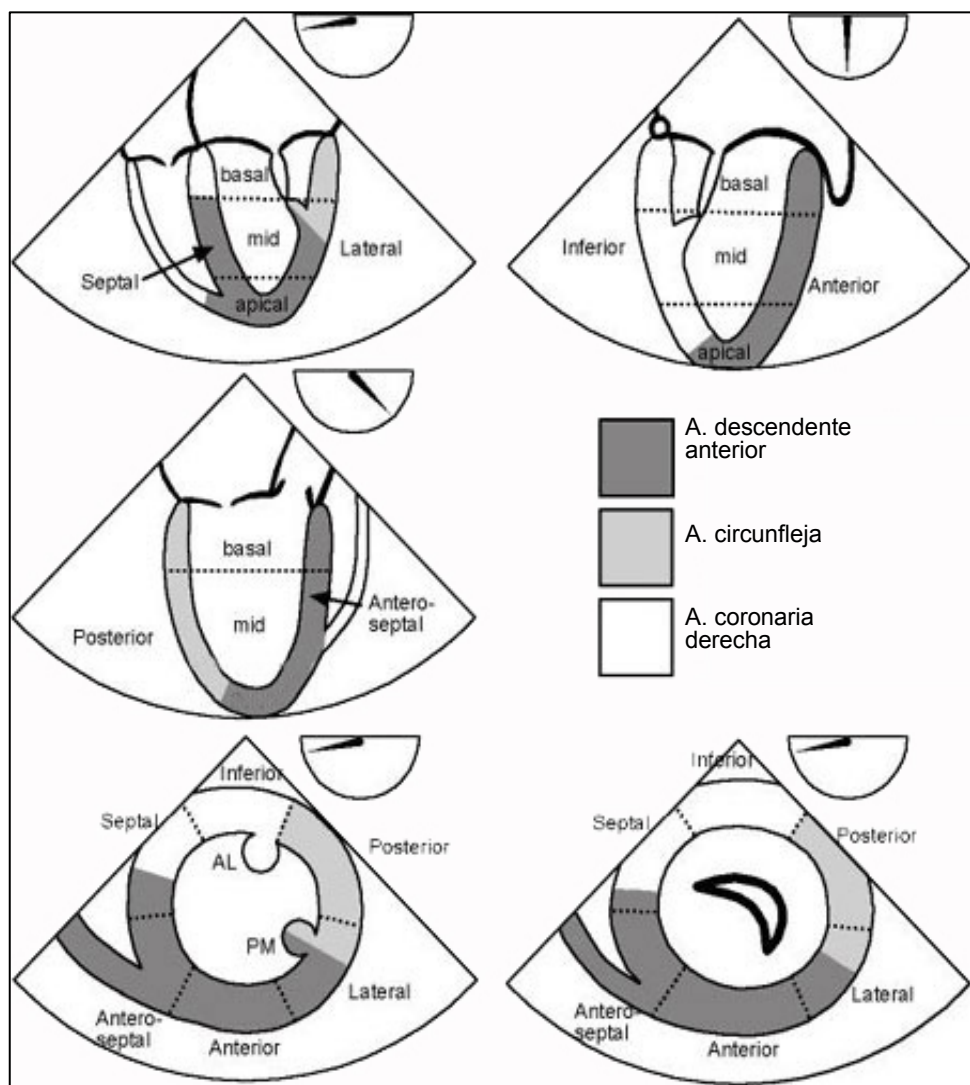
Contractilidad patológica





Alteraciones segmentarias

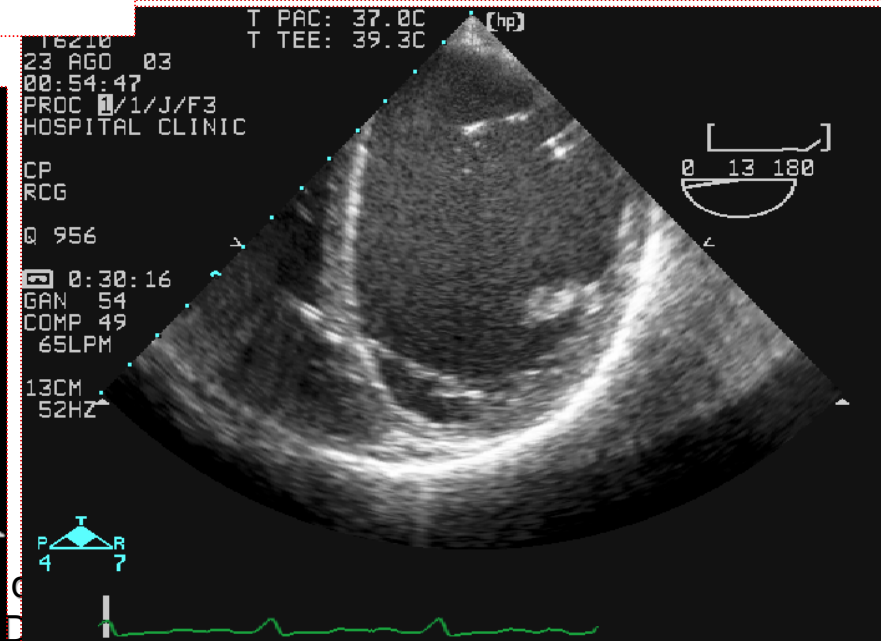
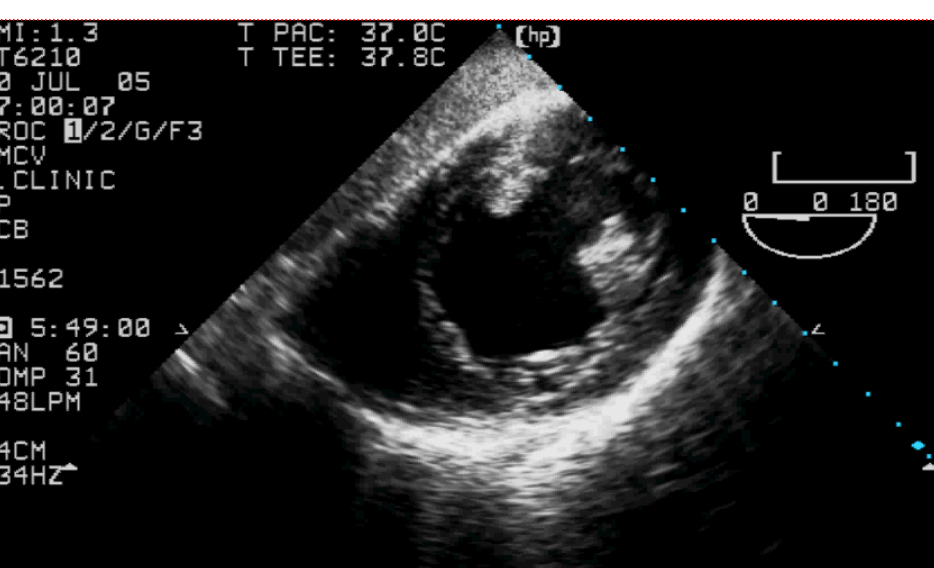
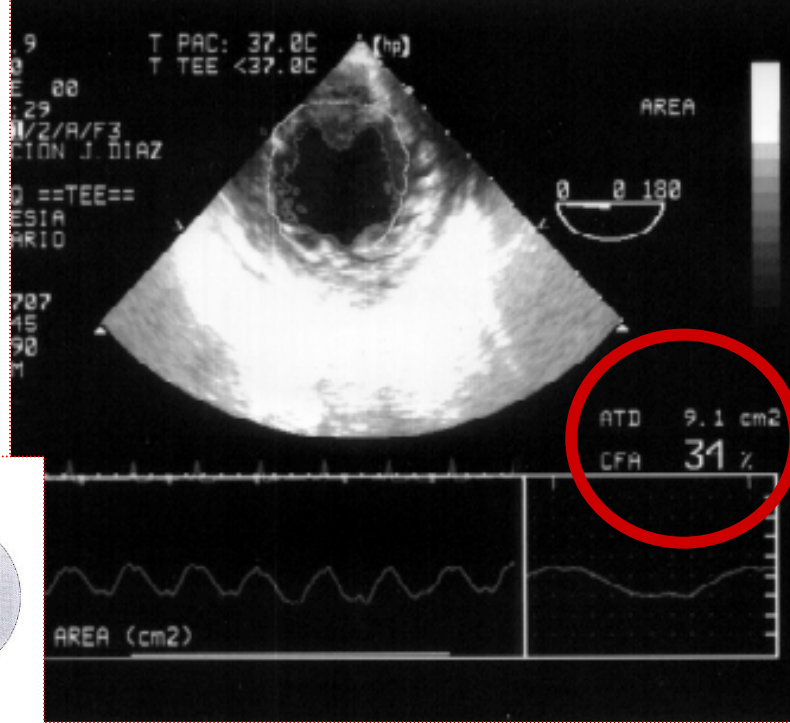
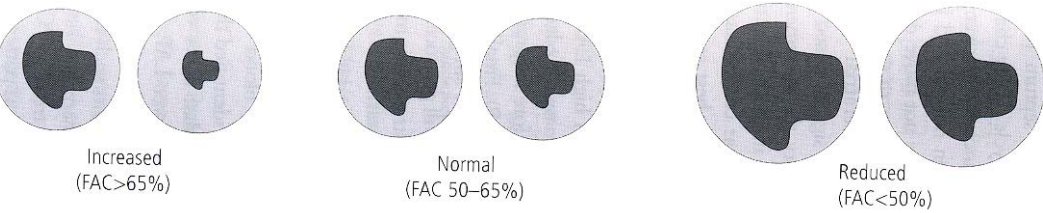




Contractilidad

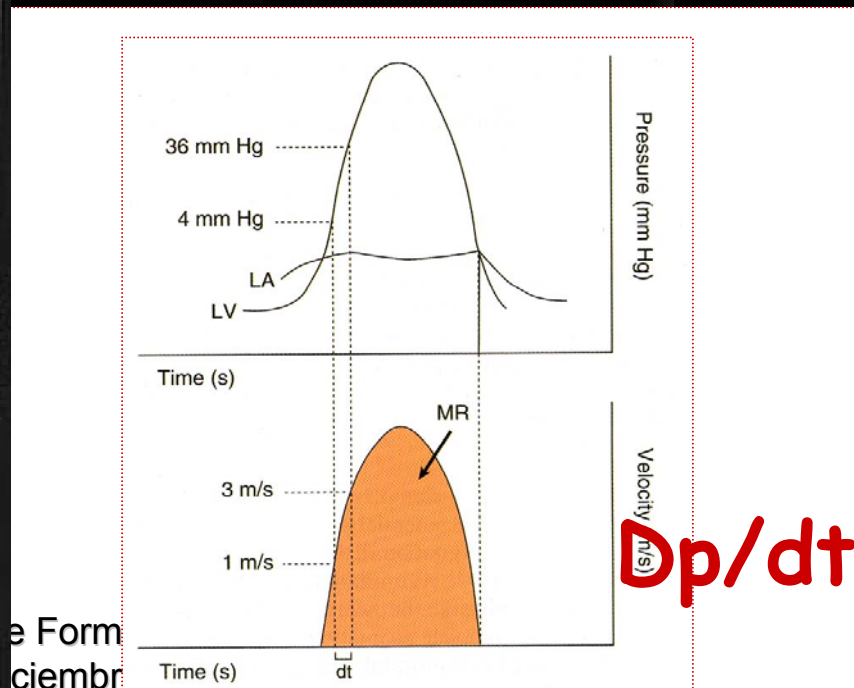
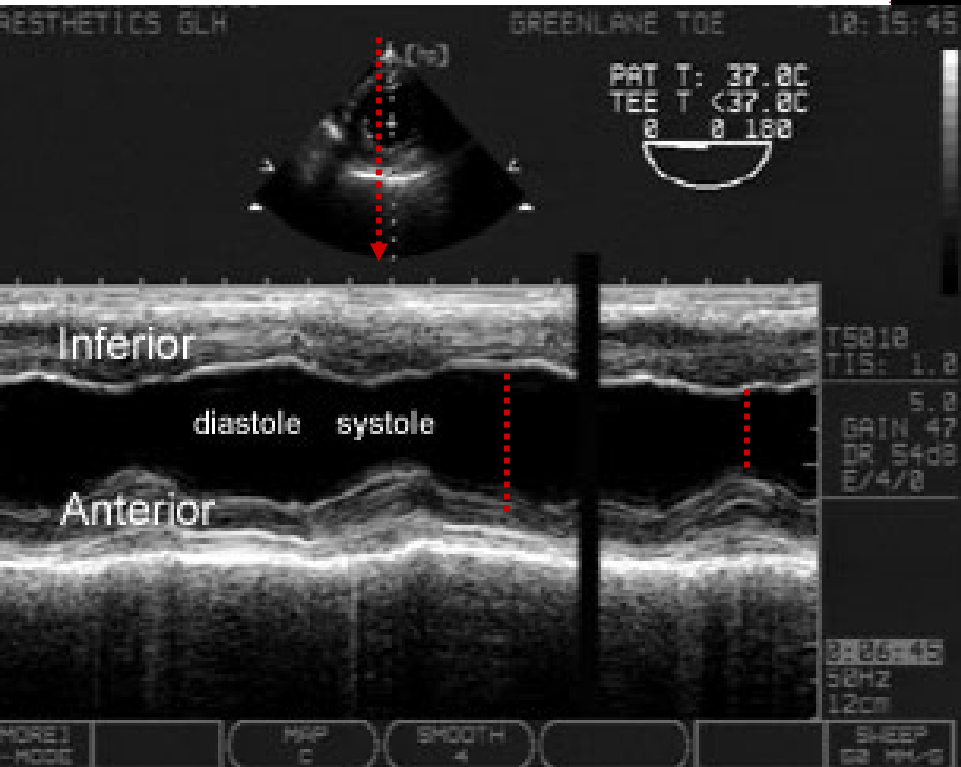
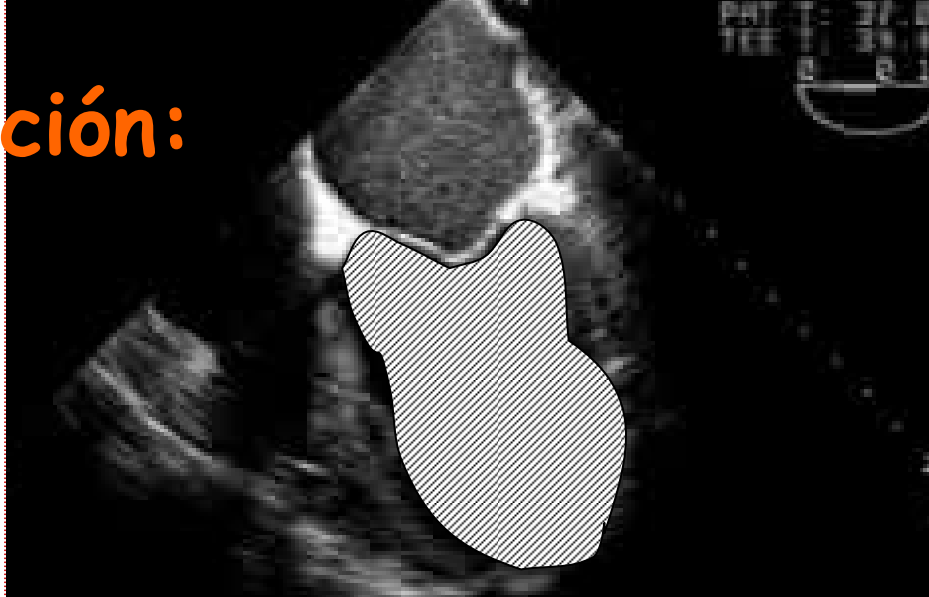


FAC= Fracción área cambio

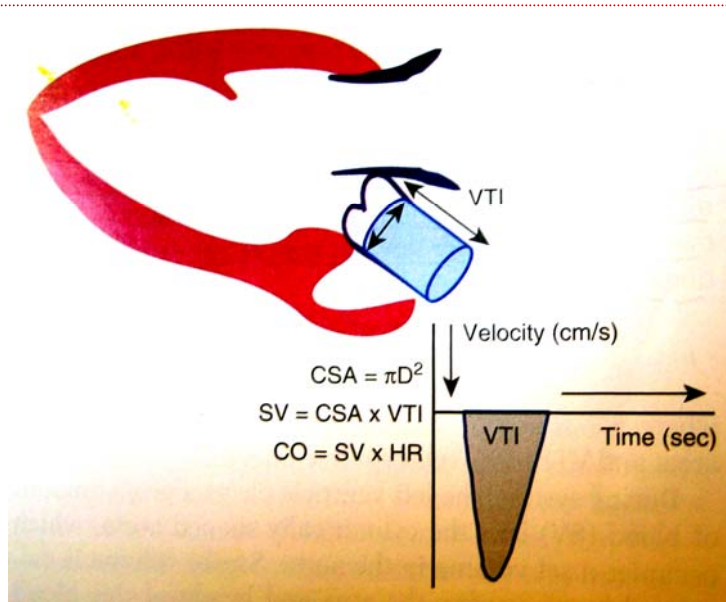


FE= fracción de eyección:

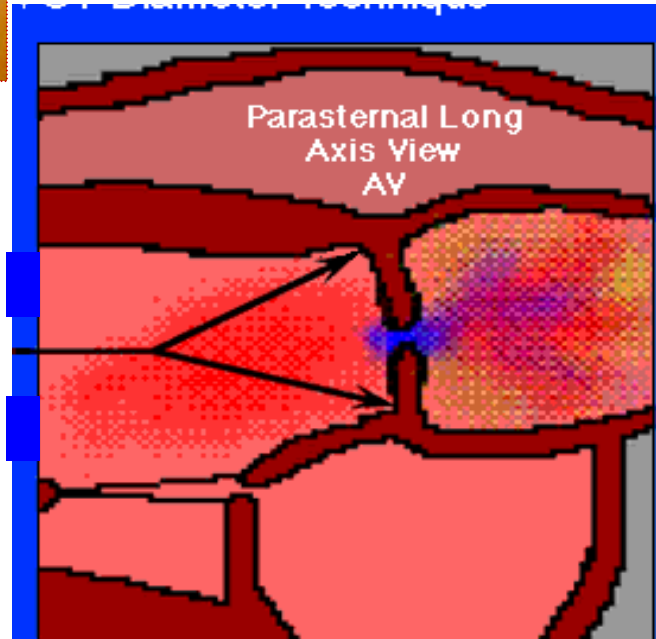
- M. Simpson
- M. Teicholz



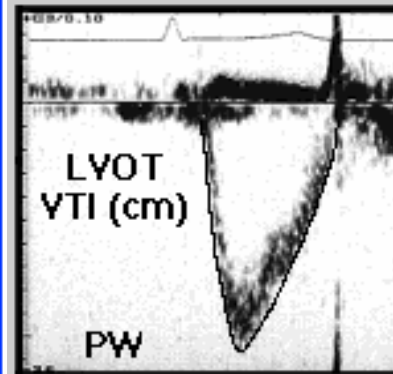
Gasto cardíaco



Medición del flujo por Doppler a través de la VAo y del área TSVI



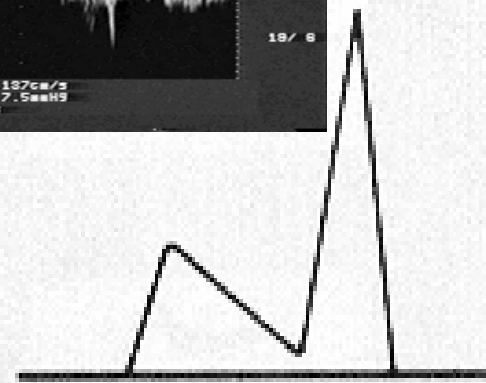
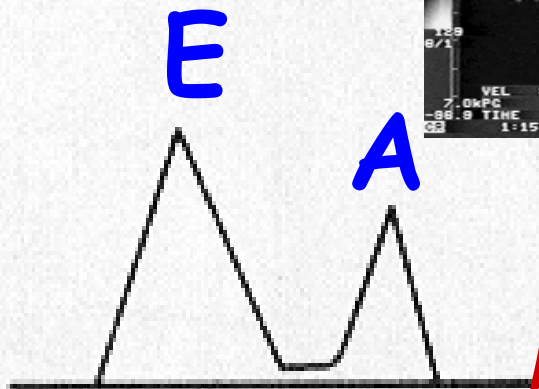
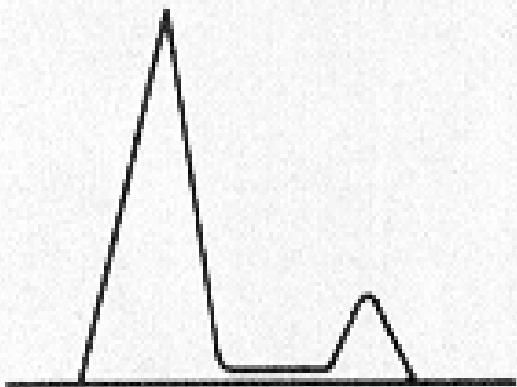
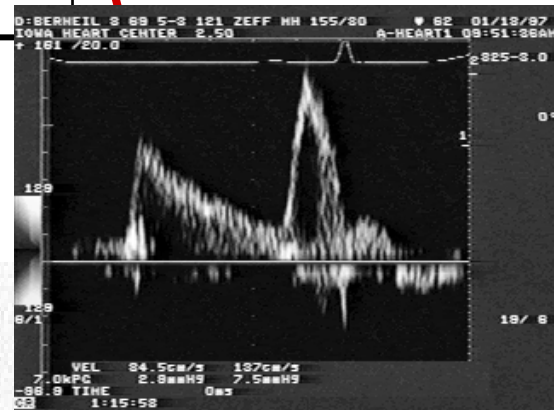
And Aortic Valve



$E \uparrow$; $A \downarrow$;
 $E/A > 1,5$

E/A ;
1-1,5

$E \downarrow$; $A \uparrow$;
 $E/A < 1$



Restrictivo

Normal

Alteración
relajación

"The hemodynamically unstable patient in the intensive care unit: Hemodynamic vs. transesophageal echocardiographic monitoring"

Costachescu T. Canadá.

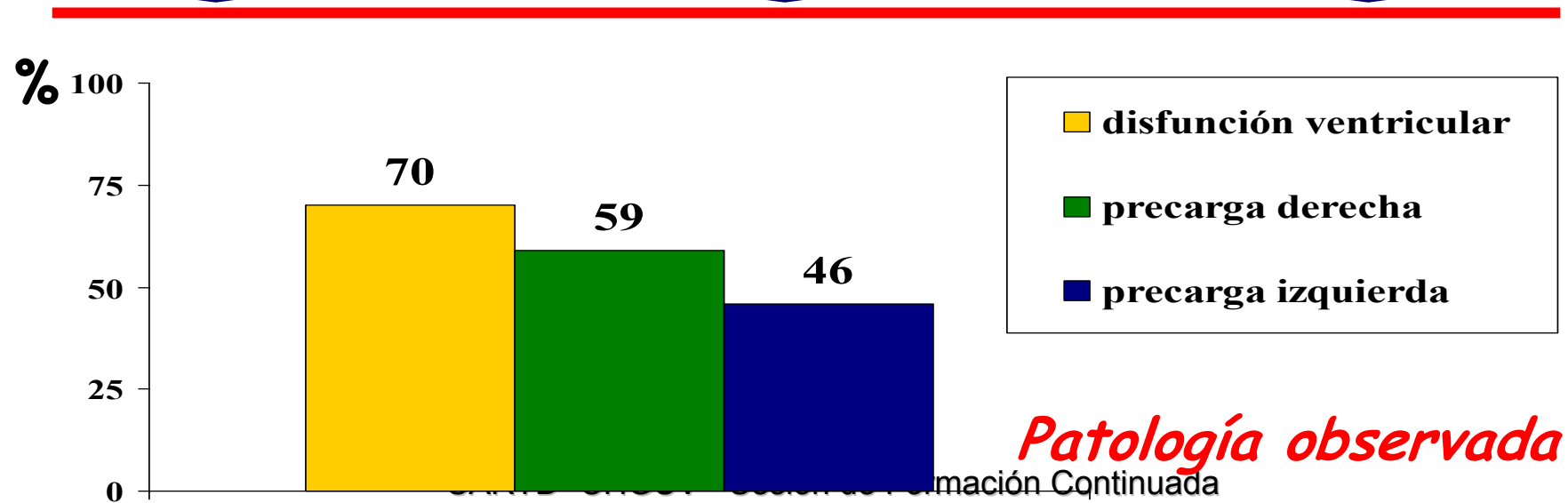
20 pacientes inestables de cirugía cardiaca

Hemodinámica vs ETE (5 vs 5)

Ingreso

2 h

4 h



Patología observada

Información Continuada

Conclusiones:

- discordancia entre las evaluaciones "hemodinámicas" y "ecocardiográficas" en el paciente inestable de cirugía cardiaca.
- Variabilidad en el diagnóstico entre los evaluadores "hemodinámicos"

Concordancia media
 $37 \pm 7\%$ vs $67 \pm 14\%$

SARTD- CHGUV - Sesión de
Valencia 19 de Diciembre

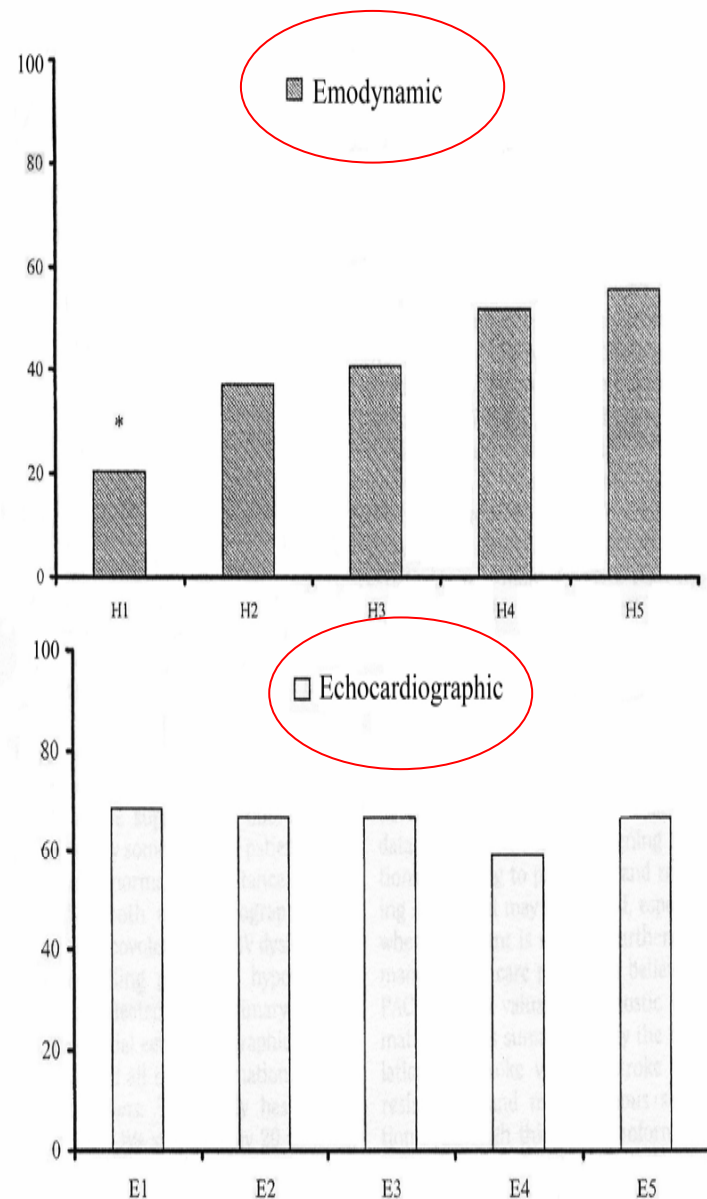


Figure 1. Diagnostic agreement between each hemodynamic (H1-H5) and echocardiographic (E1-E5) evaluator compared with his or her respective working hypothesis (H0 and E0). H1 had a lower agreement compared with the other hemodynamic evaluators (* p < 0.05).



“Goal-directed **transesophageal echocardiography** performed by **intensivists** to assess left ventricular function: comparison with pulmonary artery catheterization”.

Interpretaciones

correctas en:

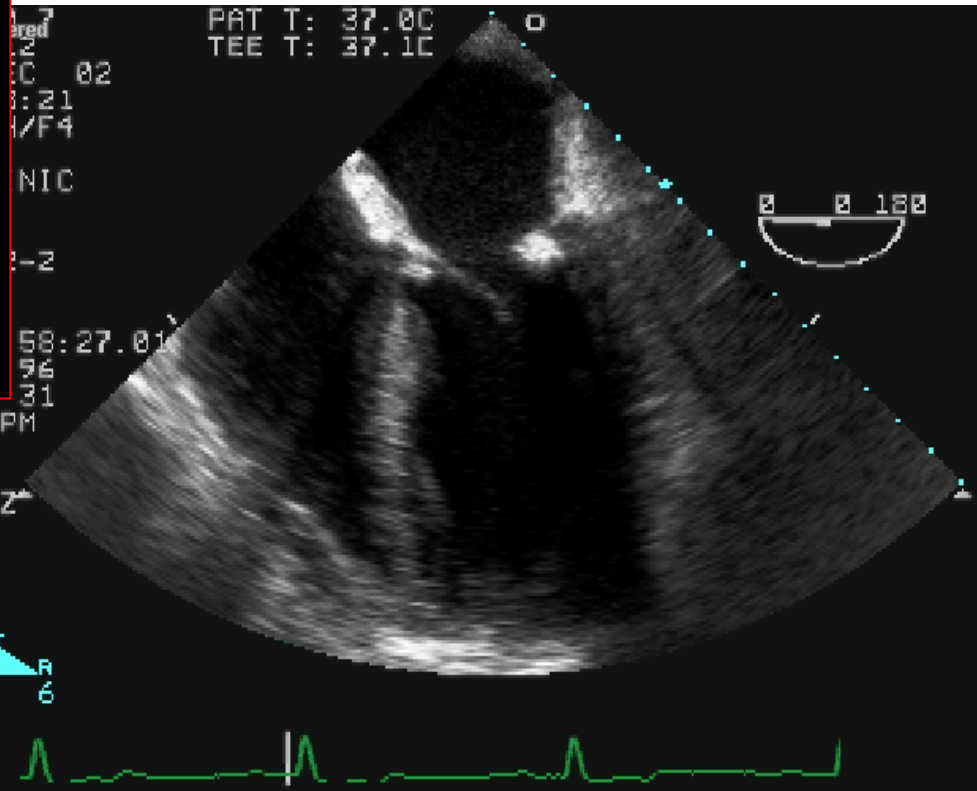
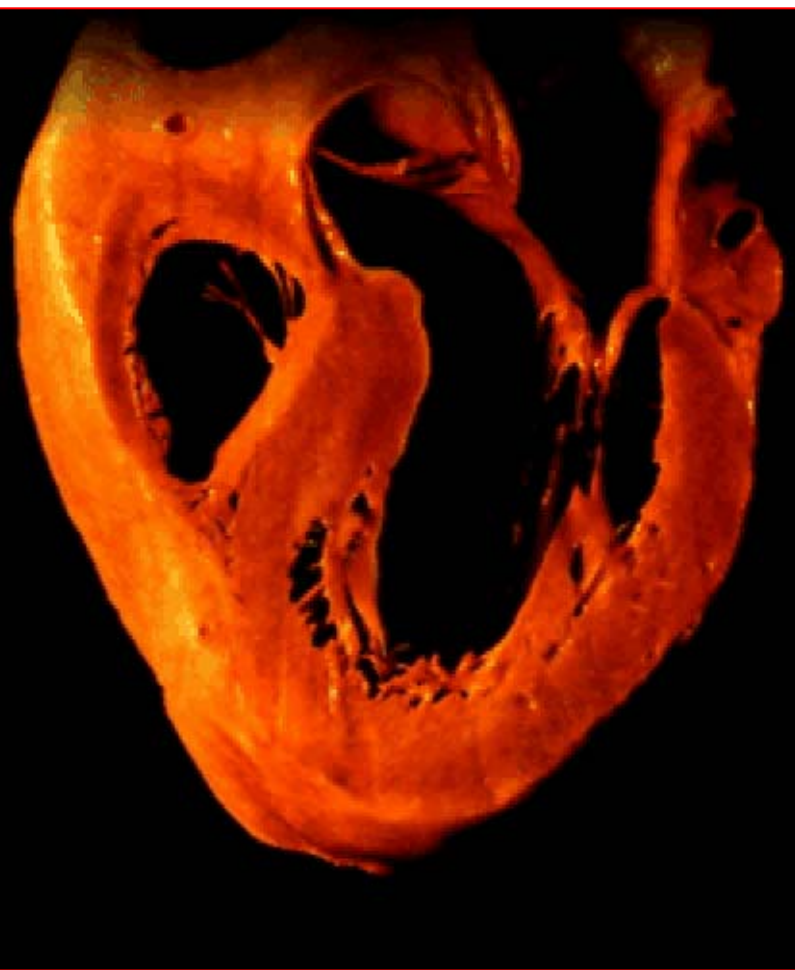
- 93% hipertrofia VI
- 87% precarga
- 77% función global del VI

No concordancia CAP vs ETE

- 55% valoración precarga
- 39% función global VI

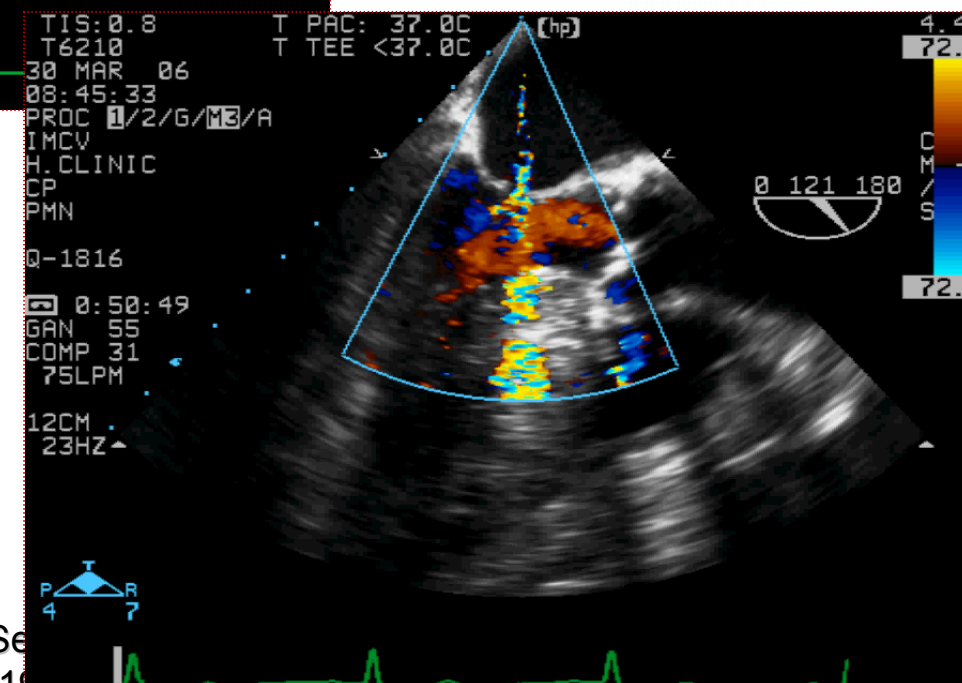
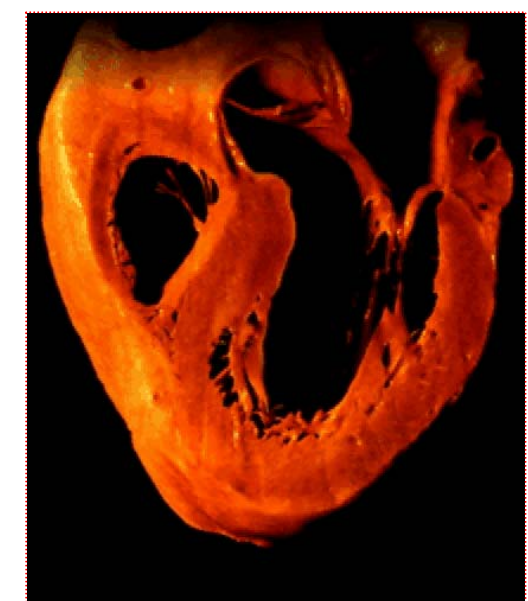
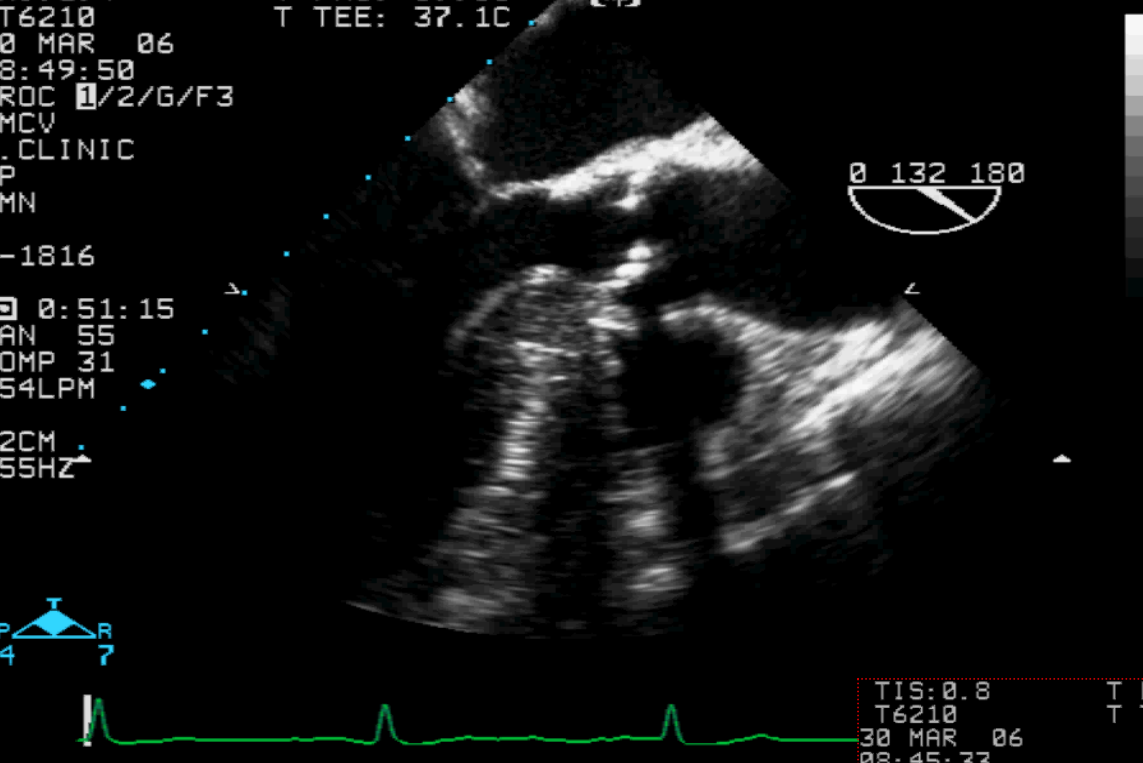
Obstrucción del TSVI

- Tejido valvular muy redundante
- Ángulo mitro-aórtico estrecho
- Ventrículo izquierdo hipertrófico, no dilatado
- Hipovolemia, inotrópicos...



SAM: Systolic Anterior Motion

SARTD- CHC
Va

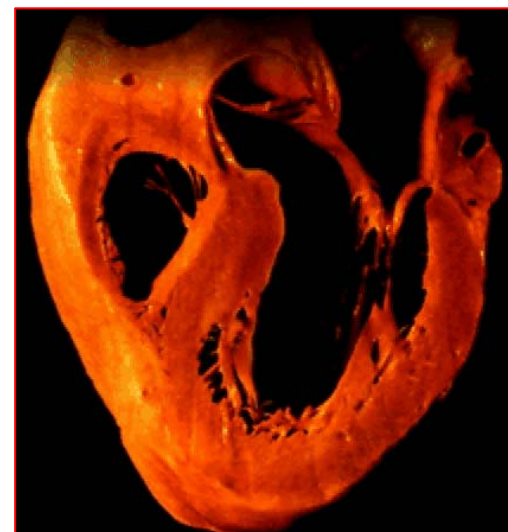
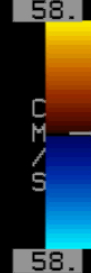
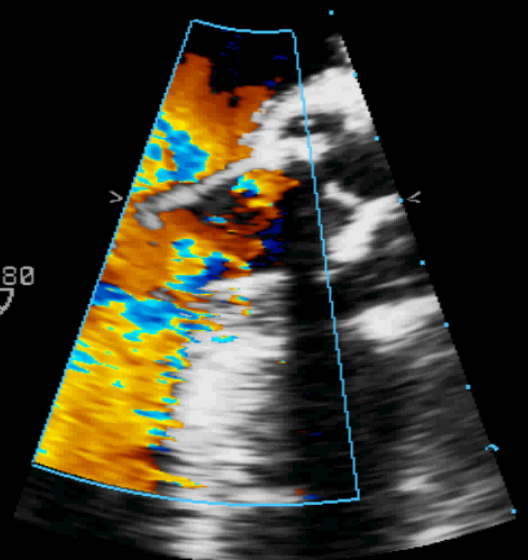
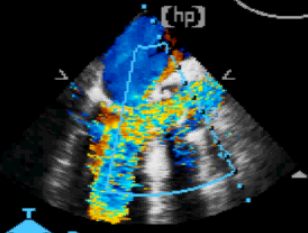


**Obstrucción
del TSVI**

**Hipertofia
VI + SAM**

210 T TEE: 38.7C
AGO 05
: 28: 38
DC 1/2/G/M3/A
CV
CLINIC

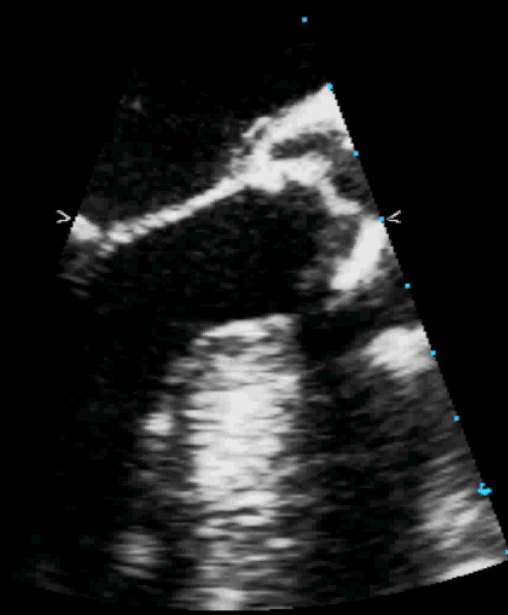
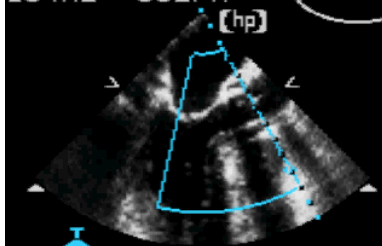
1591
N 82 1:21:47
MP 31 13CM 0 153 180
2HZ 79LPM



T PAC: 37.0C
T TEE: 38.8C



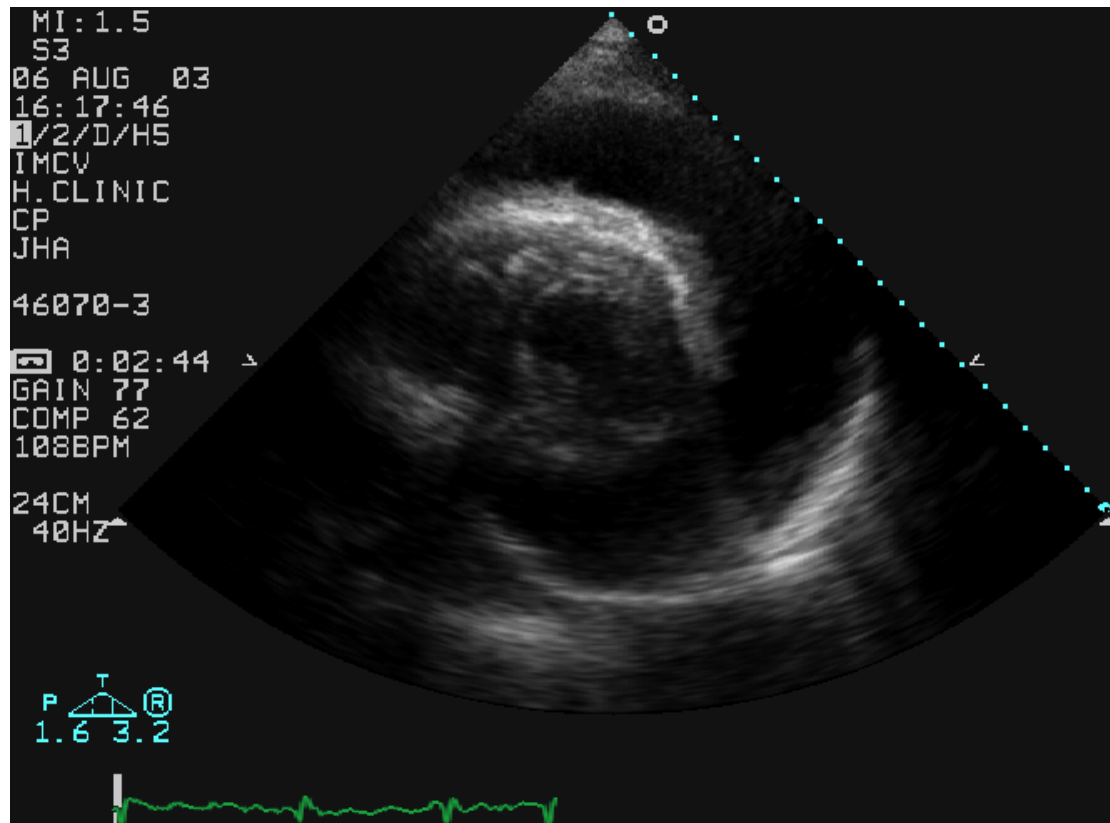
IMCV
H. CLINIC
CP
AMS
Q-1591
GAN 82 1:21:47
COMP 31 13CM 0 153 180
104HZ 83LPM



SARTD- CHG
Val

Derrame pericárdico

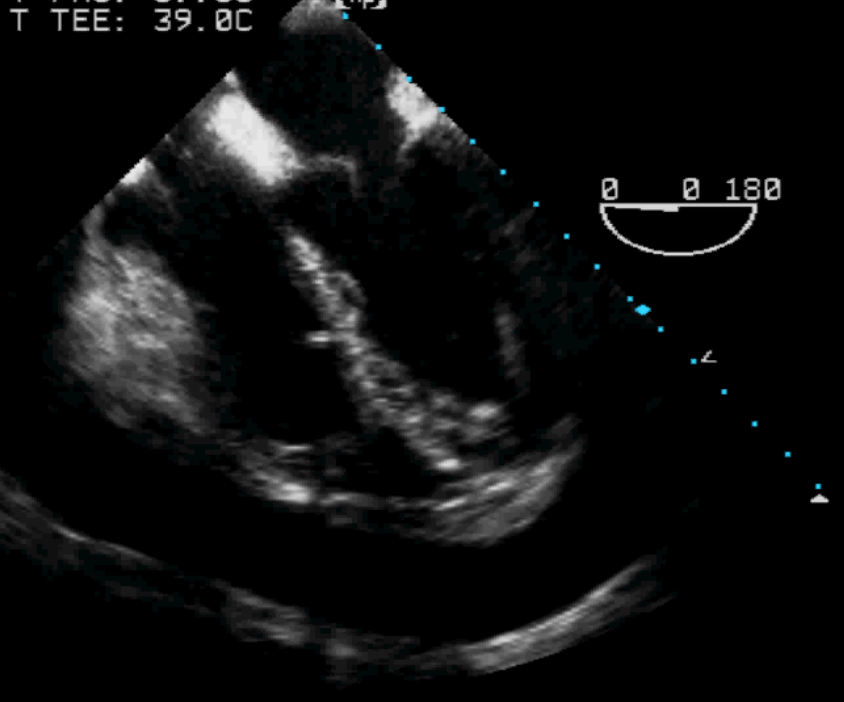
- ETE eje corto transgástrico
- ETT subxifoideo



- Espacio no ecogénico alrededor de las cavidades cardiacas
- Compresión del VD y AD en diástole
- VI "vacío"

T6210
8 AGO 05
9:22:25
ROC 1/2/G/F3
IMCV
H. CLINIC
P
GC
-1571
7:08:32
AN 55
COMP 31
77LPM
6CM
34HZ

T TEE: 39.0C



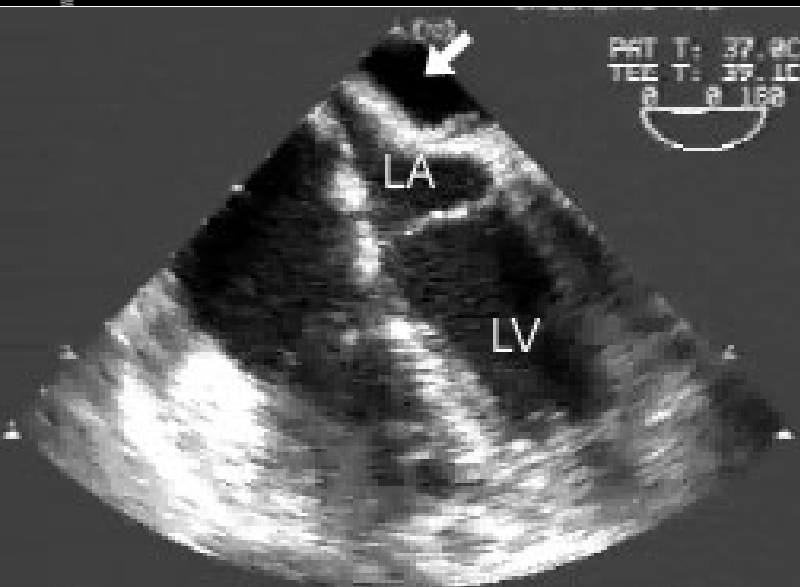
Derrame pericárdico



MI: 1.3
T6210
04 ABR 06
10:33:23
PROC 1/2/G/F3
IMCV
H. CLINIC
CP
RS
Q=1821
1:28:54.1
GAN 51
COMP 31

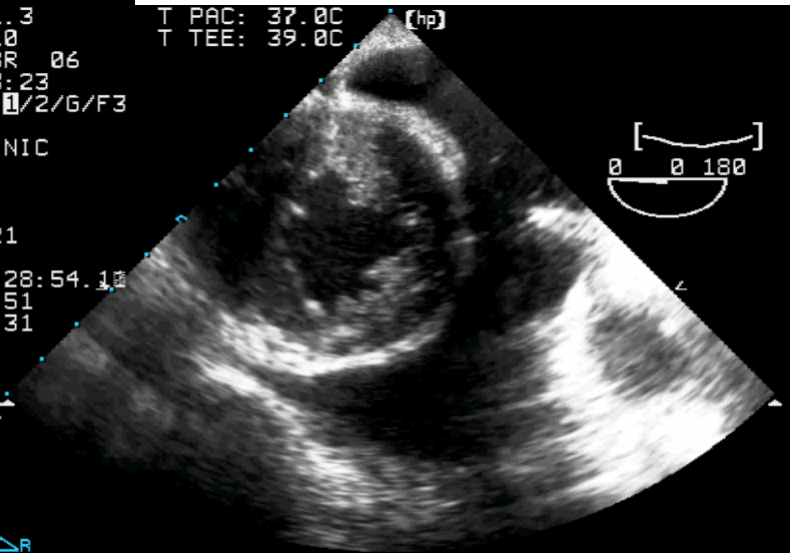
T PAC: 37.0C
T TEE: 39.0C

[hp]

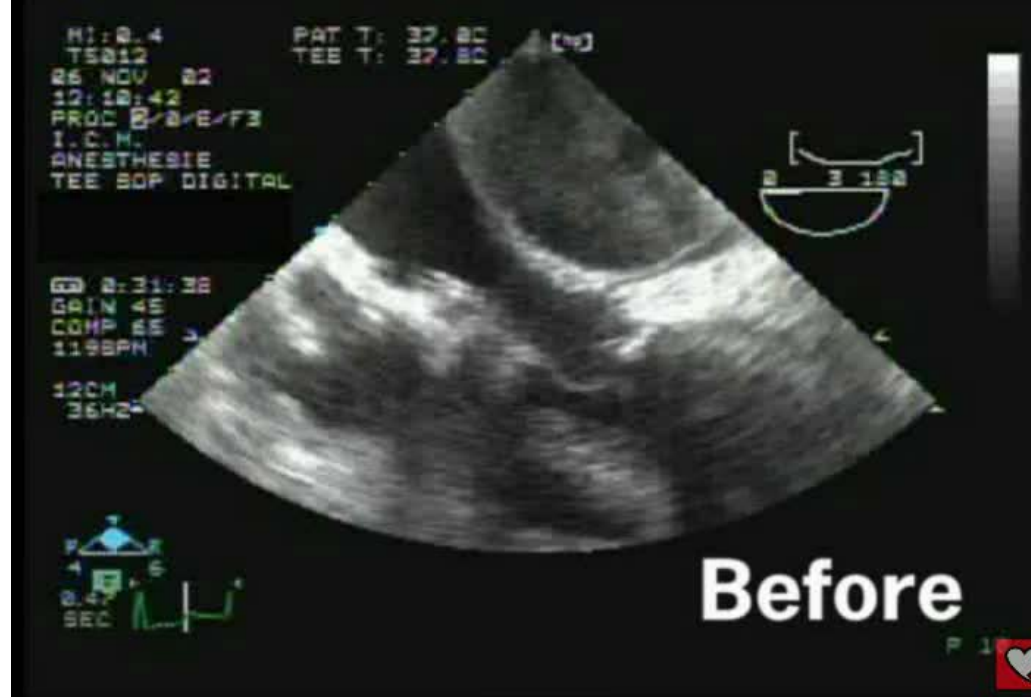
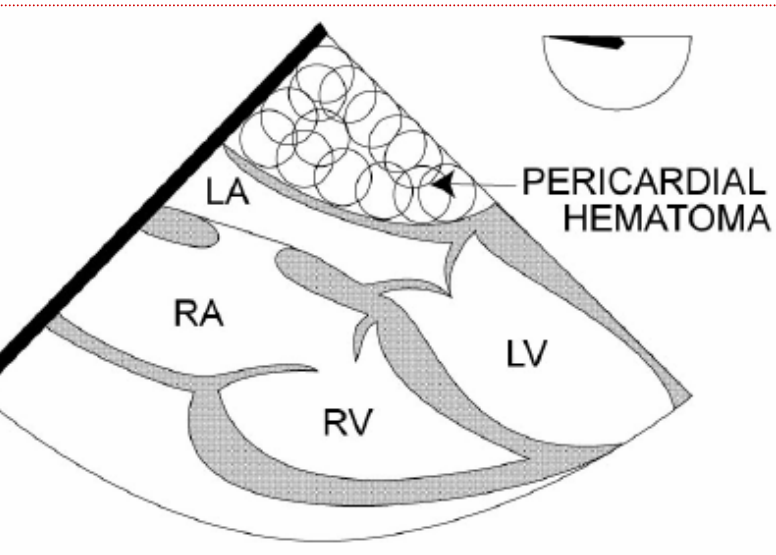


PAT T: 37.0C
TEE T: 39.1C
0 180

11CM
58HZ



0 180



TAPONAMIENTO CARDIACO

- Pr. pericardio > Pr. cavidades: ↓ presión llenado
- Cantidad / rapidez
- Tras cirugía cardiaca: localizados
- Sospecha clínica + signos ECG

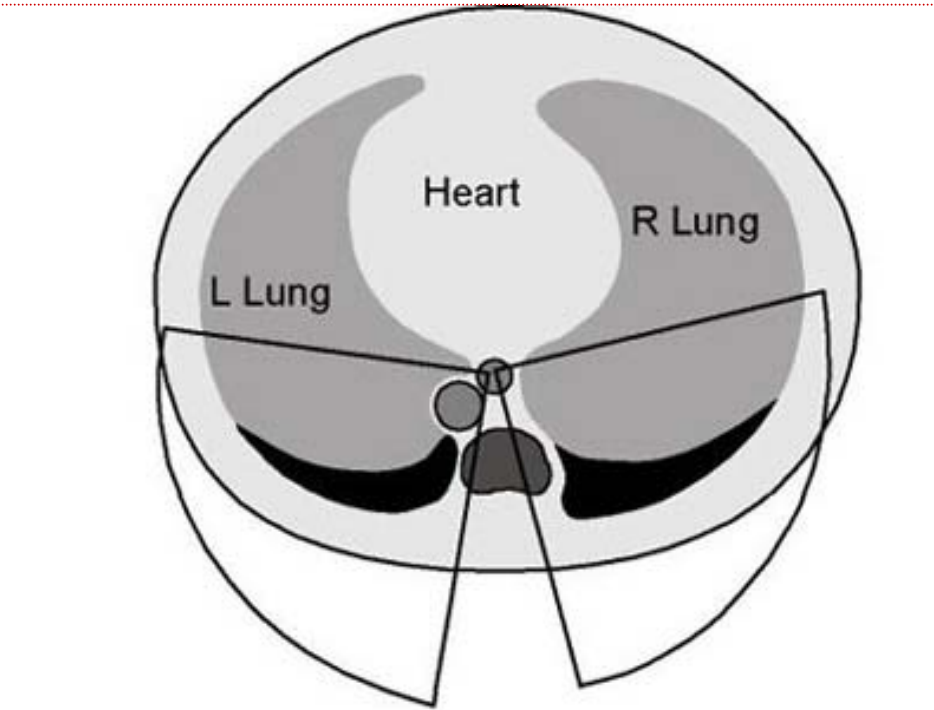
The hemodynamically unstable patient in the intensive care unit:
Hemodynamic vs. transesophageal echocardiographic monitoring

Costachescu T. *Crit Care Med.* 2002;30:1214-23

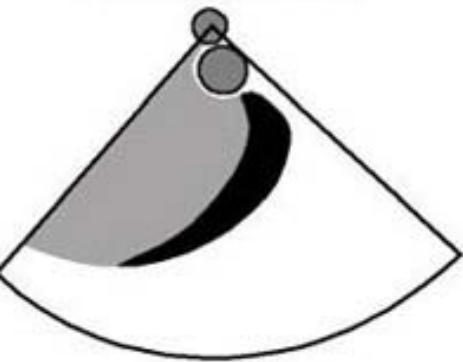
- 4 pacientes hemopericardio por ECO
- 9 pacientes por hemodinámica
- Sólo 1 paciente ECO+hemodinámica

La ECO puede prevenir intervenciones
innecesarias

Derrame pleural

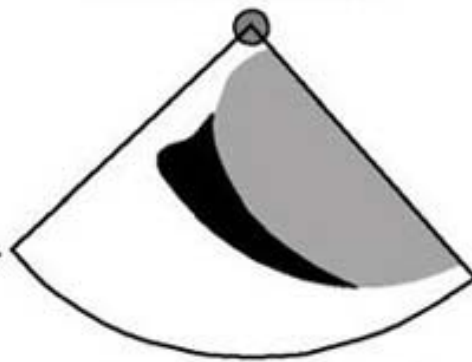


Left pleural effusion

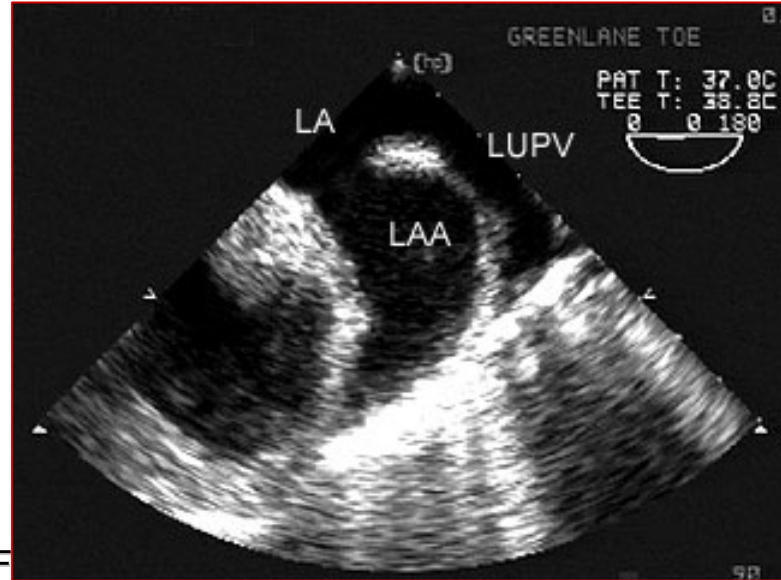
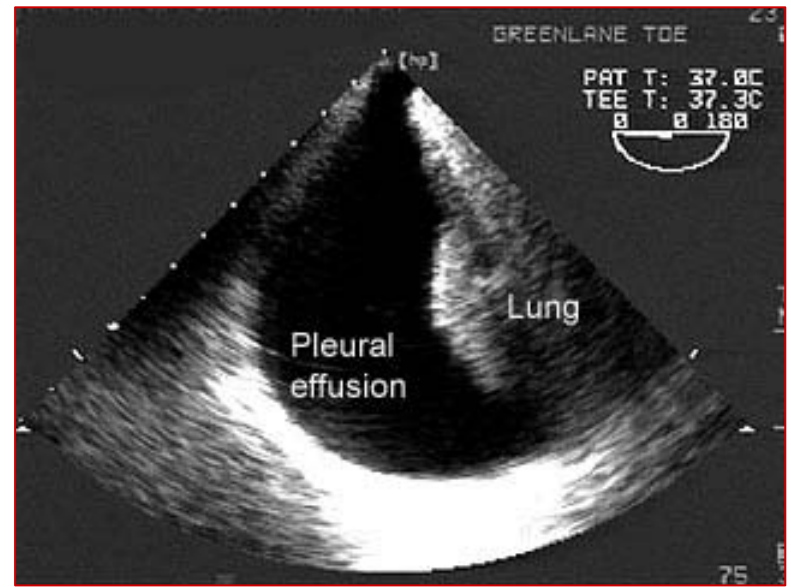


Tiger claw points to the left

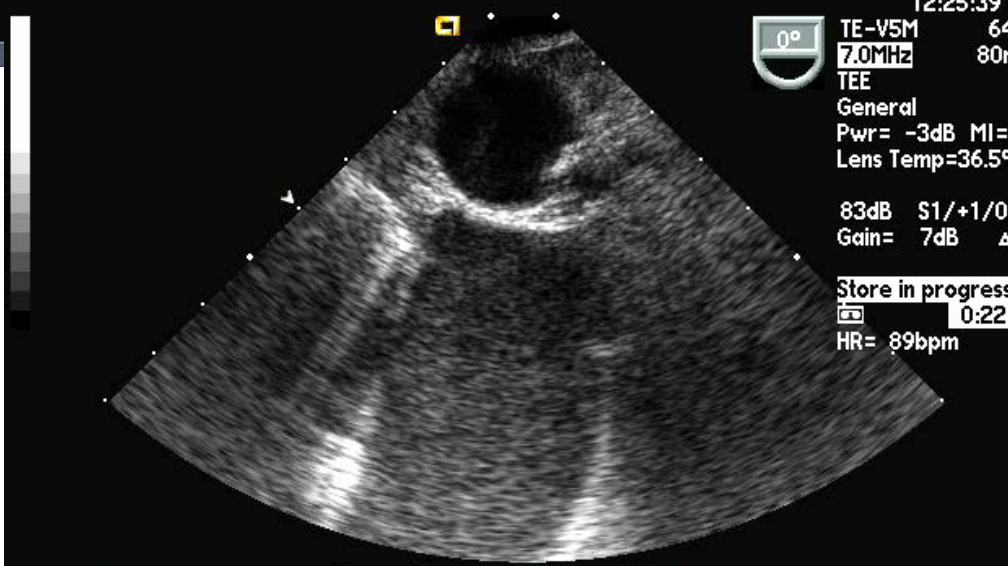
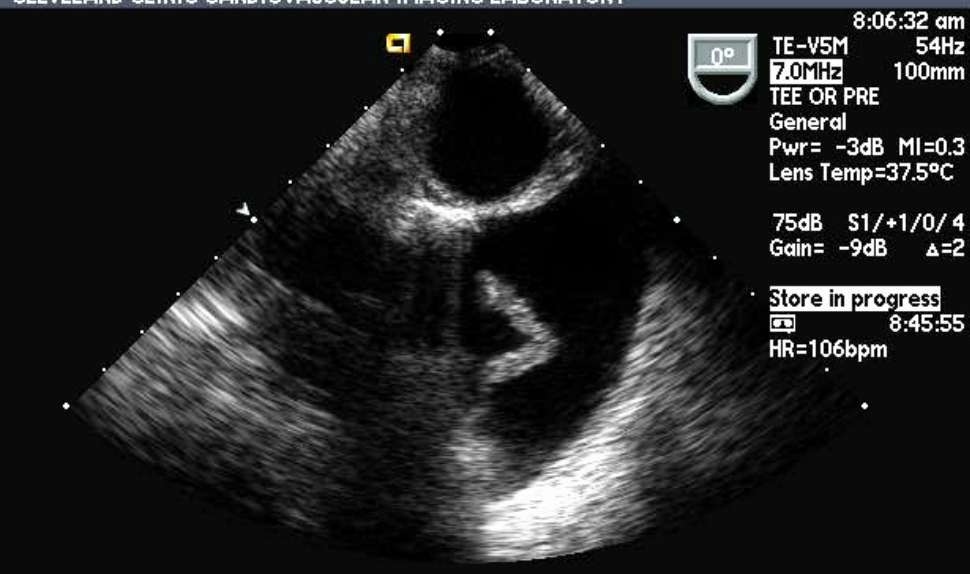
Right pleural effusion



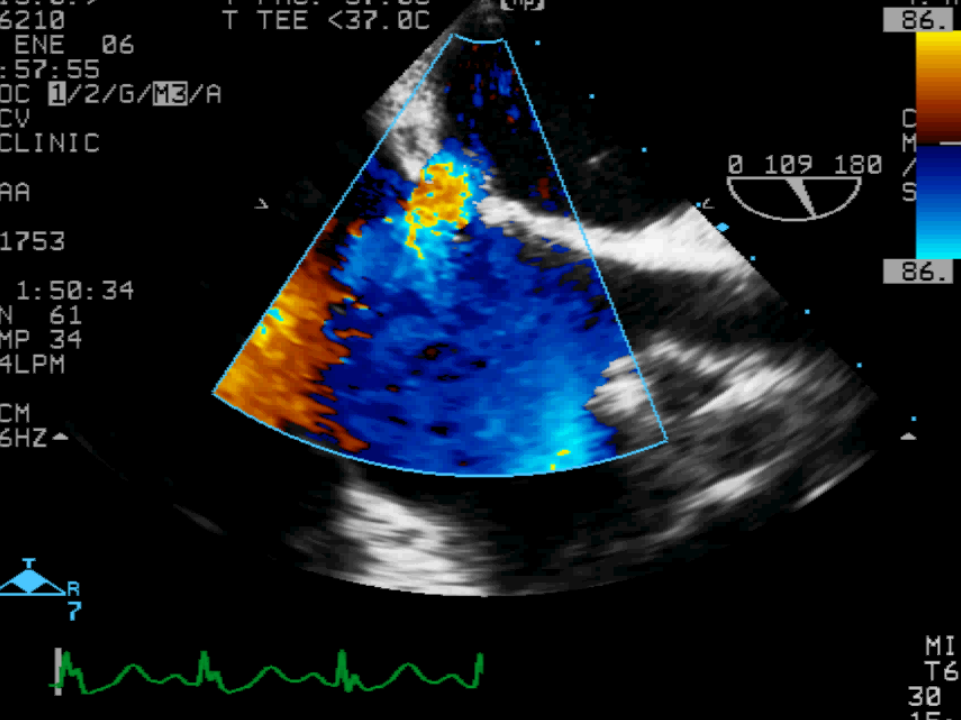
Tiger claw points to the right



Derrame pleural



SARTD- CHGUV -
 Valencia



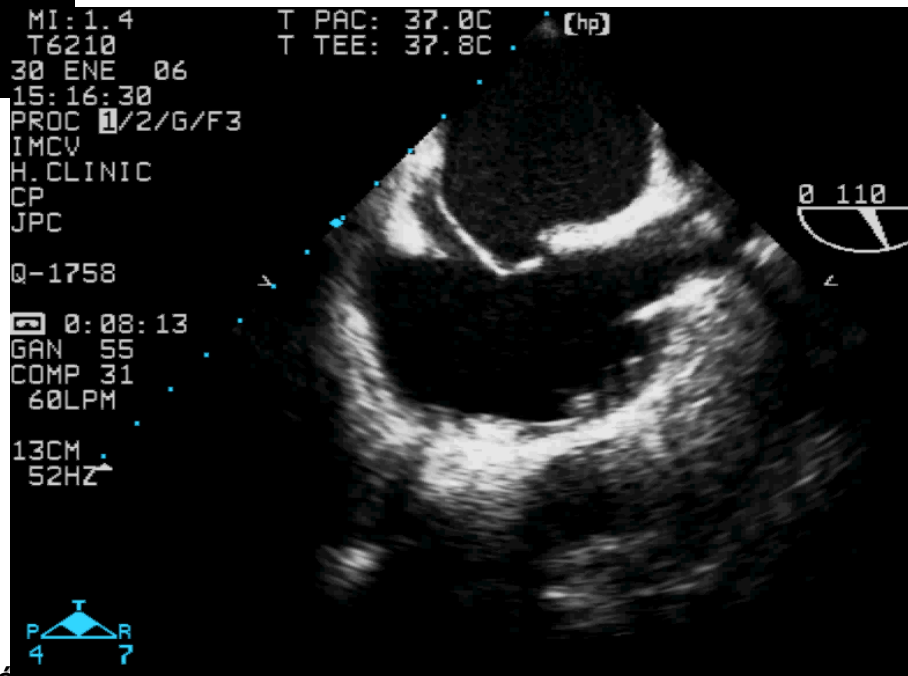
Hipoxemia: "shunt" intracardiaco

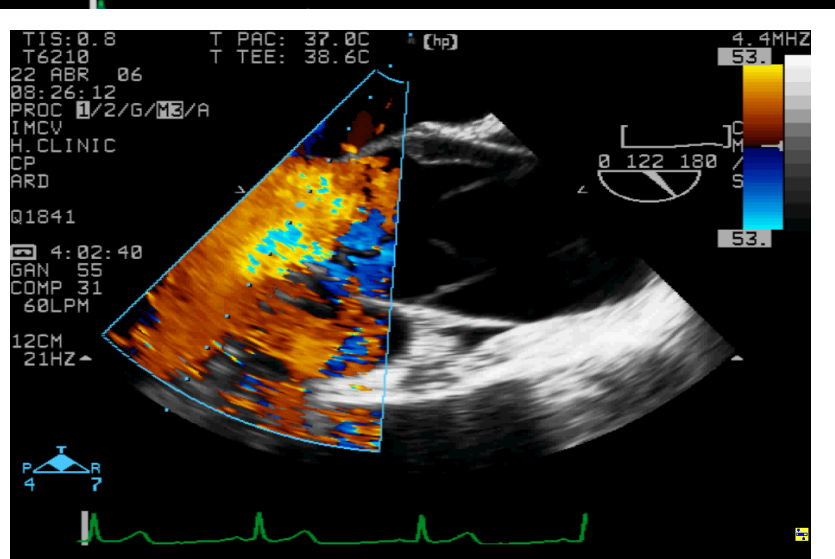
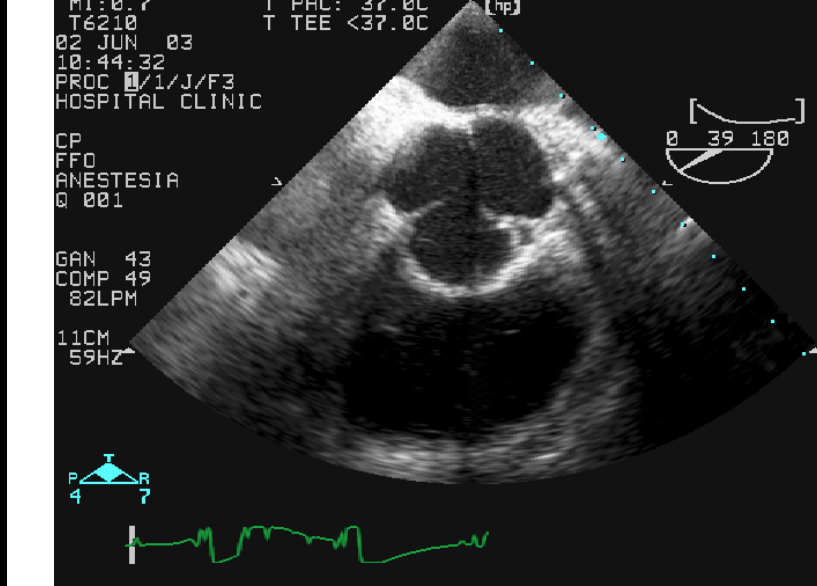
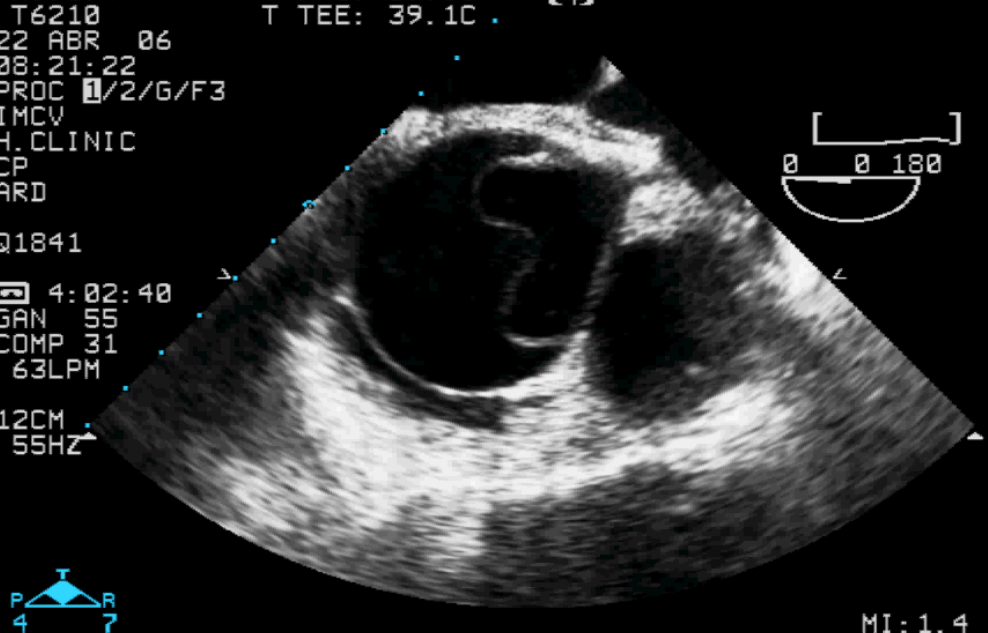
- Persistencia foramen oval permeable:
- IAM derecho
 - Embolismo pulmonar
 - VM + PEEP

Defectos septales

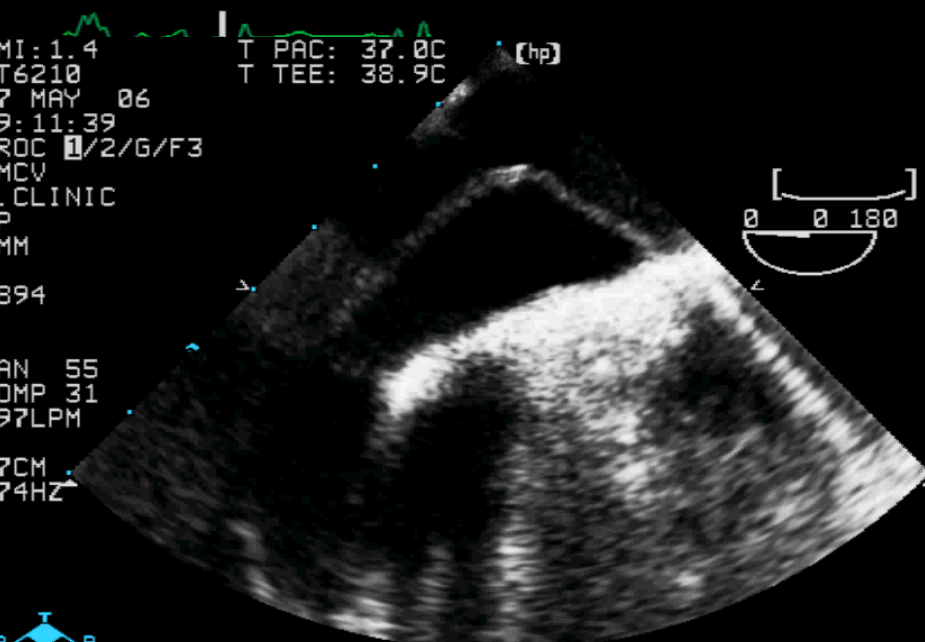
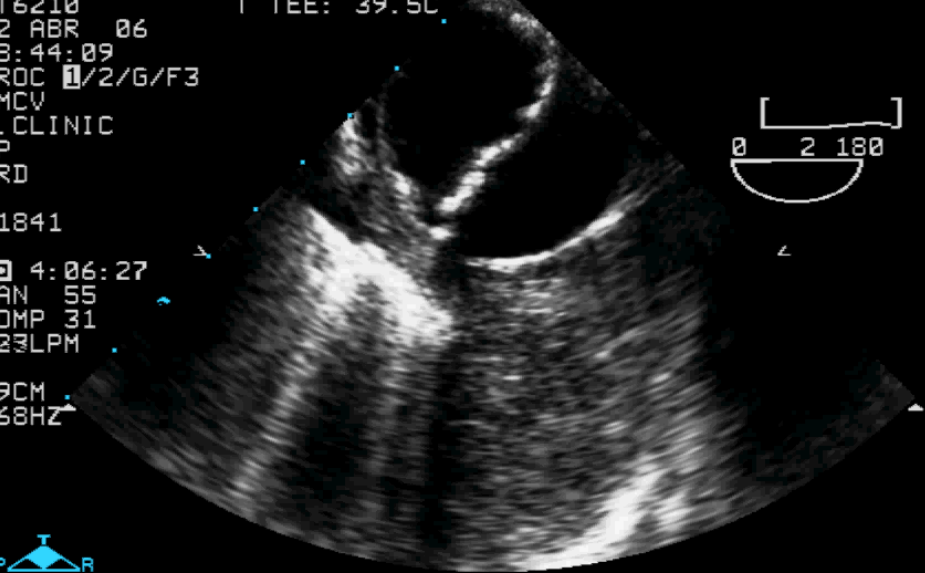
- CIA (ostium primum)

Sukernik. Anesthesia Analg. 2001. POF and its significance in the perioperative period.





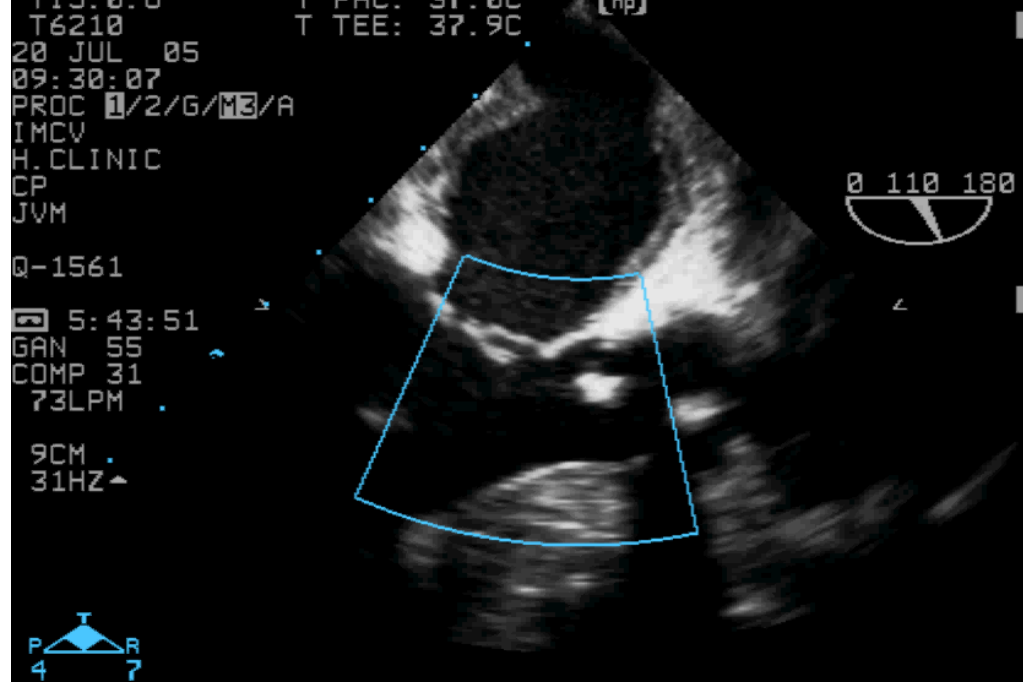
Dissección AoA SAFTD, CIGUV - S València 1



Dissección aorta:

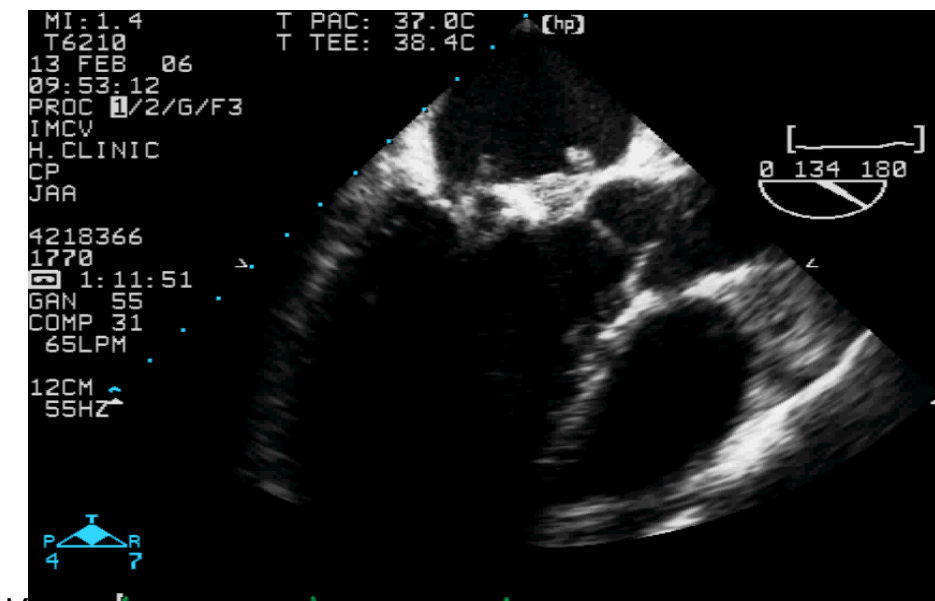
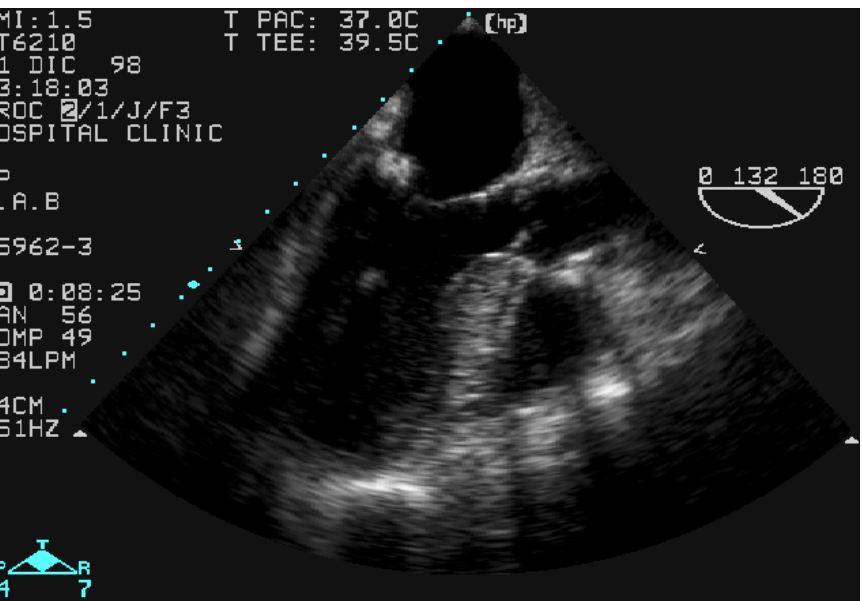
- Ao descendente

- Diagnóstico
- Luz falsa/verdadera
- Puerta de entrada
- VAo
- Coronarias
- Función ventricular

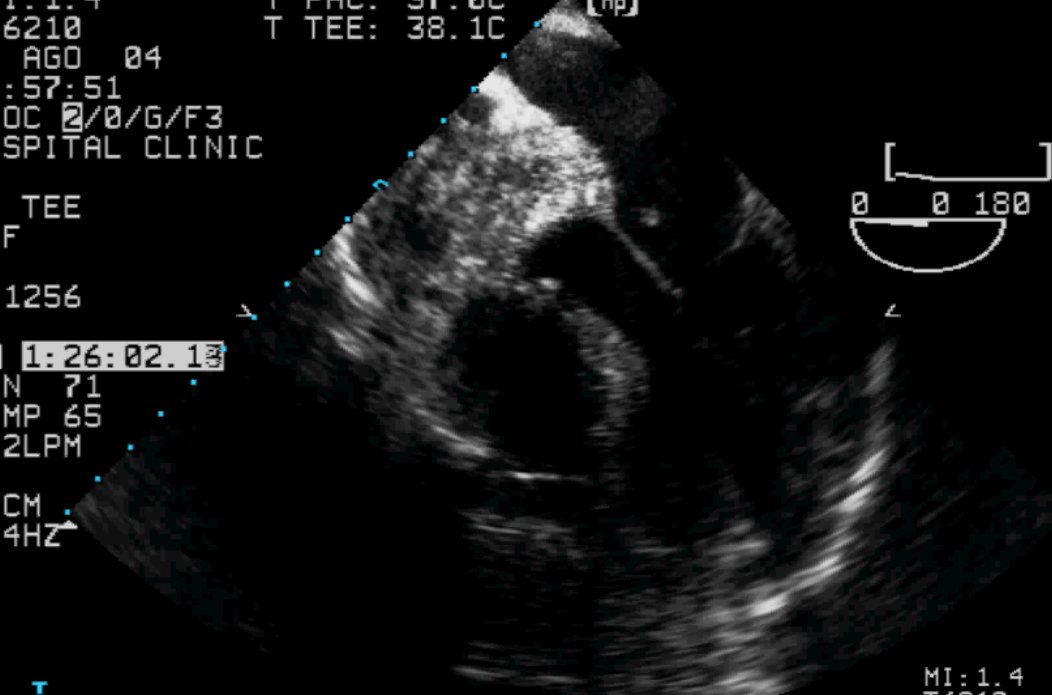


**Endocarditis
aórtica**

**Endocarditis
mitral**

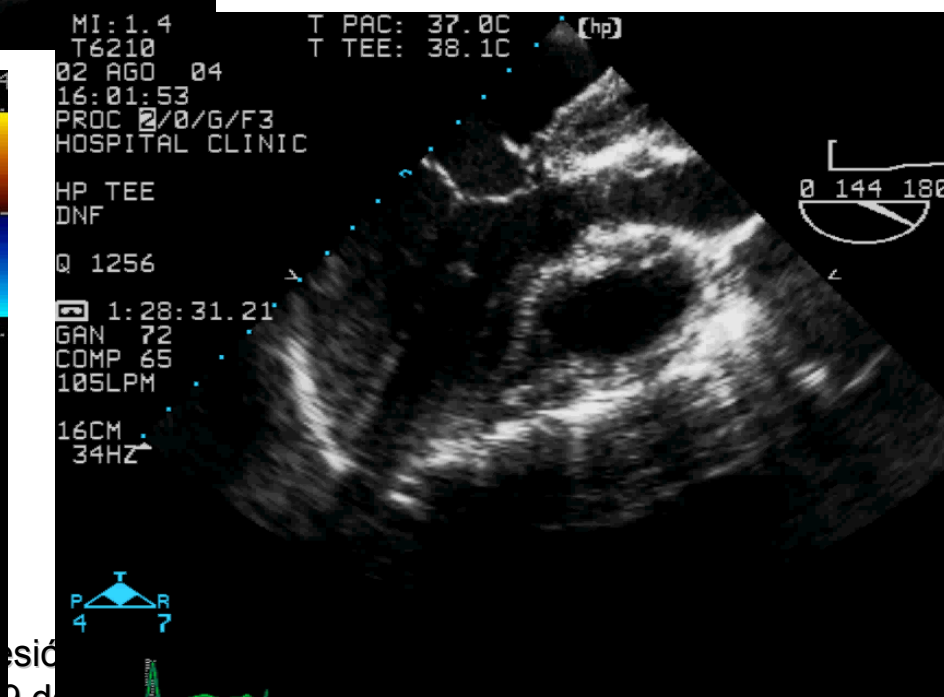
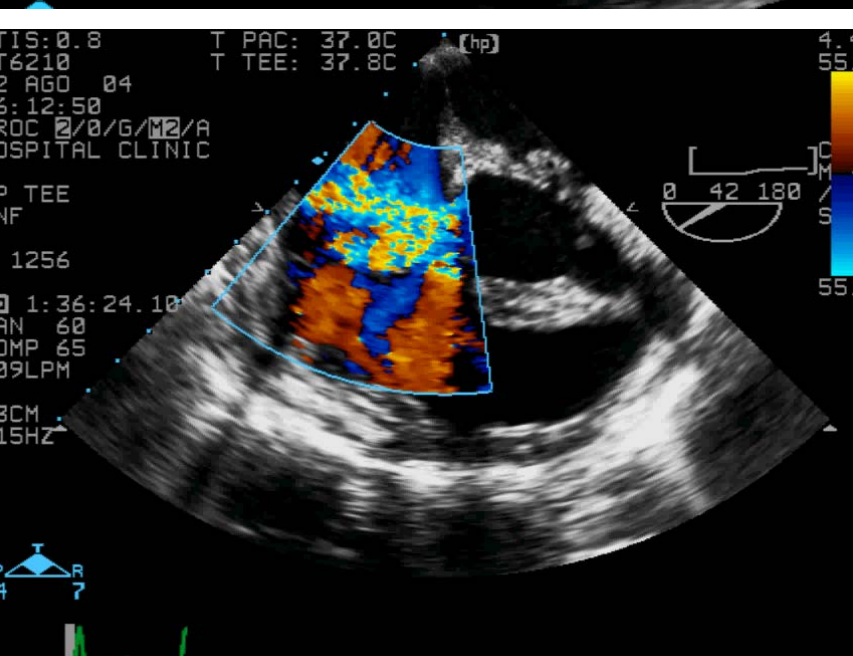


sió
9 de Diciembre 2000



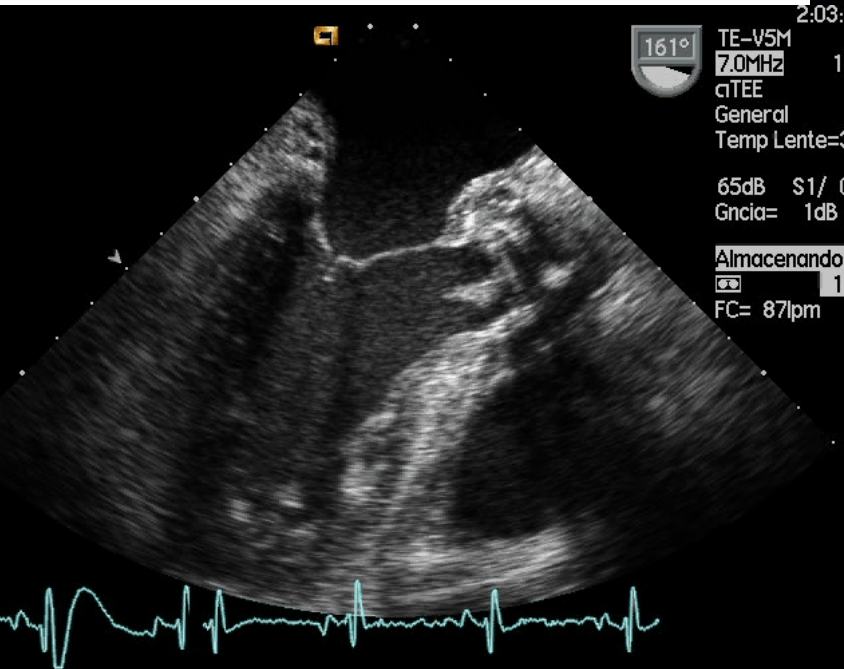
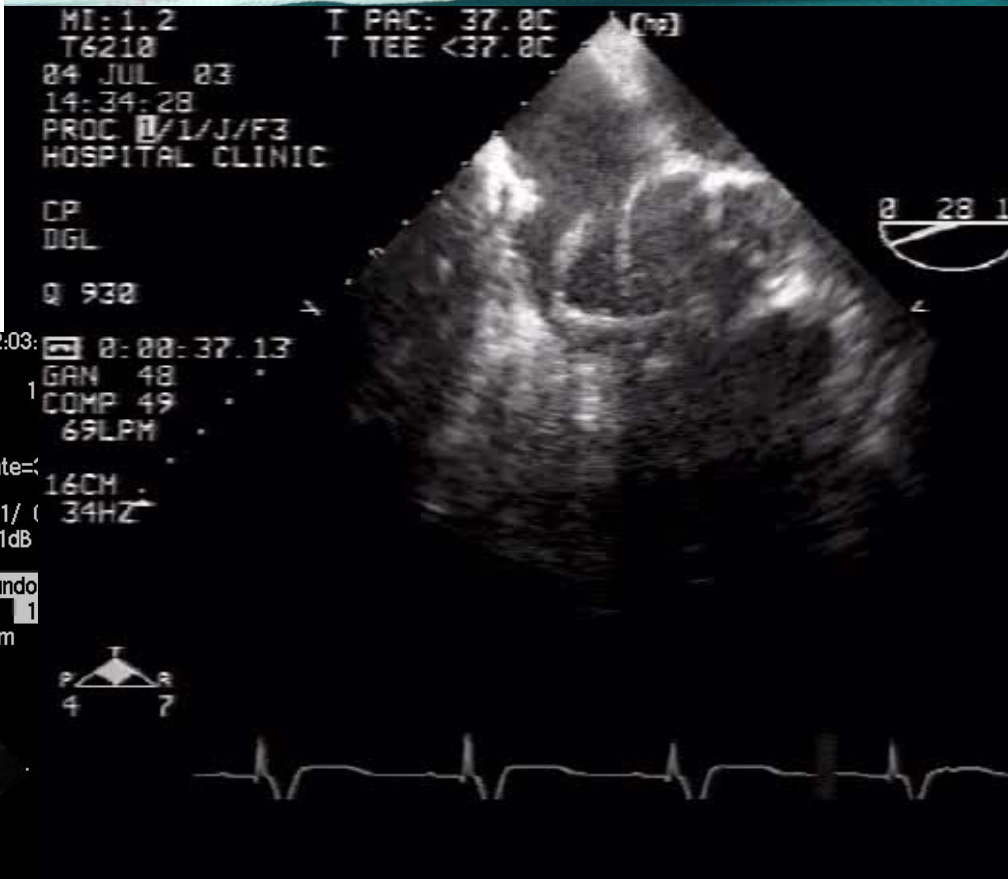
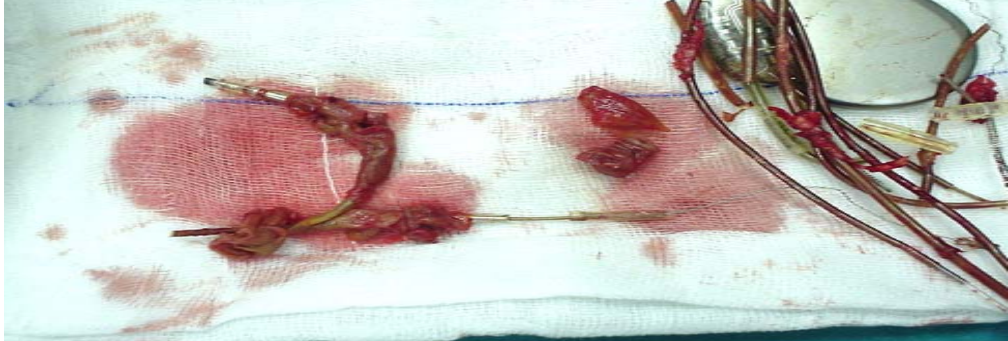
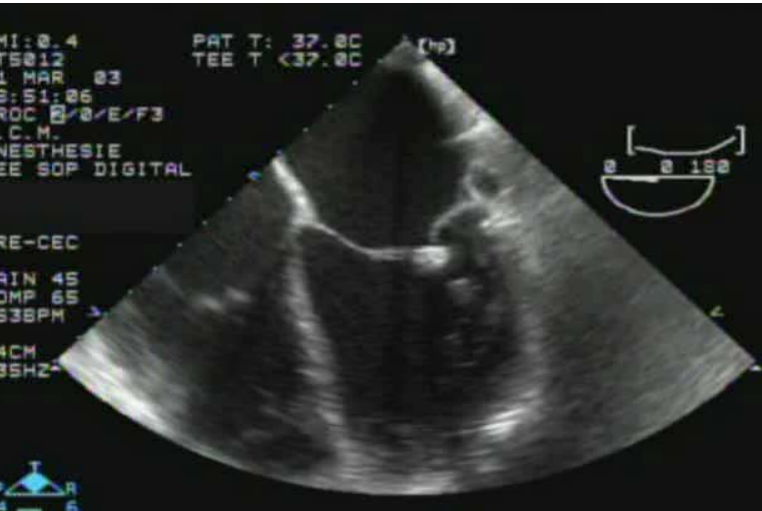
Endocarditis VAo:

- absceso
- mitro-aórtico
- fístula Ao-AD



esic
9 d

Endocarditis mitral A2



Absceso y verruga VAo

Embolismo pulmonar

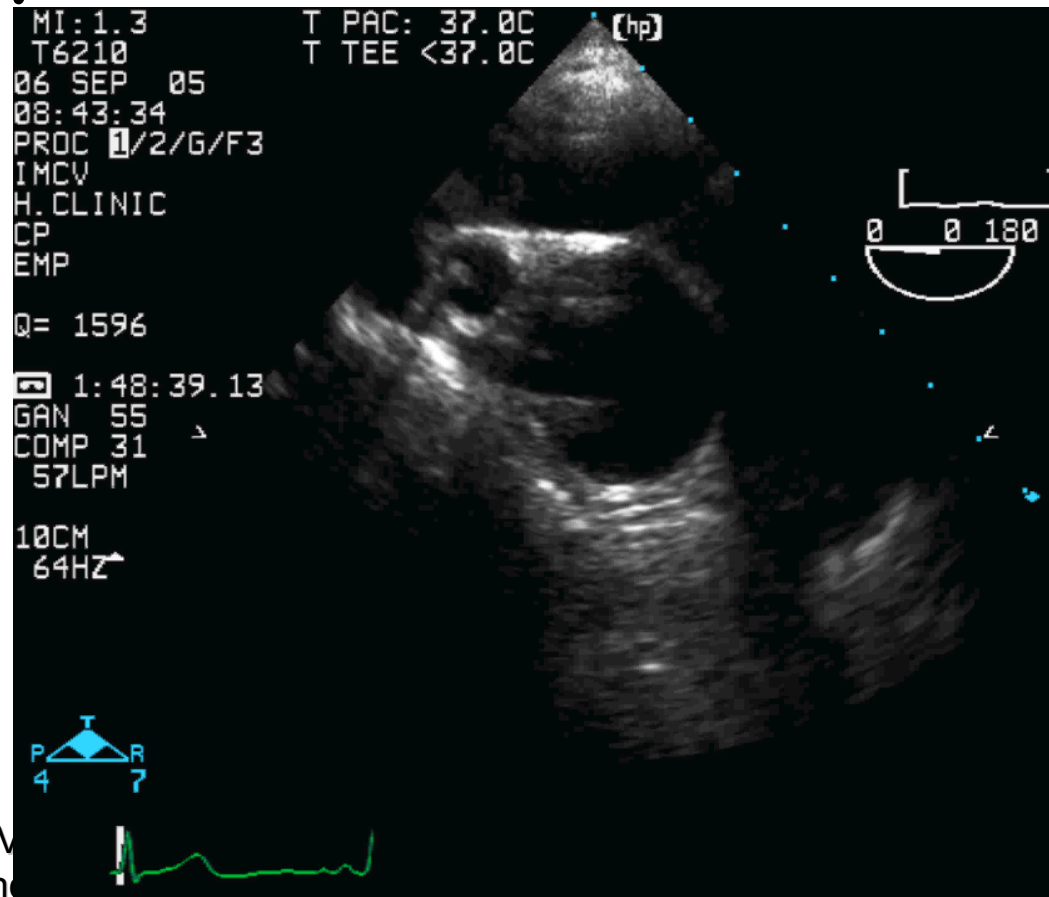
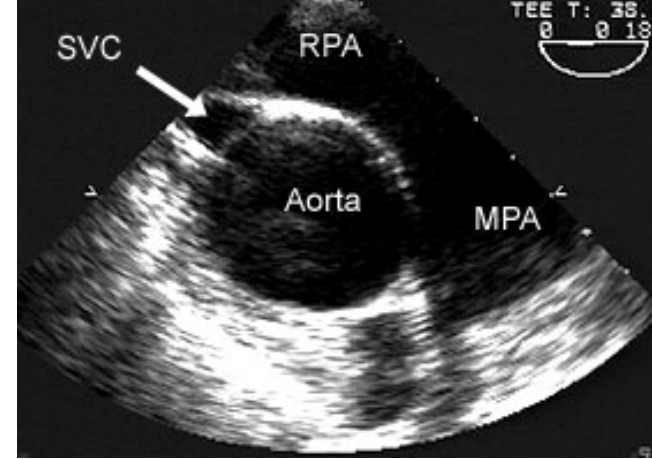
Krivec B. Diagnosis and treatment of shock due to massive pulmonary embolism. Chest 1997

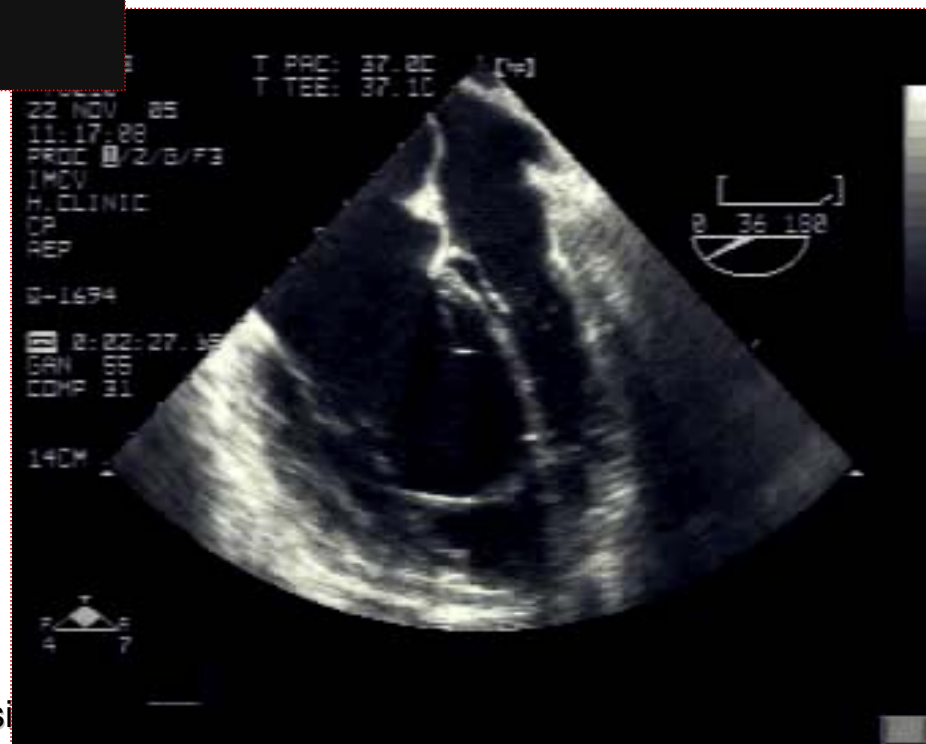
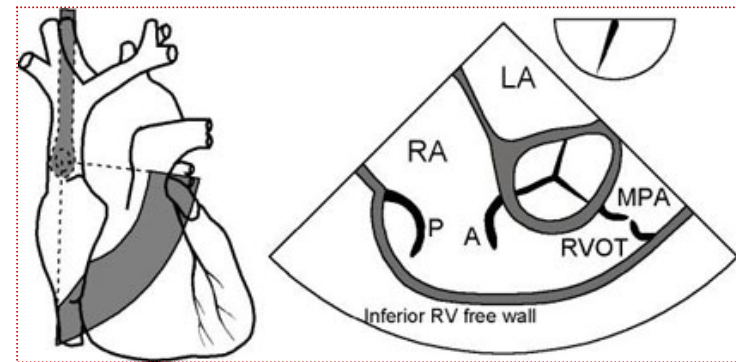
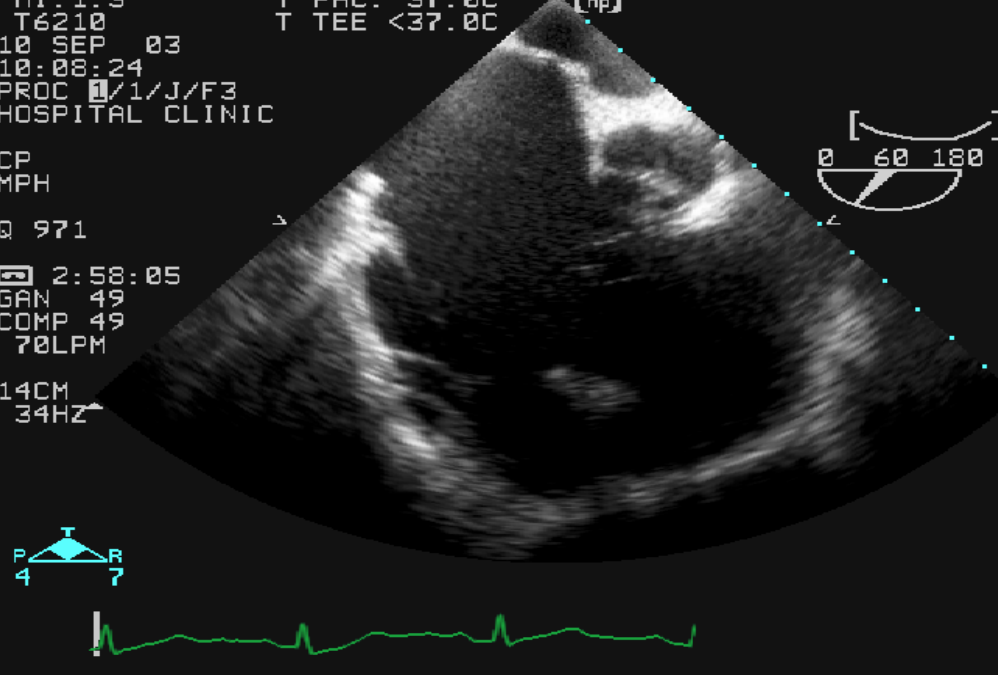
En TEP agudo

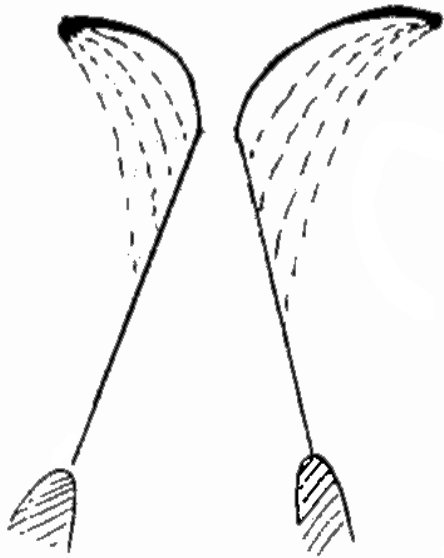
92% sensibilidad

100% especificidad

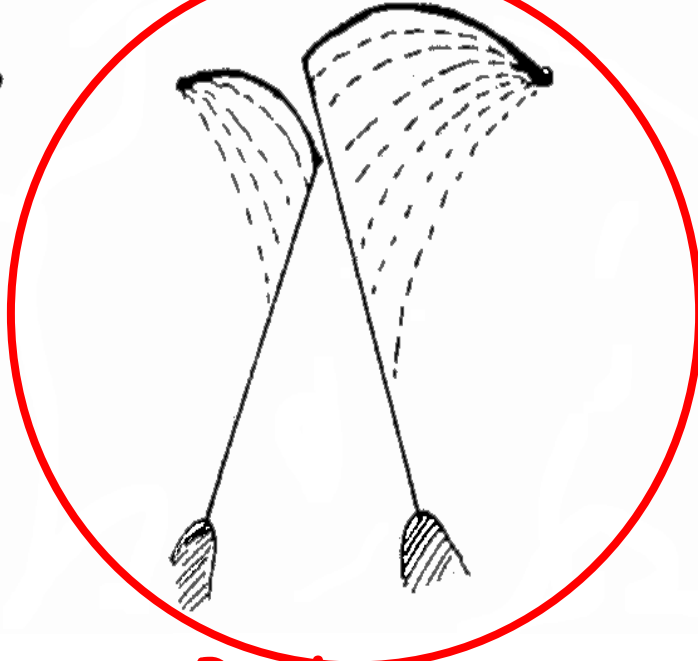
Visión directa
trombo en tronco o
AP derecha o signos
indirectos de fallo
VD.







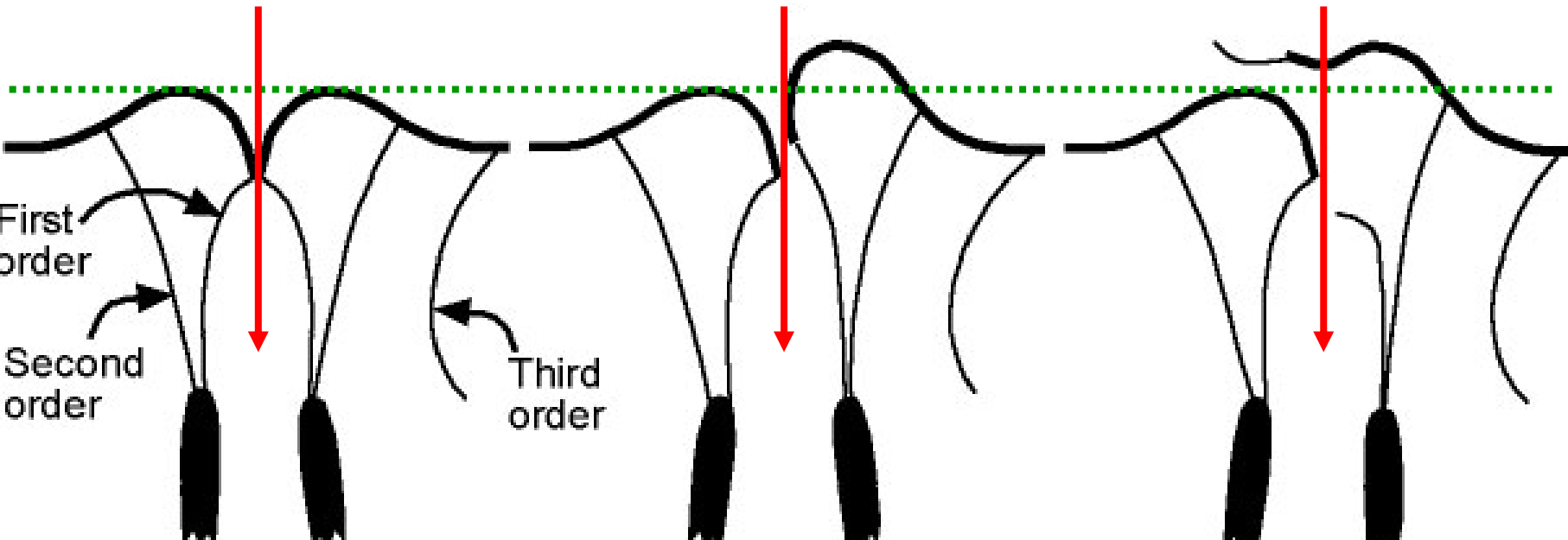
Normal



Prolapso



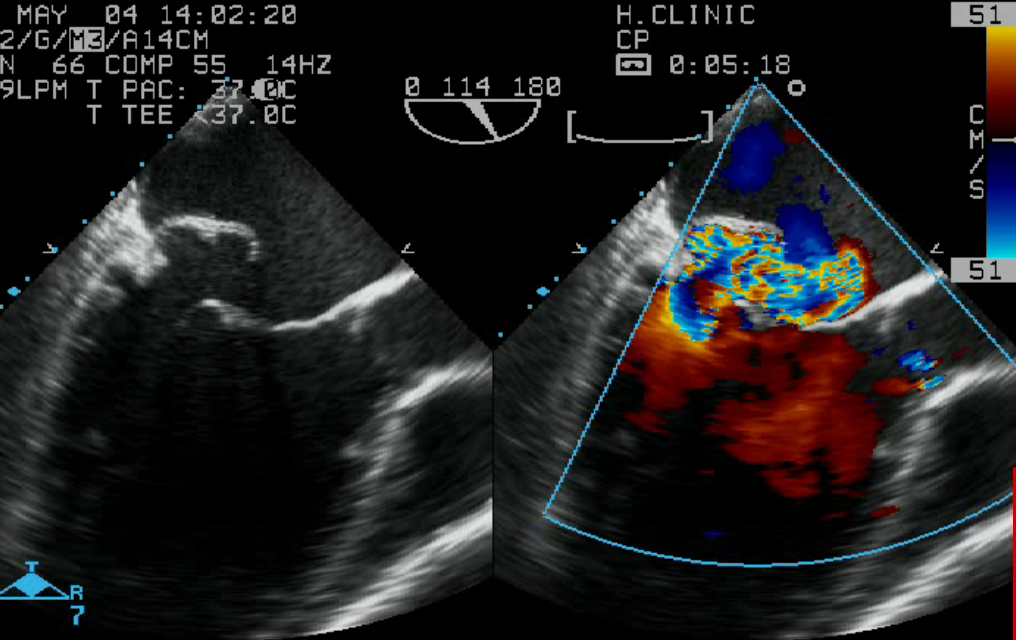
Flail



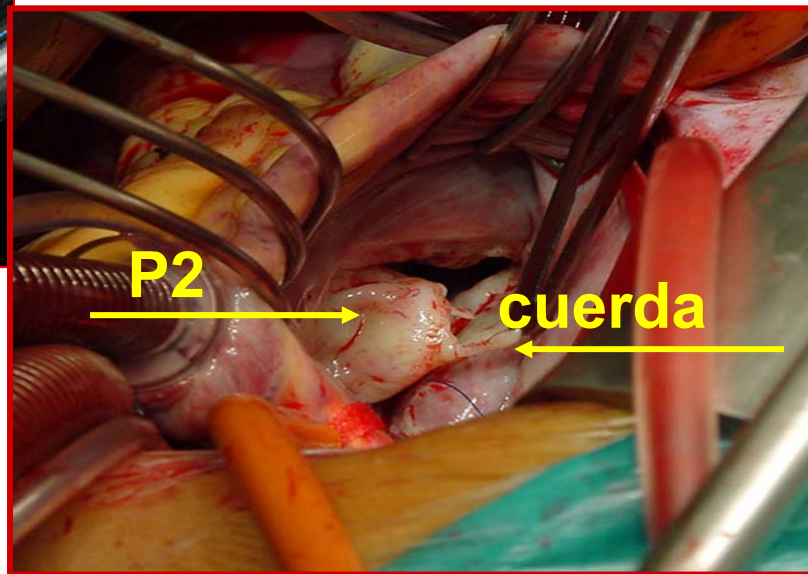
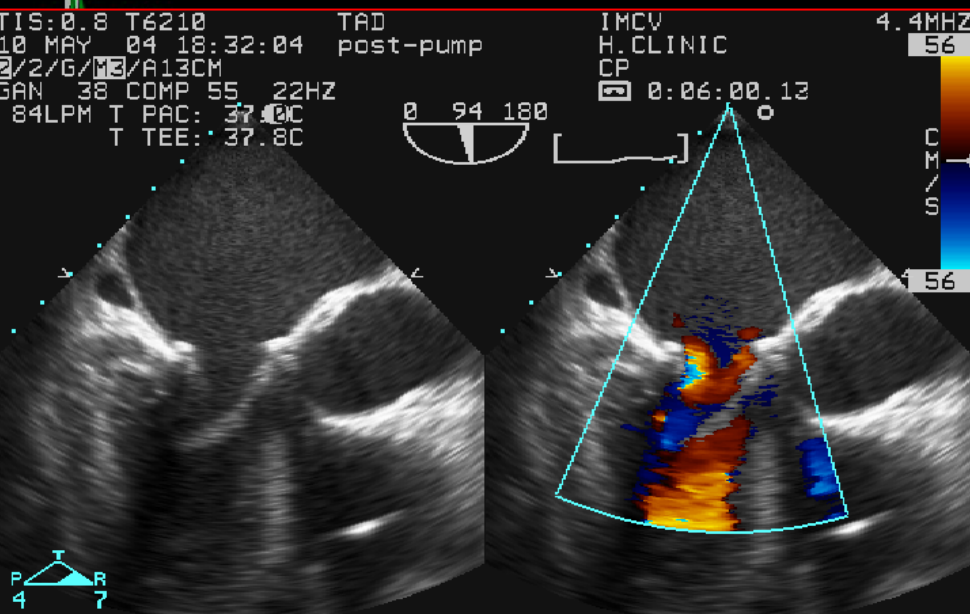
First order

Second order

Third order

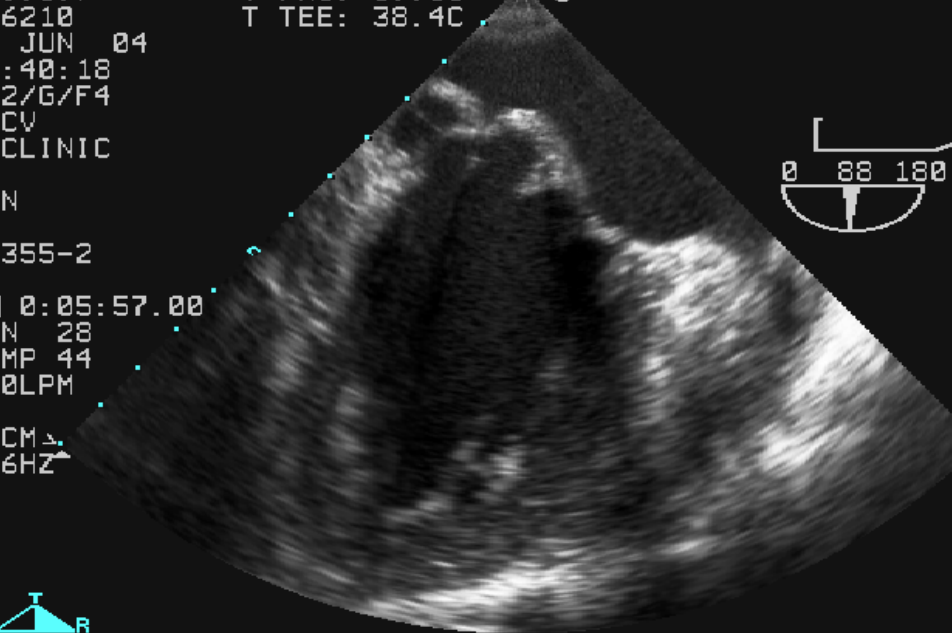


• Prolapso P2 + cuerda



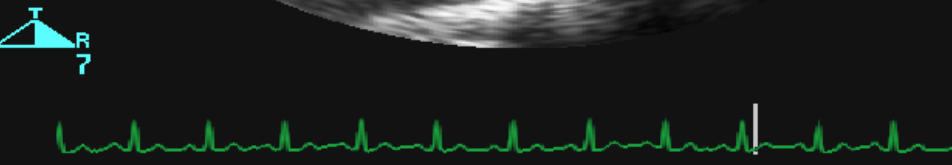
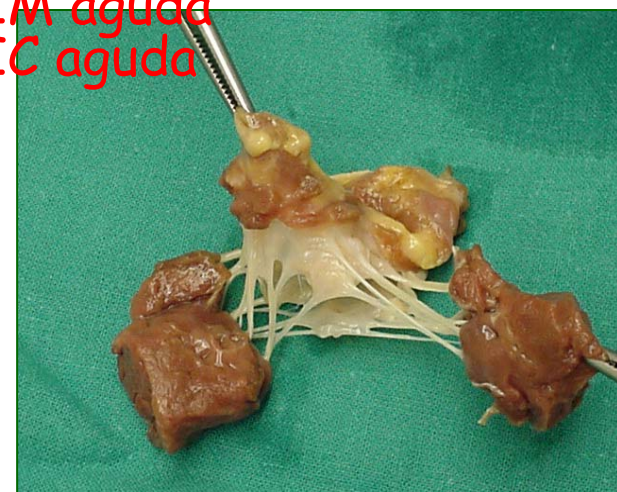
• Post-reparación



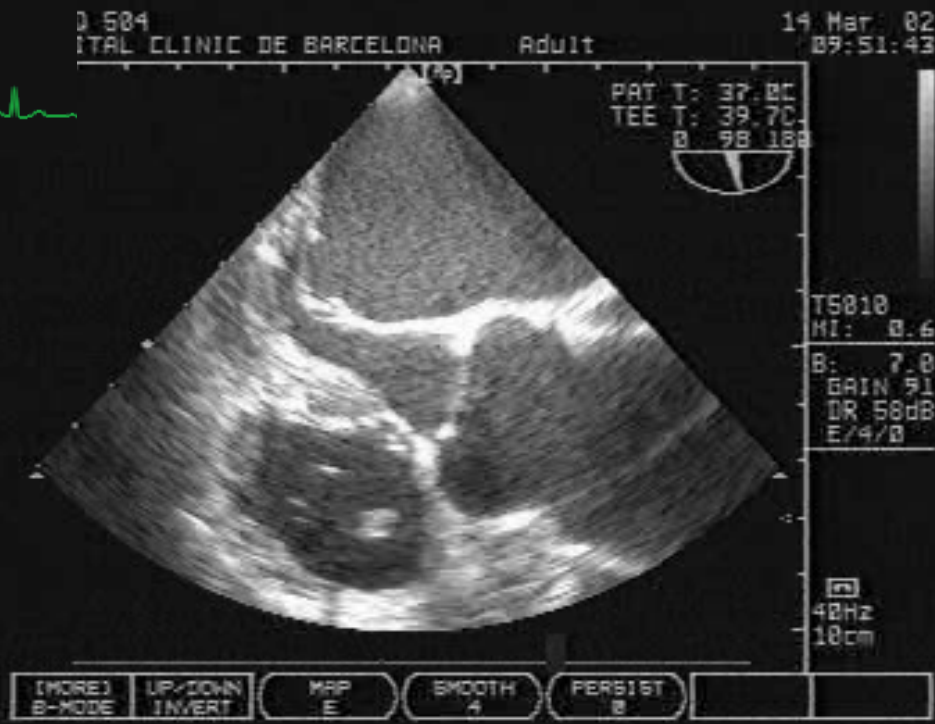


• Rotura músculo papilar post-IAM

- IM aguda
- IC aguda



Barlow



SARTD- CHGUV - Ses
Valencia 19

Etiología:

Primaria lesión válvula

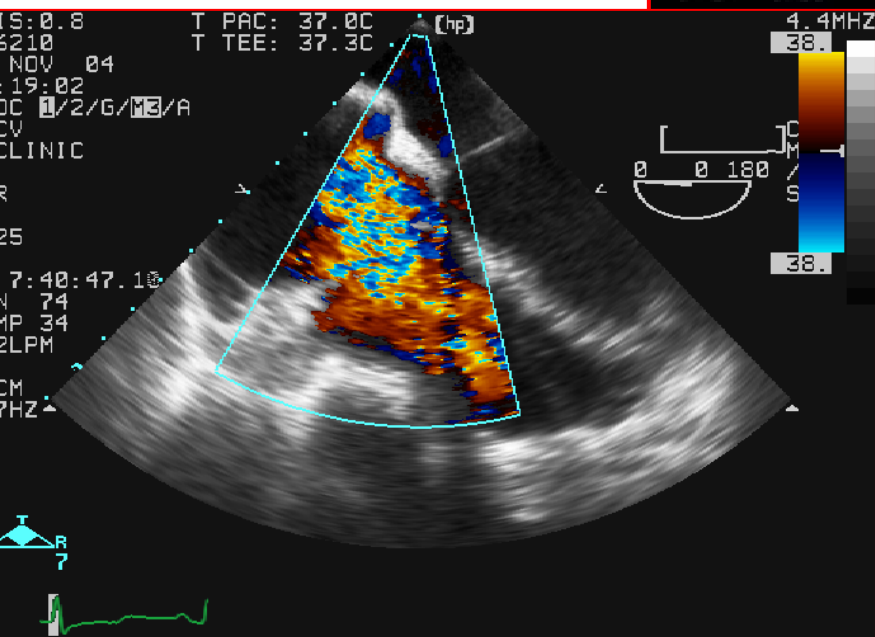
Secundaria:

- HTP
- Patología VP

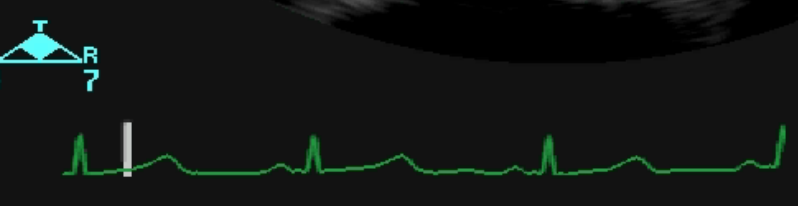
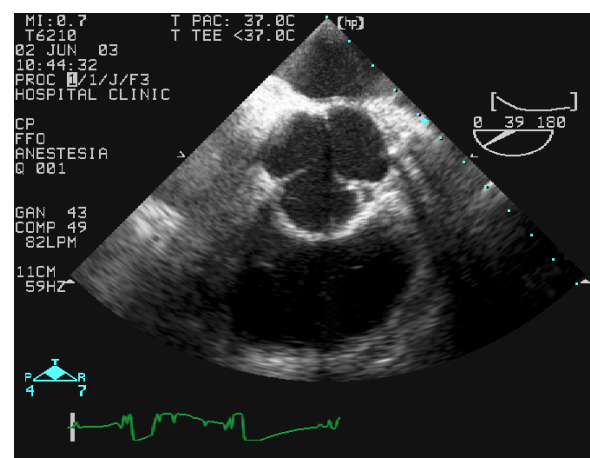
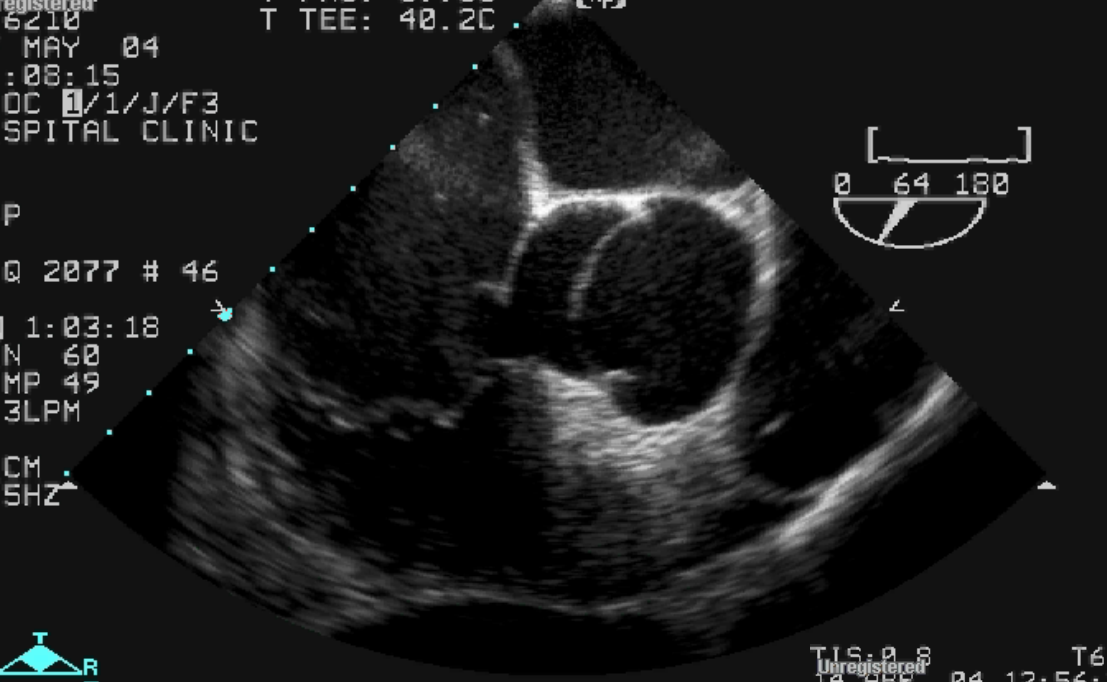
Clínica:

IT

Insuficiencia cardiaca D.



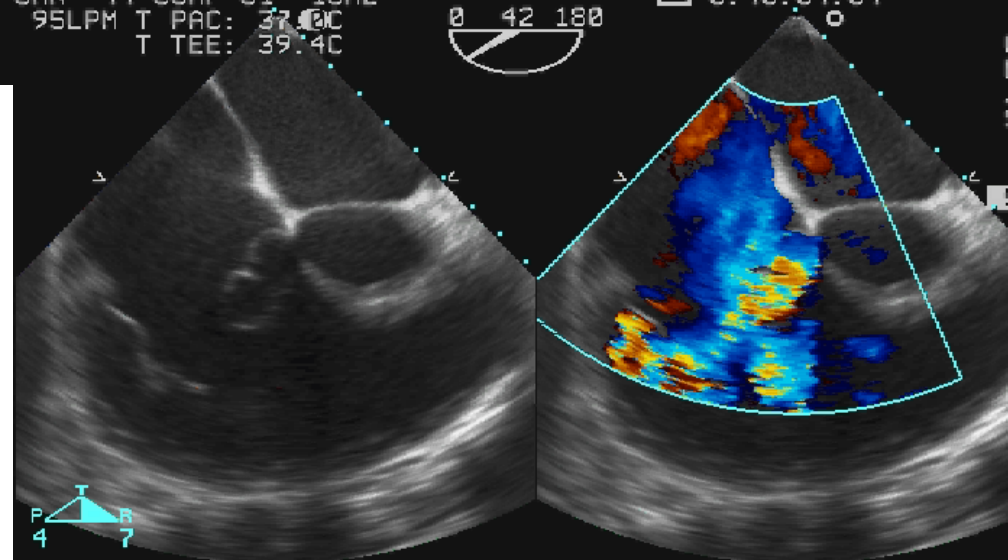
**Regurgitación
tricúspidea por
prolapso valva
septal**



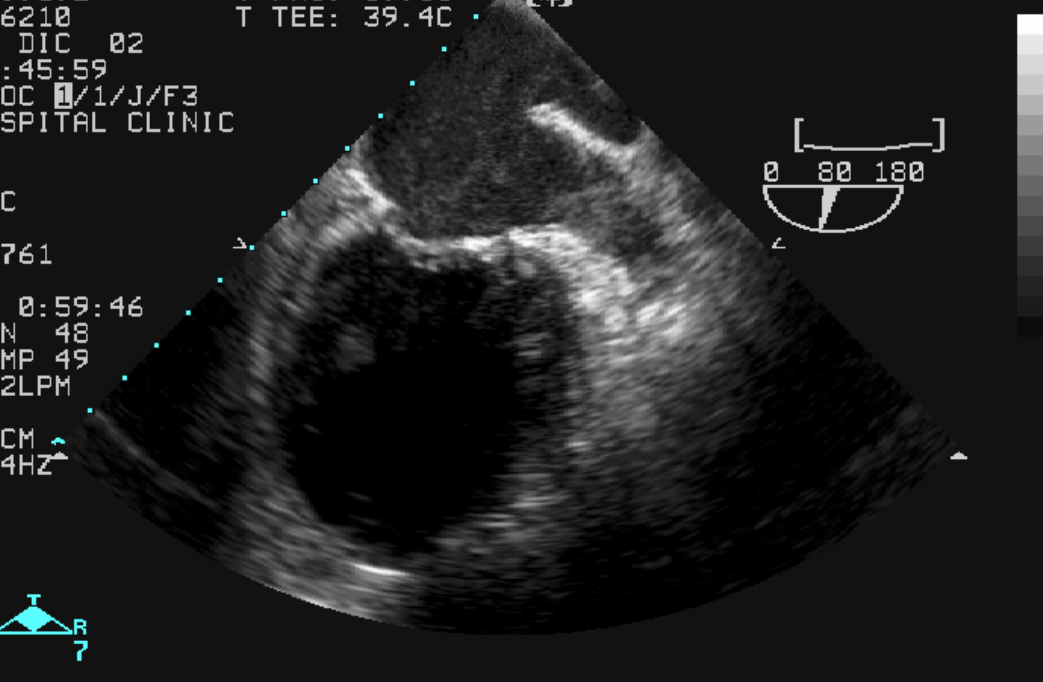
TIS:0.8 T6210 ACP
 Unregistered
 14 APR 04 12:56:25
 1/2/G/M3/M14CM 48413
 GAN 44 COMP 81 16HZ
 95LPM T PAC: 37.00
 T TEE: 39.40

0 42 180

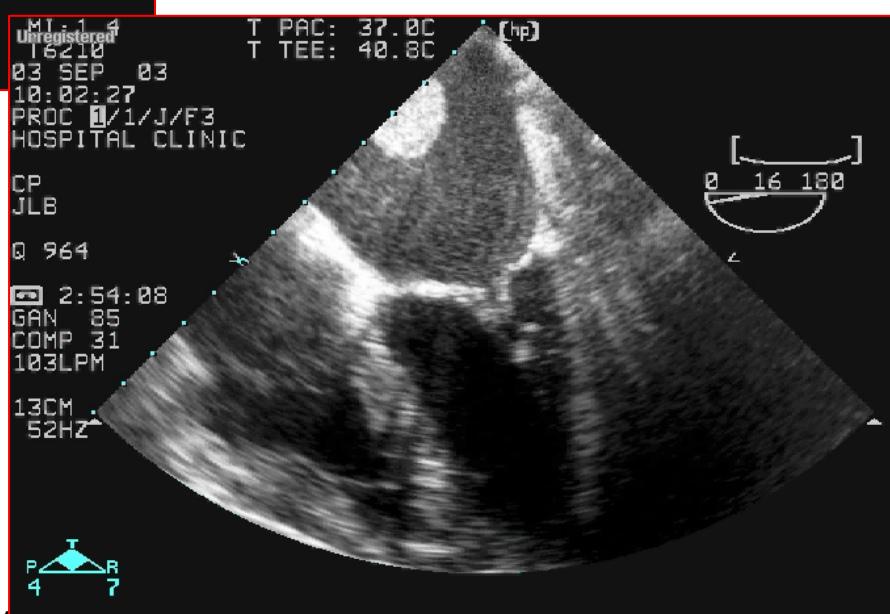
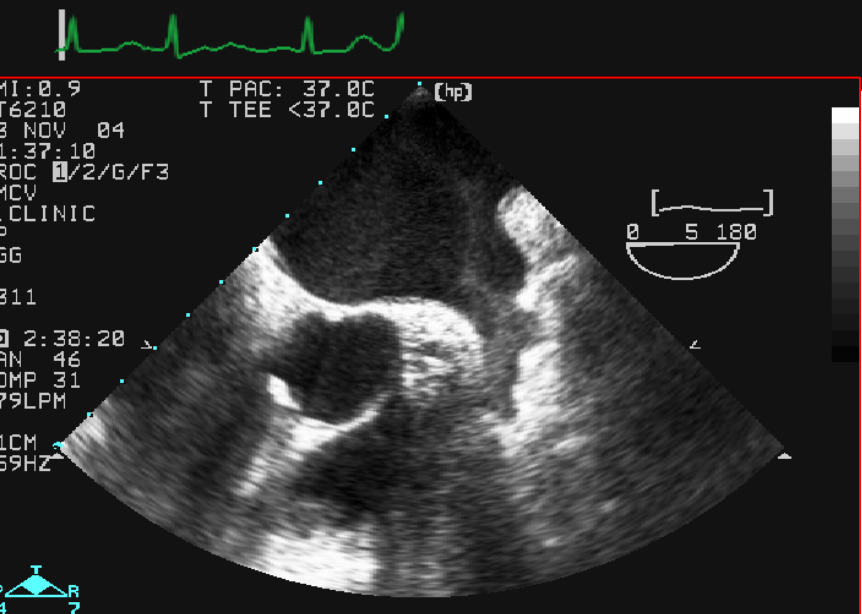
IMCV 4.4M
 H. CLINIC
 CP
 0:40:04.04



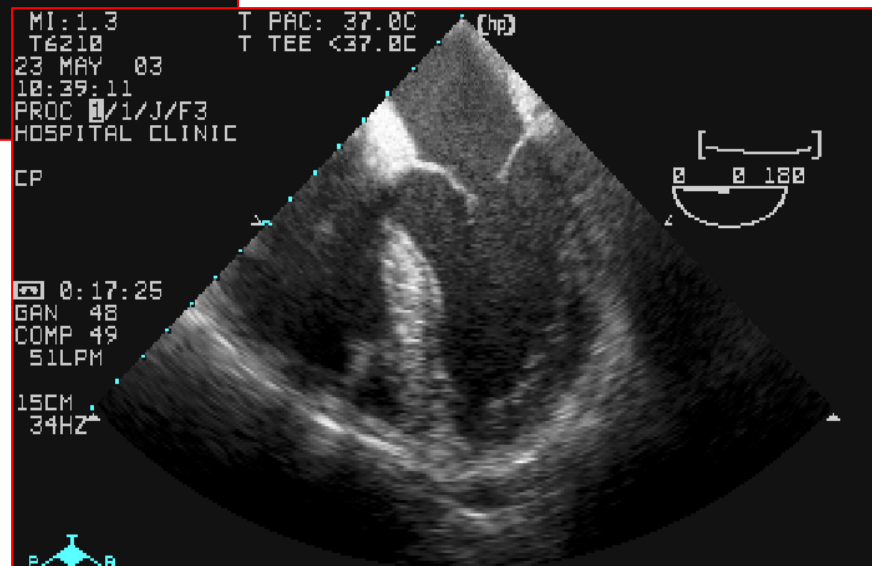
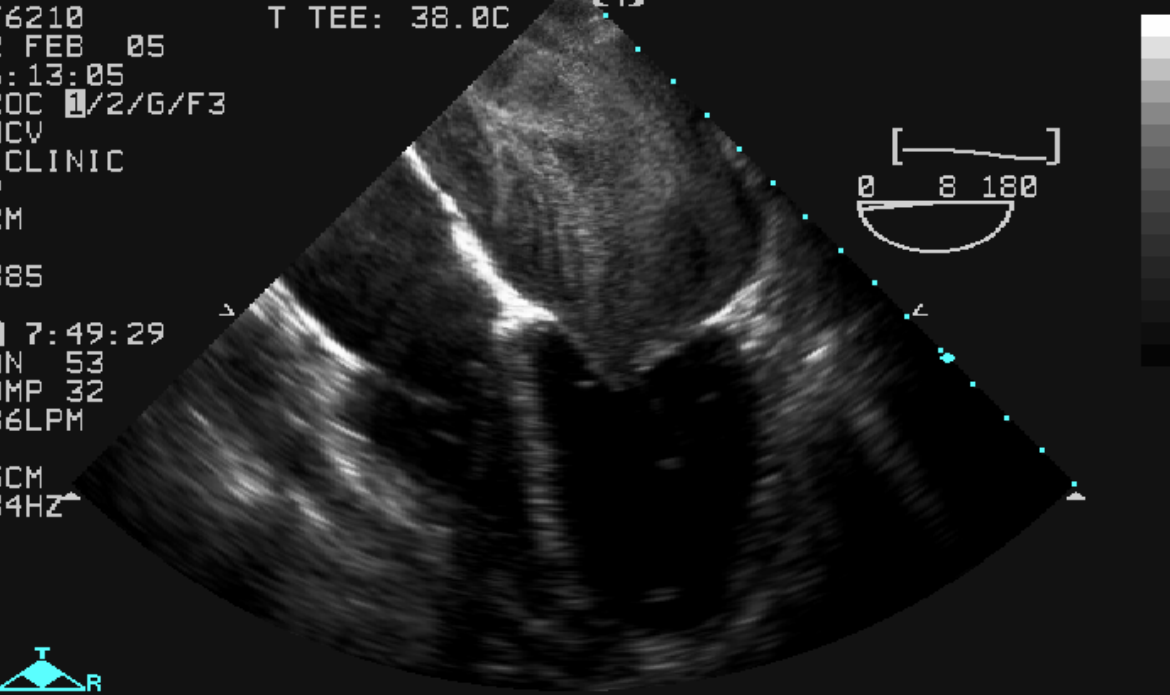
Fístula seno valsalva



- Estenosis mitral:**
- **Contraste espontáneo**
 - **Trombos orejuela**
 - **Trombo AI**

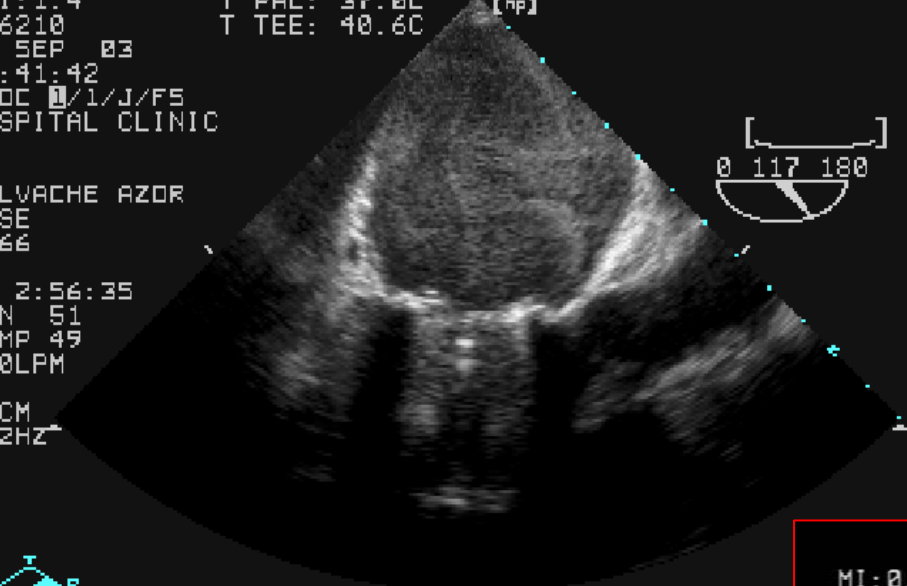


si
 9 d



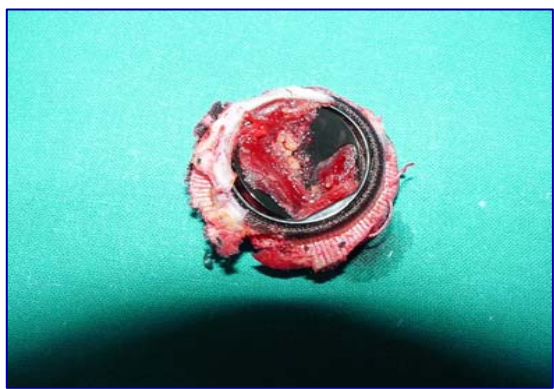
- Sesión de
 a 19 de D





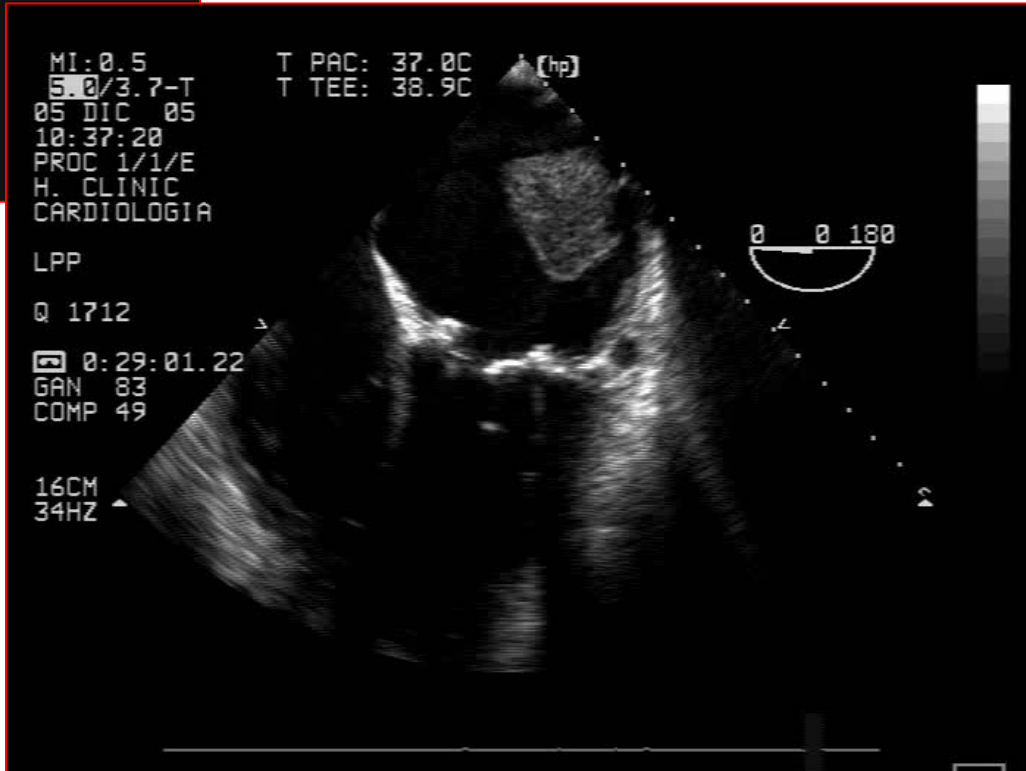
Estenosis mitral:

- "Humo" AI
- Trombo AI

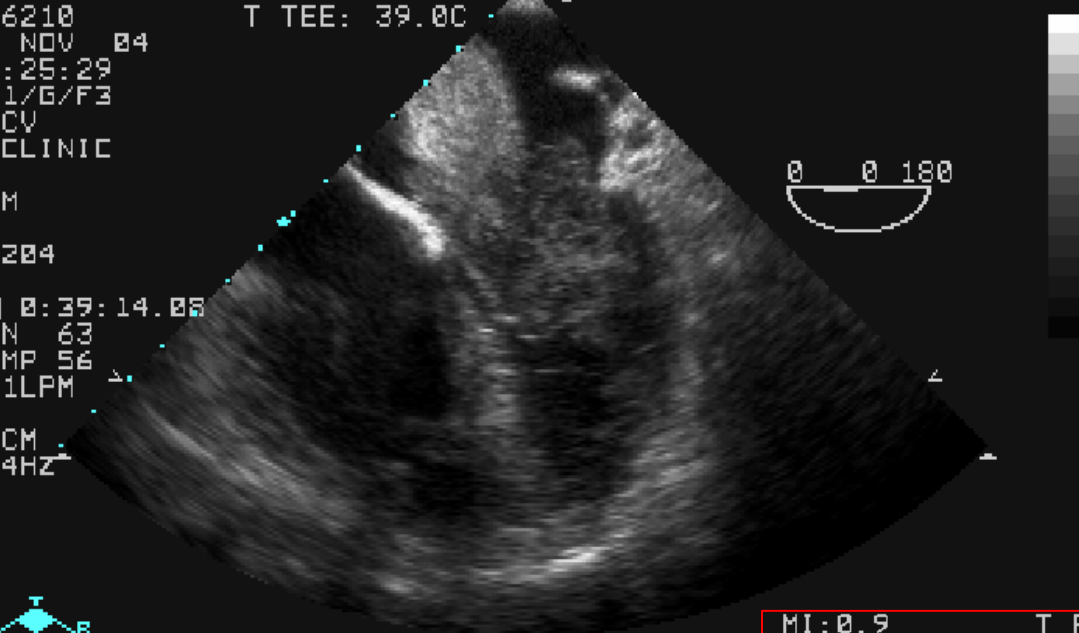


• Prótesis mitral disfuncionante

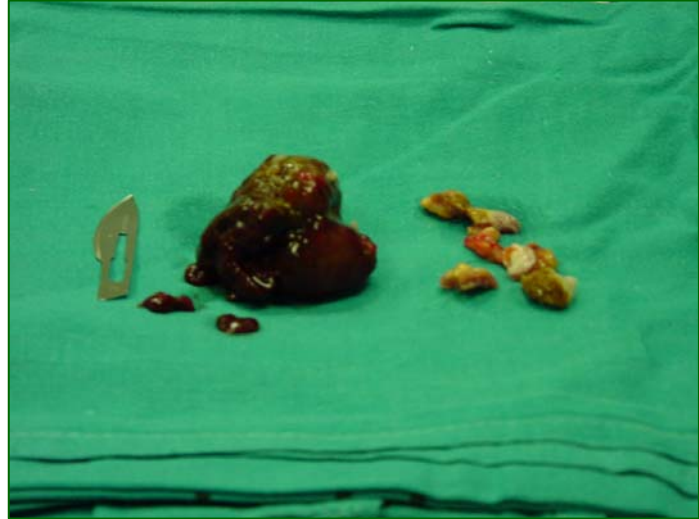
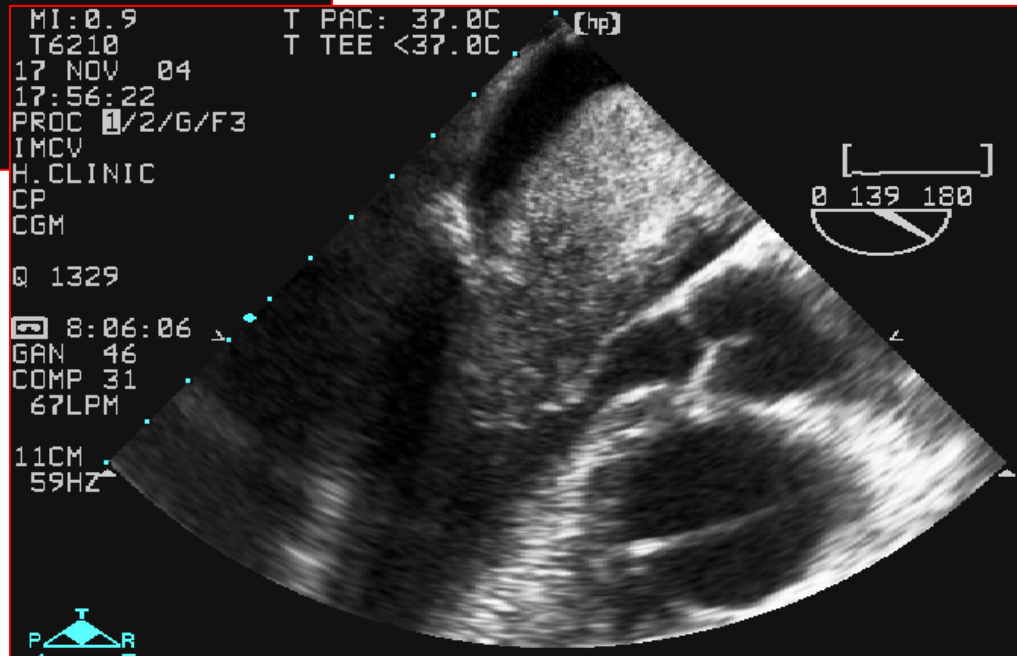
SARTD- CHGUV
Valenc



E.M. SOBRE VÁLVULA PROTÉSICA + TROMBO Au.



Mixoma



GU
 valer

T TEE: 37.80
NOV 04
:41:39
OC 1/2/G/F3
CV
CLINIC

M
1329
7:52:14.17
N 44
MP 31
1LPM
CM
44HZ



MI:0.9
T6210
17 NOV 04
17:47:40
PROC 1/2/G/F3
IMCV
H. CLINIC
CP
CGM

T PAC: 37.0C
T TEE: 37.6C [hp]

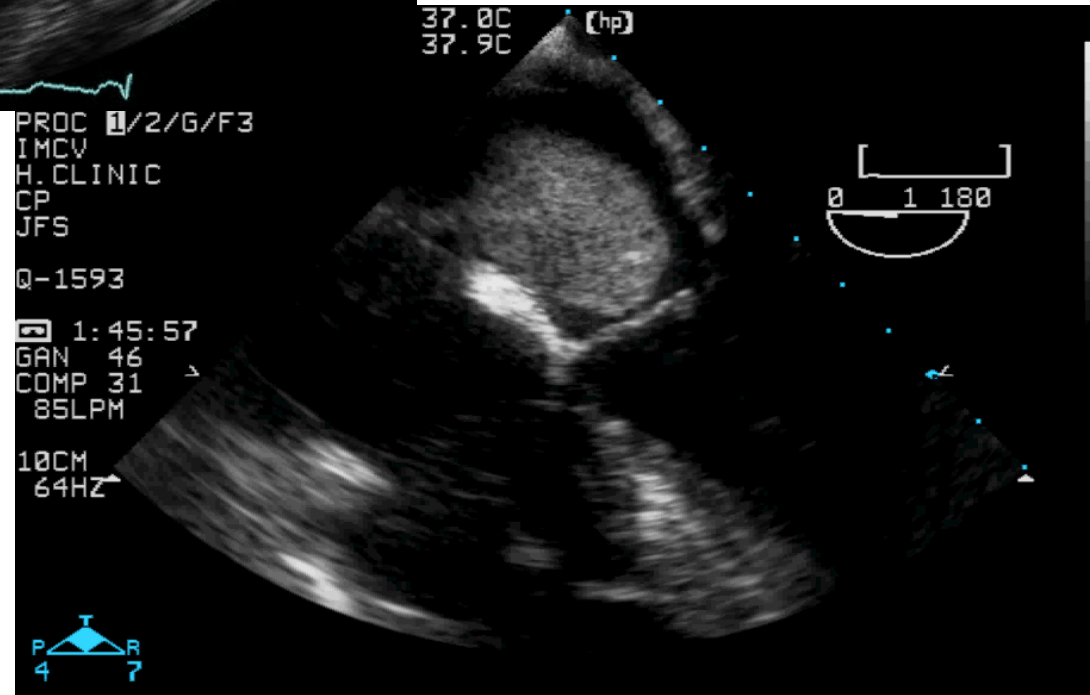
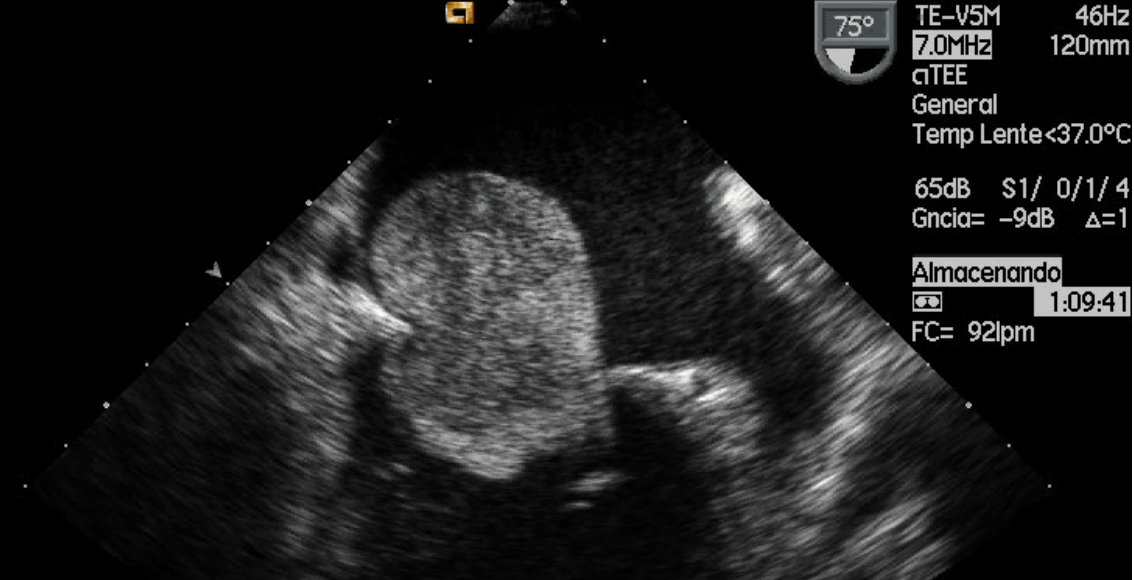
Q 1329
7:58:15.03
GAN 46
COMP 31
84LPM
10CM
64HZ



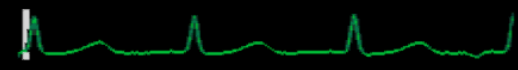
SARTD- CHGU
Vale

Clínica:

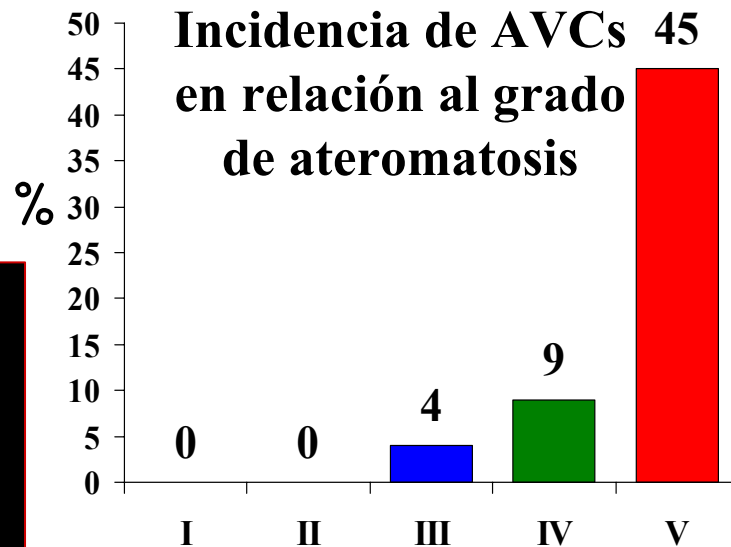
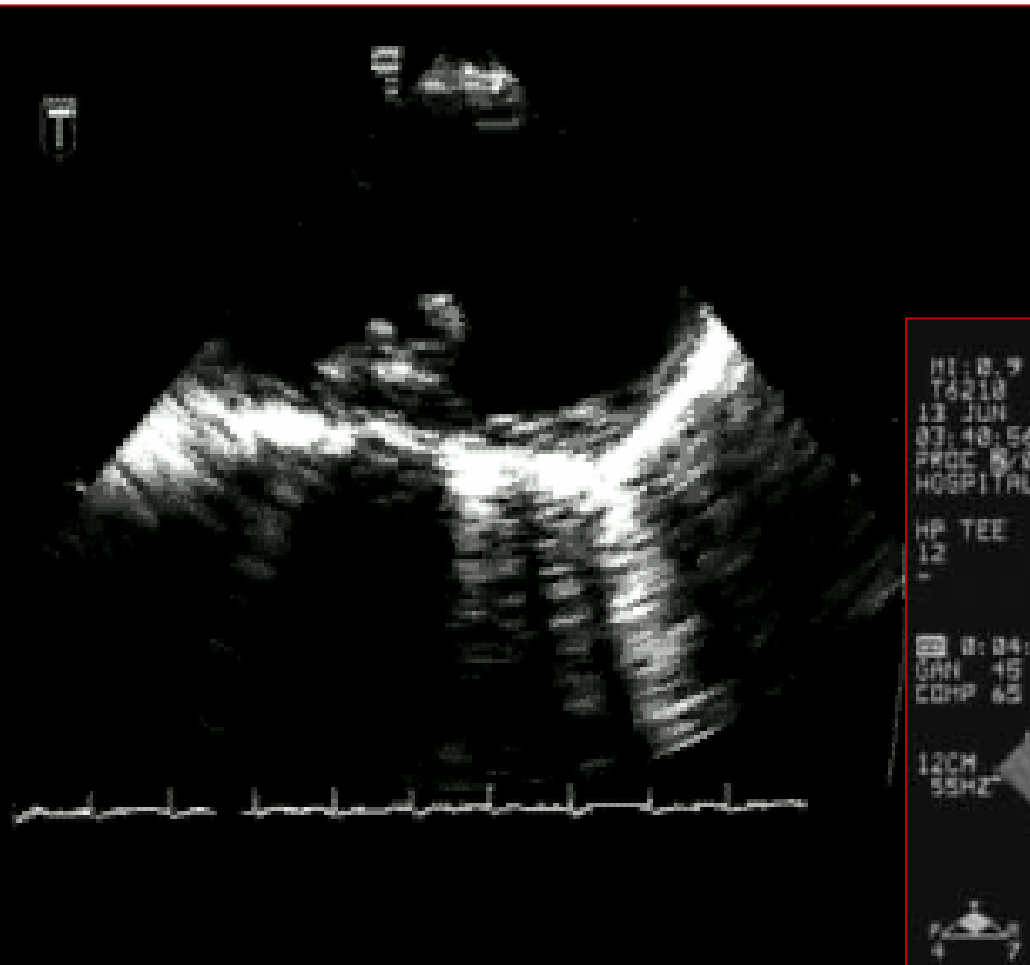
- "Hallazgo casual"
- Arritmias
- Embolias
- Síncope

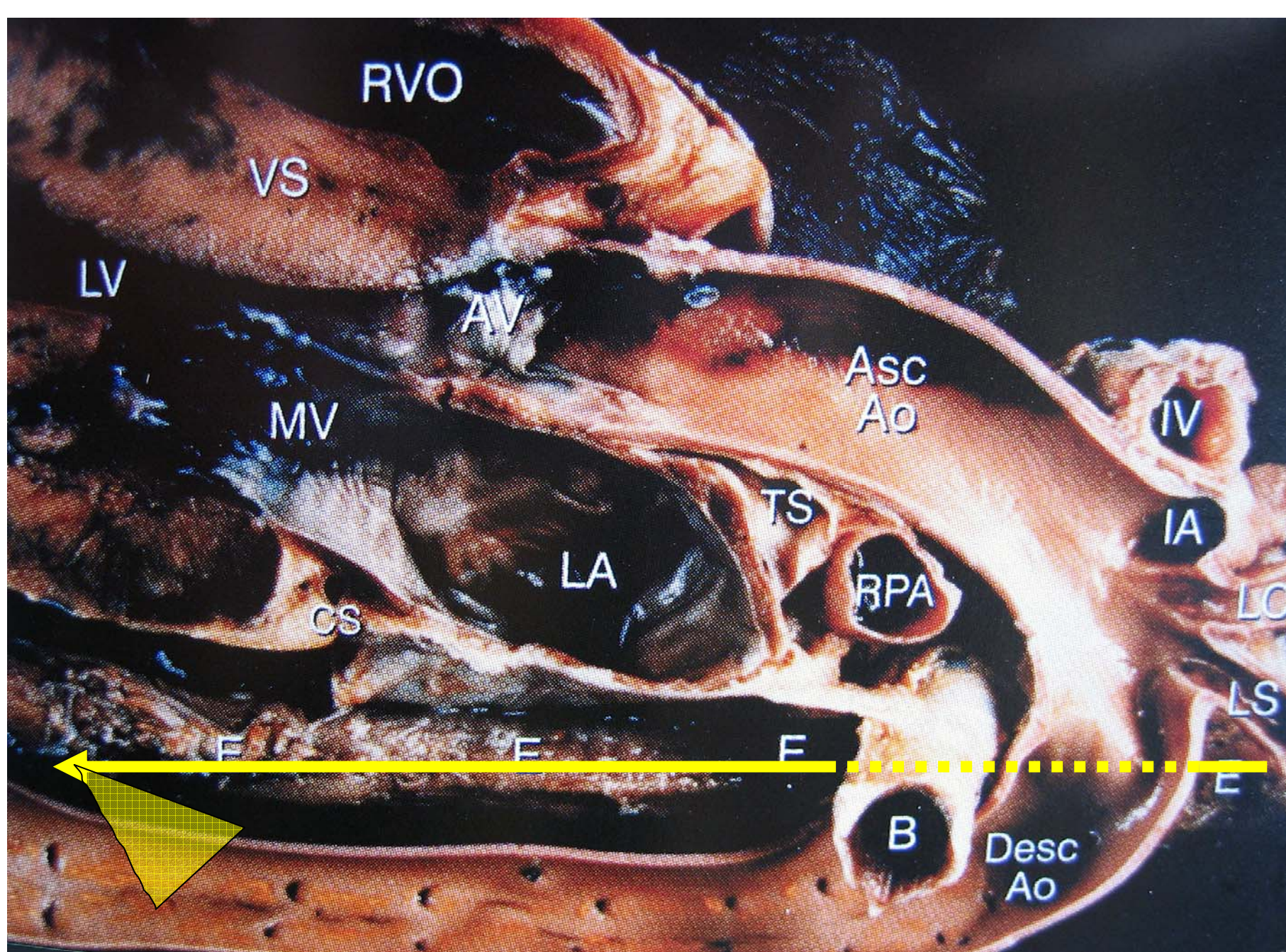


SARTD- CHG
Val

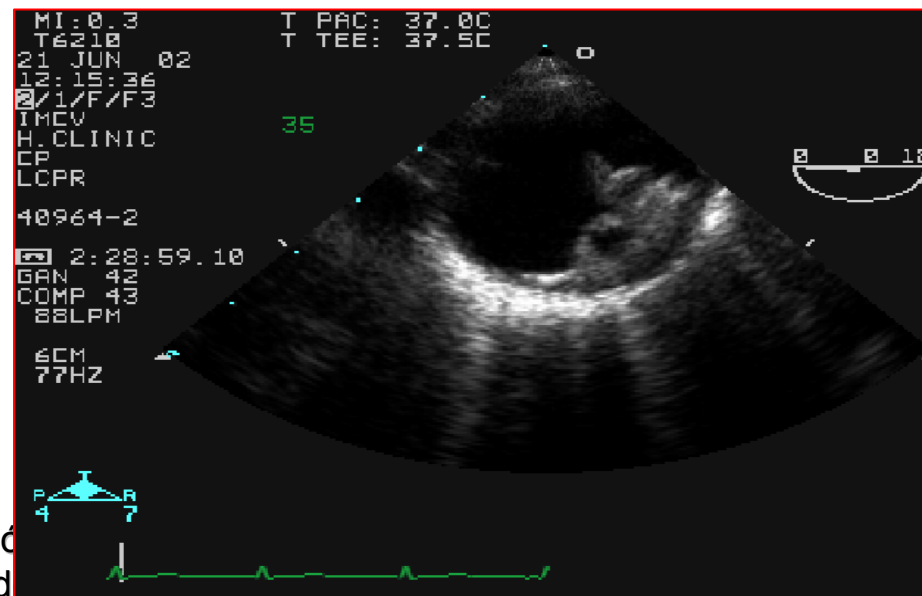
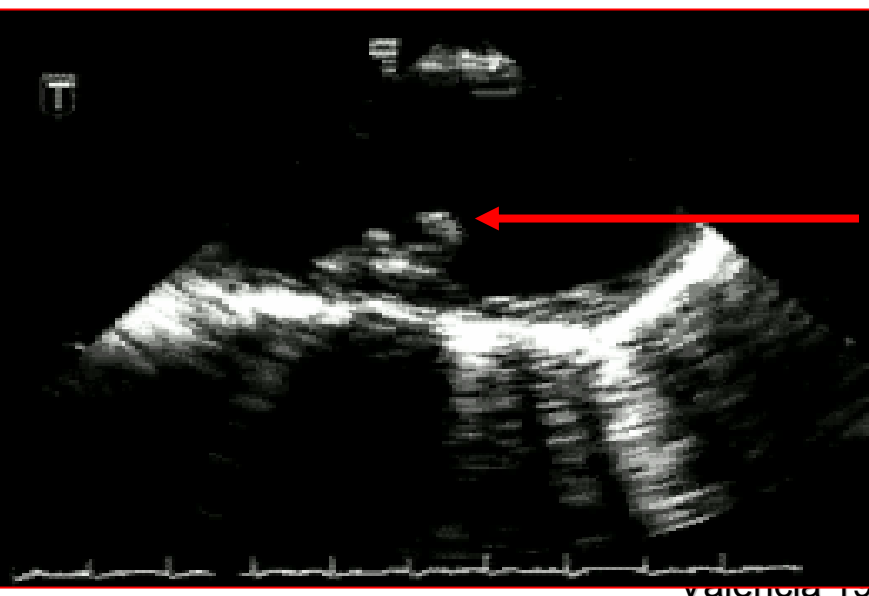
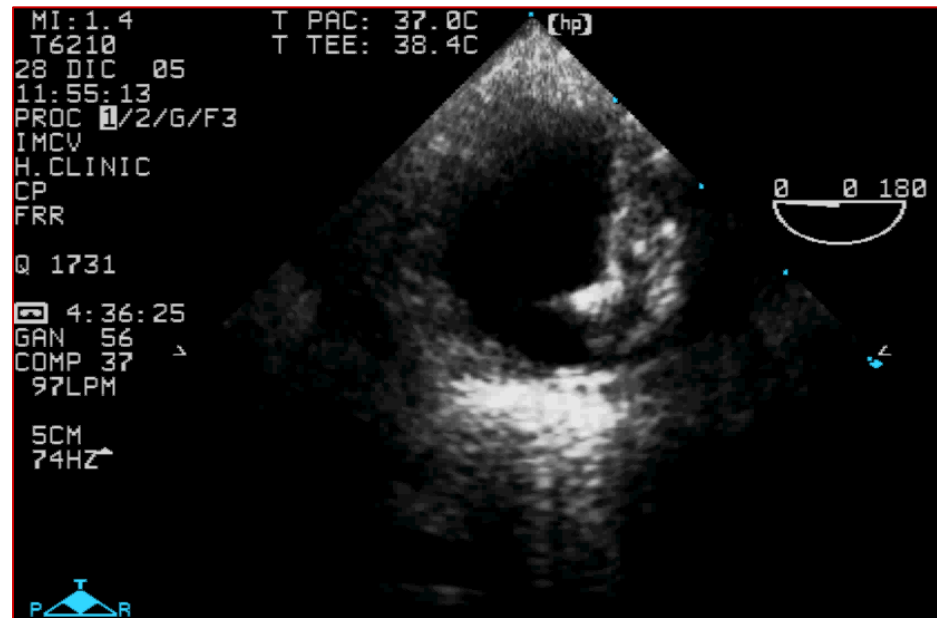
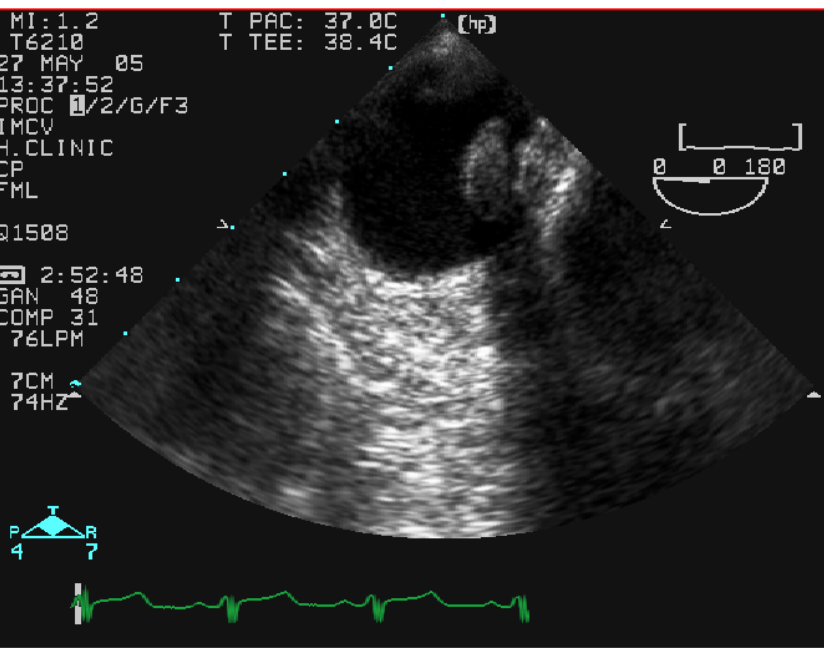


Otros diagnósticos: patología aórtica

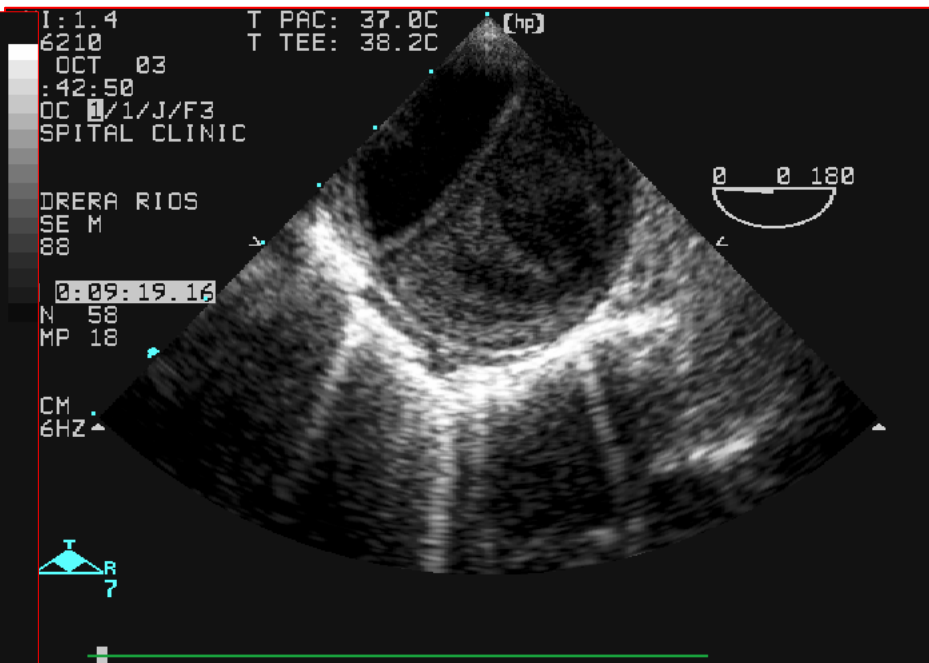
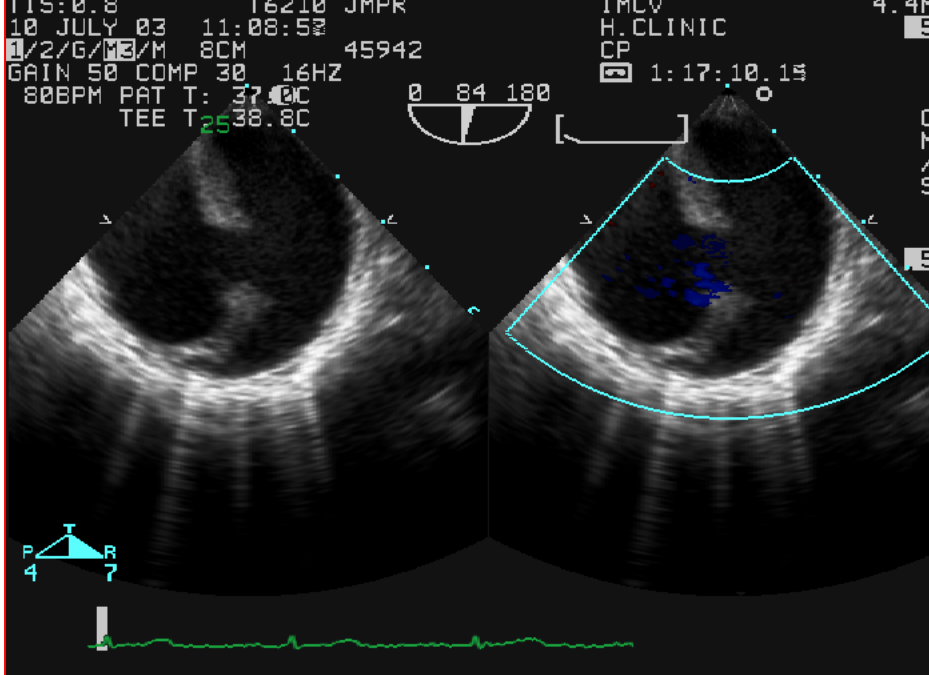
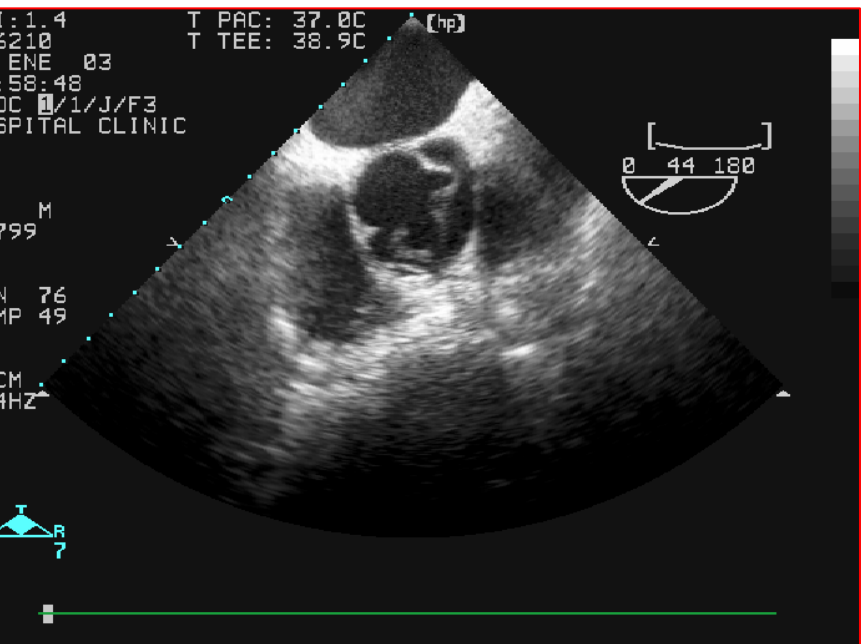




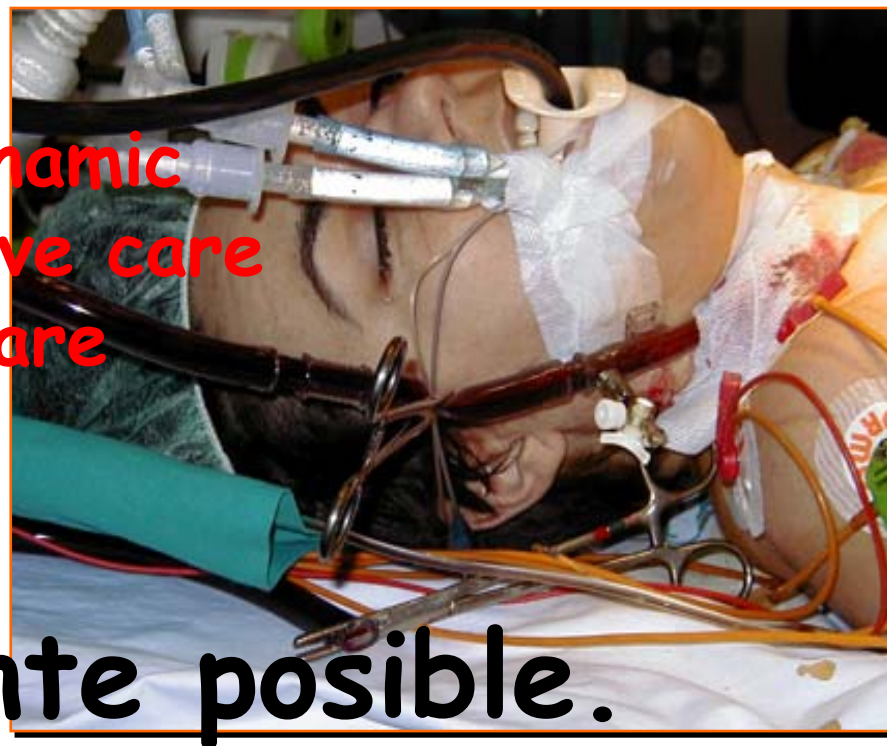
Placas de ateroma en Ao descendente



Disseccion Ao

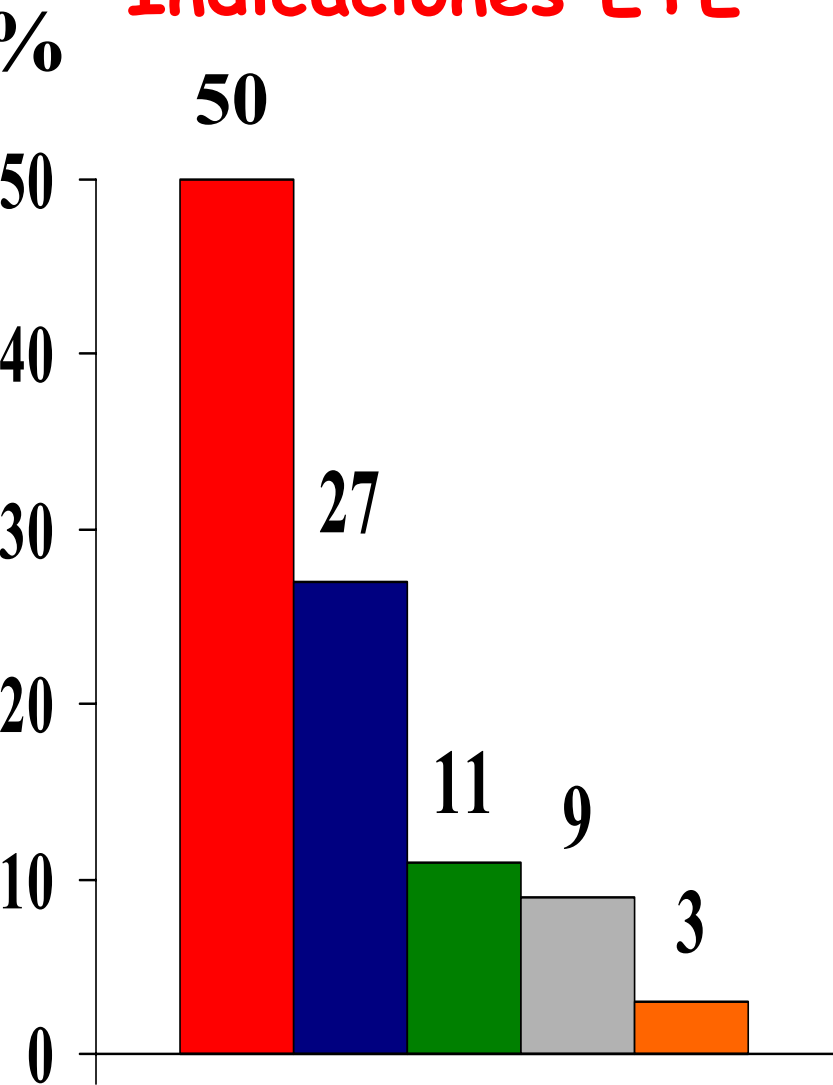


Clinical Review: Hemodynamic monitoring in the intensive care unit. J Boldt. Critical Care 2002; 6:52-59.



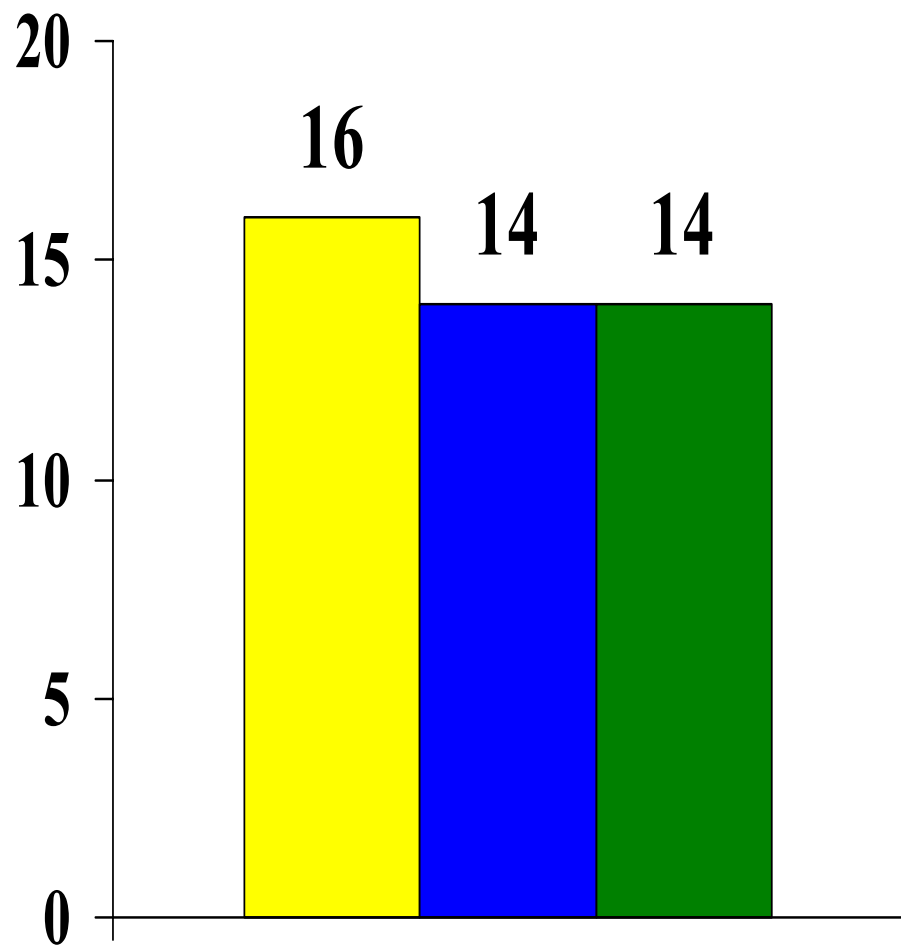
- 1- Técnicamente posible.**
- 2- ¿Mejora nuestra actitud terapéutica o el pronóstico del paciente?.**

Indicaciones ETE



■ Contractilidad ■ Precarga ■ Válvulas
■ Endocarditis ■ Extracardiacas

Cambio tratamiento (43%)



■ Inodilatadores ■ Fluidoterapia
■ Intervencionista



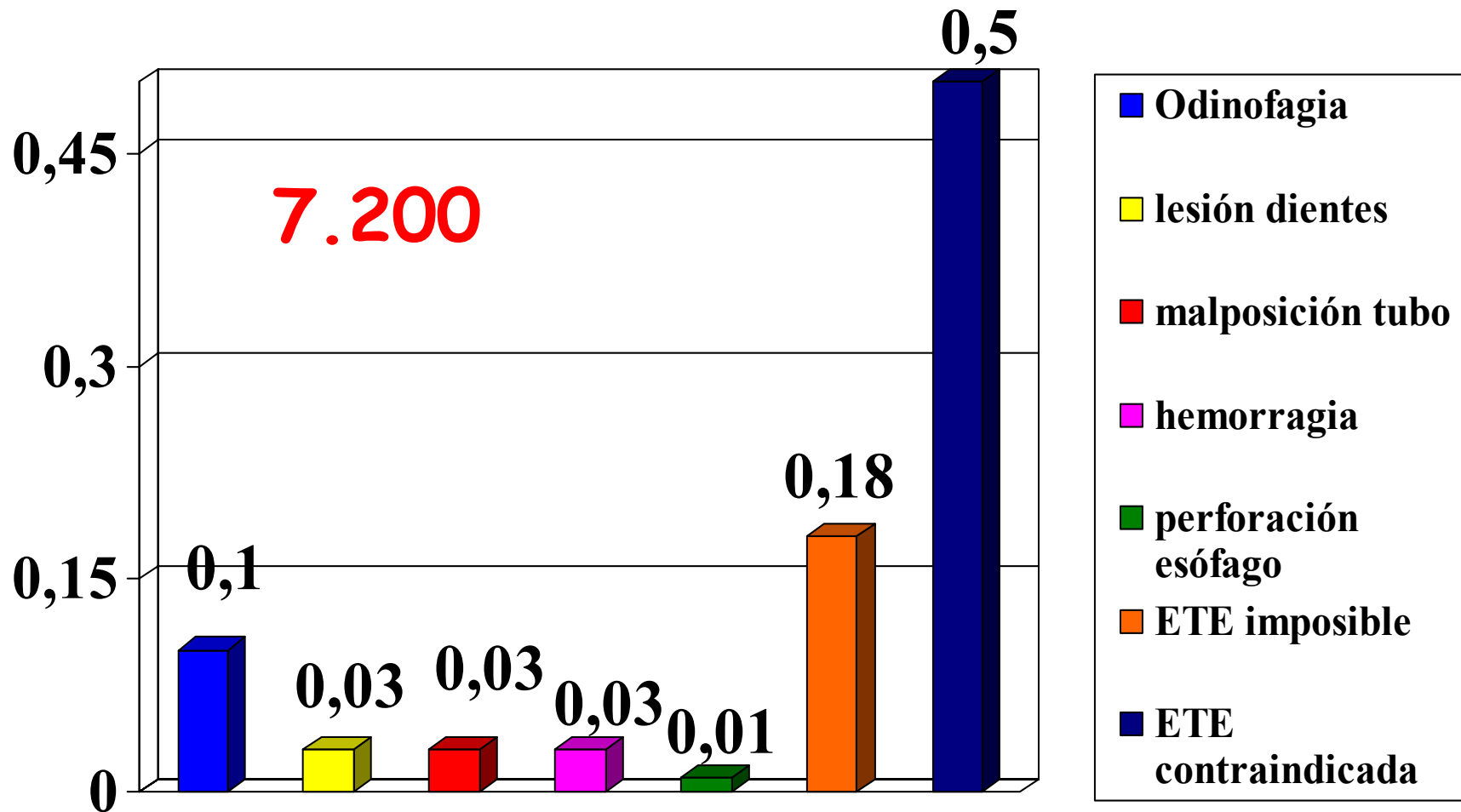
Polanczyk CA. Right heart catheterization and cardiac complications in patients undergoing noncardiac surgery.
JAMA 286:309-314, 2001

JAMA

The Journal of the American Medical Association

Que la utilización de la
ETE no sea
un **marcador** de un estilo
invasivo en el tratamiento
de los **pacientes**"

Complicaciones de la ETE



Kallmeyer I. 2001.

- 1- Aunque no hay datos concluyentes impresión clínica es que la ECO es para el paciente crítico inestable. ¿Relevancia y validez?
 - 2- ¿Infrautilizada?
 - 3- ¿"Estandar ideal": ¿cuál es el estándar?
 - 4- ETT antes que ETE. Sin embargo, ETE mejora la valoración de la función cardíaca en el 50%-70% de los pacientes.
 - 5- Límites de la ECO: monitorización "esporádica", "dependiente de la experiencia", "dependiente del operador".
- semi-invasiva (ETE), cara...

Útil para diagnosticar y descartar patología pero NO para monitorización prolongada.