



XXXII Congreso Nacional de la SEMI

XIV Congreso de la Sociedad Canaria de Medicina Interna
26-28 Octubre 2011



Ecocardiografía básica para internistas

José María Cepeda
Hospital Vega Baja
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www.ecografiaclinica.org



Costa Meloneras

Palacio de Congresos Expomeloneras
Maspalomas, San Bartolomé de Tirajana
Gran Canaria, Las Palmas



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ESQUEMA

Introducción: ¿Porqué utilizar ultrasonidos en Medicina Interna?

Principios de ecografía

Ventanas y planos ecocardiográficos

Modo M y doppler

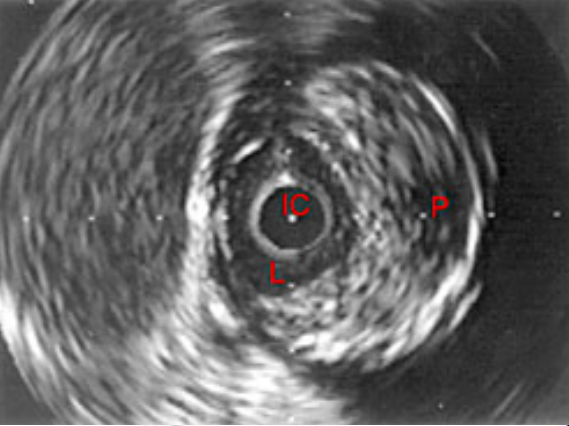
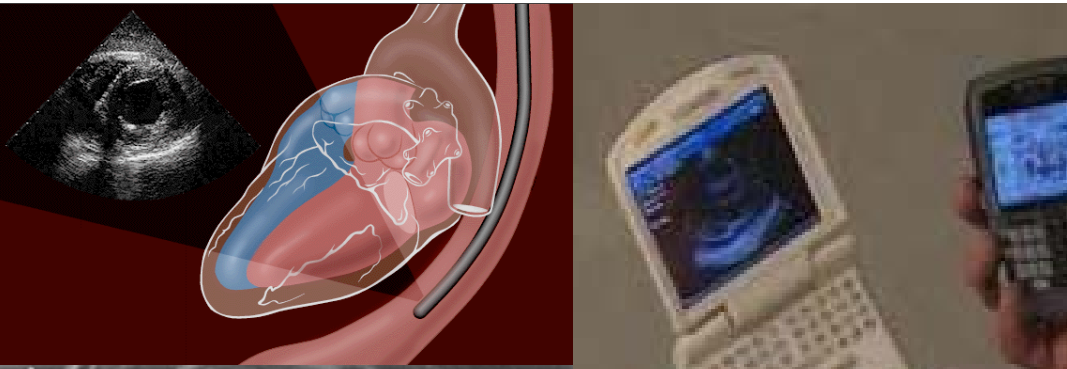
Utilidad de la ecocardiografía en Medicina Interna

Imágenes y casos

Costa Meloneras

Palacio de Congresos Expomeloneras
Maspalomas, San Bartolomé de Tirajana
Gran Canaria, Las Palmas

Miniaturización de la ecocardiografía





Ecografía de bolsillo

Eco-estetoscopio

- **¿Es apropiada para obtener imágenes interpretables?**
- **¿Cuáles son sus ventajas y cuáles sus limitaciones?**
- **¿Es adecuada para su utilización en MI?**
- **¿Qué habilidades son necesarias para utilizarlos?**
- **¿Qué formación necesita el internista para alcanzarlas?**
- **¿Cuál es el beneficio clínico para los pacientes?**
- **¿Cuál es el coste en equipamiento, en formación y en tiempo de dedicación clínica?**
- **¿Es rentable?**



Ecografía de bolsillo

Eco-estetoscopio

ECOCARDIOGRAFÍA-DOPPLER

Ecocardiograma portátil: ¿qué añade a la valoración cardiovascular inicial?

Arturo Martín-Peñato^a, José L. Zamorano^b, Carlos Almería^b, José L. Rodrigo^b, Cecilia Corros^b, María Luaces^b, Antonio Conde^b, Isidro Vilacosta^b y Carlos Macaya^b

^aServicio de Cardiología. Hospital Universitario de Getafe. Getafe. Madrid. ^bInstituto de Cardiología. Hospital Clínico San Carlos. Madrid. España.



Ecografía de bolsillo Eco-estetoscopio



European Journal of Echocardiography (2008) 9, 721-725
doi:10.1093/ejehocard/ehn177

ER

¿Qué añade a la valoración cardiovascular

Almería^b, José L. Rodrigo^b, Cecilia Corros^b,
Carlos Macaya^b

^bInstituto de Cardiología.

TECHNICAL ADVANCES

The pocket echocardiograph: a useful new tool?

Margaret Egan and A. Ionescu*

Morrison Cardiac Centre, Morrison, Swansea SA6 6NL, UK
Received 21 February 2008; accepted after revision 18 May 2008; online publish-ahead-of-print 20 June 2008

KEYWORDS
Hand-carried ultrasound
scanner,
Clinical use

Aims Hand-carried ultrasound scanners are getting smaller. The Acuson P10 is the latest and smallest portable echocardiograph available on the market. **Methods and results** We tested the ability of this scanner to allow qualitative assessment of LV size and function in an unselected group of 30 patients [19 male, 11 female; mean age (SD) 64.7 (10.3) years] seen by a consultant cardiologist (accredited for advanced echocardiography) during a week on call in a regional cardiac tertiary facility. Patients had focused scans (parasternal long-axis and apical four-chamber views) for a maximum of 4 min, and an assessment of LVEF (normal/abnormal) and LV dimension (LVD) (dilated/non-dilated) was recorded. It was possible to assess LVEF and LVD; of these, 19 (83%) had alternative imaging modalities, which confirmed the findings. It was possible to obtain a parasternal long-axis image in 28 (93%) patients and apical four-chamber views in 23 (77%). **Conclusion** The 'pocket-scanner' allow accurate qualitative assessment of left ventricular dimensions and function in a substantial proportion of patients seen in tertiary cardiology practice.



Ecografía de bolsillo Eco-estetoscopio



European Journal of Echocardiography (2008) 9, 721-727
doi:10.1093/ejechocard/ken177

TECHNICAL ADVANCES

The pocket echocardiogram

Margaret Egan and A. Ionescu*
Morrison Cardiac Centre, Morrison, Swaziland
Received 21 February 2008; accepted after revision 1 March 2008

KEYWORDS
Hand-carried ultrasound scanner,
Clinical use

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The European Journal of Heart Failure
www.elsevier.com/locate/ehj

vascular

The European Journal of Heart Failure 5 (2003) 767-774

Screening for left ventricular dysfunction using a hand-carried cardiac ultrasound device

Eleni C. Vourvouri^a, Arend F.L. Schinkel^a, Jos R.T.C. Roelandt^a, Frans Boomsma^b, Georgios Sianos^c, Manolis Boumtioukos^a, Fabiola B. Sozzi^a, Vittoria Rizzello^a, Jeroen J. Bax^{a,d}, Haralambos I. Karvounis^a, Don Poldemans^{a,*}

^aDepartment of Cardiology, Erasmus Medical Centre, Rotterdam, The Netherlands
^bDepartment of Interventional Cardiology, Erasmus Medical Centre, Rotterdam, The Netherlands
^cThoraxcentre and Department of Internal Medicine, Erasmus Medical Centre, Rotterdam, The Netherlands
^dDepartment of Cardiology, Leiden Medical Centre, Leiden, The Netherlands

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age (mean
33 years)
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Ecografía de bolsillo Eco-estetoscopio



TECHNICAL ADVANCES
The pocket echocardiogram

Margaret Egan and A. Ionescu*
Morrison Cardiac Centre, Morrison, Swaziland
Received 21 February 2008; accepted after revision 1

KEYWORDS
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European Journal of Echocardiography (2008) 9, 721-724
doi:10.1093/ejechocard/jei177

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The European Journal of Heart Failure
www.elsevier.com/locate/ehj

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Journal of Heart Failure 5 (2003) 767-774

hand-carried cardiac

Journal of Cardiac Failure Vol. 16 No. 1 2010

Georgios Sianos^{a,d},
Bax^{a,d},

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e Netherlands

Use of Hand Carried Ultrasound, B-type Natriuretic Peptide, and Clinical Assessment in Identifying Abnormal Left Ventricular Filling Pressures in Patients Referred for Right Heart Catheterization

SASCHA N. GOONEWARDENA, MD,¹ JOHN E. A. BLAIR, MD,² AMIN MANUCHEHRY, MD,² J. MATTHEW BRENNAN, MD,³ MICHAEL KELLER, MD,² RYAN REEVES, MD,⁴ ADAM PRICE, MD,⁴ KIRK T. SPENCER, MD,⁴ JYOTHY PUTHUMANA, MD,¹ AND MIHAI GHEORGHIADE, MD¹

Ann Arbor, Michigan; Chicago, Illinois; Durham, North Carolina

dimensions
able to
its
(77%).

Ecografía de bolsillo Eco-estetoscopio



European Journal of Echocardiography (2008) 9, 721-727
doi:10.1093/ejehocard/jei177

TECHNICAL ADVANCES The pocket echocard

Margaret Egan and A. Ionescu*
Morrison Cardiac Centre, Morrison, Swaziland
Received 21 February 2008; accepted after revision 1 April 2008

KEYWORDS
Hand-carried ultrasound scanner, Clinical use

Aims Hand carried ultrasound scanner (HCU) was used to assess left ventricular function in 70 patients with heart failure.

ER



European Journal of Echocardiography (2008) 9, 381-383
doi:10.1016/j.ejehocard.2007.06.013

The Journal of Heart Failure

www.elsevier.com/locate/ehaj

Hand carried echocardiography screening for LV systolic dysfunction in a pulmonary function laboratory*

James N. Kirkpatrick, Syed Nasir Ghani, and Kirk T. Spencer*
University of Chicago, 5841 S. Maryland Avenue, MC 5084, Chicago, IL 60637, USA
Received 9 April 2007; accepted after revision 10 June 2007; online publish-ahead-of-print 15 August 2007

KEYWORDS
Hand carried ultrasound; Left ventricular function; Ejection fraction; Pulmonary function testing

Aims Dyspnea is a common indication for pulmonary evaluation but also a common symptom in heart failure. Identification of dyspneic patients with significant LV systolic dysfunction is critical because of high morbidity of untreated heart failure. We sought to determine whether screening patients with LV systolic dysfunction using a hand carried ultrasound (HCU) device could identify LV systolic dysfunction. **Methods** Forty-nine subjects with a full featured echocardiogram machine as a gold standard. **Results** All subjects with normal PFT had normal LV systolic function. Among subjects with abnormal PFT, 6 (15%) had LV systolic dysfunction and the remainder had normal LV systolic function. No subjects with LV systolic dysfunction by full featured echocardiogram were missed by the HCU (sensitivity 100%, specificity 95%; negative predictive value 100%, positive predictive value 75%). **Conclusions** LV systolic dysfunction is prevalent among patients with pulmonary disease and can be accurately screened for by a physician using a hand carried ultrasound device with subsequent confirmation with complete echocardiography.

Use of Hand Carried Ultrasound and Clinical Assessment in Identifying Left Ventricular Filling Pressures in Patients Undergoing Heart Catheterization

SASCHA N. GOONEWARDENA, MD,¹ JOHN E. A. BLAIR, MD,² AMIN MANUCHEHRY, MD,³ MICHAEL KELLER, MD,² RYAN REEVES, MD,⁴ ADAM PRICE, MD,⁴ KIRK T. SPENCER, MD,⁵ AND MIHAI GHEORGHIADU, MD¹

Ann Arbor, Michigan; Chicago, Illinois; Durham, North Carolina



Ecografía de bolsillo Eco-estetoscopio



European Journal of Echocardiography (2008) 9, 721-727
doi:10.1093/ejechocard/jei177

TECHNICAL ADVANCES The pocket echocard

Margaret Egan and A. Ionescu*
Morrison Cardiac Centre, Morrison, Swaziland
Received 21 February 2008; accepted after revision 1

KEYWORDS
Hand-carried ultrasound scanner, Clinical use

Aims: HCU device seen in 70% of patients.

The Journal of Heart Failure
European Journal of Echocardiography (2008) 9, 381-383
doi:10.1093/ejechocard/jei177

vascular

cardiac

diagnosis

Left Ventricular Geometric Abnormality Screening in Hypertensive Patients Using a Hand-Carried Ultrasound Device

echocardiography screening for LV systolic dysfunction in a pulmonary function laboratory*
Syed Nasir Ghani, and Kirk T. Spencer*
841 S. Maryland Avenue, MC 5084, Chicago, IL 60637, USA
Received 10 June 2007; online published-ahead-of-print 15 August 2007

Aims: Dyspnea is a common indication for pulmonary evaluation but also a common symptom in heart failure. Identification of dyspneic patients with significant LV systolic dysfunction is critical because of high morbidity of untreated heart failure. We sought to determine whether screening patients referred for pulmonary function testing (PFT) using a hand-carried ultrasound (HCU) device could identify LV systolic dysfunction.
Methods: Forty-nine subjects with a full-featured echocardiogram machine as a gold standard, and 49 subjects with a hand-carried echocardiogram machine as a gold standard, were recruited from a pulmonary function lab to undergo a brief echocardiographic examination by an internist using a HCU device. All subjects also received an examination with a full-featured echocardiogram machine and the remainder had normal LV systolic function.
Results: All subjects with normal PFT had normal LV systolic function. Among subjects with abnormal PFT, 6 (15%) had LV systolic dysfunction and the remainder had normal LV systolic function. No subjects with LV systolic dysfunction by full-featured echocardiograms were missed by the HCU (sensitivity 100%, specificity 95%; negative predictive value 100%; positive predictive value 75%).
Conclusions: LV systolic dysfunction is prevalent among patients with pulmonary disease and can be accurately screened for by a physician using a hand-carried ultrasound device with subsequent confirmation with complete echocardiography.

N. GOONEWARDENA, MD,¹ JOHN E. A. BLAIR, MD,² AMIN MANUCHEHRY,³ AEL KELLER, MD,² RYAN REEVES, MD,⁴ ADAM PRICE, MD,⁴ KIRK T. SPENCER, MD,⁵ AND MIHAI GHEORGHIADE, MD¹

Ann Arbor, Michigan; Chicago, Illinois; Durham, North Carolina

Diagnostic Accuracy of Hospitalist-Performed Hand-Carried Ultrasound Echocardiography After a Brief Training Program

TABLE 1. Twenty-Seven-Hour Training Program in Hand-Carried Ultrasound Echocardiography

Six cardiac assessments learned using 2-dimensional gray scale and color Doppler imaging

- Left ventricular systolic dysfunction
- Mitral valve regurgitation
- Left atrium enlargement
- Left ventricular hypertrophy
- Pericardial effusion
- Inferior vena cava diameter

Lecture (2 hours)*

- Basic principles of echocardiography
- HCUE scanning protocol and helpful techniques to optimize image quality

Hands-on training with instructor

- Orientation to machine and demonstration of scanning protocol (1 hour)
- Sessions 1 through 3: HCUE performed on 1 patient per hour (6 patients in 6 hours)
- Sessions 4 through 10: HCUE performed on 2 patients per hour (28 patients in 14 hours)

Feedback sessions on image quality and interpretation with cardiologist

- After hands-on training session 3 (2 hours)
- After hands-on training session 10 (2 hours)

Clinically Pertinent Cardiac Abnormality by Standard Echocardiography	Prevalence n/total n	Sensitivity* % (95% CI)	Specificity* %
Left ventricular systolic dysfunction	80/314	85 (75–92)	88 (83–92)
Mitral valve regurgitation, severe	11/314	100 (72–100)	83 (79–87)
Left atrium enlargement, moderate or severe	19/313	90 (67–99)	74 (68–79)
Left ventricular hypertrophy, moderate or severe	33/314	70 (51–84)	73 (67–78)
Pericardial effusion, moderate or large	3/314	100 (29–100)	95 (92–97)
Inferior vena cava, dilated	45/284	56 (40–70)	86 (81–90)

La precisión diagnóstica de HCU realizado por internistas después de un breve programa de capacitación fue de moderada a excelente para 6 anomalías cardíacas importantes

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Aplicaciones en Medicina Interna

Cardiaca

- Función VI
- HVI
- Dilatación AI
- Examend de las válvulas en caso de soplo
- Volumen intravascular
- Derrame pericárdico

Vascular

- Aterosclerosis carotídea

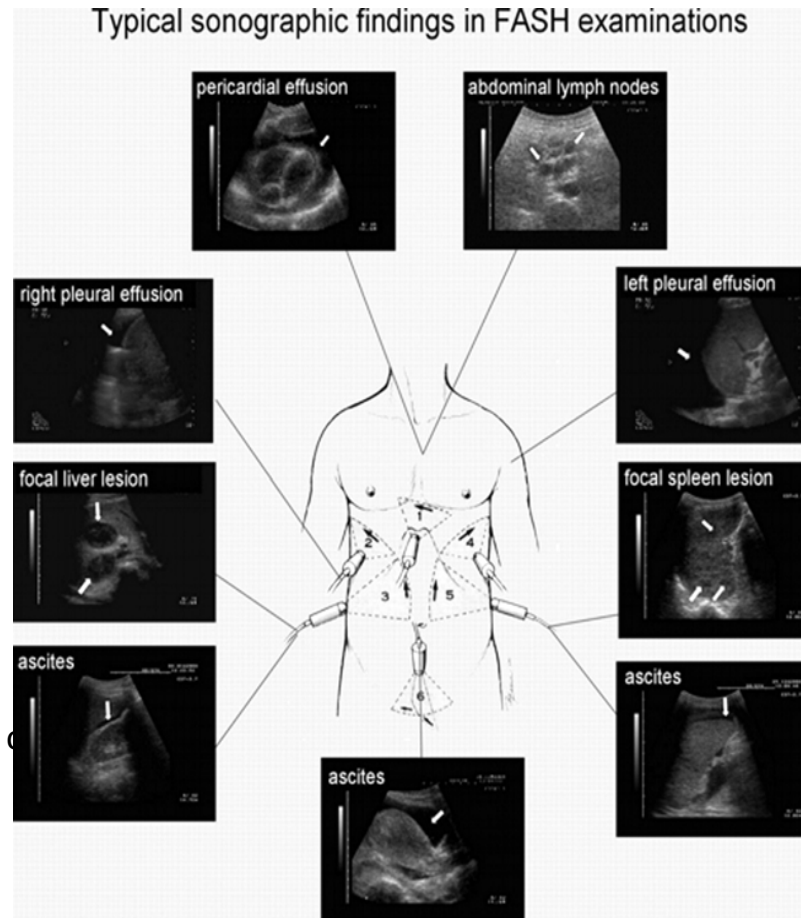
Aneurisma de Ao Abdominal

Musculoesqueletico

- Derrame articular
- Erosión articular
- Lesión o edema del tendón o la fascia

Dermatología

- Abscesos subcutáneos



Heller, et al. 2010

Pulmonar

- Derrame pleural

Nefrología

- Hidronefrosis
- Nefrolitiasis

Gastrointestinal

- Ascitis
- Hepatoesplenomegalia
- Colelitiasis

Endocrino

- Nódulos tiroideos (quiste vs. sólido)

Procedimientos

- Colocación de un catéter central
- Toracentesis/paracentesis
- PAAF (ganglio linfático, tiroides)

Point-of-Care Ultrasonography

Christopher L. Moore, M.D., and Joshua A. Copel, M.D.

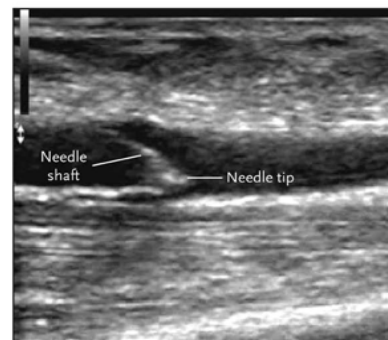
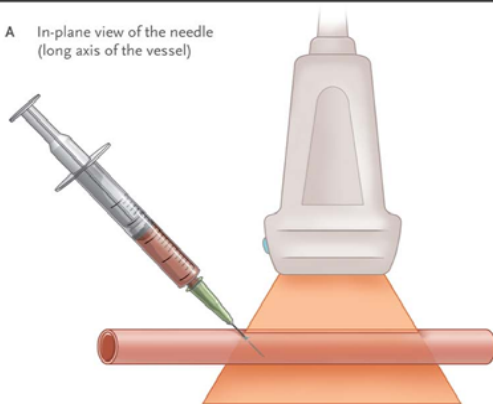
ULTRASONOGRAPHY IS A SAFE AND EFFECTIVE FORM OF IMAGING THAT has been used by physicians for more than half a century to aid in diagnosis and guide procedures. Over the past two decades, ultrasound equipment has become more compact, higher quality, and less expensive, which has facilitated the growth of point-of-care ultrasonography — that is, ultrasonography performed and interpreted by the clinician at the bedside. In 2004, a conference on compact ultrasonography hosted by the American Institute of Ultrasound in Medicine (AIUM) concluded that “the concept of an ‘ultrasound stethoscope’ is rapidly moving from the theoretical to reality.” This conference included representatives from 19 medical organizations; in November 2010, the AIUM hosted a similar forum attended by 45 organizations.¹⁻³ Some medical schools are now beginning to provide their students with hand-carried ultrasound equipment for use during clinical rotations.⁴

Although ionizing radiation from computed tomographic (CT) scanning is increasingly recognized as a potentially major cause of cancer, ultrasonography has been used in obstetrics for decades, with no epidemiologic evidence of harmful effects at normal diagnostic levels.^{5,6} However, ultrasonography is a user-dependent technology, and as usage spreads, there is a need to ensure competence, define the benefits of appropriate use, and limit unnecessary imaging and its consequences.⁷⁻¹⁰ This article provides an overview of the history and current status of compact, point-of-care ultrasonography, with examples and discussion of its use.

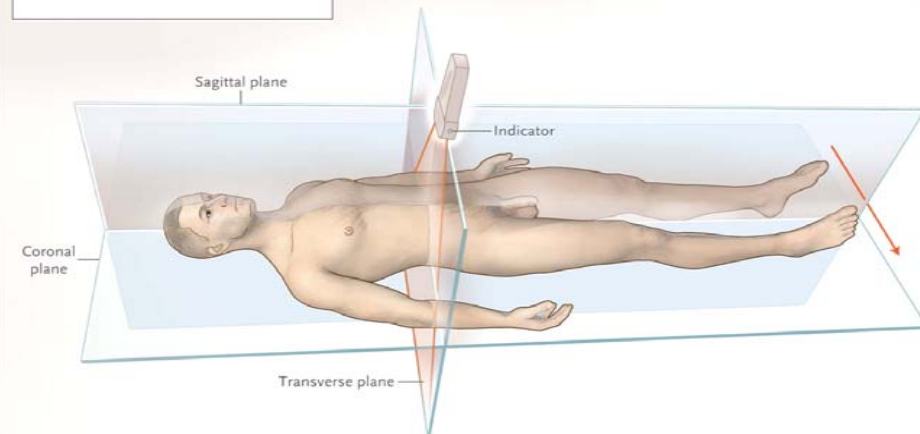
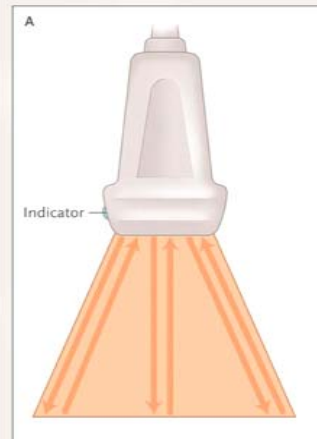
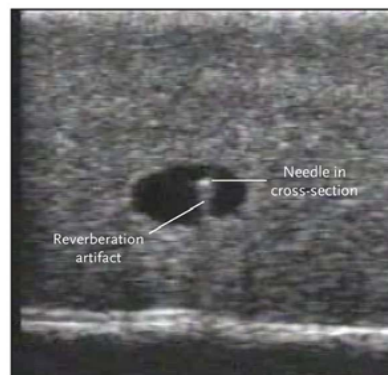
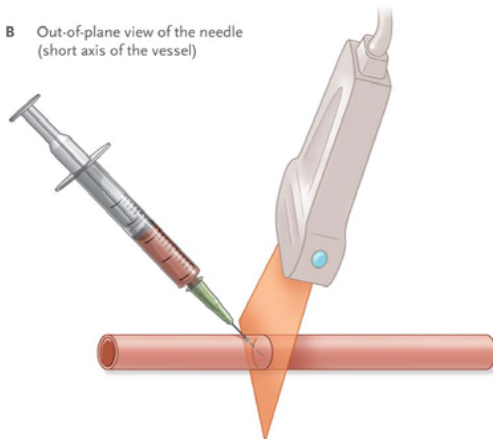
From the Departments of Emergency Medicine (C.L.M.) and Obstetrics, Gynecology, and Reproductive Sciences (J.A.C.), Yale University School of Medicine, New Haven, CT. Address reprint requests to Dr. Moore at the Department of Emergency Medicine, Yale University School of Medicine, 464 Congress Ave., Suite 260, New Haven, CT 06519, or at chris.moore@yale.edu.

N Engl J Med 2011;364:749-57.
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A In-plane view of the needle (long axis of the vessel)



B Out-of-plane view of the needle (short axis of the vessel)

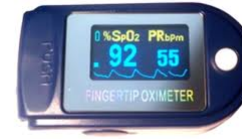


EDITORIAL

THE AMERICAN
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Should a Hand-carried Ultrasound Machine Become Standard Equipment for Every Internist?

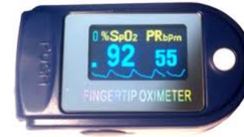
EDITORIAL



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Should a Hand-carried Ultrasound Machine Become Standard Equipment for Every Internist?

EDITORIAL



THE AMERICAN
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Should a Hand-carried Ultrasound Machine Become Standard Equipment for Every Internist?



- El eco portátil está disponible, tiene un precio razonable y es muy seguro cuando se utiliza correctamente.
- ¿Con qué rapidez, seguridad y facilidad puede el internista aprender su uso?
- Adquirir la imagen es más difícil que interpretarla.
- Algunos centros universitarios han comenzado a integrar el aprendizaje en ultrasonidos en los currículum pre y postgraduado.



GREAT
EXPECTATIONS *Ecografía en M.I.*



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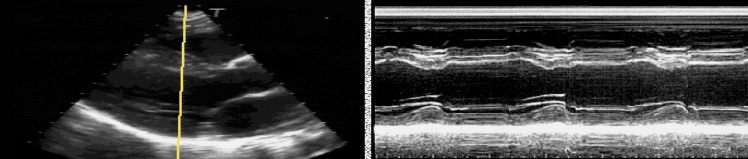
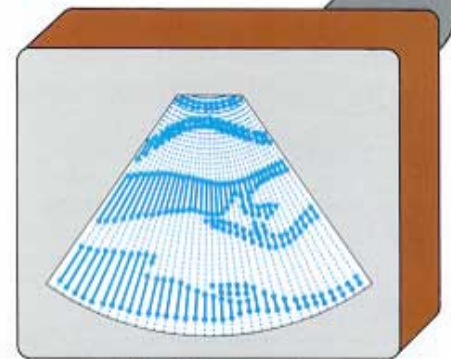
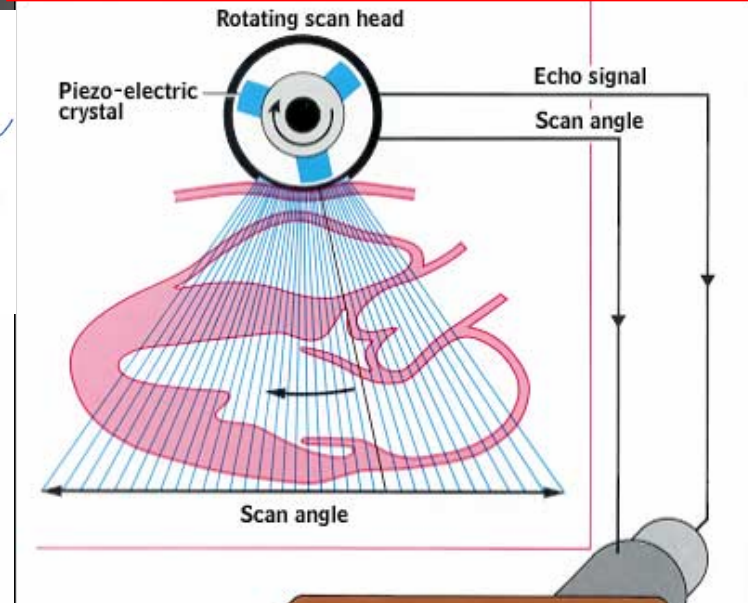
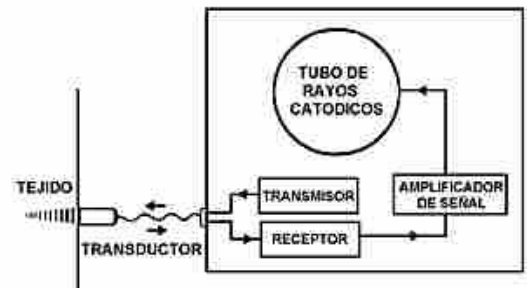
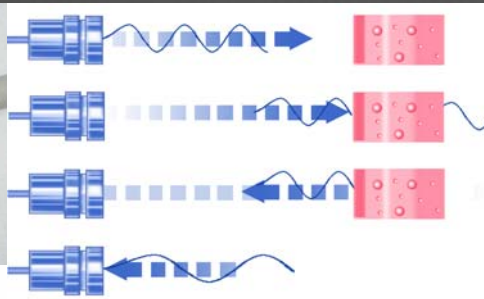
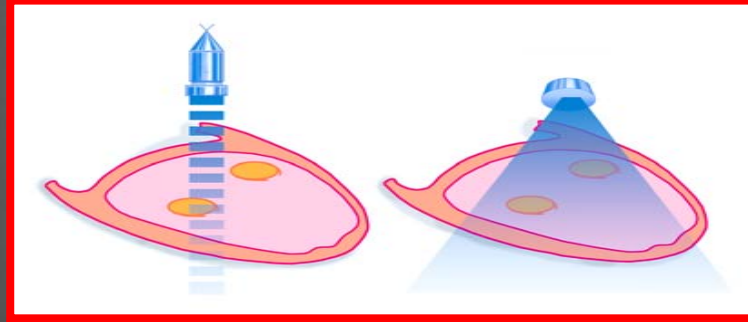
Utilidad de la ecocardiografía en Medicina Interna

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Ecocardiografía





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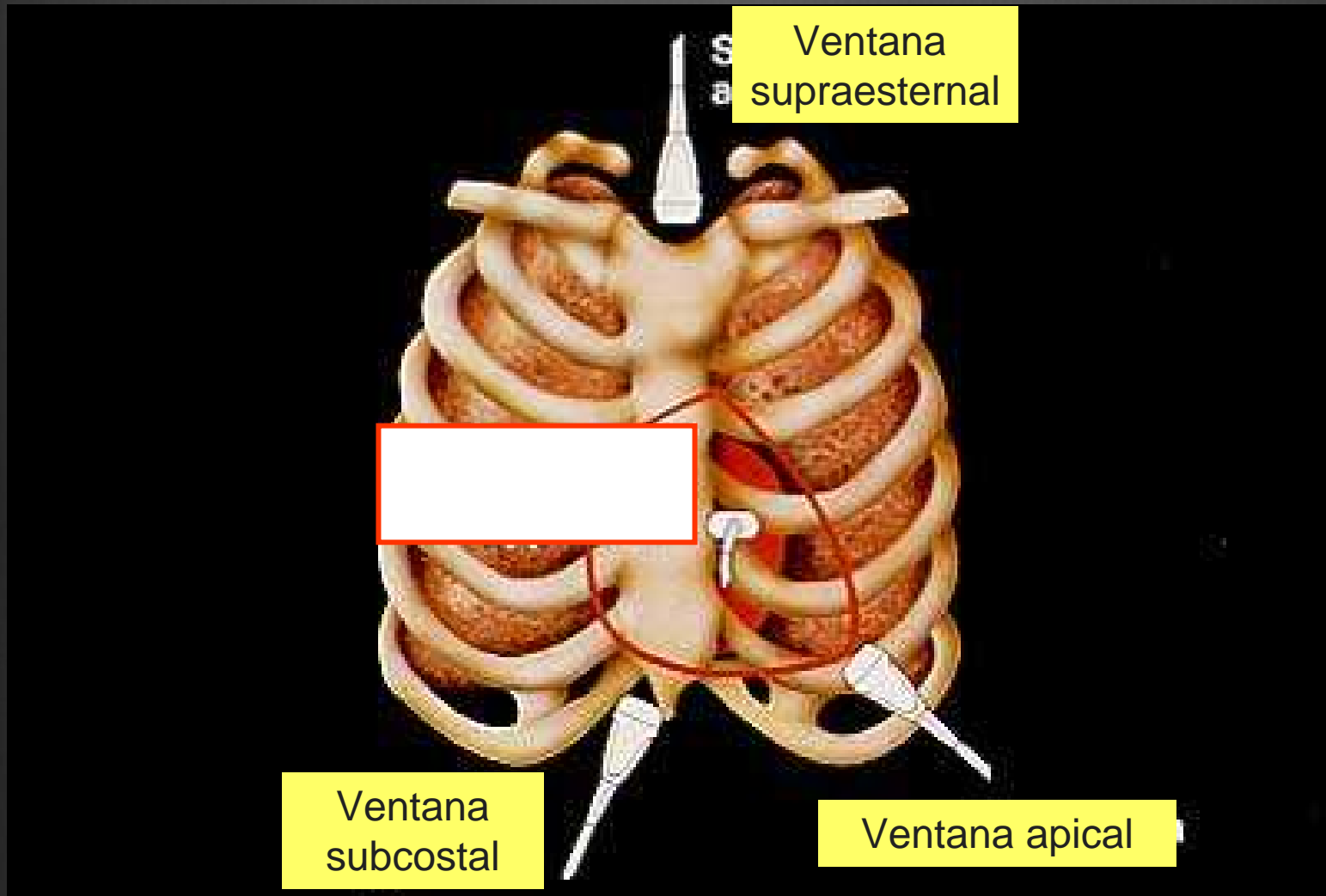
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Imágenes y casos

Costa Meloneras

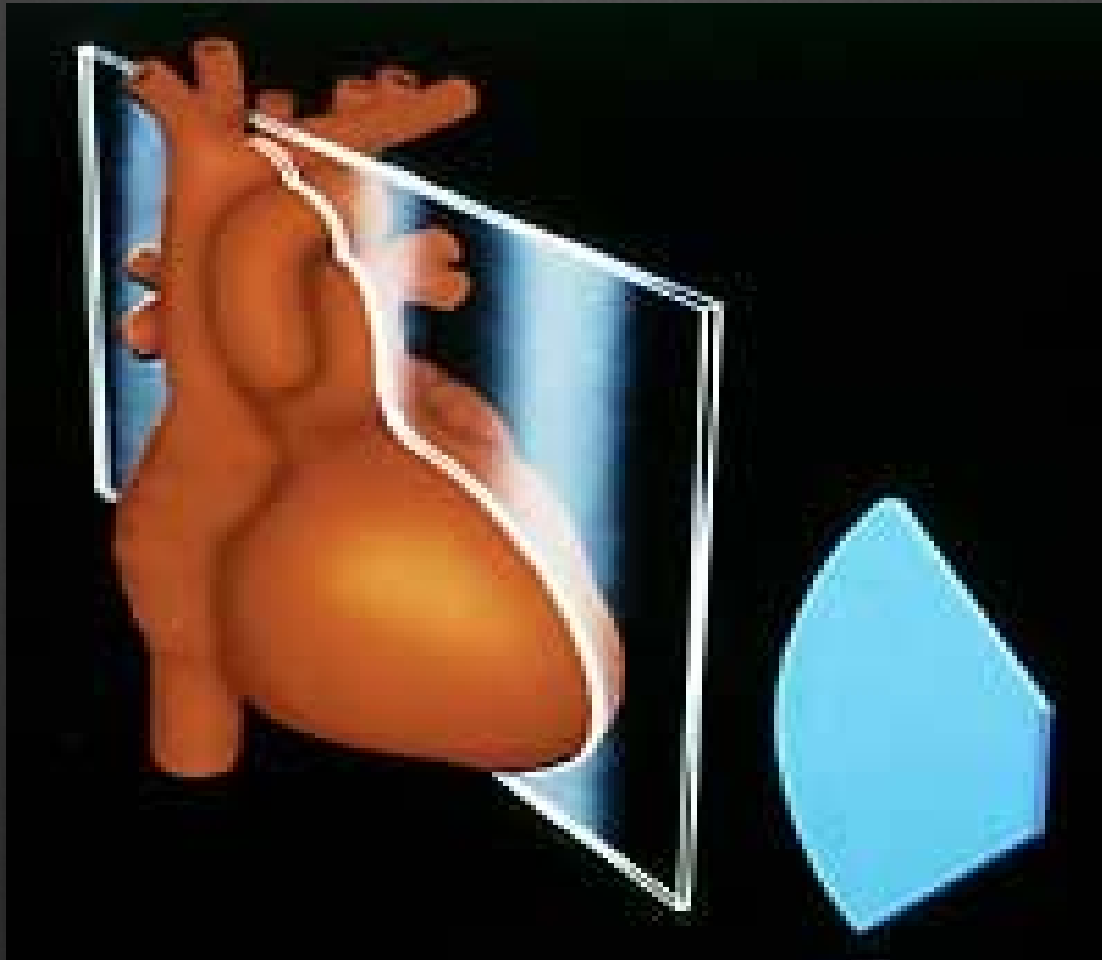
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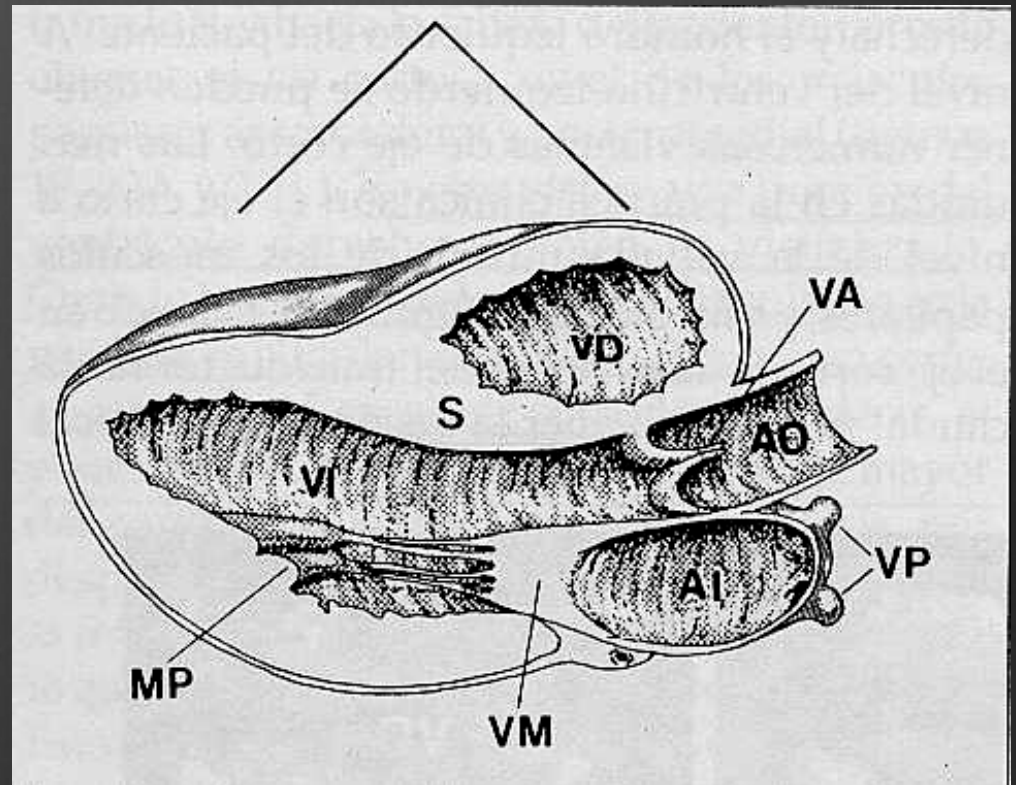
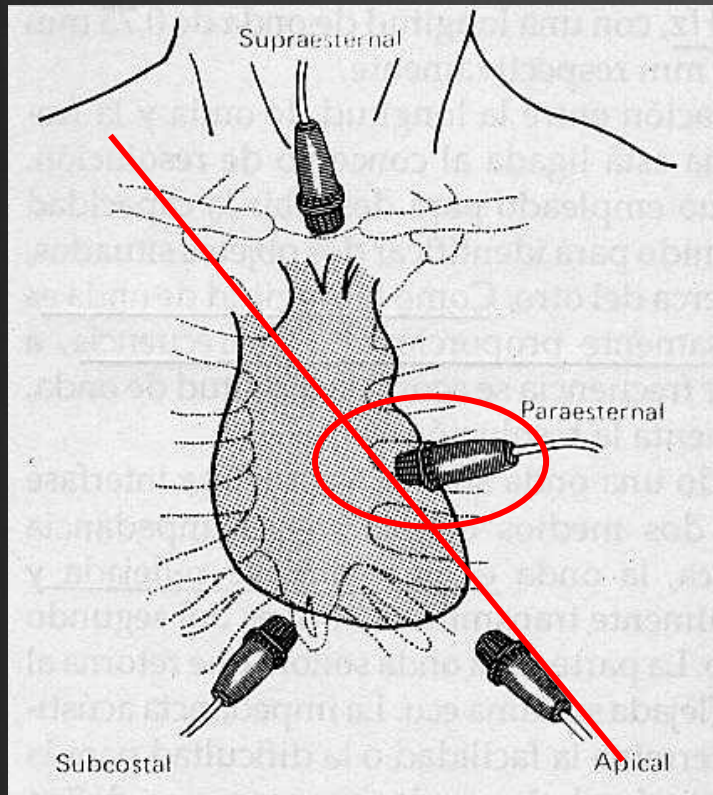


EL EXAMEN ECOCARDIOGRÁFICO

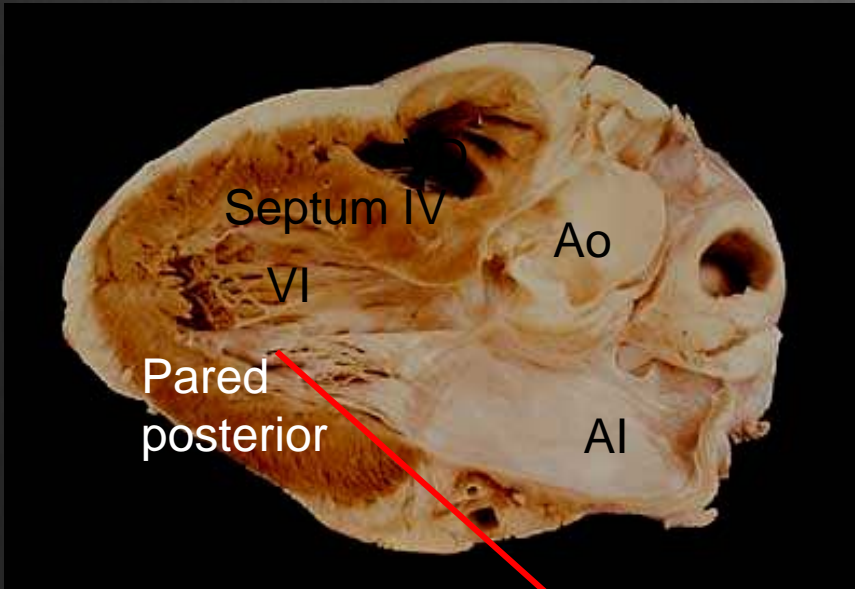
PLANO PARAESTERNAL EJE LARGO



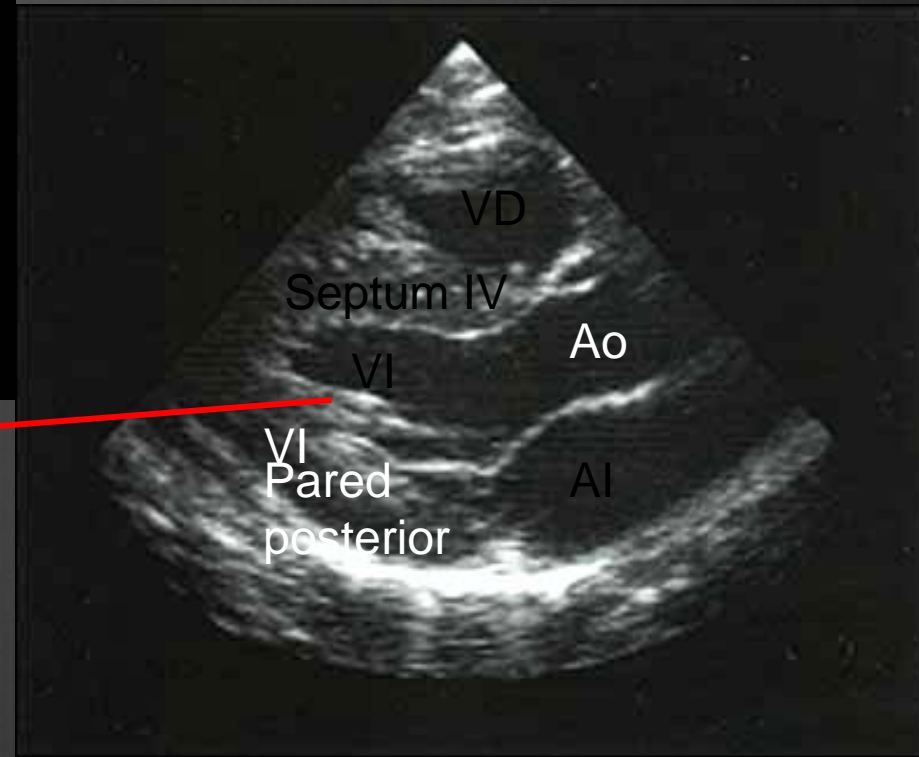
Corte paraesternal longitudinal.



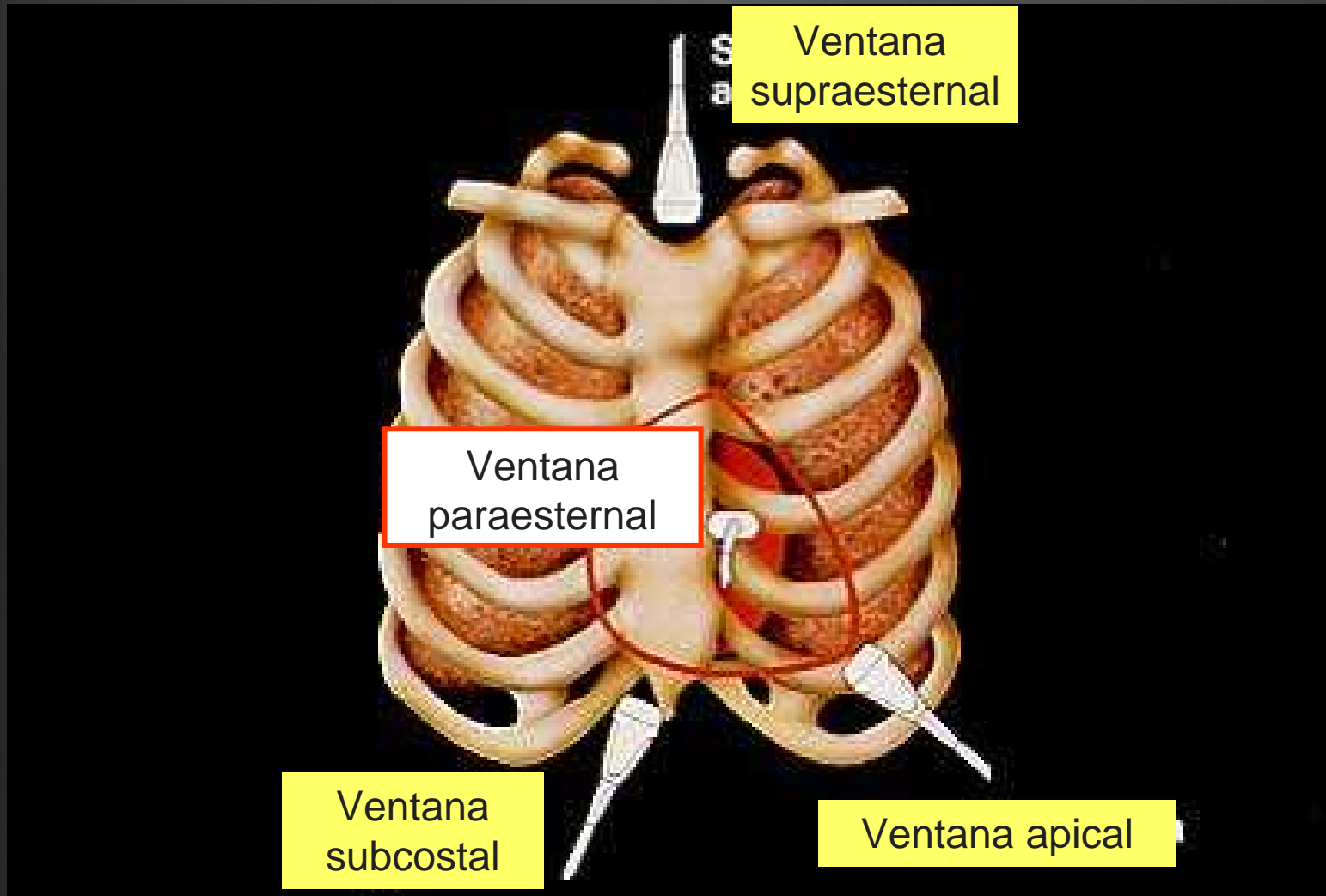
Corte paraesternal longitudinal.



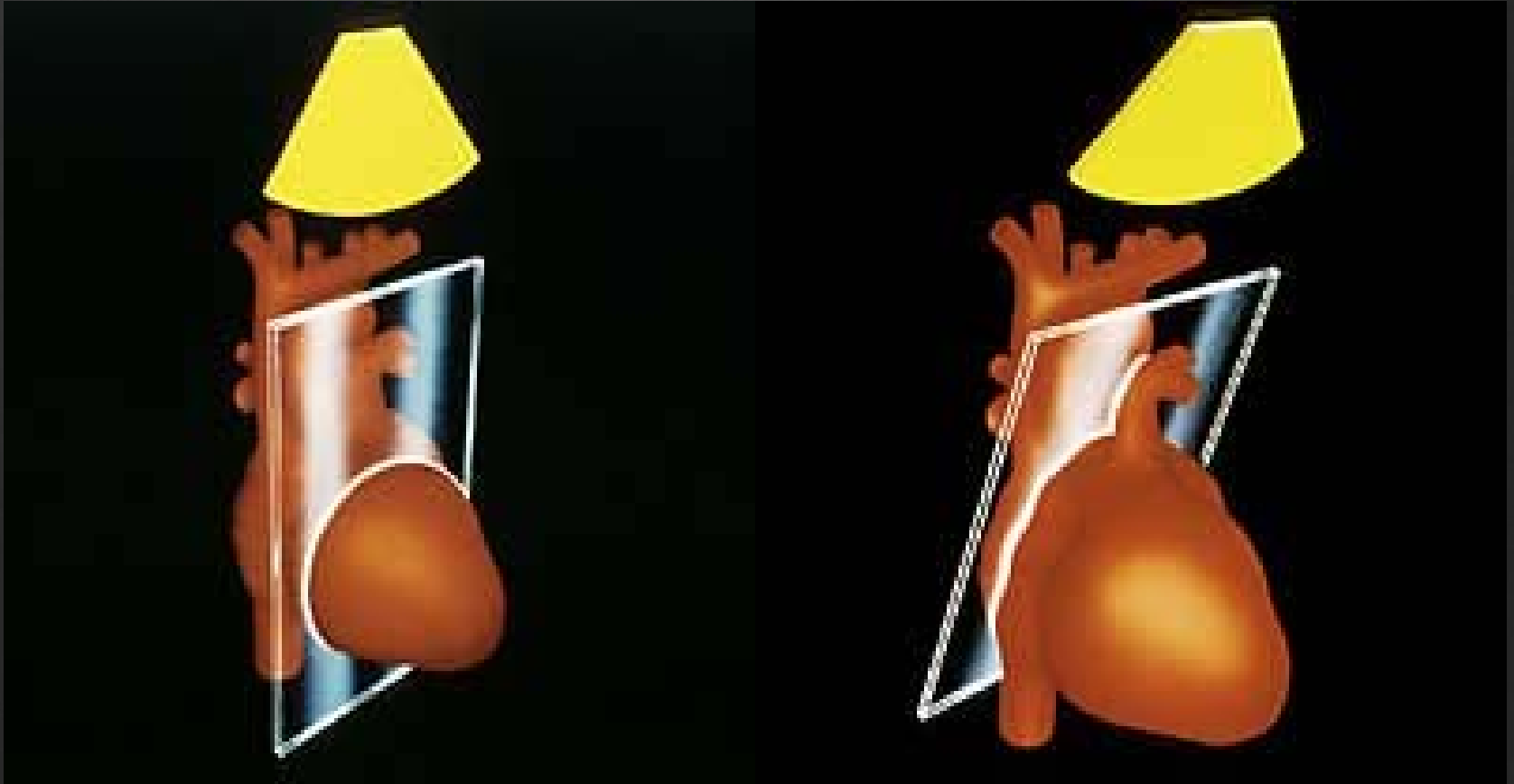
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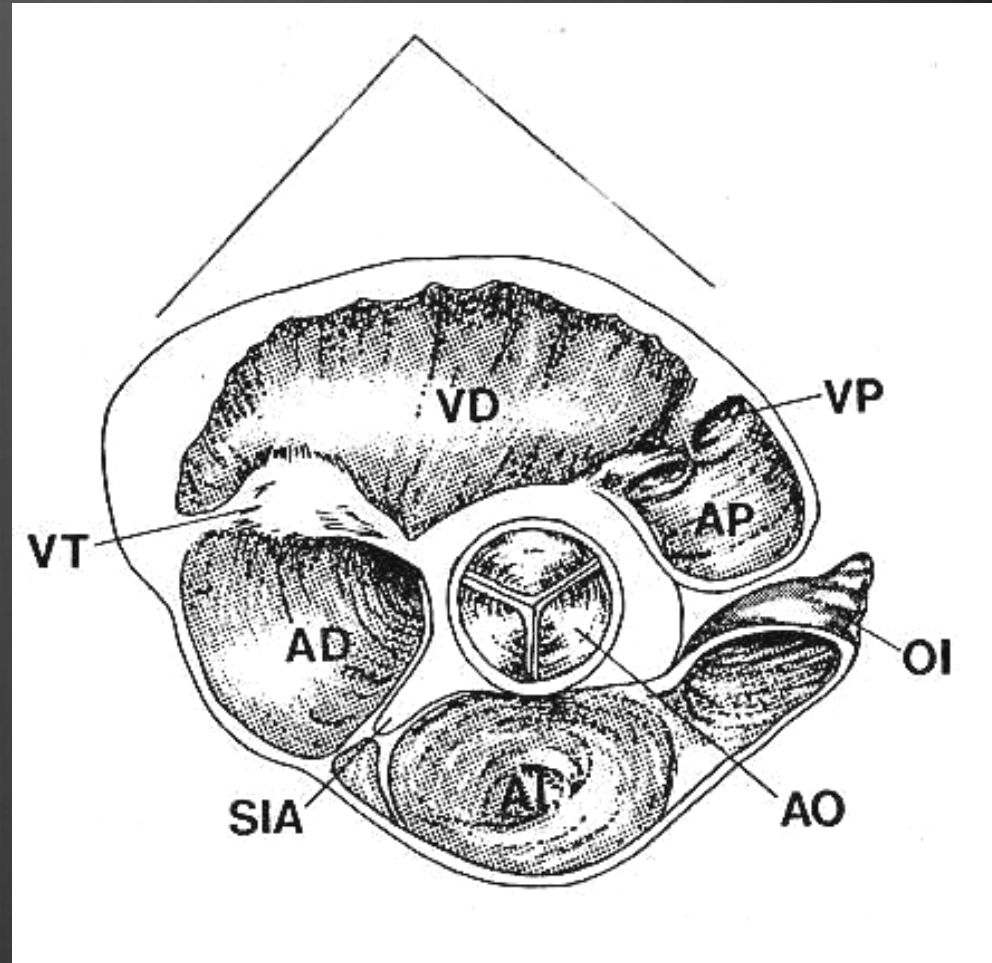
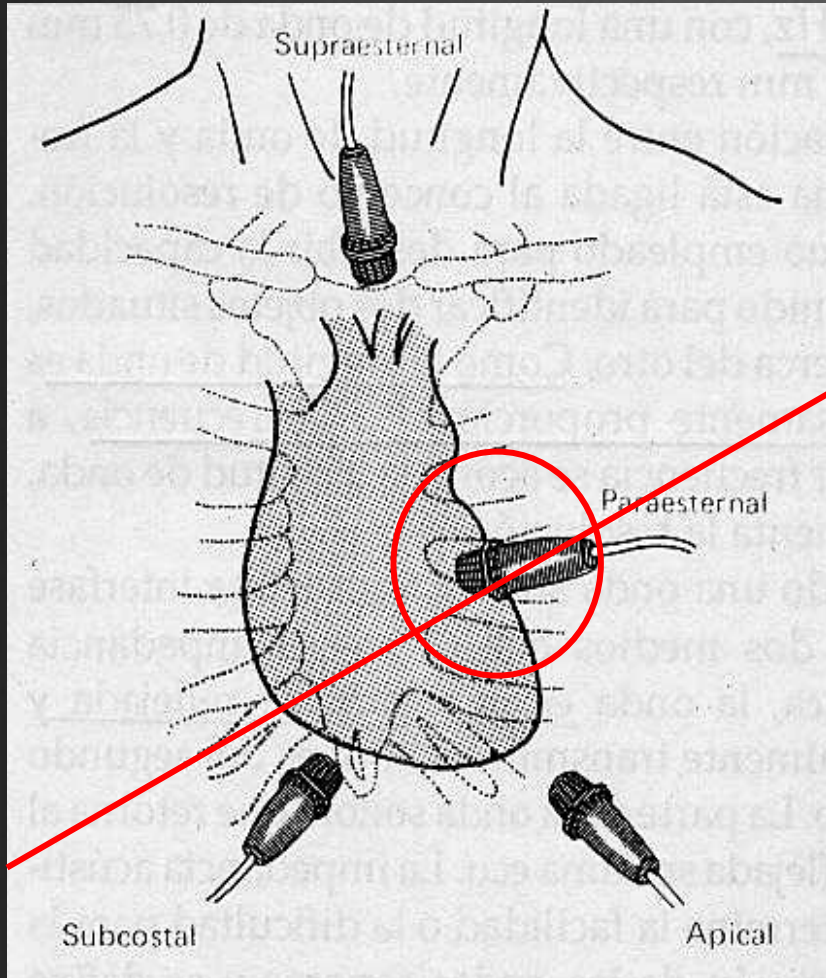
Cortes paraesternales estándar.



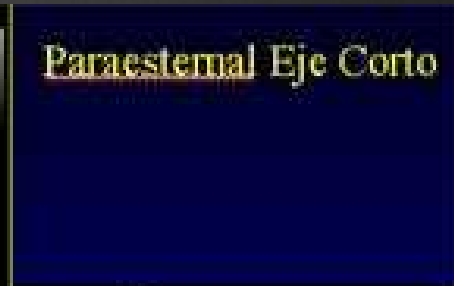
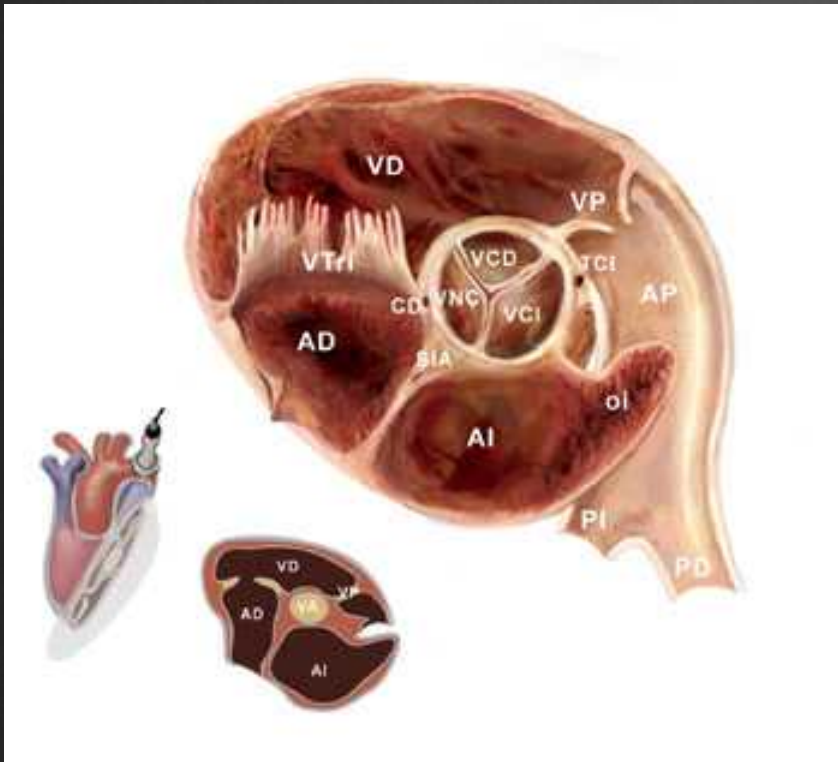
PLANO PARAESTERNAL EJE CORTO



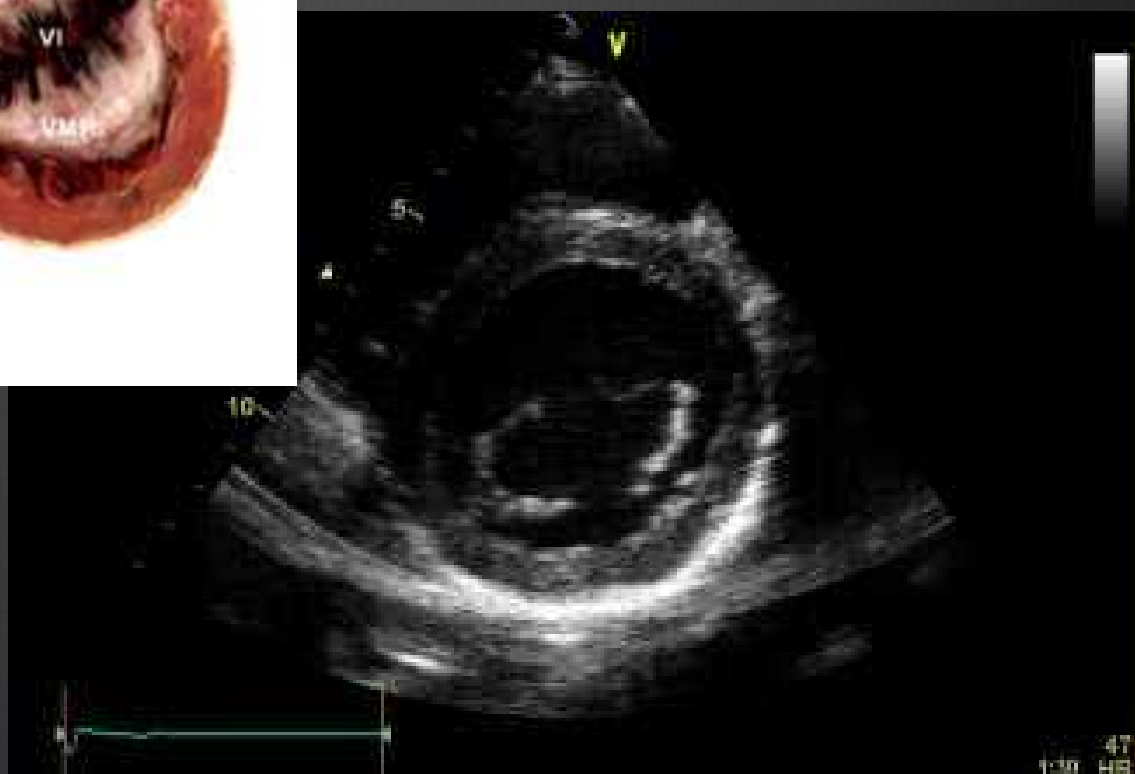
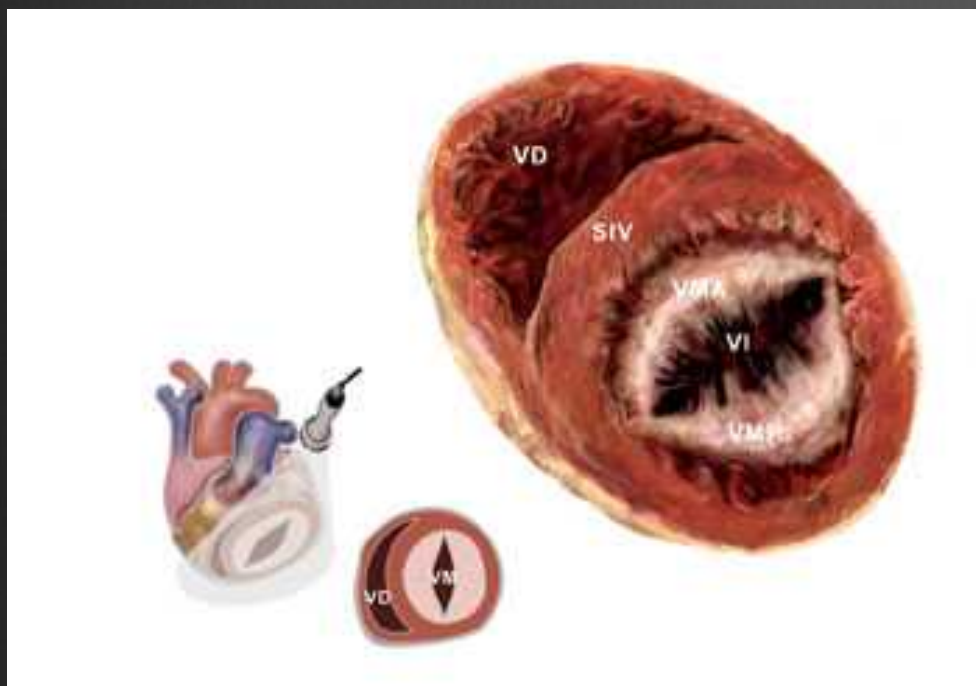
Corte paraesternal transversal.



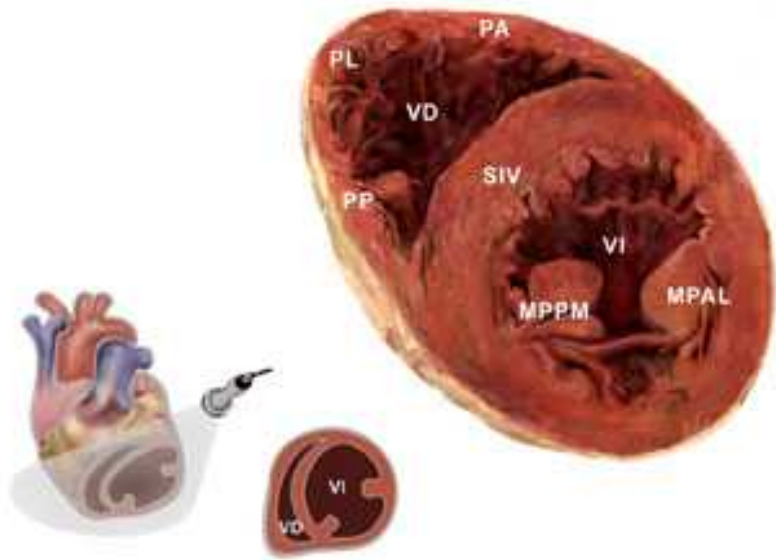
Corte paraesternal transversal Nivel de válvula aórtica.



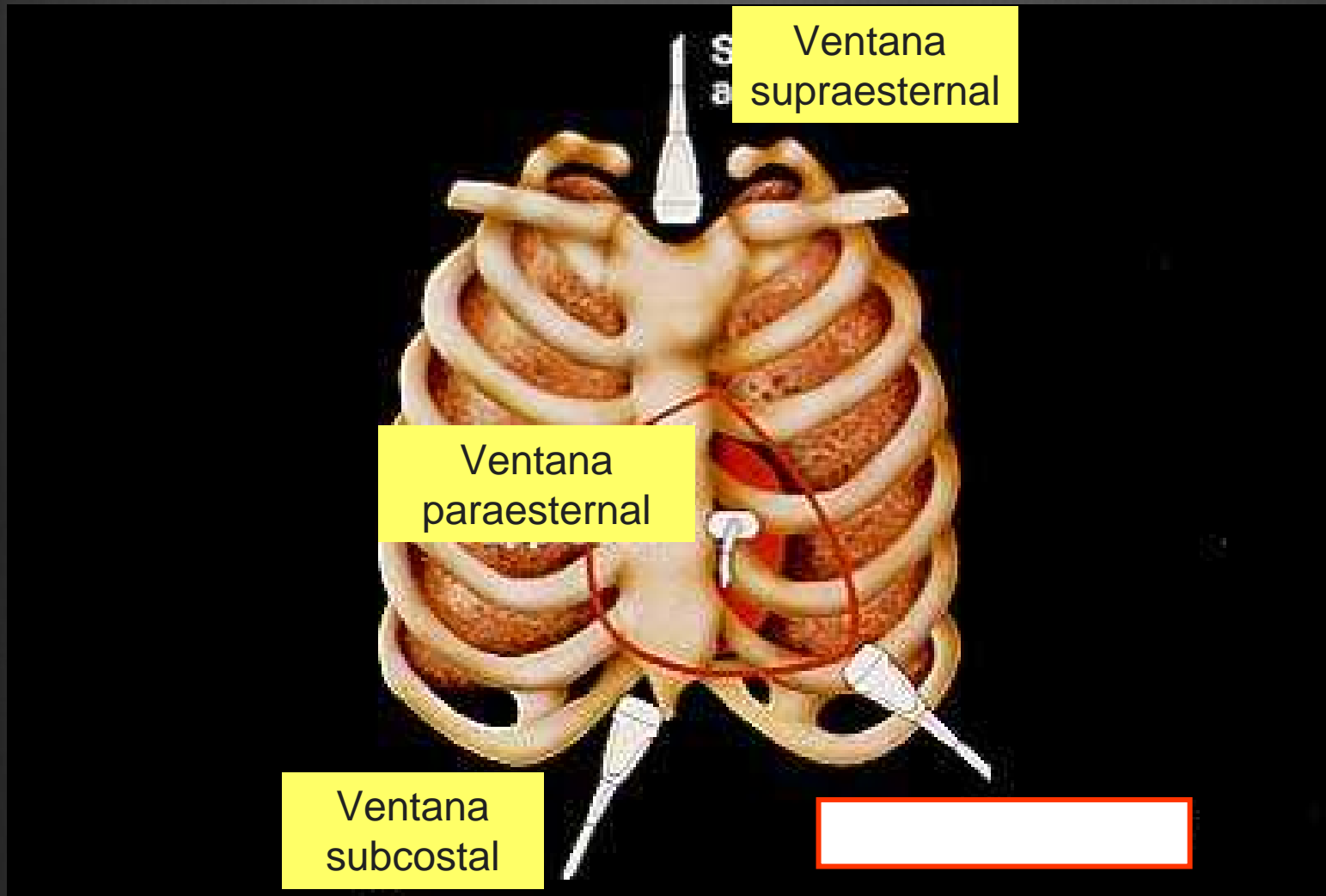
Corte paraesternal transversal Nivel de válvula mitral.



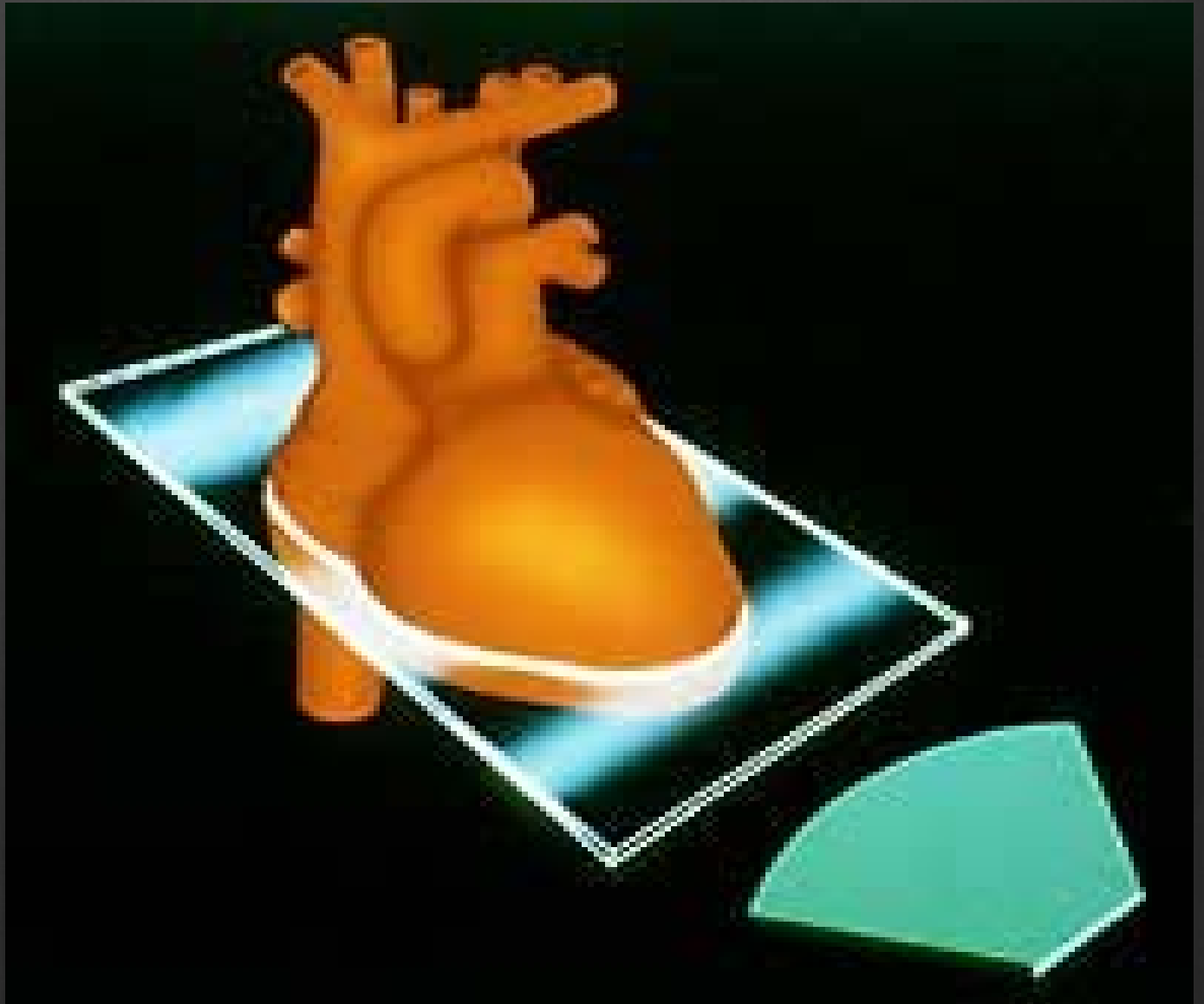
Corte paraesternal transversal Nivel de los músculos papilares.



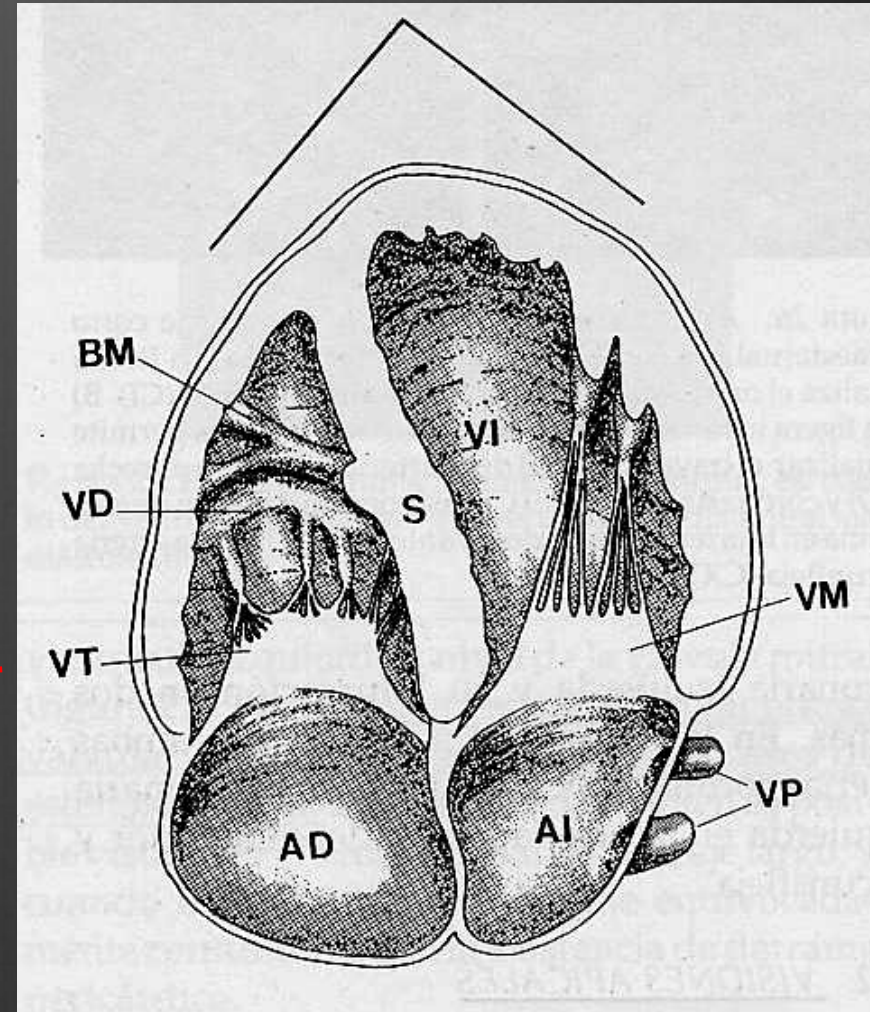
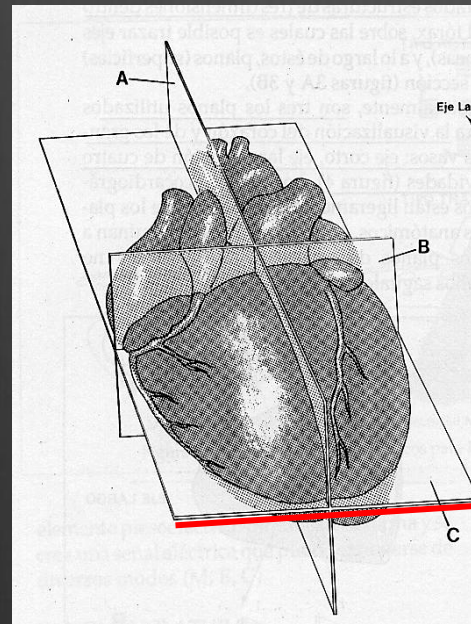
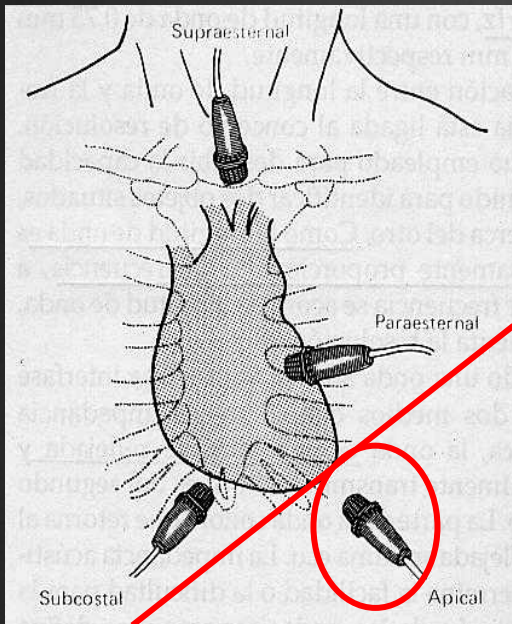
Cortes apicales estándar.



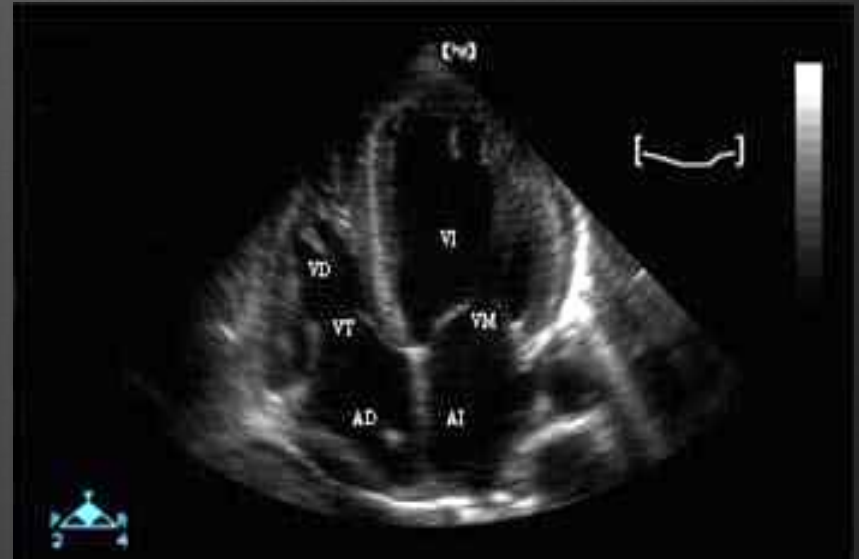
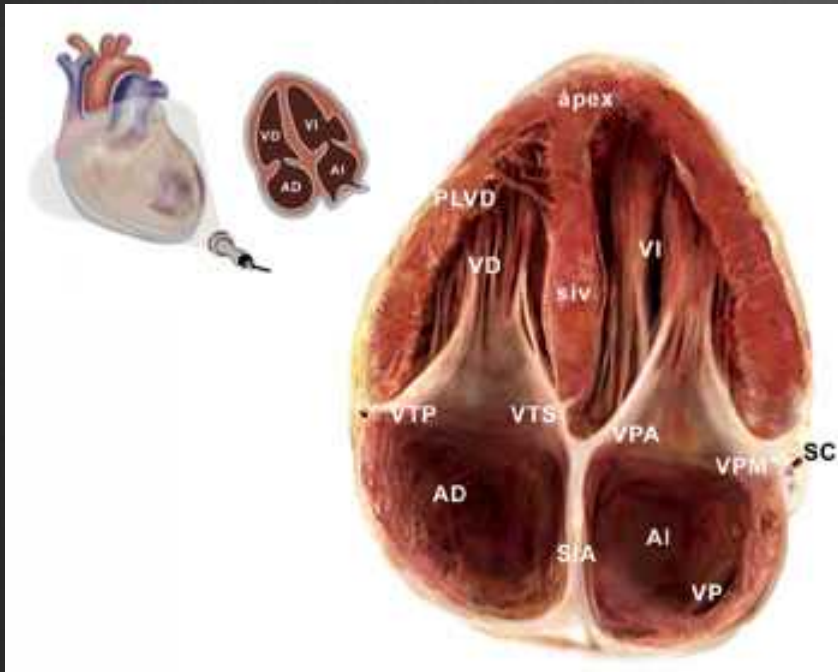
PLANO APICAL CUATRO CAMARAS



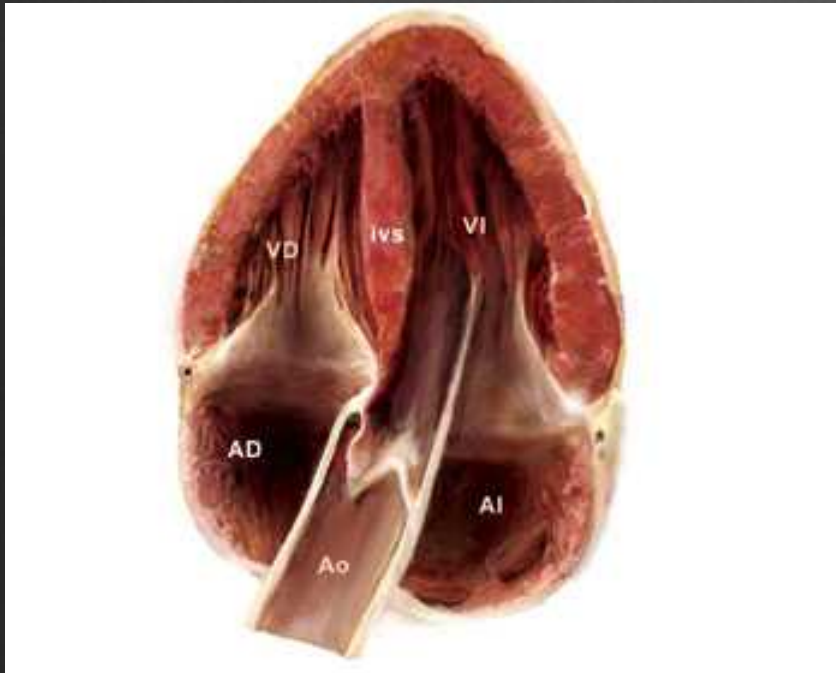
Corte apical de 4 cavidades



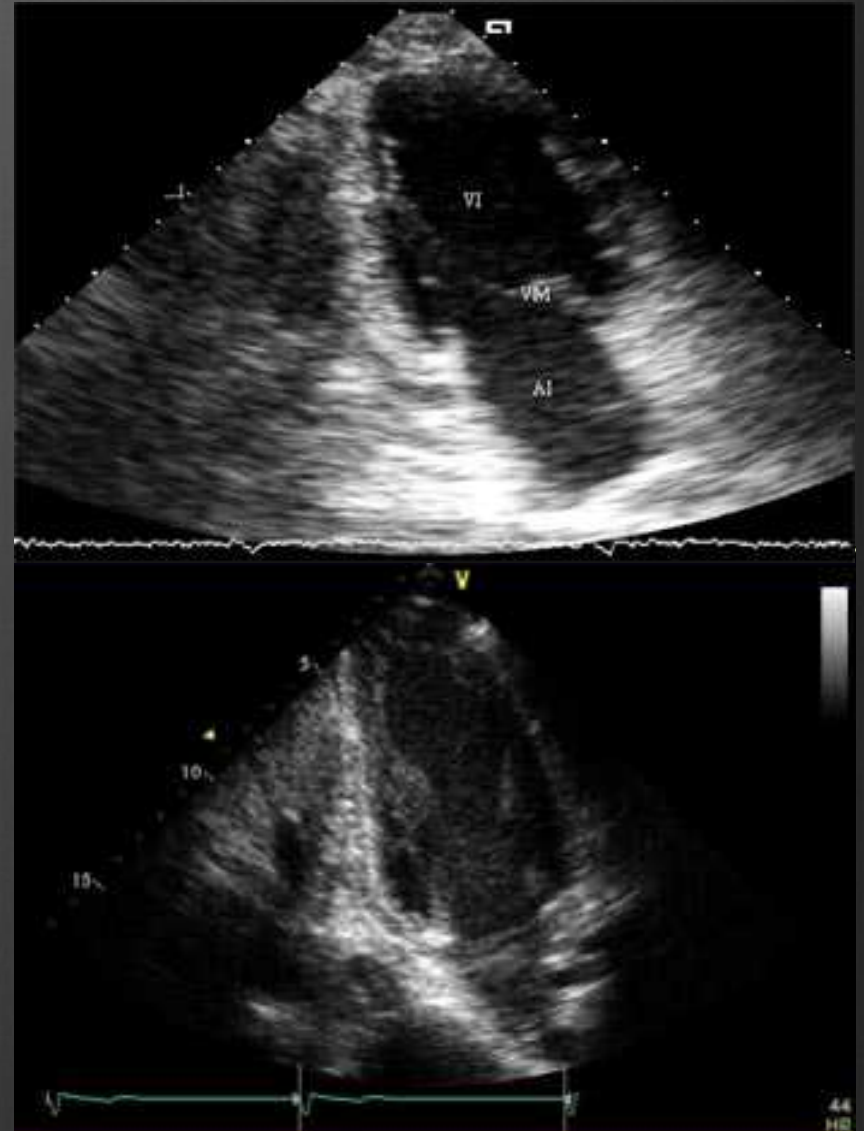
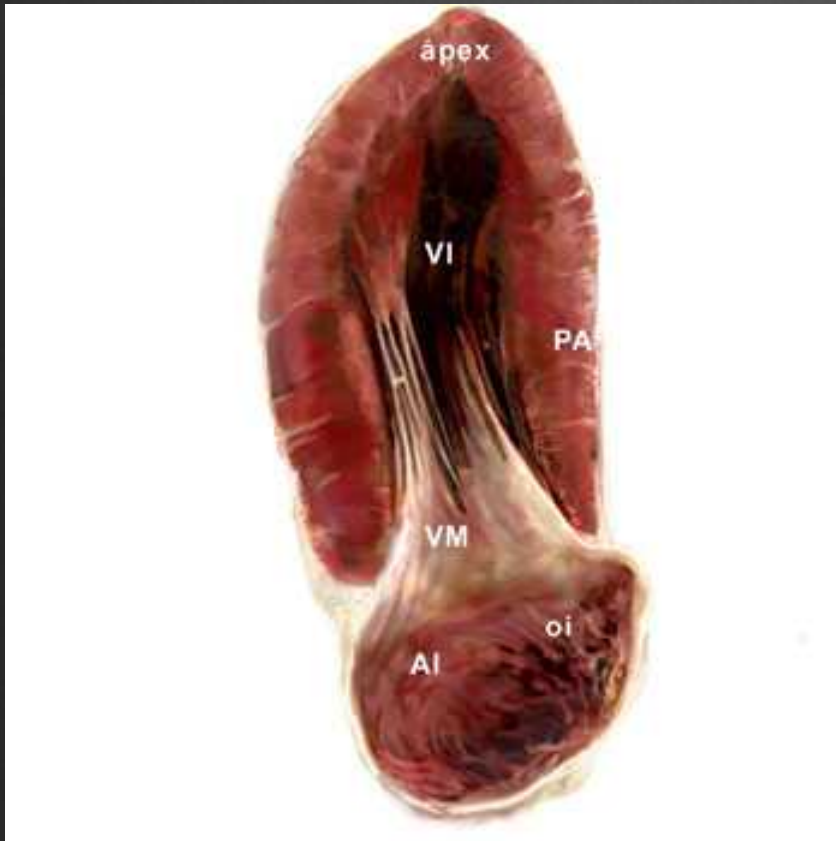
Corte apical de 4 cavidades



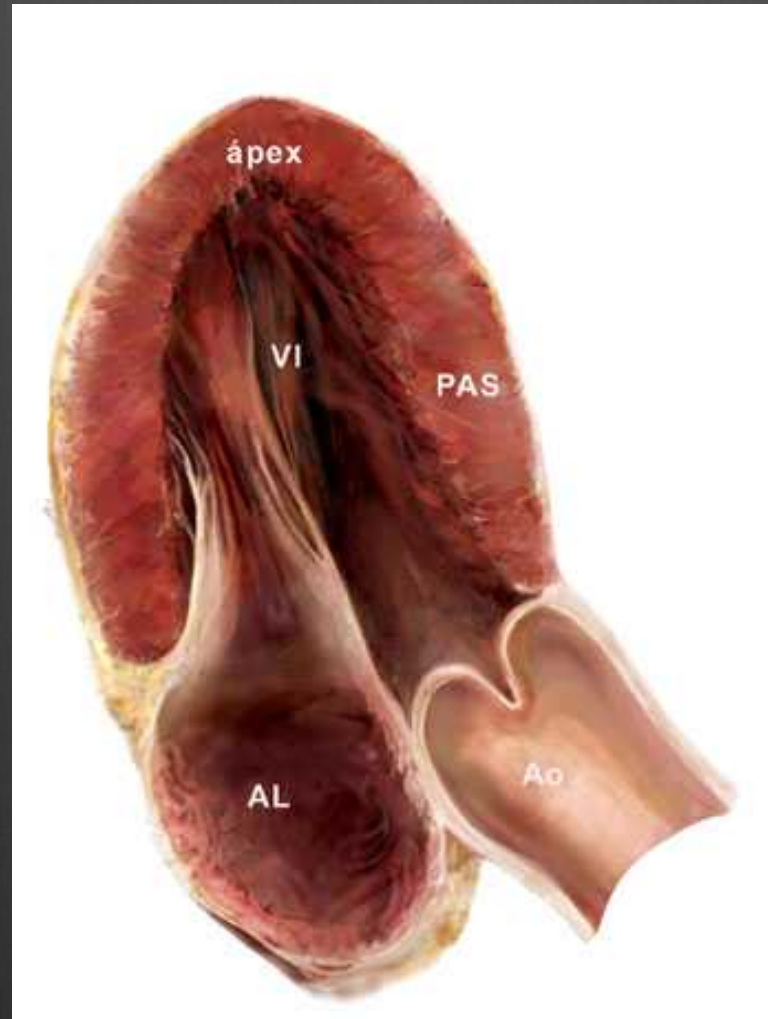
Corte apical de 5 cavidades



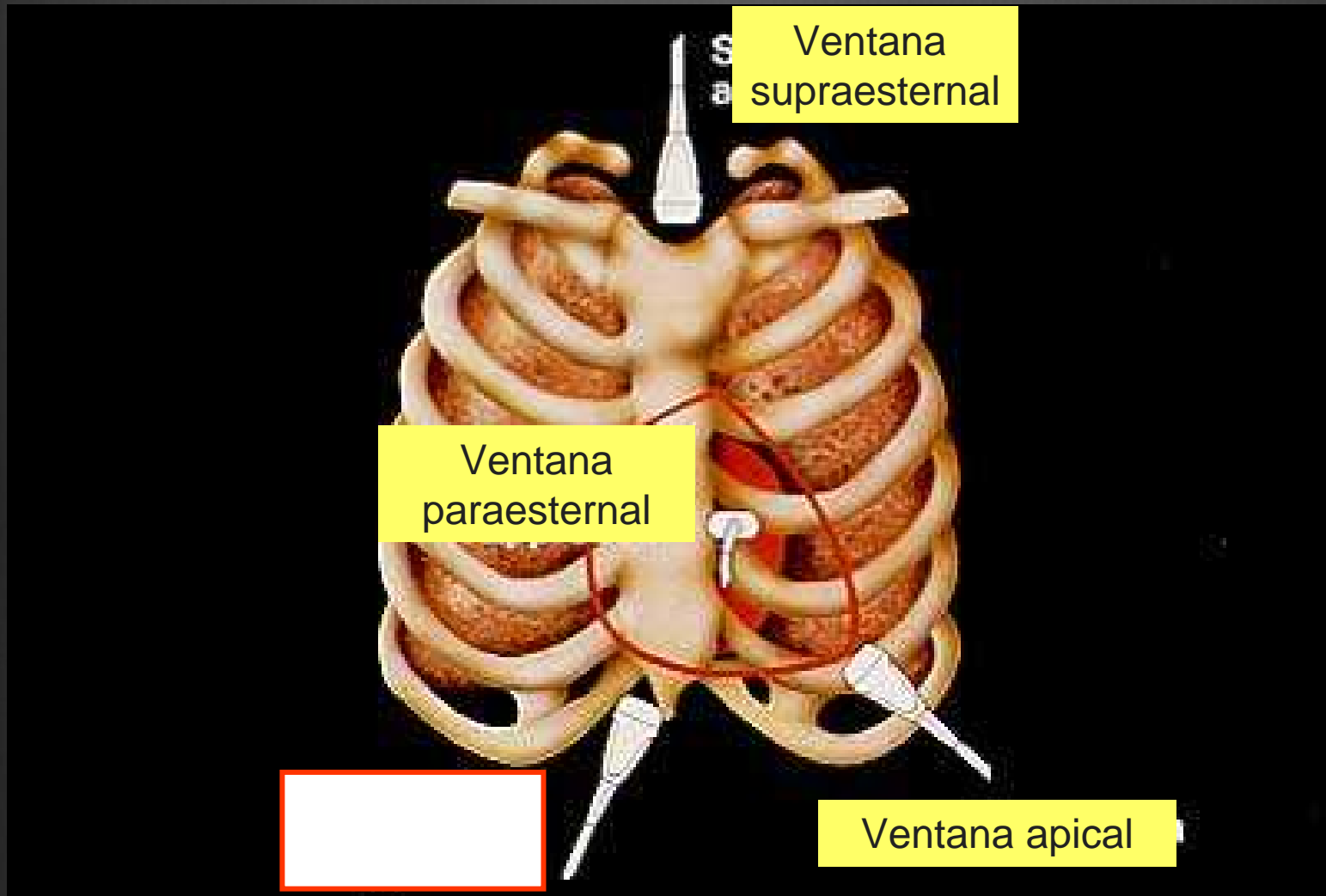
Corte apical de 2 cavidades



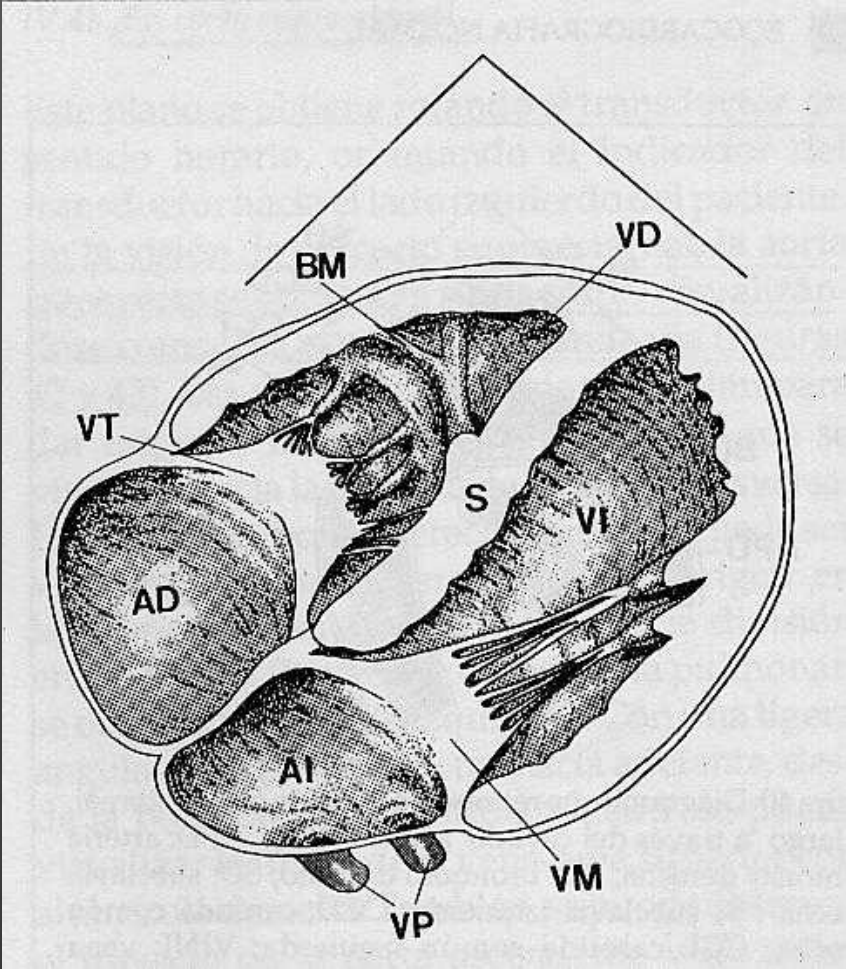
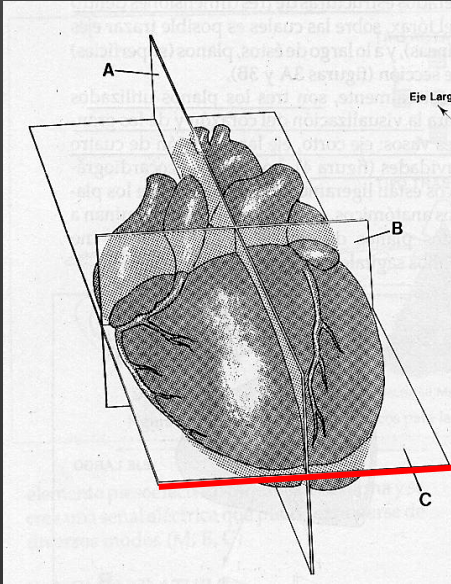
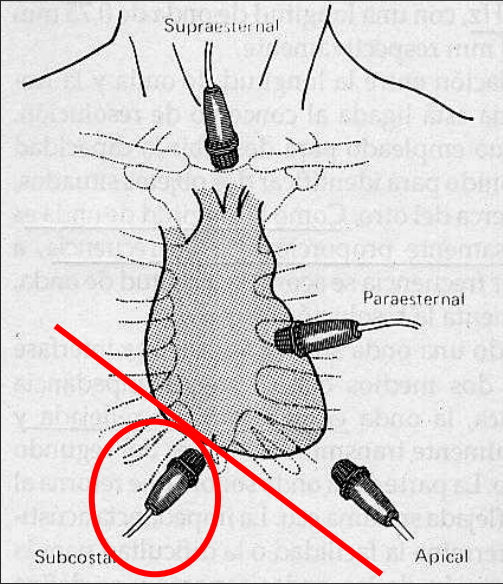
Corte apical de 3 cavidades



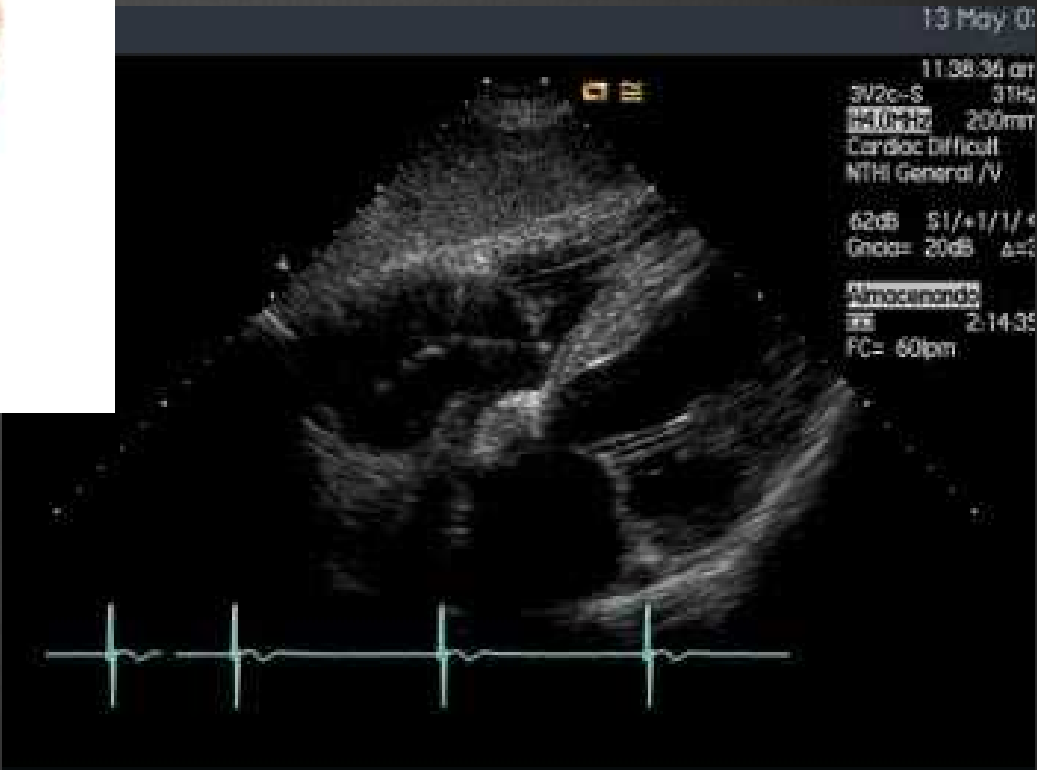
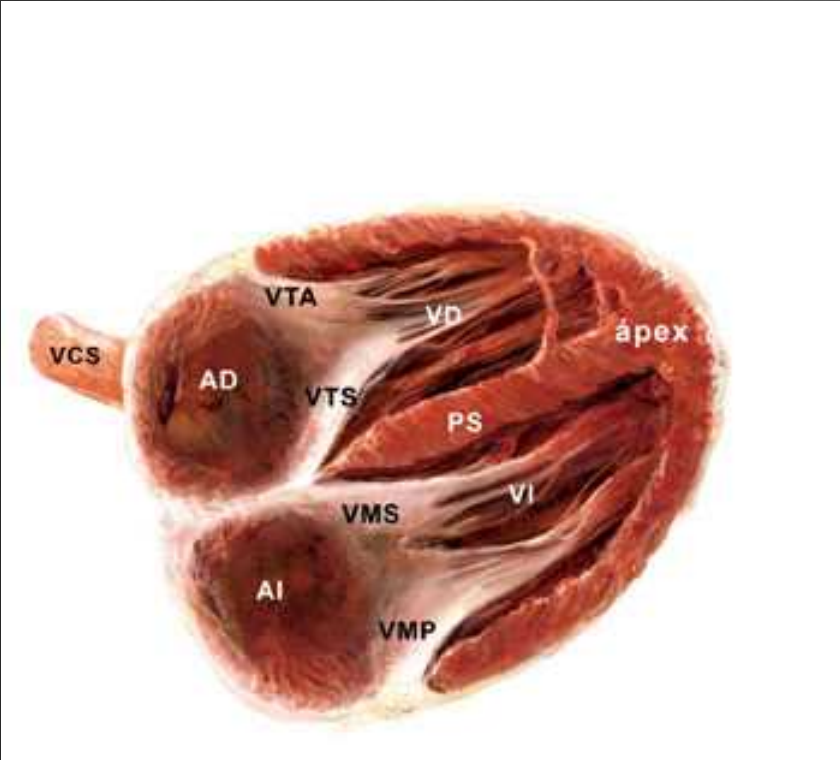
Cortes subcostales estándar.



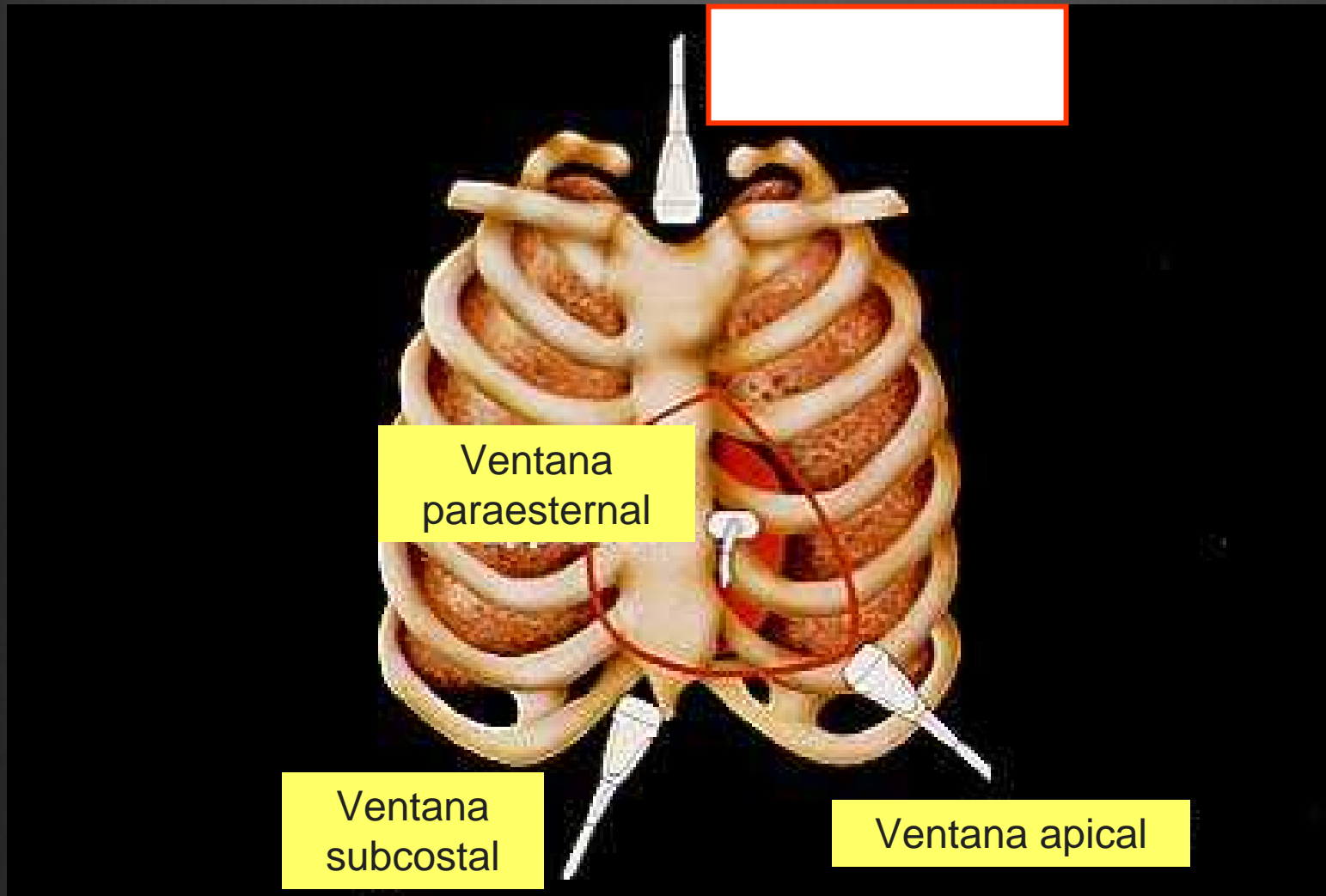
Corte subcostal de 4 cavidades



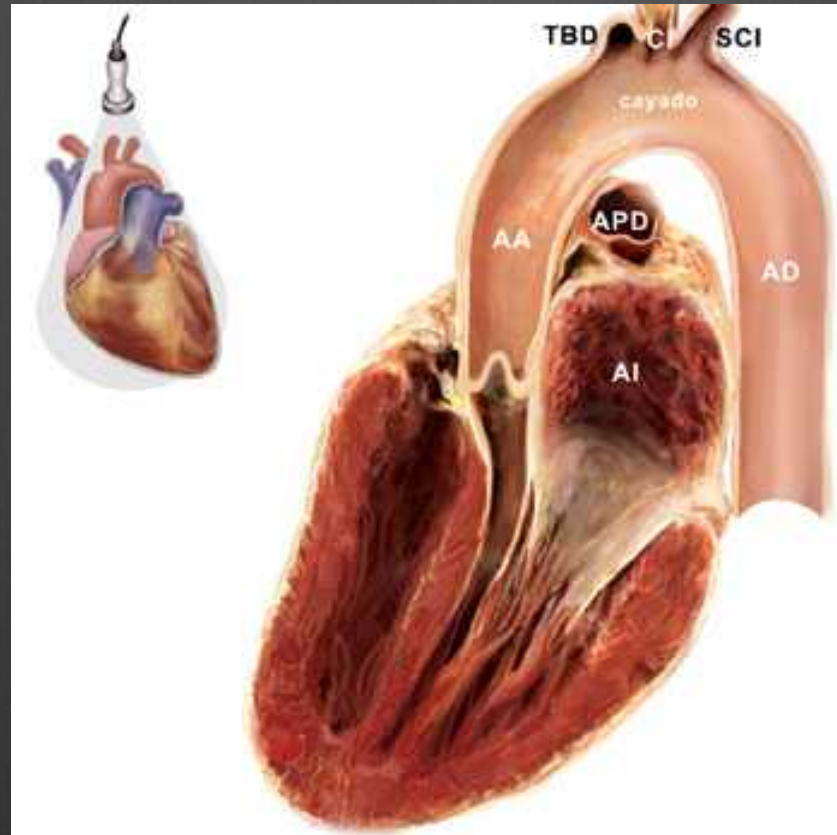
Corte subcostal de 4 cavidades



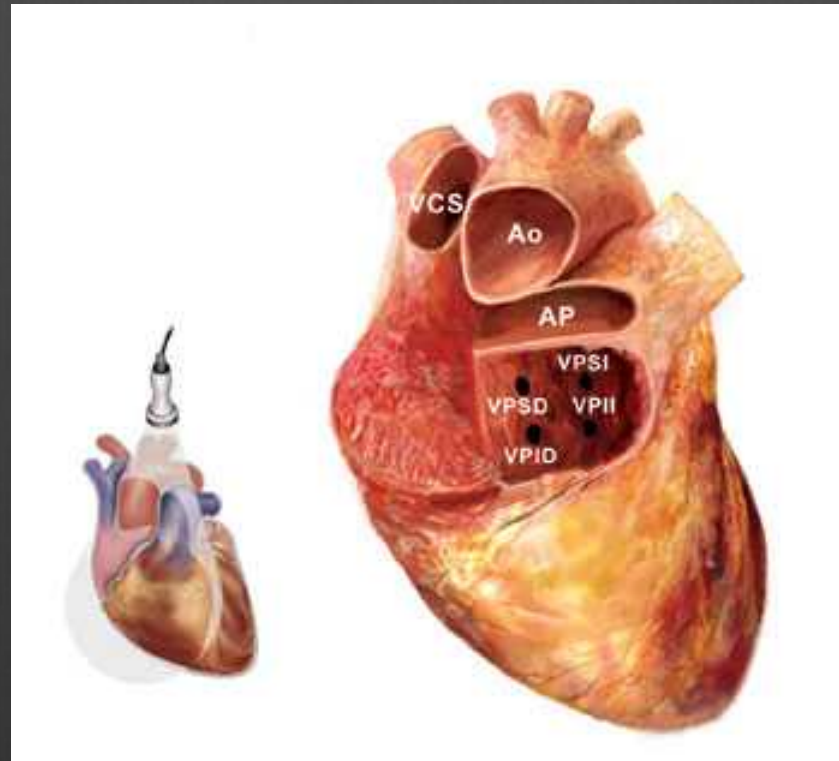
Cortes supraesternales estándar.



Corte supraesternal longitudinal.



Corte supraesternal transversal.





XXXII Congreso Nacional de la SEMI

XIV Congreso de la Sociedad Canaria de Medicina Interna
26-28 Octubre 2011



ESQUEMA

Modo M y Doppler

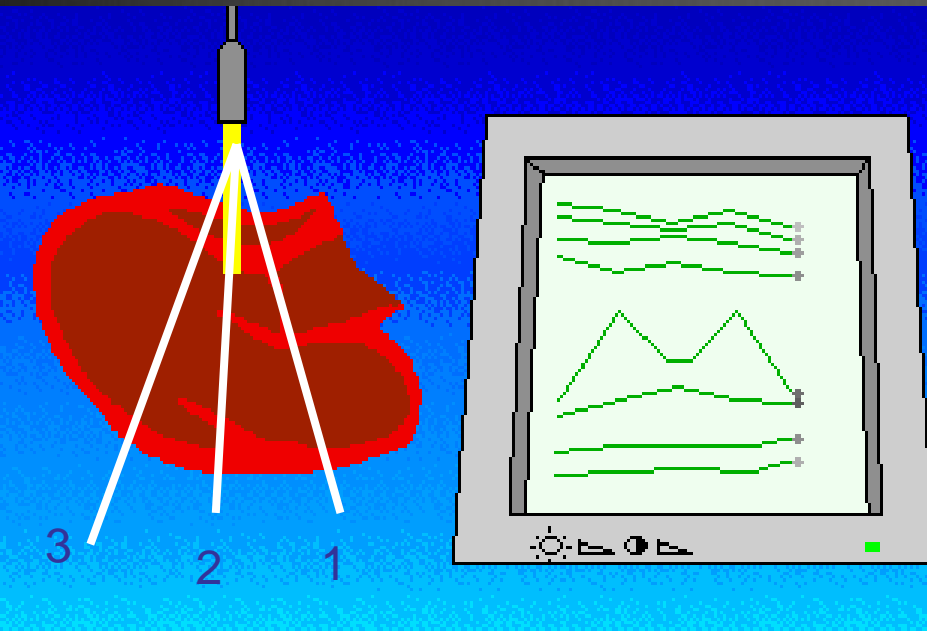
Utilidad de la ecocardiografía en Medicina Interna

Imágenes y casos

Costa Meloneras

Palacio de Congresos Expomeloneras
Maspalomas, San Bartolomé de Tirajana
Gran Canaria, Las Palmas

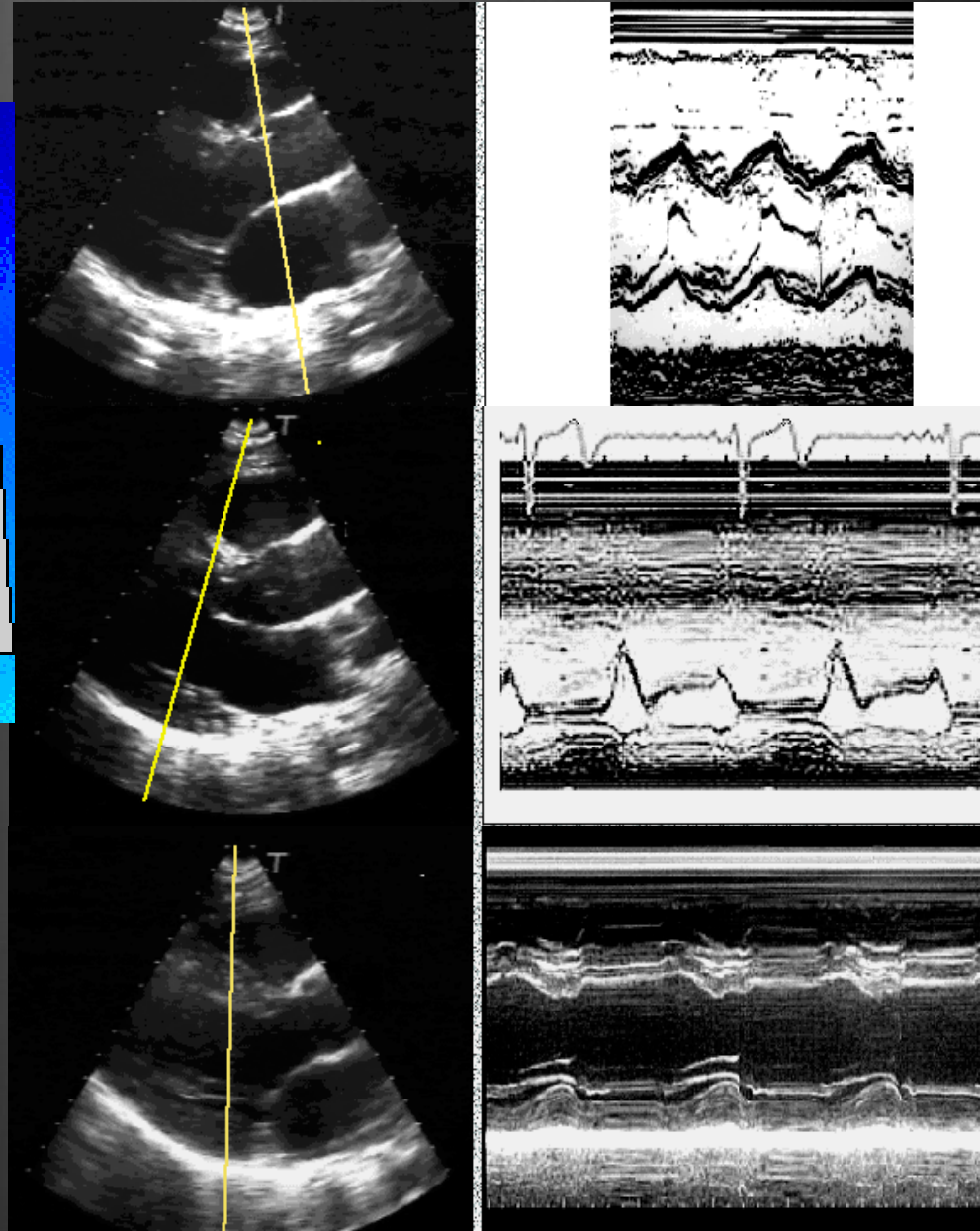
- Ecocardiograma modo M



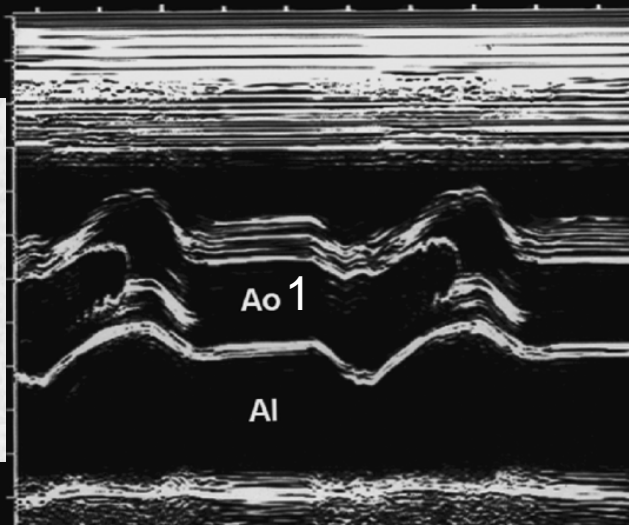
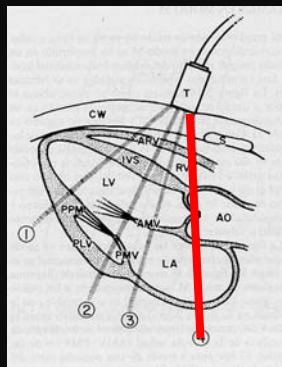
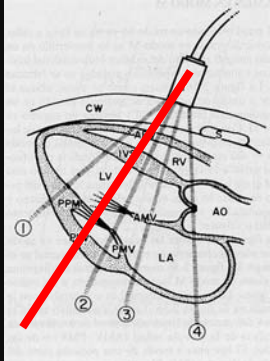
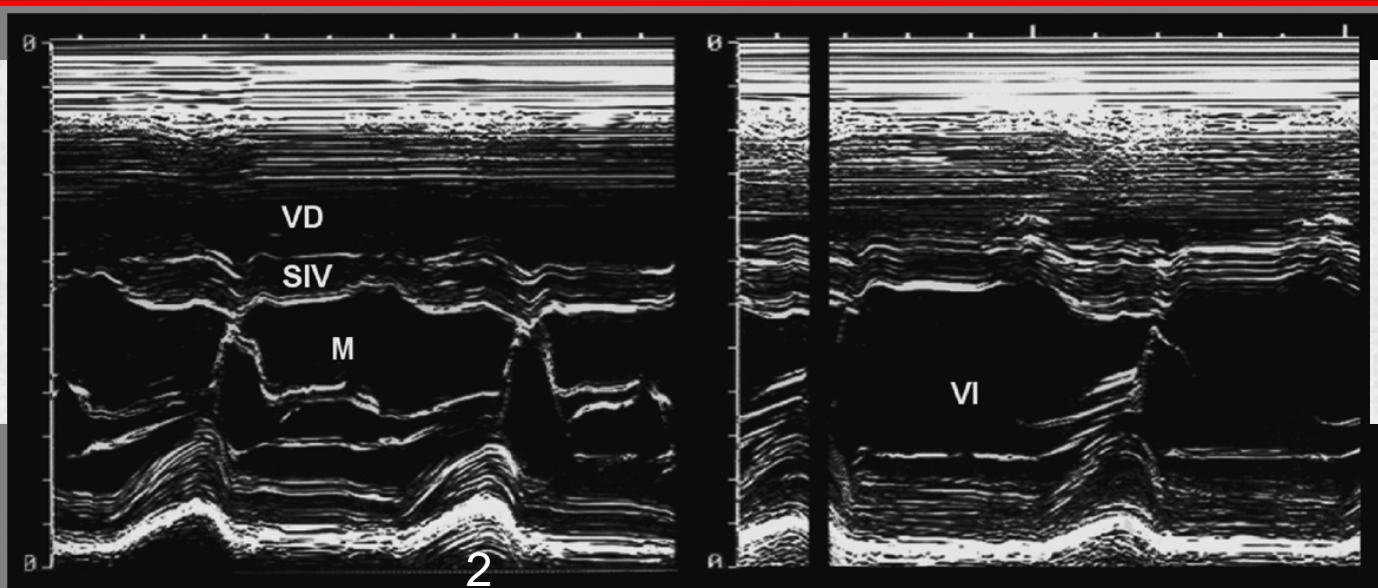
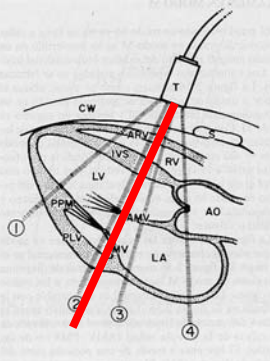
1- Aorta/Aurícula izquierda

2- Válvula mitral

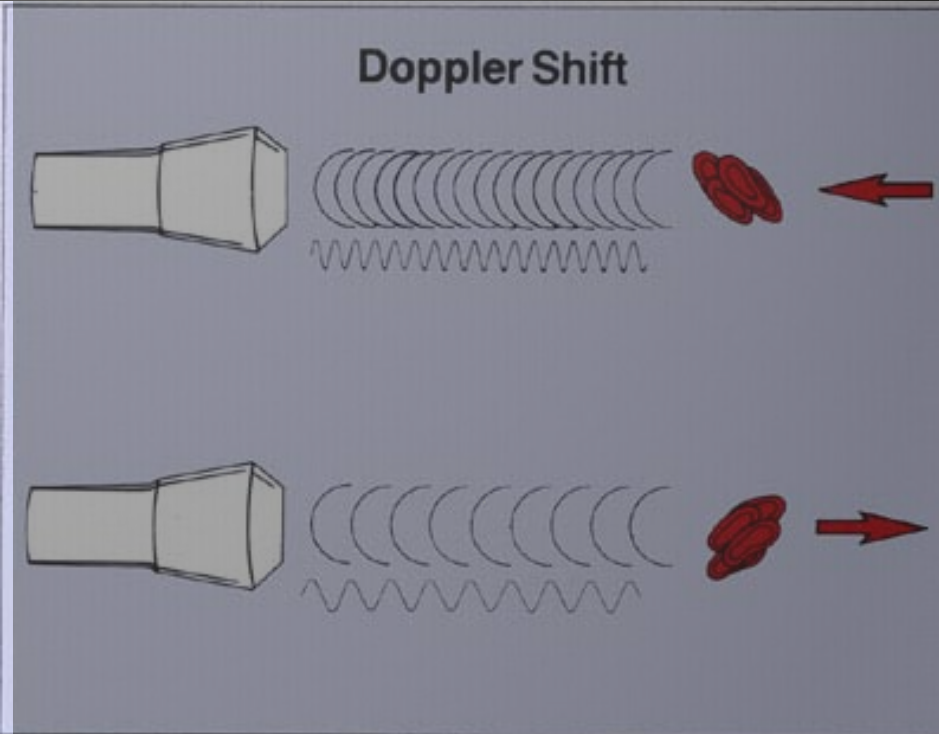
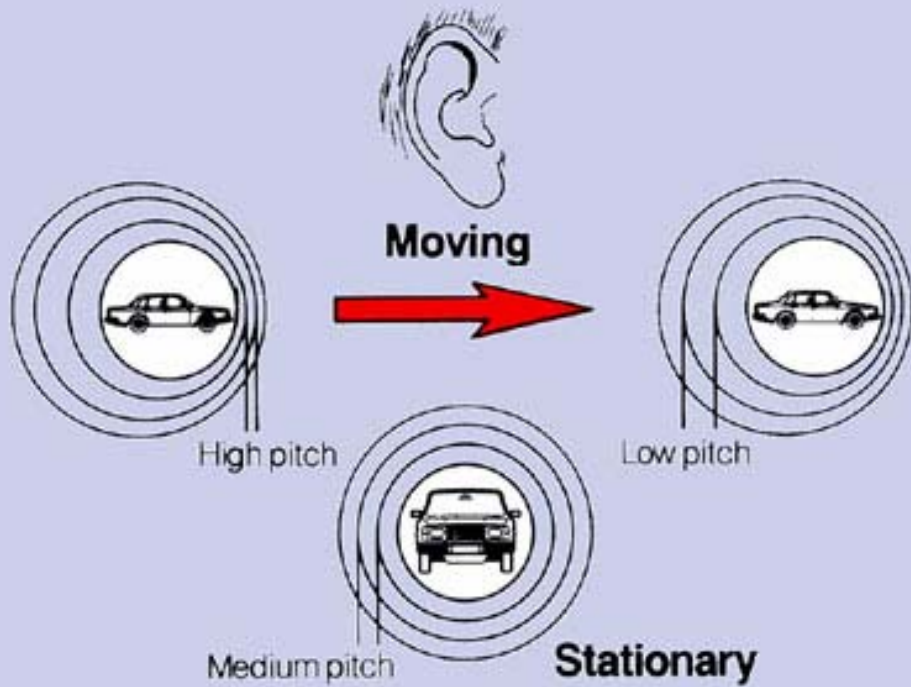
3- Ventrículo izquierdo



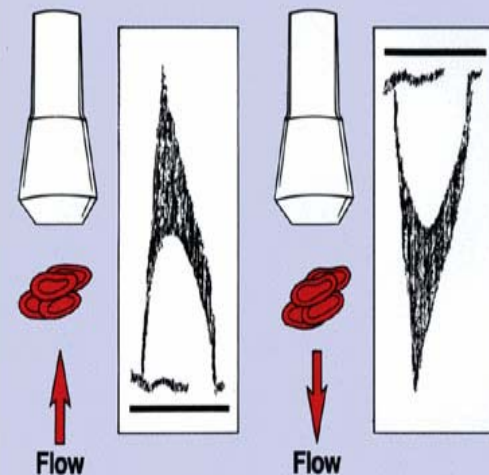
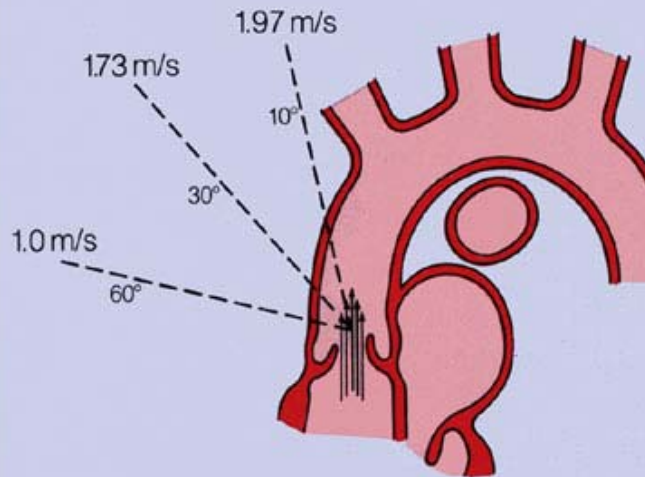
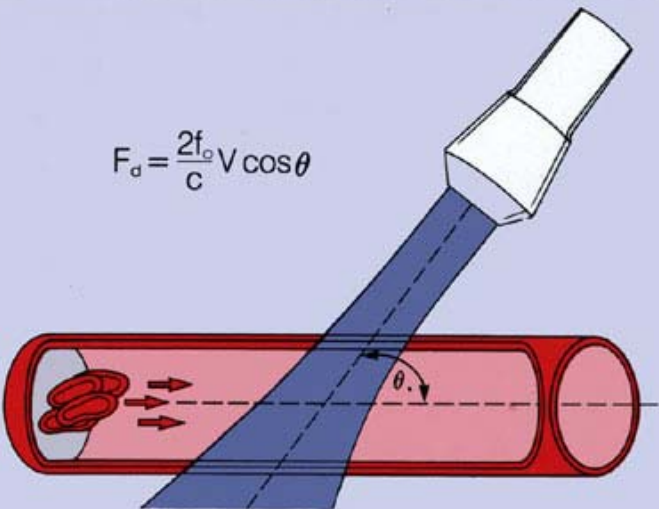
Ecocardiografía: Modo M



EFEKTO DOPPLER



$$F_d = \frac{2f_o V \cos \theta}{C}$$



Técnicas de estudio Doppler

- Básicamente existen tres modalidades de estudio Doppler de los flujos intracardíacos:
 - pulsado,
 - continuo y
 - color.



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Ecocardiografía en MI

Función ventricular izquierda

Hipertrofia ventricular izquierda

Dilatación auricular izquierda

Morfología valvular. I. mitral

Derrame pericárdico

Vena cava inferior