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HOSPITAL GENERAL  
UNIVERSITARI  
VALÈNCIA

# Ecografía perioperatoria en anestesia: "Point of Care" pensar más allá de los bloqueos nerviosos

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Consorcio Hospital General Universitario de Valencia



SARTD-CHGUV Sesión de Formación Continuada  
Valencia 3 de Junio de 2019

# ECOGRAFÍA



SARTD-CHGUV Sesión de Formación Continua  
Valencia 3 de Junio de 2019

# ECOGRAFÍA

Mucha información

Valoración rápida y fiable

A pie de cama → Point of Care (UCI, perioperatorio, urgencias...)

Método sencillo (aunque requiere cierto conocimiento)

Reduce el retraso en el diagnóstico y ...

Limitaciones: acceso restringido por apósitos/campo qx, enfisema subcutáneo y la variabilidad interobservador



# ECOGRAFÍA

Mucha información

Valoración rápida y fiable

A pie de cama → (perioperatorio, urgencias...)

**GUÍA LAS DECISIONES MÉDICAS EN TIEMPO REAL**

(aunque requiere cierto conocimiento)

Reduce el retraso en el diagnóstico y ...

Limitaciones: acceso restringido por apósitos/campo qx,  
enfisema subcutáneo y la variabilidad interobservador



# EVIDENCIA POCUS

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[\[Point-of-care ultrasonography. update on practices and a concept of implementation in an emergency department\].](#)

1. Azarnoush K, Guechi Y, Schmutz T, Peyrony O, Fumeaux T, Ribordy V. Rev Med Suisse. 2019 May 8;15(650):984-989. French. PMID: 31066531 [Similar articles](#)

[Point-of-care ultrasound in management of gallstone ileus - a case report.](#)





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- 1) Introducción
- 2) Exámenes
  - Vía aérea
  - Pulmonar
  - EcoCardiografía
  - Otros
- 3) Casos
- 4) Conclusiones
- 5) Referencias



# VÍA AÉREA

## Difficult Airway

JAMA | The Rational Clinical Examination

### Will This Patient Be Difficult to Intubate?

### The Rational Clinical Examination Systematic Review

Michael E. Detsky, MD, MSHP; Naheed Jivraj, MBBS, MSc; Neill K. Adhikari, MDCM, MSc; Jan O. Friedrich, MD, MSc, DPhil;  
Ruxandra Pinto, PhD; David L. Simel, MD; Duminda N. Wijeyesundera, MD, PhD; Damon C. Scales, MD, PhD

La revisión de JAMA incluyó 62 estudios de alta calidad (n = 33559) y tuvo una incidencia global de IOT difícil del 10% (8.2-12%).

Conclusiones:

- Ninguna prueba o SCORE es lo suficientemente sensible como para descartar una vía aérea difícil.
- La prueba más específica para predecir IOT difícil fue la prueba de mordida del labio superior.



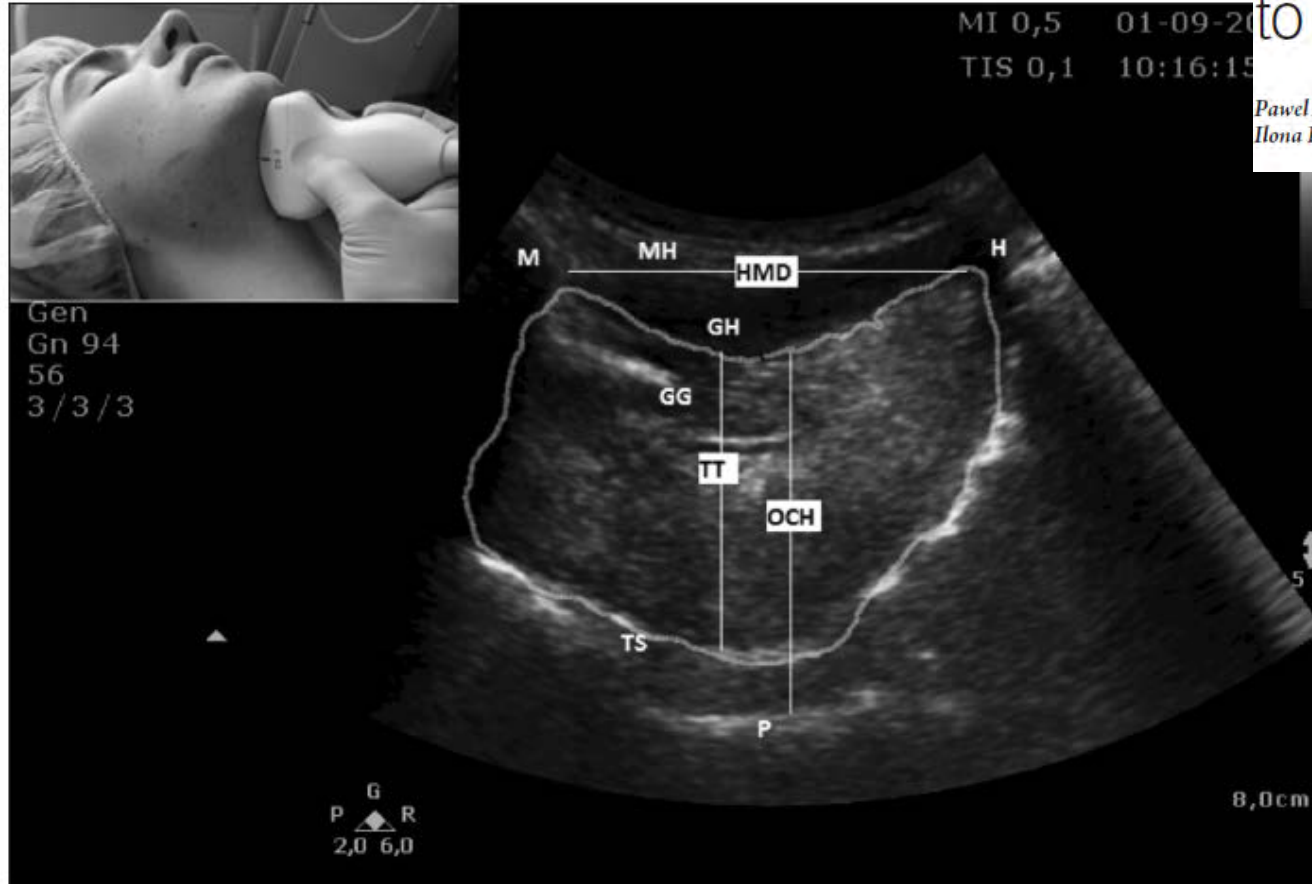
# VÍA AÉREA

## Difficult Airway

Hyomental distance

Effectiveness and Validity of Sonographic Upper Airway Evaluation to Predict Difficult Laryngoscopy

Pawel Andruszkiewicz, MD, PhD, Jacek Wojtczak, MD, PhD, Dorota Sobczyk, MD, PhD, Orest Stach, MD, Ilona Kowalik, PhD



Una distancia < 40mm se relaciona con una laringoscopia difícil

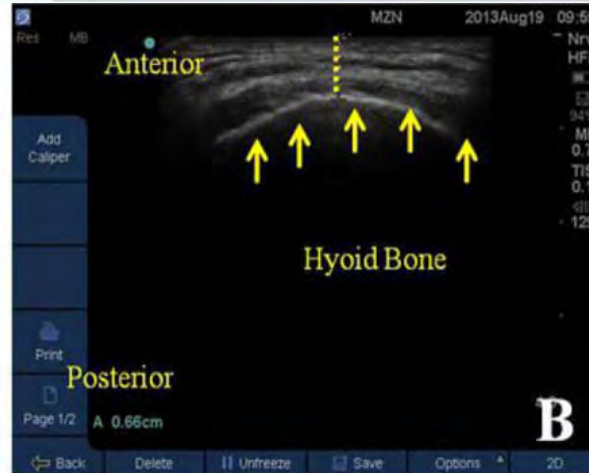
Difficult Laryngoscopy = 3.99 +/- 0.56 P<0,05



# VÍA AÉREA

## Difficult Airway

Hyoid bone (ant tissue)



Pilot Study to Determine the Utility of Point-of-care Ultrasound in the Assessment of Difficult Laryngoscopy

Srikar Adhikari, MD, MS, RDMS, Wes Zeger, DO, Charles Schmier, MD, Todd Crum, MD, Andy Craven, MD, Ilir Frrokaj, MD, Huiling Pang, MD, and Valerie Shostrom, MS

### Role of Anterior Neck Soft Tissue Quantifications by Ultrasound in Predicting Difficult Laryngoscopy

Jinhong Wu\*  
Jing Dong  
Yingchun Ding  
Jijian Zheng

1 Department of Anesthesiology, Shanghai First People's Hospital, Shanghai Jiaotong University, Shanghai, China  
2 Department of Diagnostic Ultrasound, Lujiang County People's Hospital, Lujiang County, Anhui, China

Una distancia > 16mm se relaciona con CLG III/IV

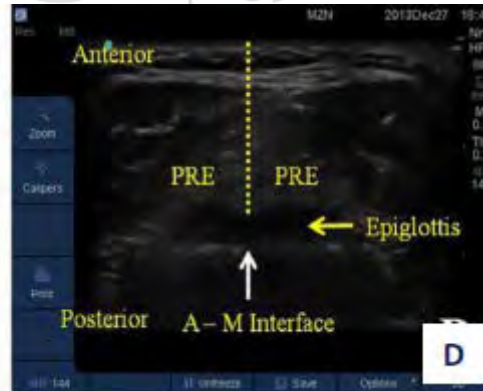
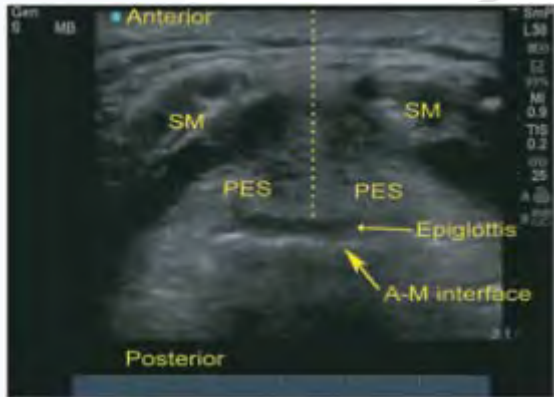
CL I-II = 1.37mm P<0,05

CL III-IV = 1.69mm P<0,05

# VÍA AÉREA

## Difficult Airway

### Thyrohyoid membrane (ant tissue)



Pilot Study to Determine the Utility of Point-of-care Ultrasound in the Assessment of Difficult Laryngoscopy

Srikar Adhikari, MD, MS, RDMS, Wes Zeger, DO, Charles Schmier, MD, Todd Crum, MD, Andy Craven, MD, Ilir Frrokaj, MD, Huiling Pang, MD, and Valerie Shostrom, MS

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1 Department of Anesthesiology, Shanghai First People's Hospital, Shanghai Jiaotong University, Shanghai, China  
2 Department of Diagnostic Ultrasound, Lujiang County People's Hospital, Lujiang County, Anhui, China

Una distancia > 25 mm se relaciona con CLG III/IV

CL I-II = 2.37mm, 95% CI = 2.29 to 2.44 P<0,05

CL III-IV = 3.47mm, 95% CI = 2.88 to 4.07 P<0,05



# VÍA AÉREA

## Intubación selectiva

### Auscultation *versus* Point-of-care Ultrasound to Determine Endotracheal *versus* Bronchial Intubation

#### A Diagnostic Accuracy Study

Davinder Ramsingh, M.D., Ethan Frank, B.S., Robert Haughton, B.S., John Schilling, B.S., Kimberly M. Gimenez, M.D., Esther Banh, B.S., Joseph Rinehart, M.D., Maxime Cannesson, M.D., Ph.D.

#### ABSTRACT

**Background:** Unrecognized malposition of the endotracheal tube (ETT) can lead to severe complications in patients under general anesthesia. The focus of this double-blinded randomized study was to assess the accuracy of point-of-care ultrasound in verifying the correct position of the ETT and to compare it with the accuracy of auscultation.

**Methods:** Forty-two adult patients requiring general anesthesia with ETT were consented. Patients were randomized to right main bronchus, left main bronchus, or tracheal intubation. After randomization, the ETT was placed *via* fiber-optic visualization. Next, the location of the ETT was assessed using auscultation by a separate blinded anesthesiologist, followed by an ultrasound performed by a third blinded anesthesiologist. Ultrasound examination included assessment of tracheal dilation *via* cuff inflation with air and evaluation of pleural lung sliding. Statistical analysis included sensitivity, specificity, positive predictive value, negative predictive value, and interobserver agreement for the ultrasound examination (95% CI).

**Results:** In differentiating tracheal *versus* bronchial intubations, auscultation showed a sensitivity of 66% (0.39 to 0.87) and a specificity of 59% (0.39 to 0.77), whereas ultrasound showed a sensitivity of 93% (0.66 to 0.99) and specificity of 96% (0.79 to 1). Identification of tracheal *versus* bronchial intubation was 62% (26 of 42) in the auscultation group and 95% (40 of 42) in the ultrasound group ( $P = 0.0005$ ) (CI for difference, 0.15 to 0.52), and the McNemar comparison showed statistically significant improvement with ultrasound ( $P < 0.0001$ ). Interobserver agreement of ultrasound findings was 100%.

**Conclusion:** Assessment of trachea and pleura *via* point-of-care ultrasound is superior to auscultation in determining the location of ETT. ([ANESTHESIOLOGY 2016; 124:1012-20](#))

POCUS:

S 93% E 96%

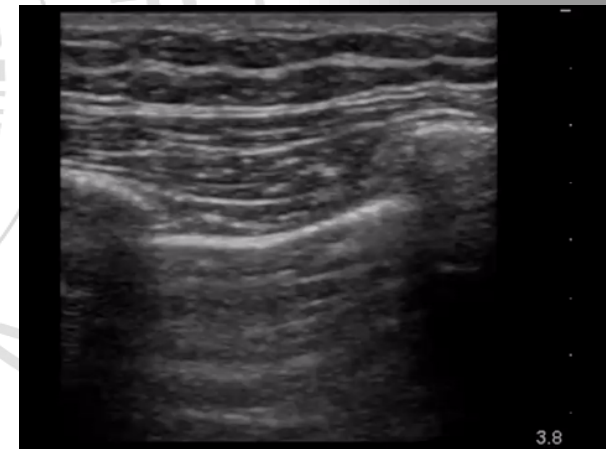
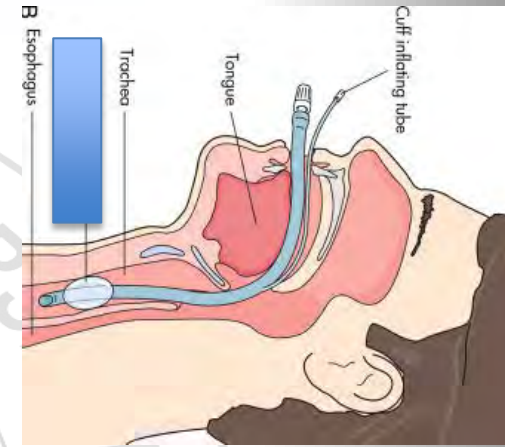
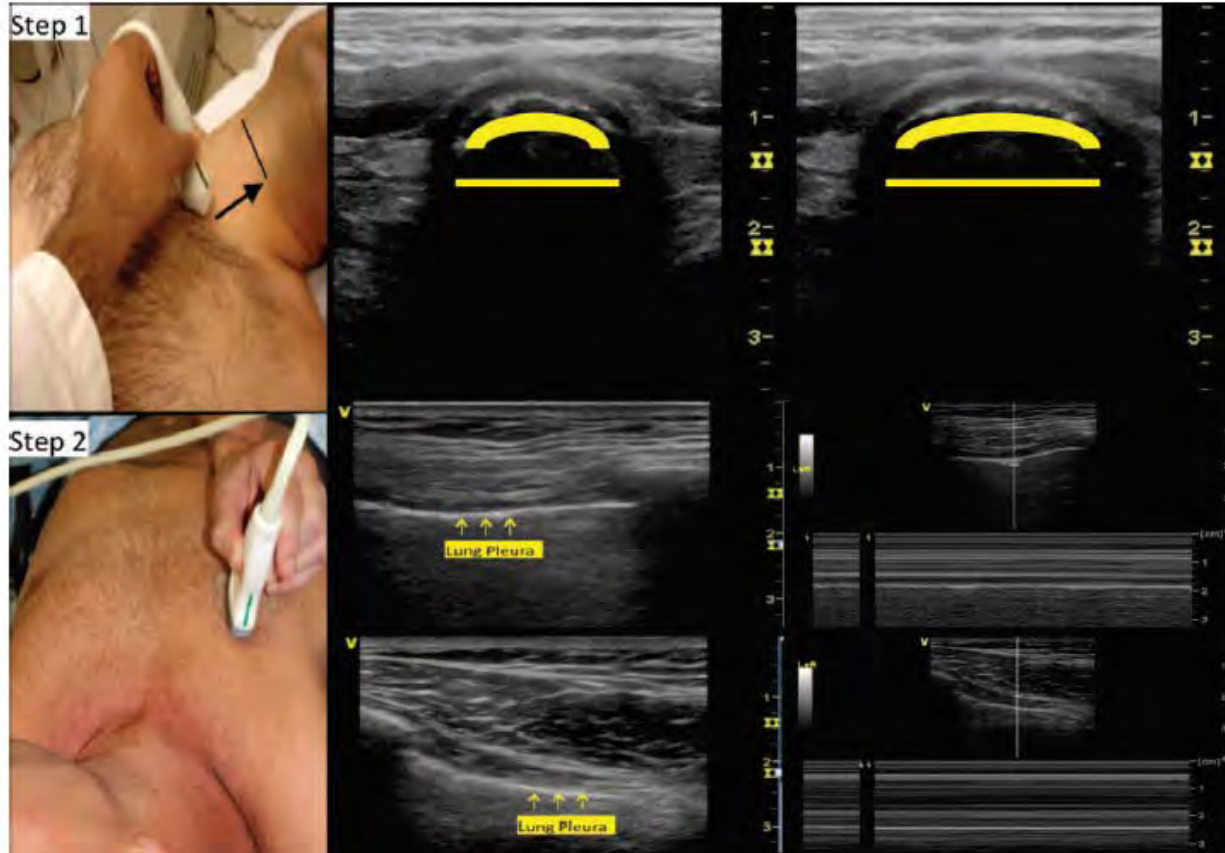
Auscultación:

S 66% E 59%



# VÍA AÉREA

## Intubación selectiva





# VÍA AÉREA

## DL tube size

EJA

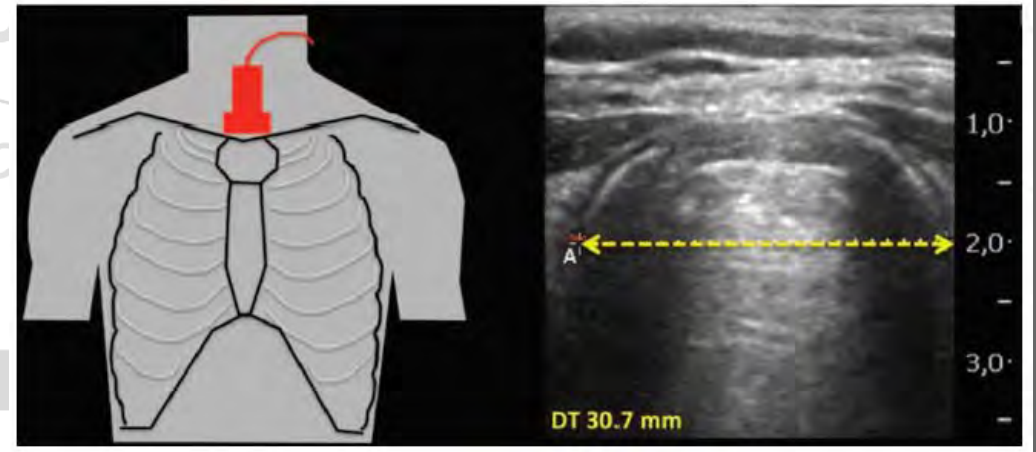
Eur J Anaesthesiol 2019; 36:215–220

ORIGINAL ARTICLE

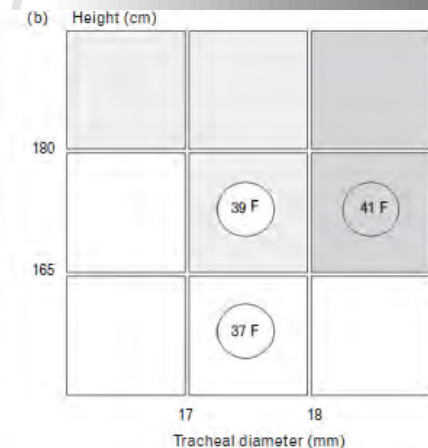
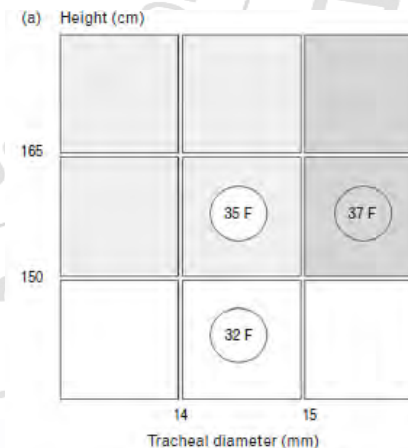
**Use of tracheal ultrasound combined with clinical parameters to select left double-lumen tube size**

*A prospective observational study*

Emanuela Roldí, Paolo Inghileri, Ophélie Dransart-Raye, Silvia Mongodi, Pierre-Grégoire Guinot, Francesco Mojoli and Belaïd Bouhemad



Combinación de parámetros clínicos con diámetro traqueal POCUS mejora la elección del tamaño adecuado del TDL (86.0 vs. 39.2%,  $P < 0.001$ )

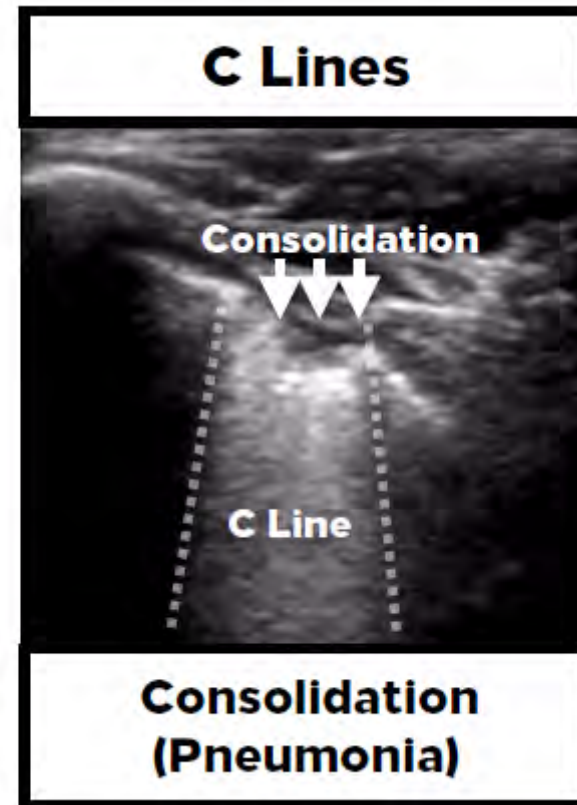
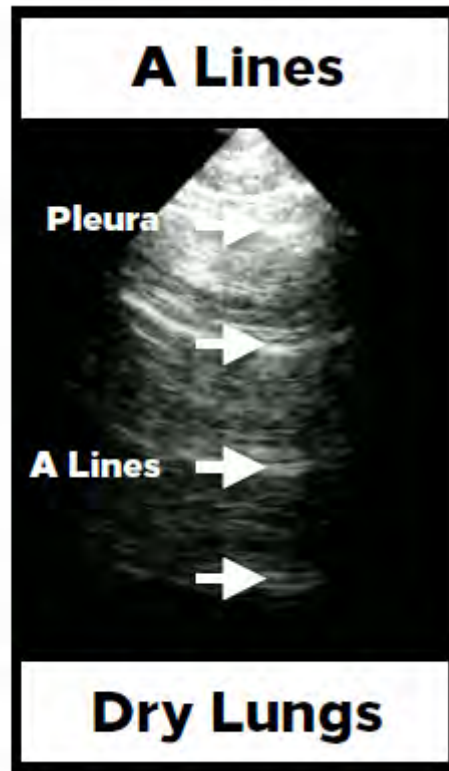
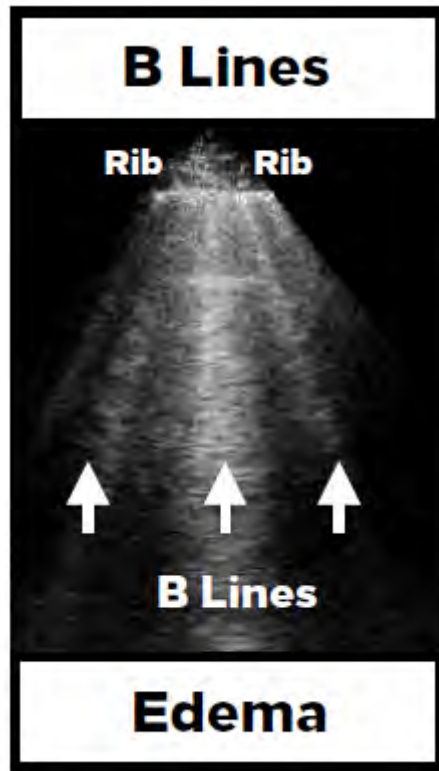


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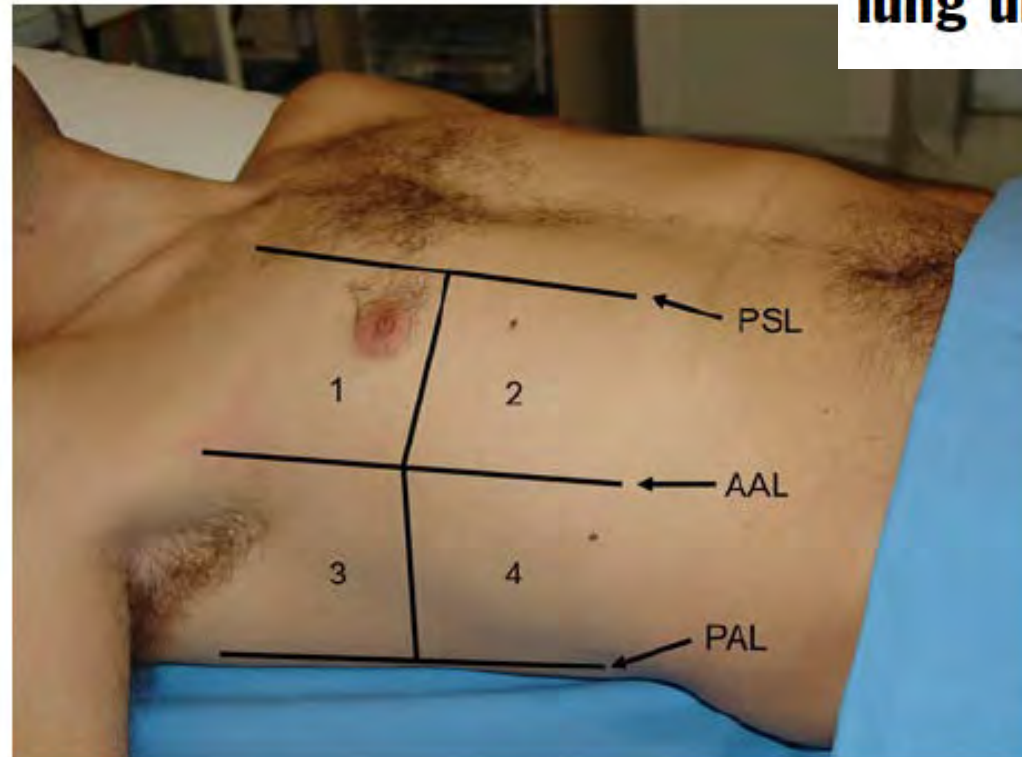


# PULMONAR

## Exploración ecográfica

### International evidence-based recommendations for point-of-care lung ultrasound

Giovanni Volpicelli  
Mahmoud Elbarbary  
Michael Blaivas  
Daniel A. Lichtenstein  
Gebhard Mathis  
Andrew W. Kirkpatrick  
Lawrence Melniker  
Luna Gargani  
Vicki E. Noble  
Gabriele Via  
Anthony Dean  
James W. Tsung  
Gino Soldati  
Roberto Copetti  
Belaid Bouhemad  
Angelika Reissig  
Eustachio Agricola  
Jean-Jacques Rouby  
Charlotte Arbelot  
Andrew Liteplo  
Ashot Sargsyan  
Fernando Silva  
Richard Hoppmann  
Raoul Breitzkreutz  
Armin Seibel  
Luca Neri  
Enrico Storti  
Tomislav Petrovic



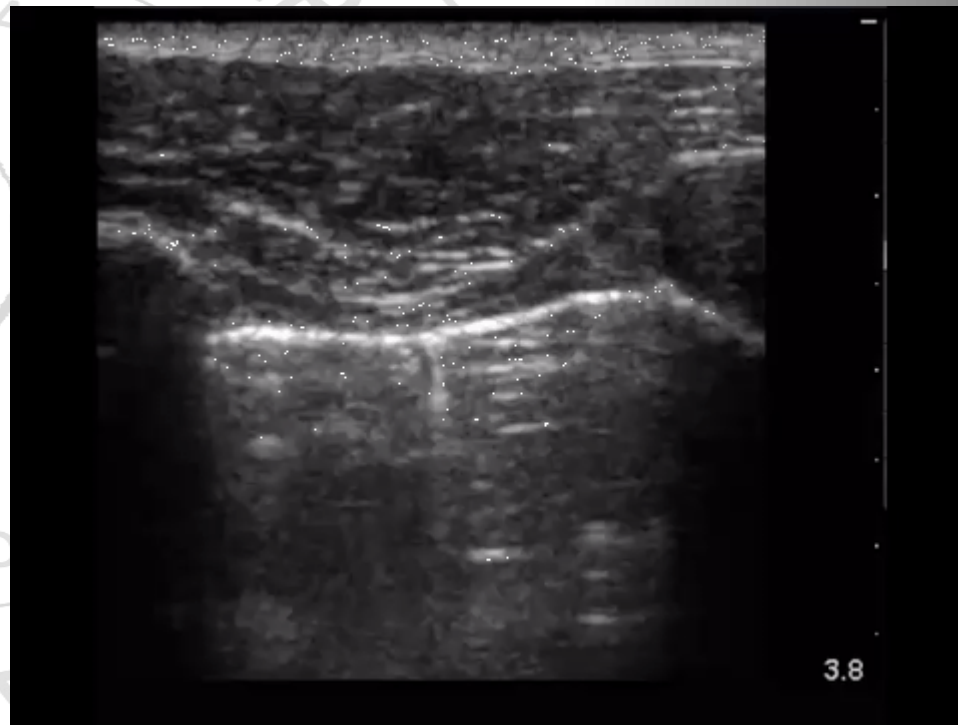
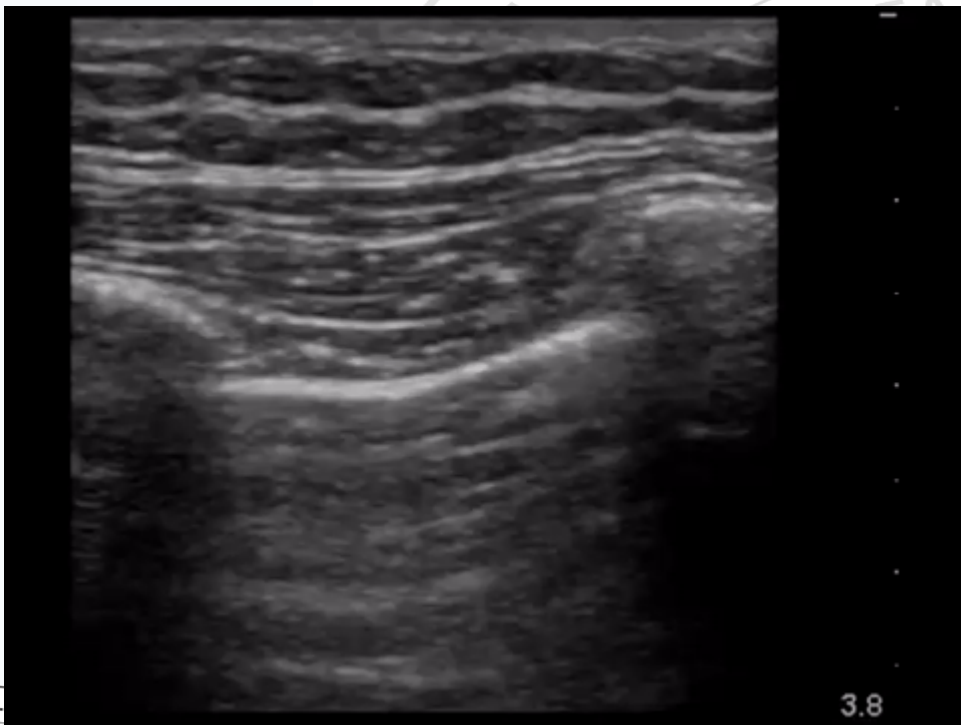
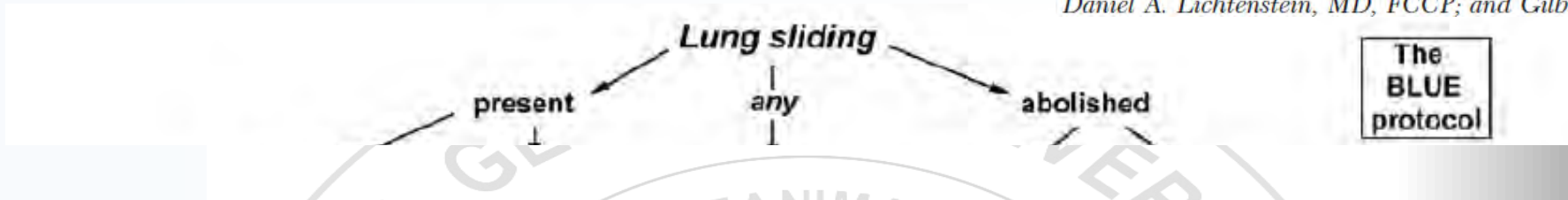
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## Relevance of Lung Ultrasound in the Diagnosis of Acute Respiratory Failure The BLUE Protocol

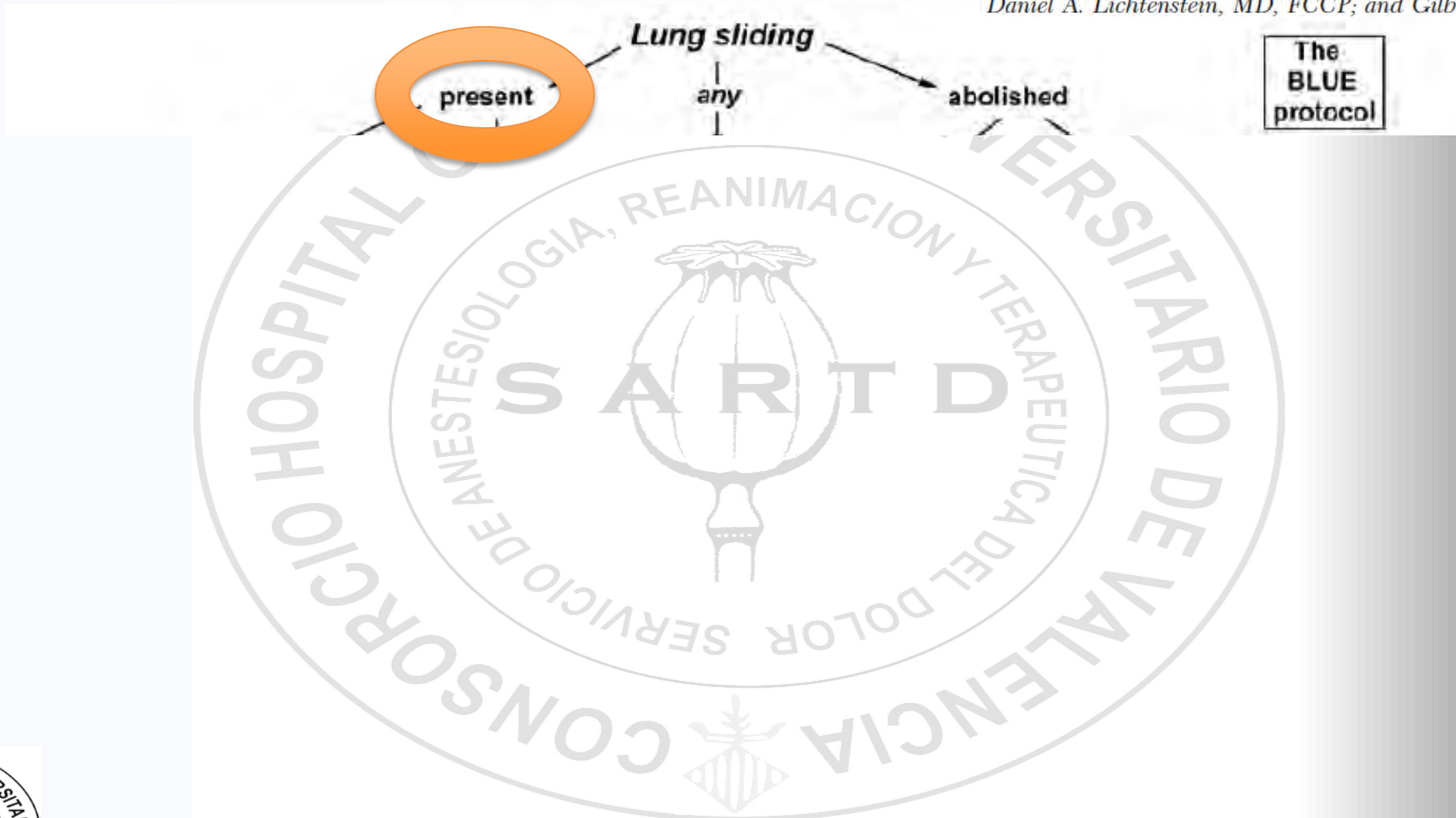
*Daniel A. Lichtenstein, MD, FCCP; and Gilbert A. Mezière, MD*



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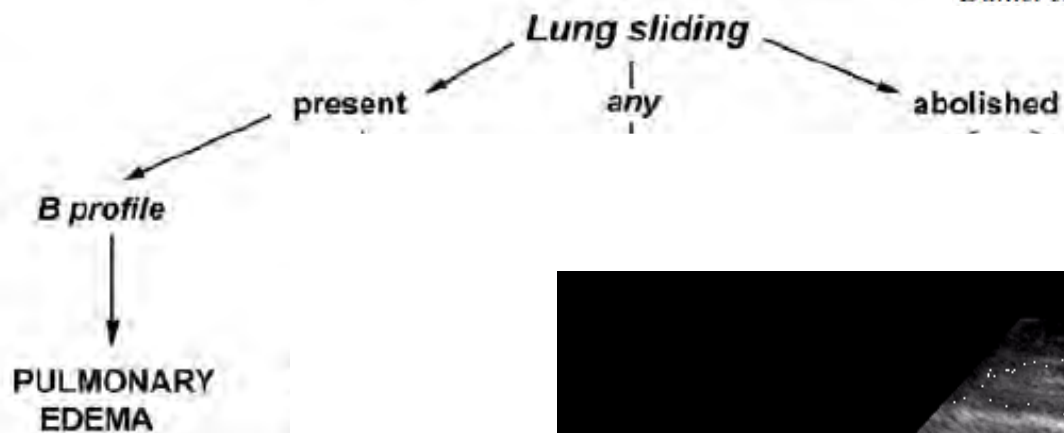
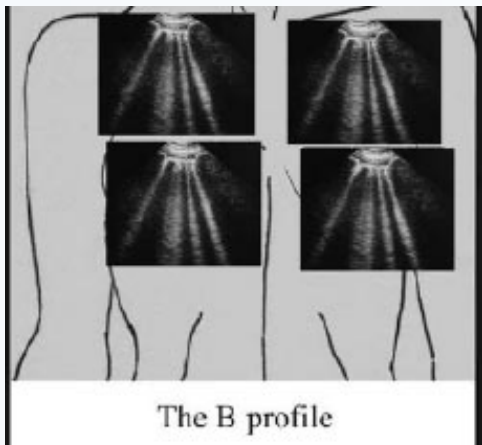




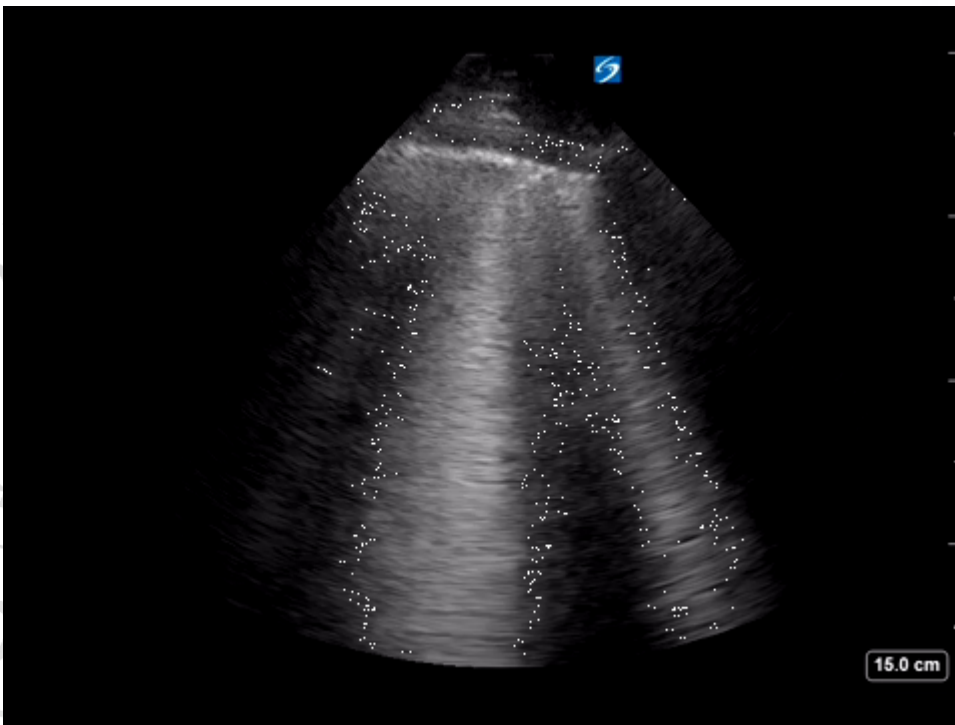
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The BLUE protocol

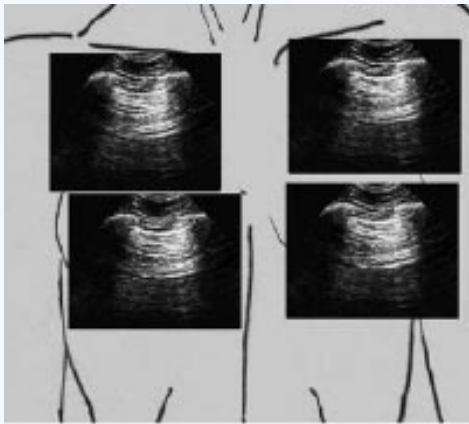




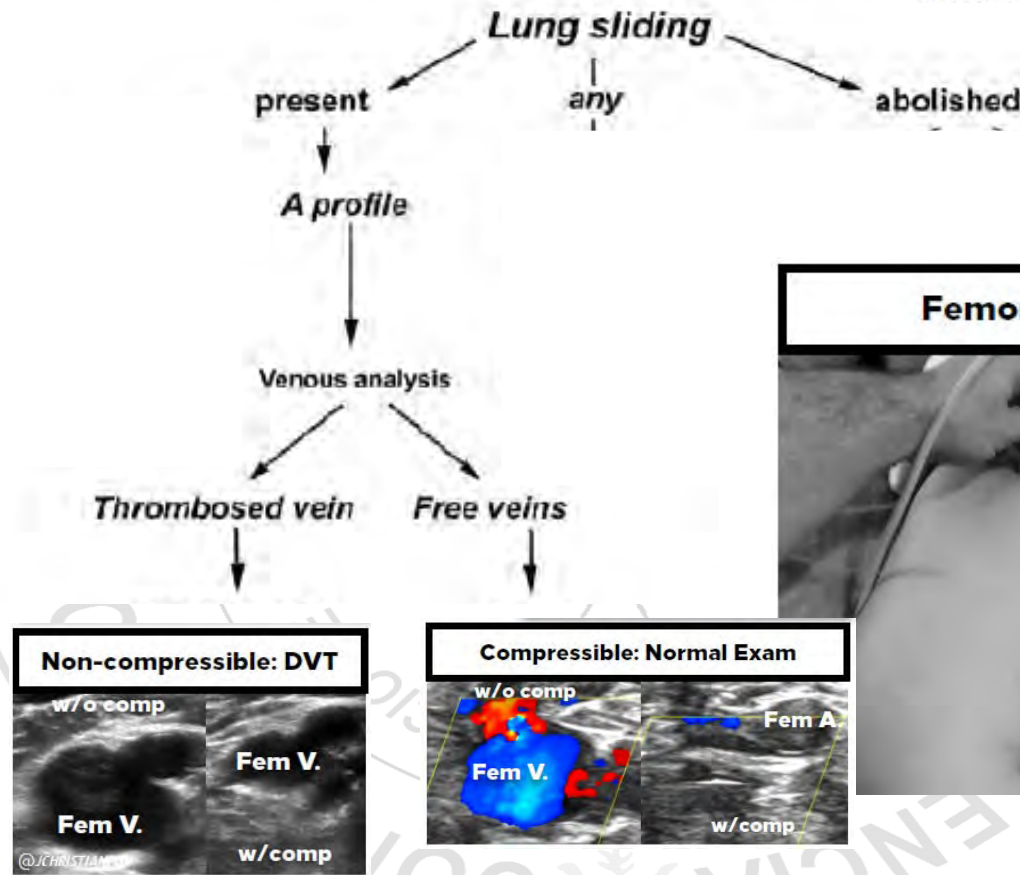
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The A profile



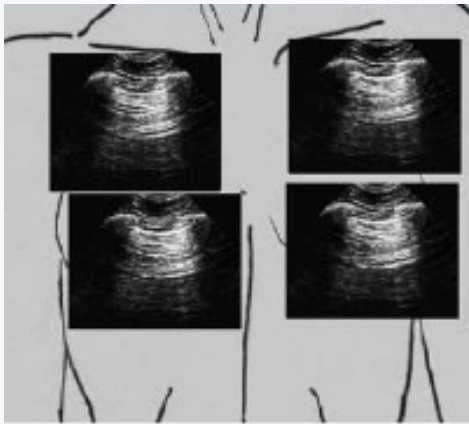
The BLUE protocol



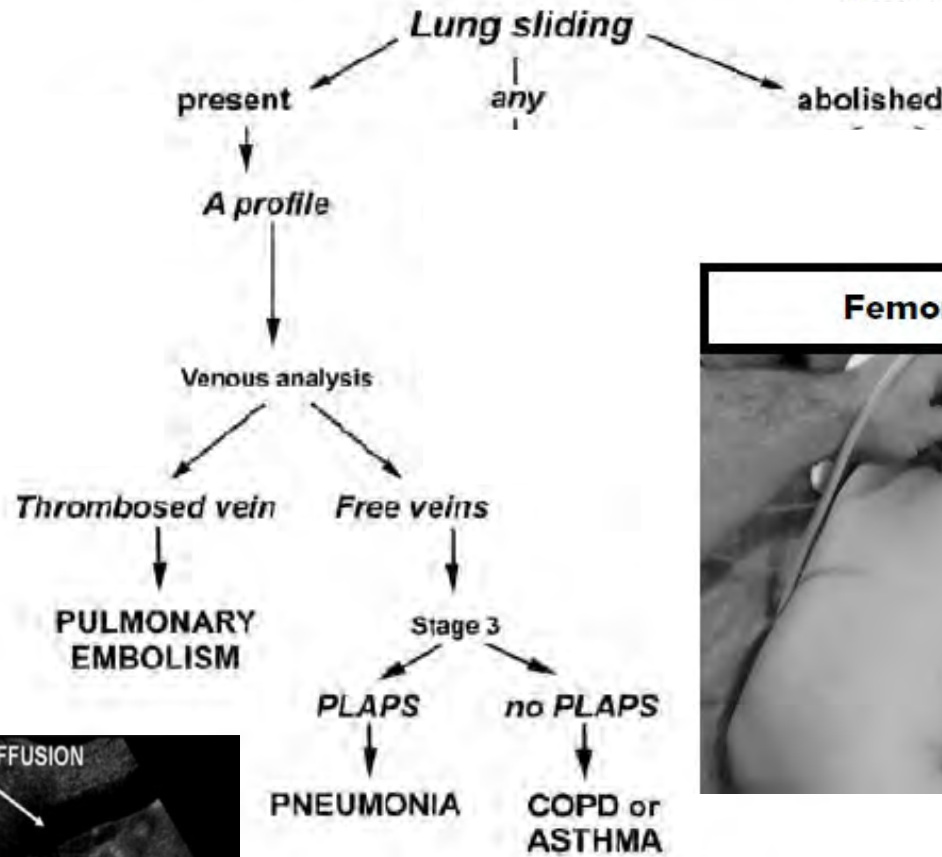
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The A profile



The BLUE protocol

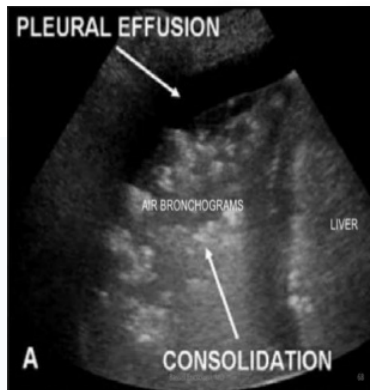


Femoral



DVT: Popliteal

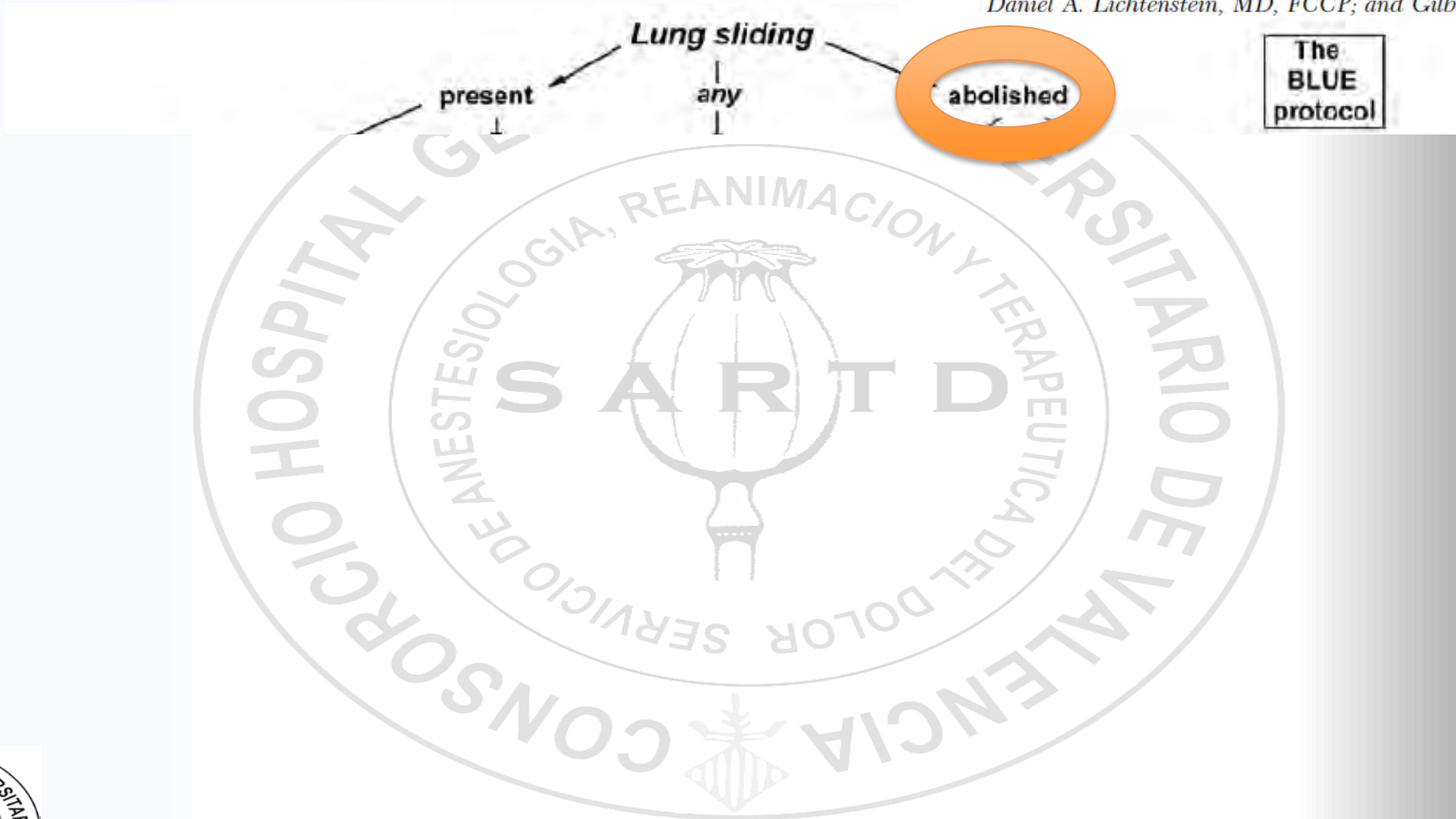
80% accuracy when using lung ultrasound

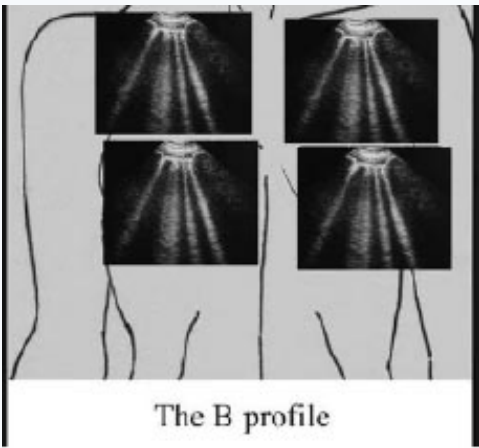


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*Daniel A. Lichtenstein, MD, FCCP; and Gilbert A. Mezière, MD*

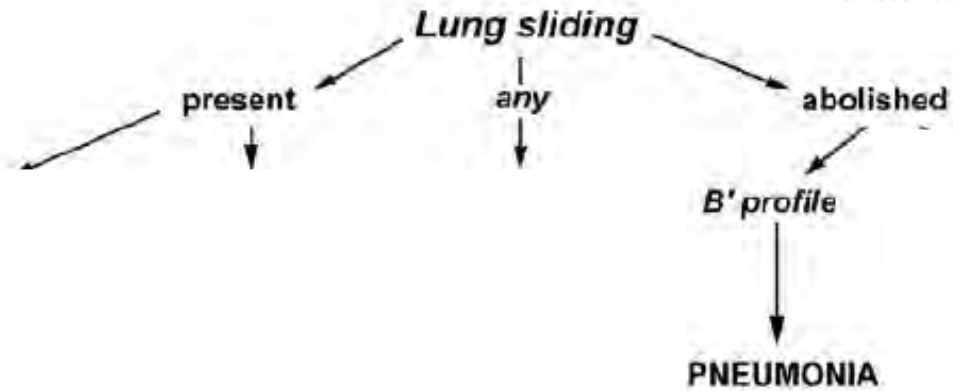




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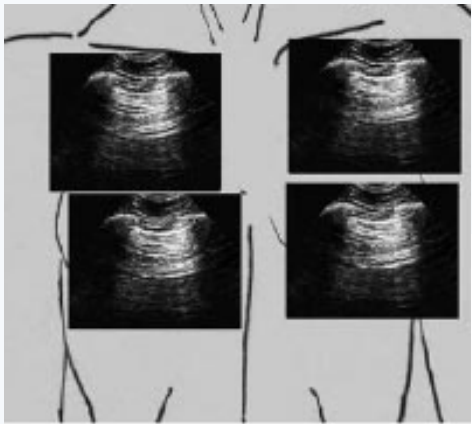
*Daniel A. Lichtenstein, MD, FCCP; and Gilbert A. Mezière, MD*



The BLUE protocol





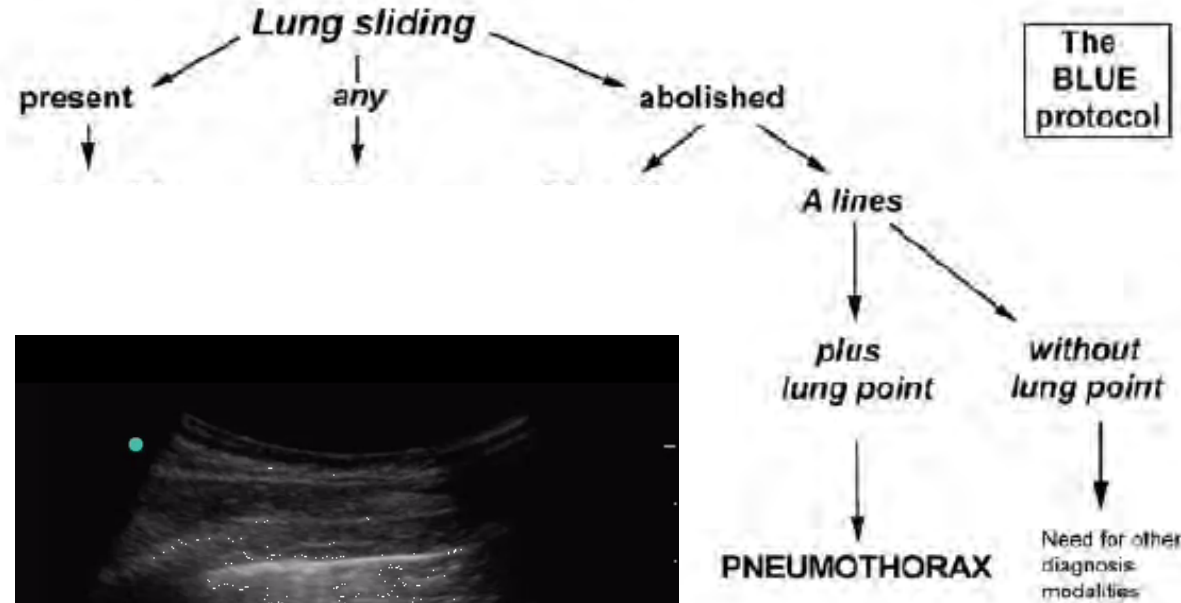


The A profile

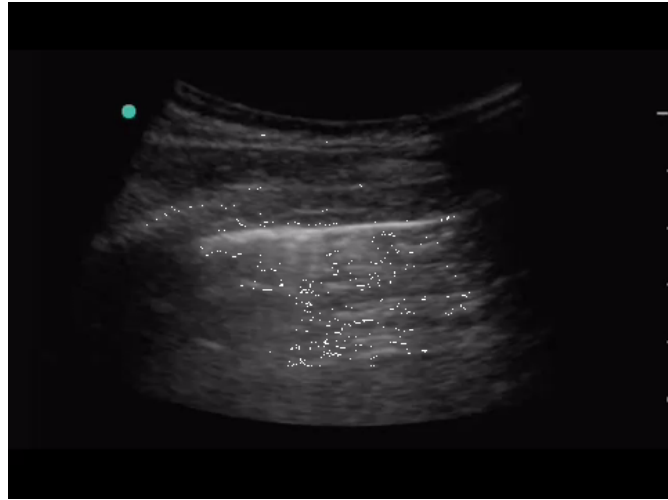
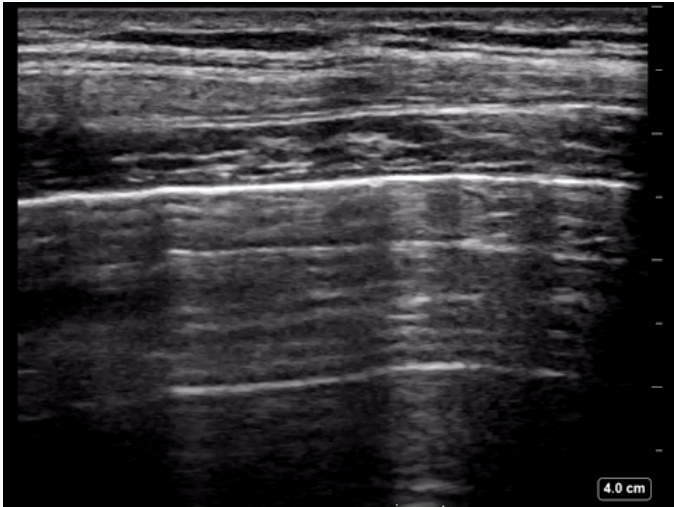
# PULMONAR

## Relevance of Lung Ultrasound in the Diagnosis of Acute Respiratory Failure The BLUE Protocol

*Daniel A. Lichtenstein, MD, FCCP; and Gilbert A. Mezière, MD*



The BLUE protocol



This decision tree does not aim at providing the diagnosis. It indicates a way for reaching a 90.5% accuracy when using lung ultrasound

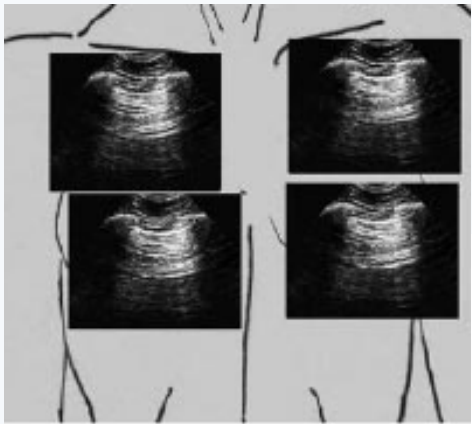




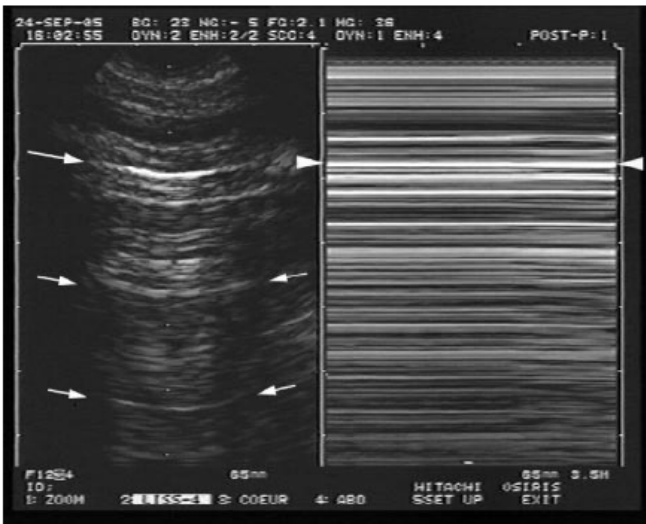
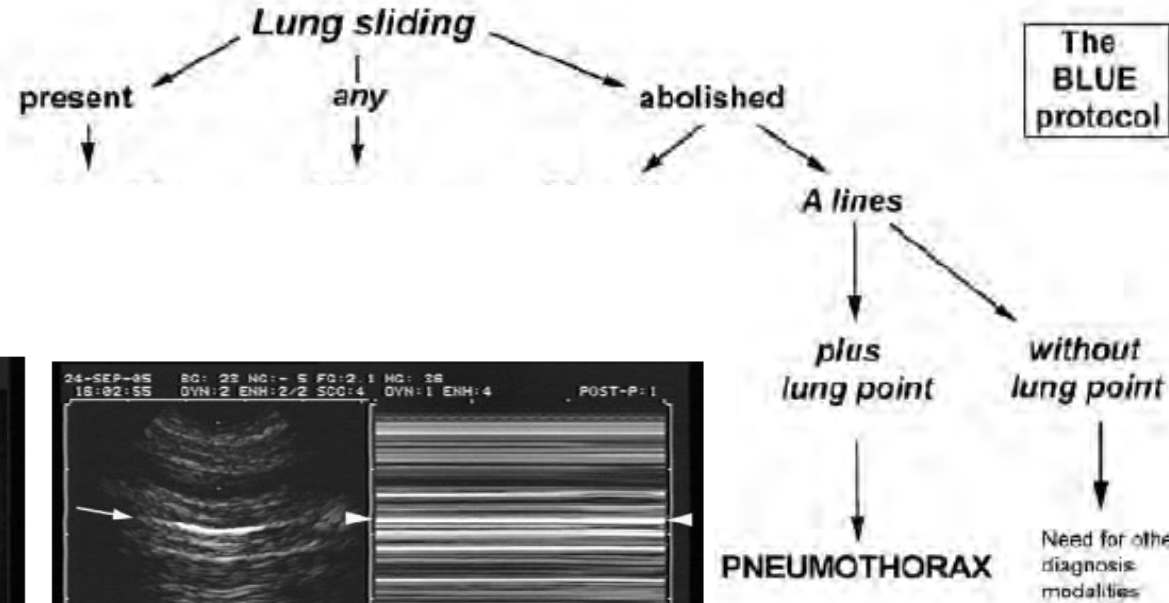
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The A profile



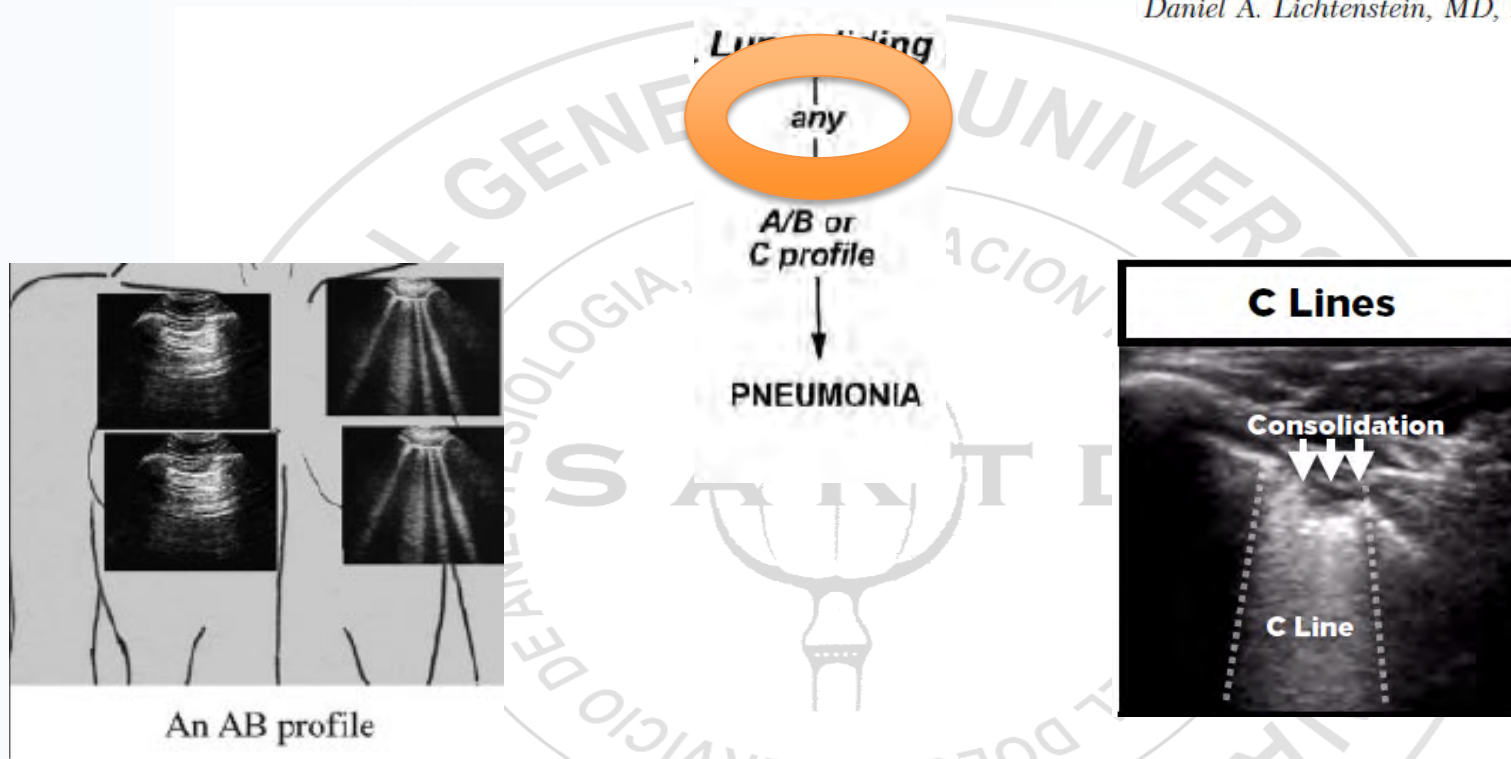
This decision tree does not aim at providing the diagnosis. It indicates a way for reaching a 90.5% accuracy when using lung ultrasound

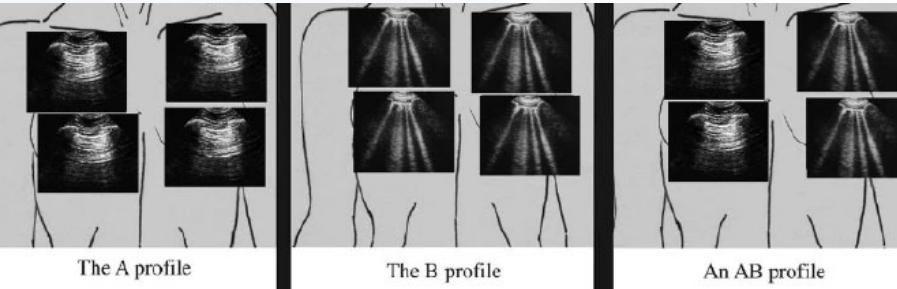


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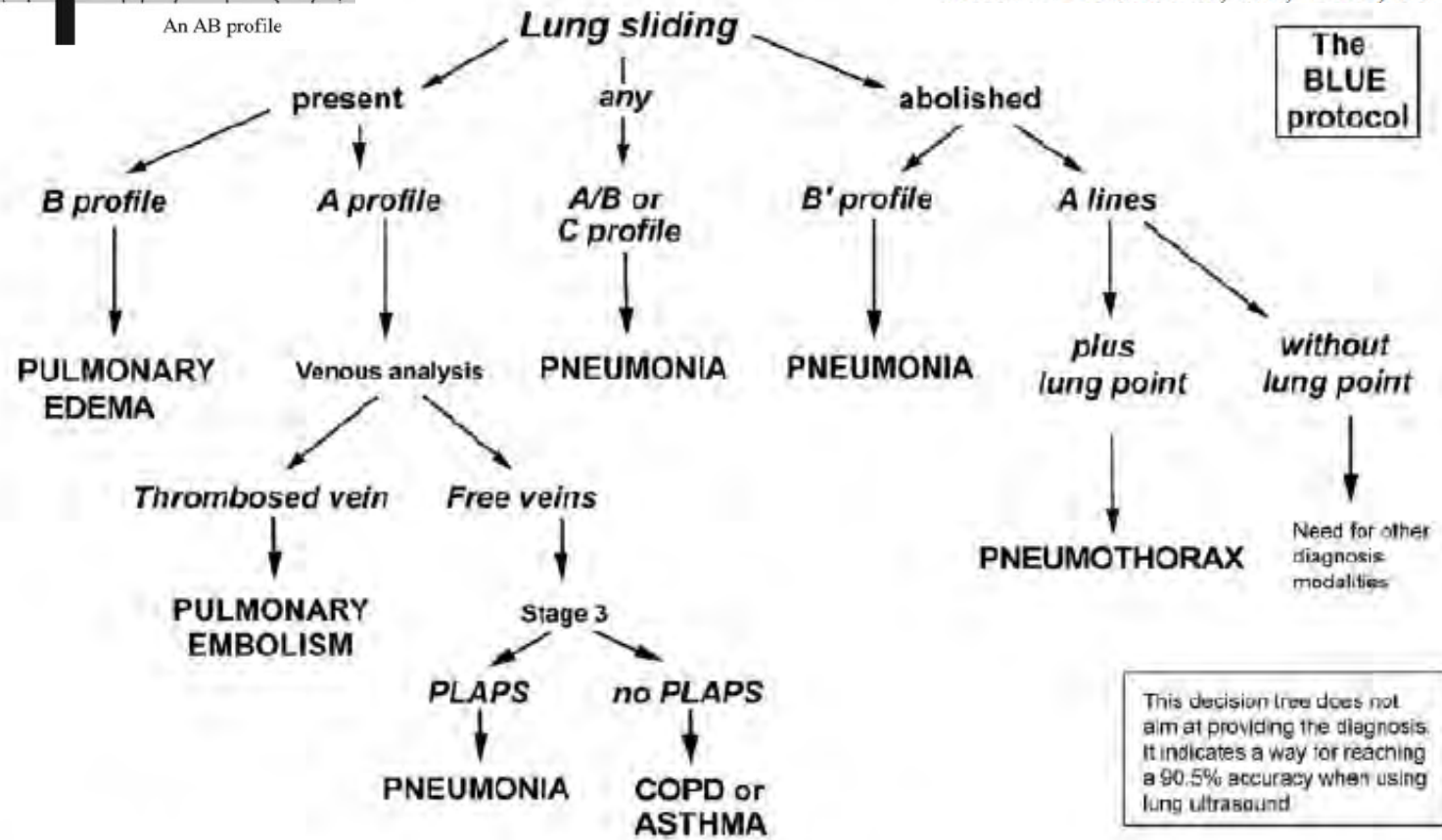




# PULMONAR

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Daniel A. Lichtenstein, MD, FCCP; and Gilbert A. Mezière, MD



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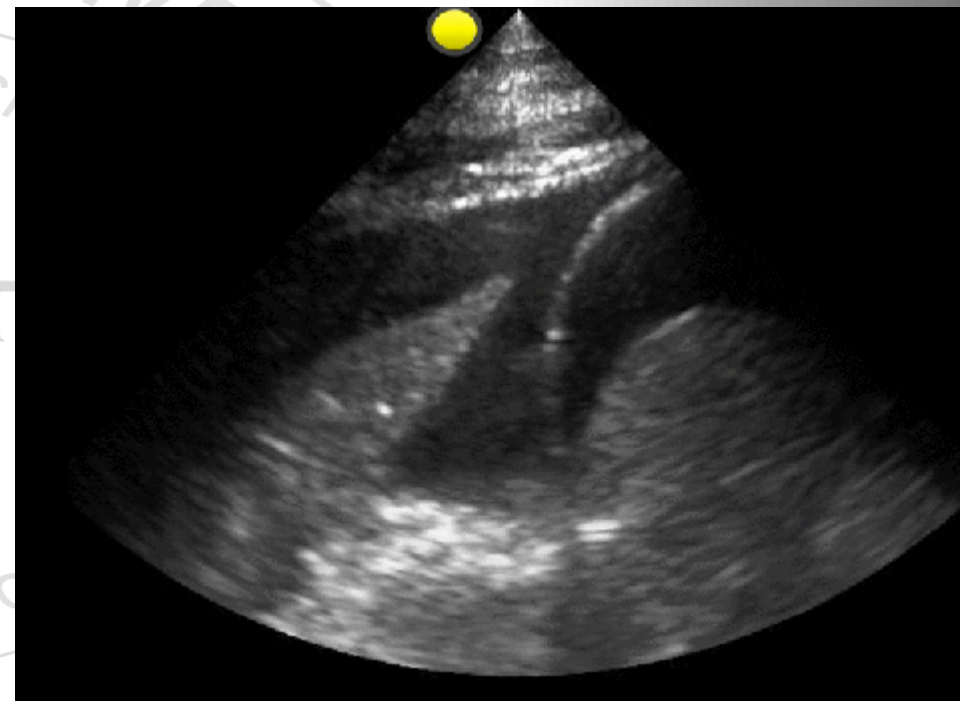
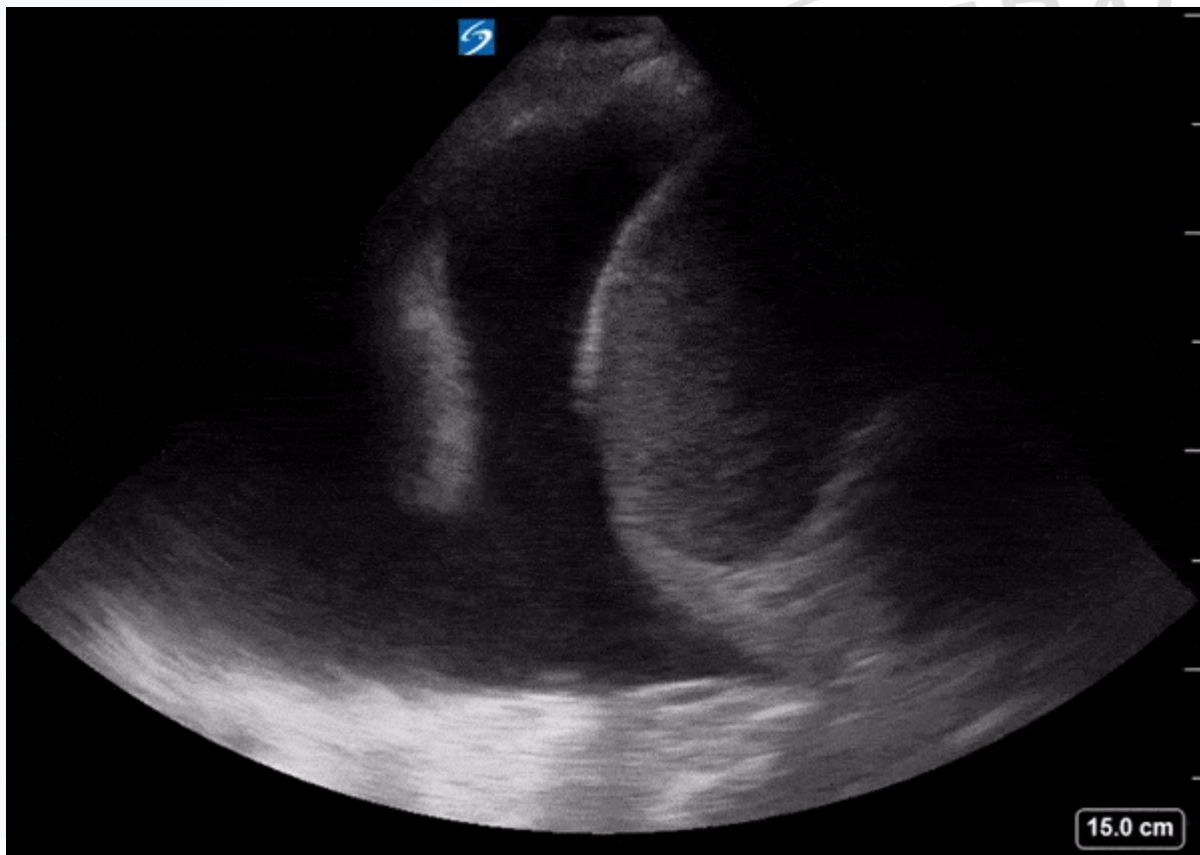
FIGURE 7. A decision tree utilizing lung ultrasonography to guide diagnosis of severe dyspnea.





# PULMONAR

## Derrame pleural





# PULMONAR

## Derrame pleural

### REVIEW ARTICLE

#### Screening Performance Characteristic of Ultrasonography and Radiography in Detection of Pleural Effusion; a Meta-Analysis

Mahmoud Youseffard<sup>1</sup>, Masoud Baikpour<sup>2</sup>, Parisa Ghelichkhani<sup>3</sup>, Hadi Asady<sup>4</sup>, Kavous Shahsavari Nia<sup>5</sup>,  
Ali Moghadas Jafari<sup>6</sup>, Mostafa Hosseini<sup>7,8\*</sup>, Saeed Safari<sup>9</sup>

### Pleural Effusion

#### Anechoic Fluid Above Diaphragm

Sensitivity	94
Specificity	98
Positive LR	47
Negative LR	0.06

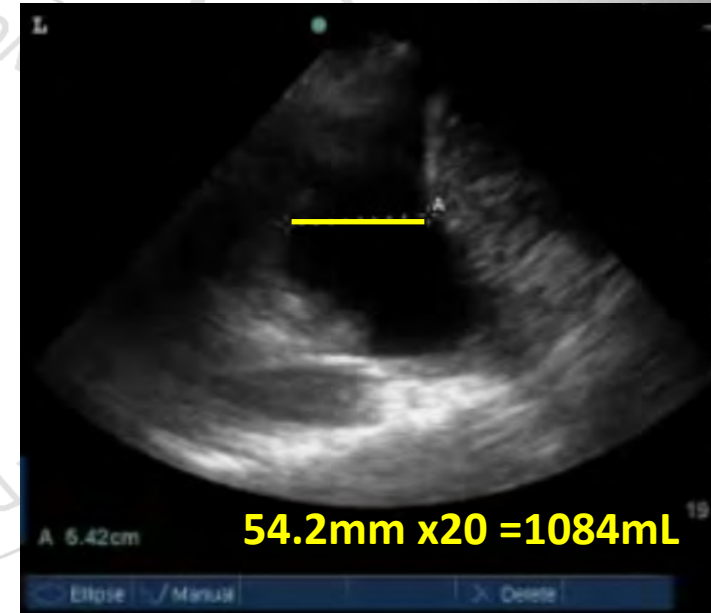


# PULMONAR

## Derrame pleural (evaluación)

- Valorar grado de Repercusión funcional
- Cuantificar ecográficamente

- Paciente en ventilación espontánea.
  - Eisenberger. (Dmax x 48 ) - 480
- Paciente en ventilación mecánica.
  - Balik. Dmax x 20
  - Roch. Dmax > 5 cm posterior : 500 ml



# ECOCARDIOGRAFÍA

## Transesofágica

Uso recomendado en cirugía cardíaca

Cirugía valvular, CEC, endocarditis, dispositivos intracardiacos....

## Transtorácica

Recurso infrautilizado

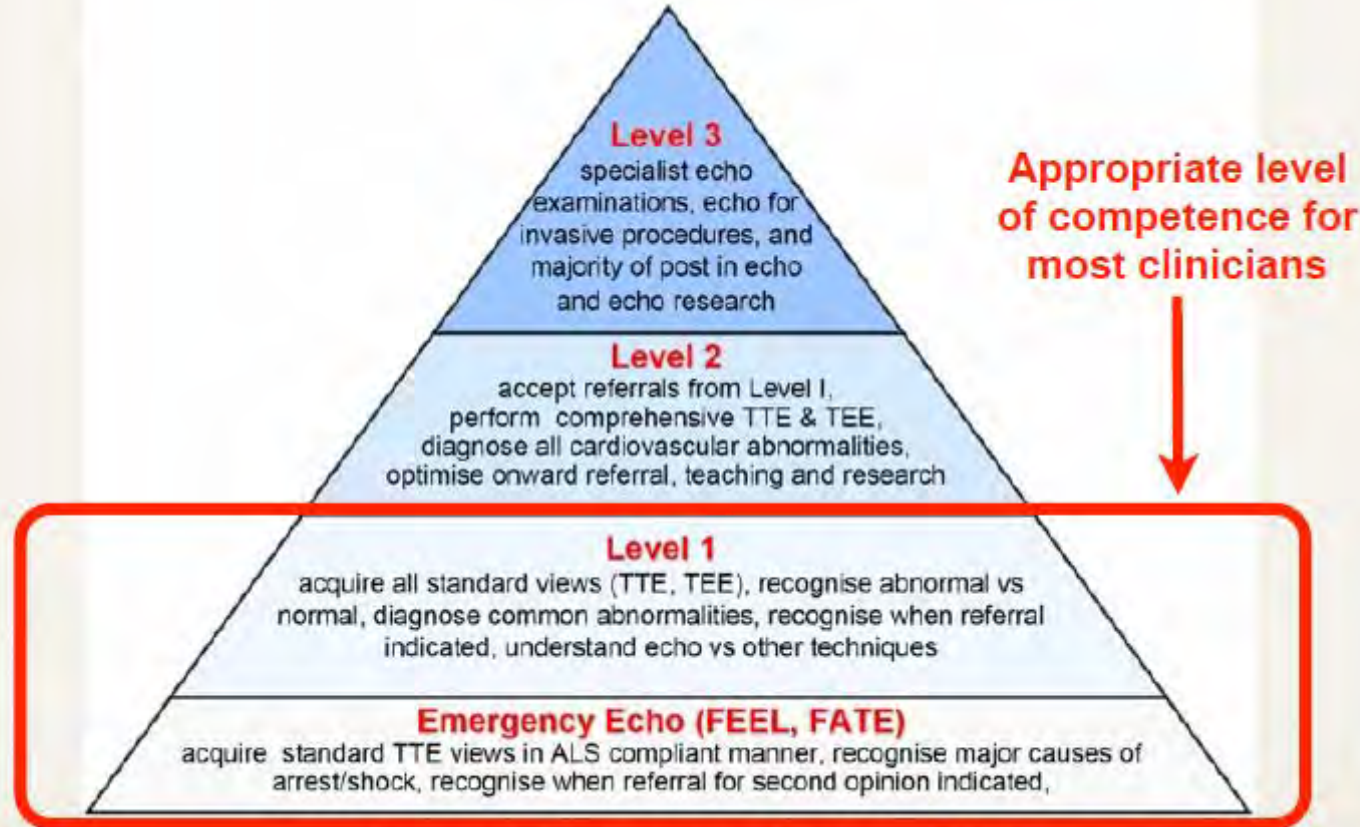




# ECOCARDIOGRAFÍA

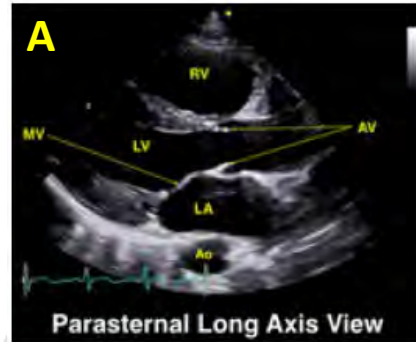
## Focused Cardiac Ultrasound (FoCUS)

- Se utiliza para profundizar y complementar la información obtenida en un contexto clínico
- ETT para diagnóstico
- Taponamiento
- Todas las aplicaciones Doppler



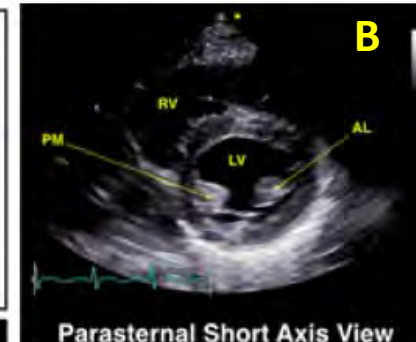
# ECOCARDIOGRAFÍA

## Focused Cardiac Ultrasound (FoCUS)

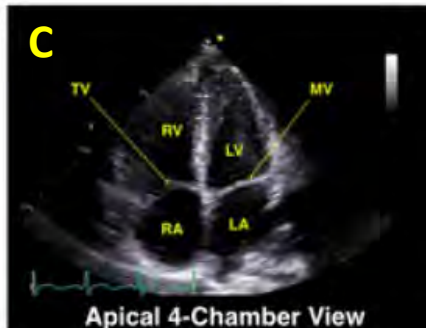


Parasternal Long Axis View

LV: Left Ventricle  
RV: Right Ventricle  
LA: Left Atrium  
RA: Right Atrium  
MV: Mitral Valve  
TV: Tricuspid Valve  
AV: Aortic Valve



Parasternal Short Axis View

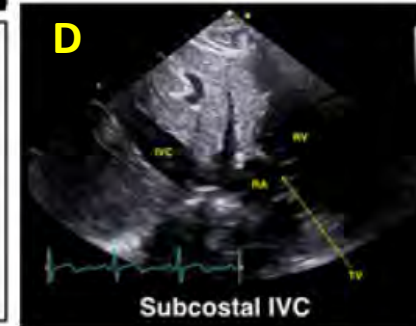


Apical 4-Chamber View

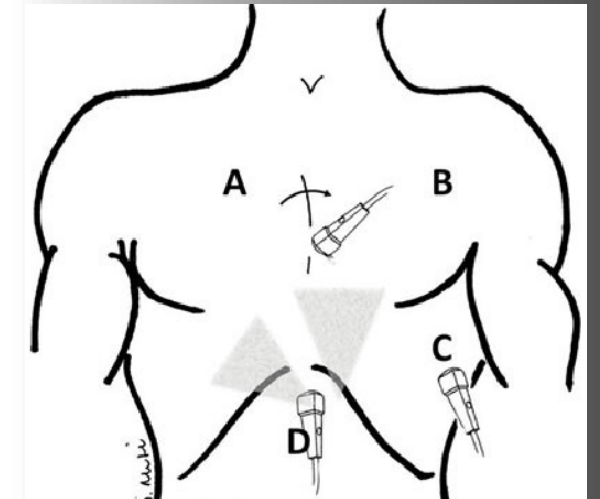


Subcostal Long Axis View

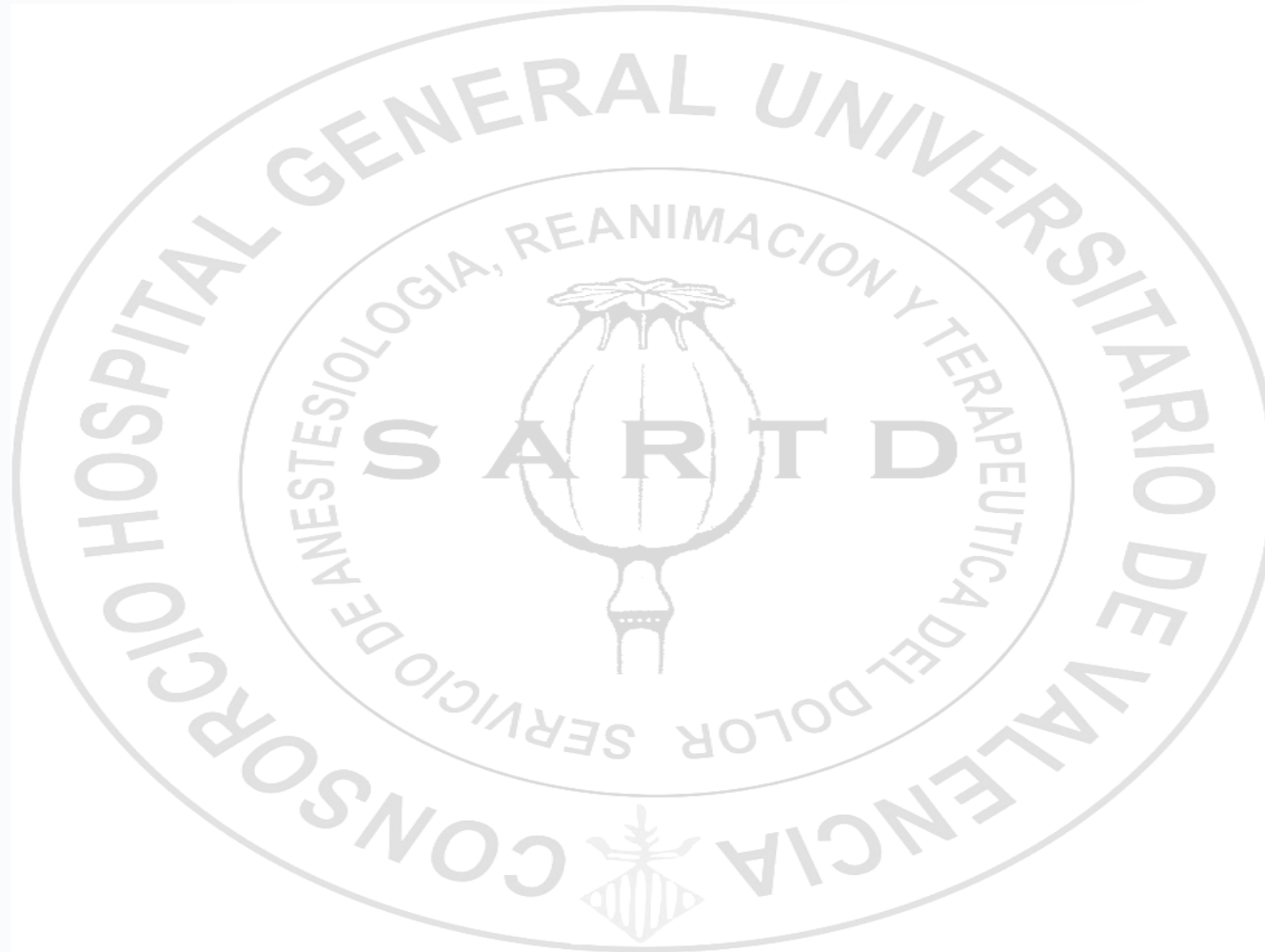
Ao: Descending Aorta  
PM: Posteromedial papillary muscle  
AL: Anterolateral papillary muscle  
IVC: Inferior vena cava



Subcostal IVC



# POCUS SHOCK



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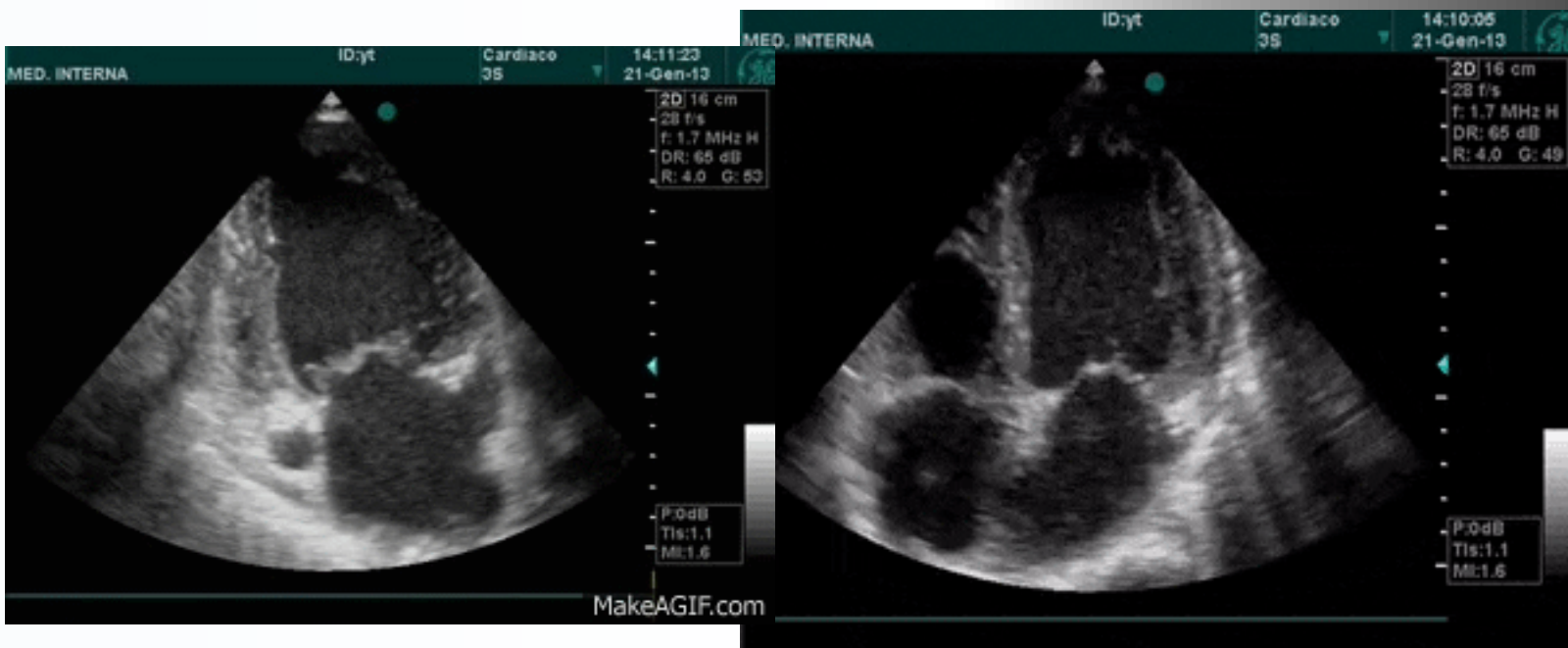
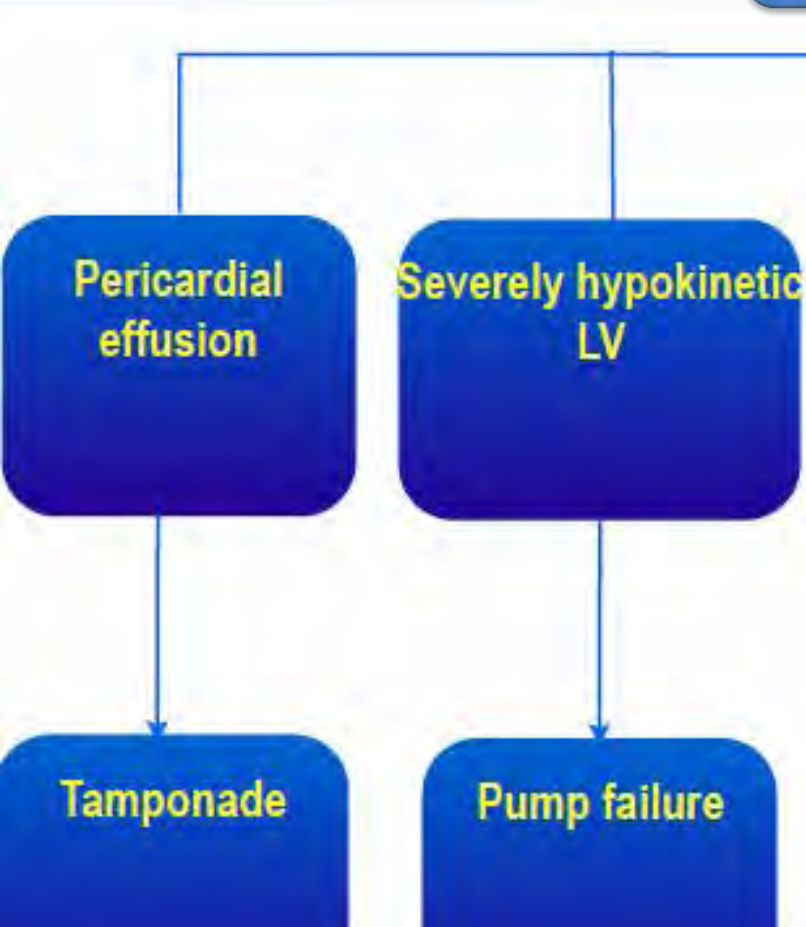
# POCUS SHOCK

Pericardial  
effusion

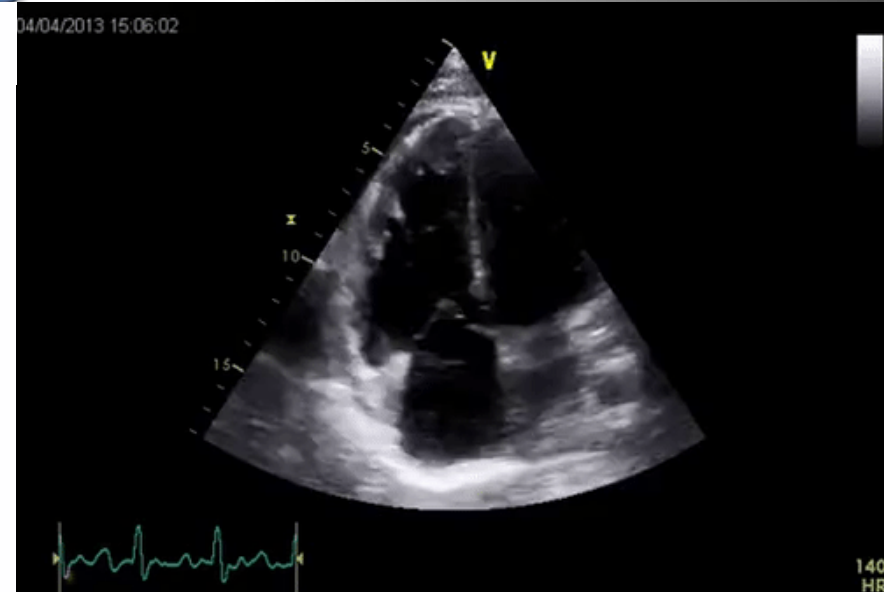
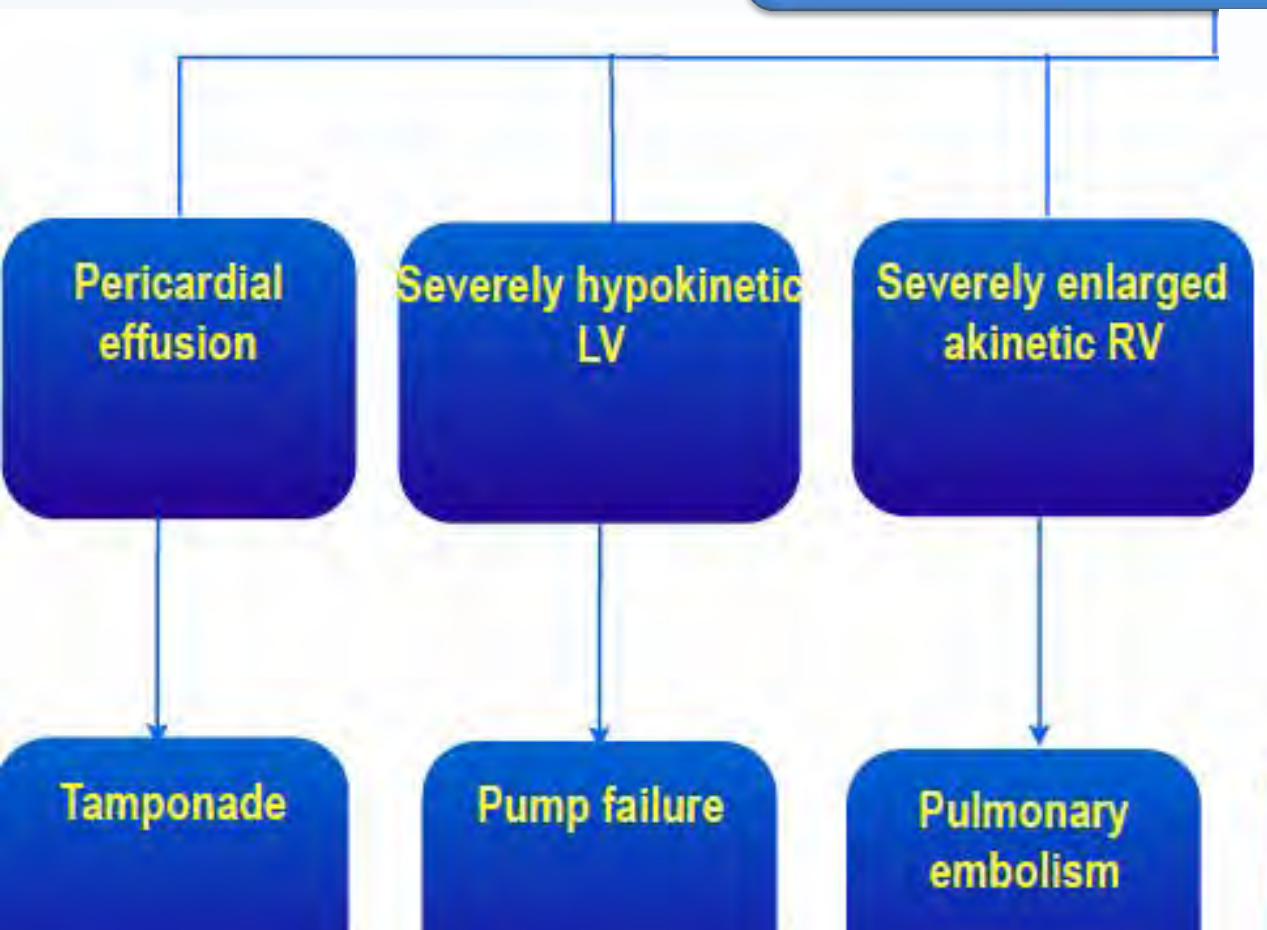
Tamponade



# POCUS SHOCK

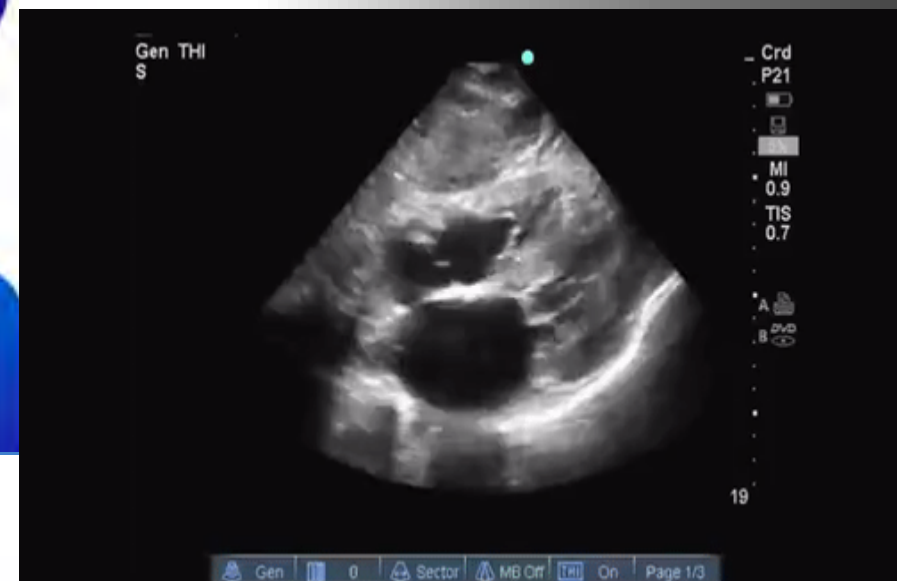
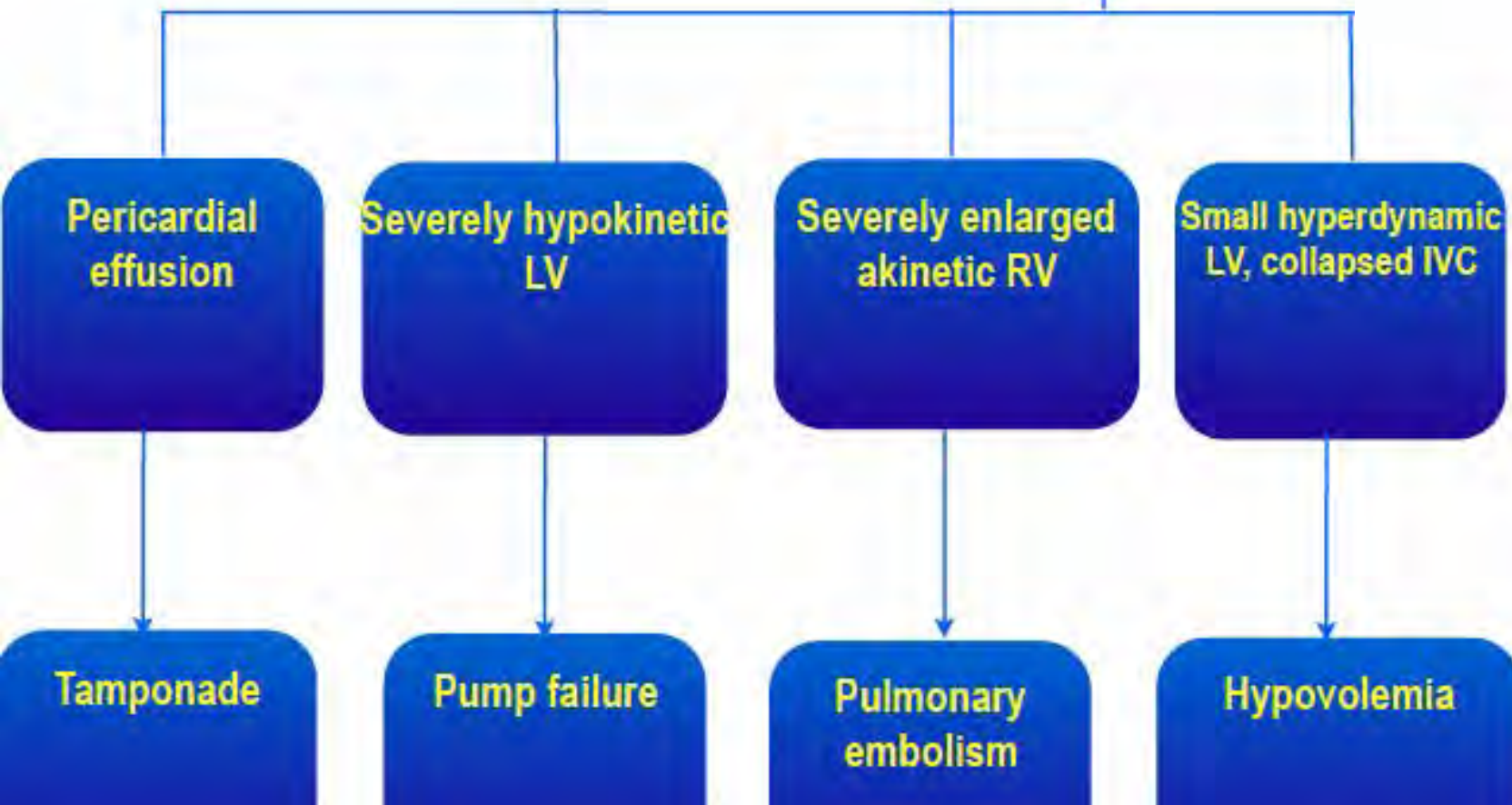


# POCUS SHOCK



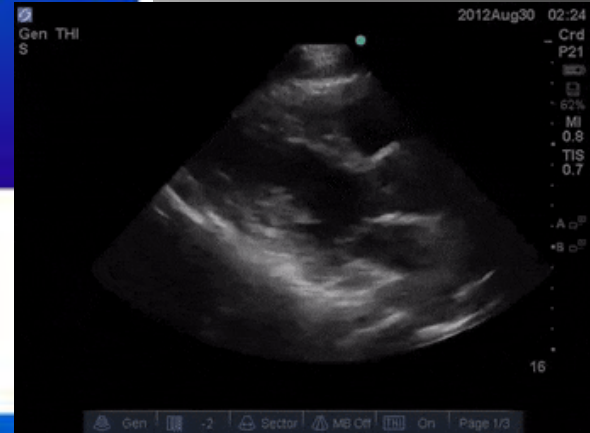
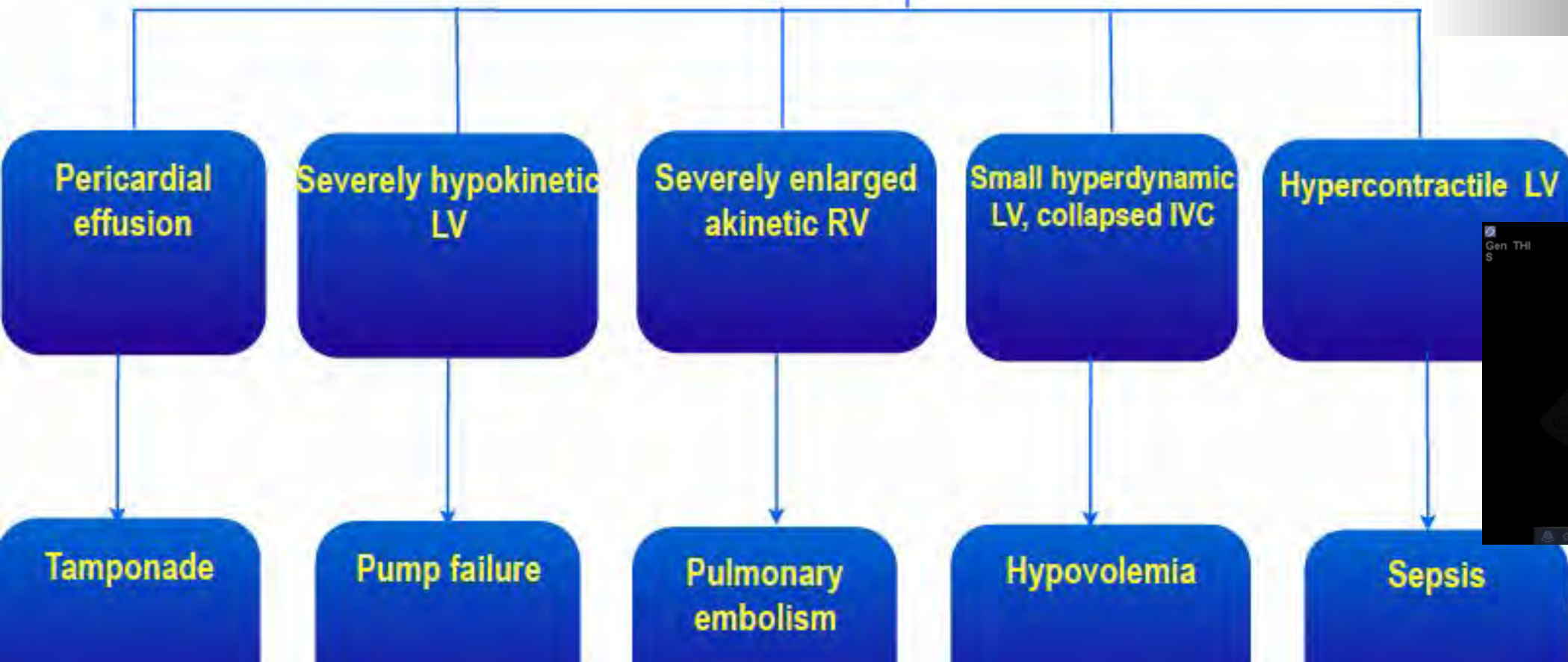


# POCUS SHOCK

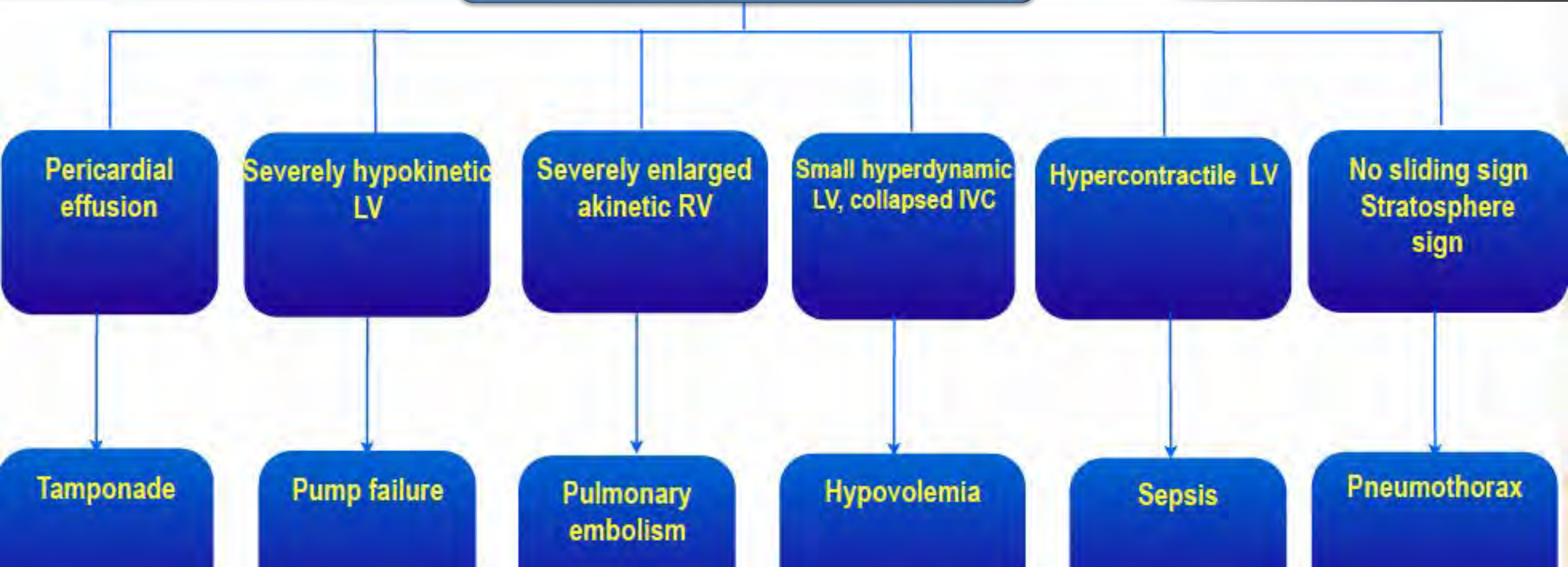




# POCUS SHOCK



# POCUS SHOCK






Perera, P., Mailhot, T., Riley, D., & Mandavia, D. (2010). The RUSH exam: Rapid Ultrasound in SHock in the evaluation of the critically ill. *Emergency Medicine Clinics*, 28(1), 29-56.

# RUSH Protocol

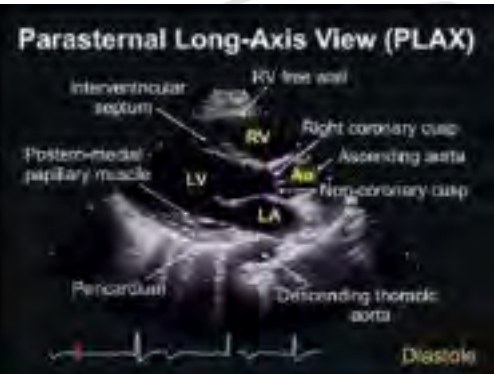
## Ultrasound Cheats

# 1. PUMP!

**PLAX**




**Parasternal Long-Axis View (PLAX)**

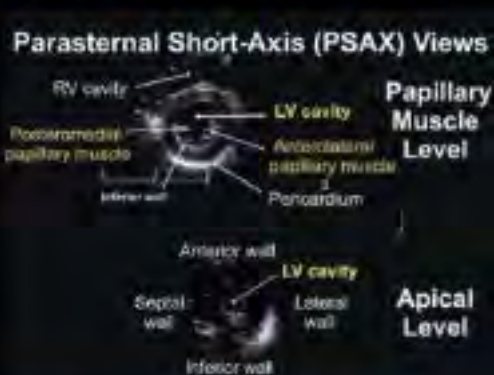


**Pericardium - Tamponade / Effusion?**

**PSAX**

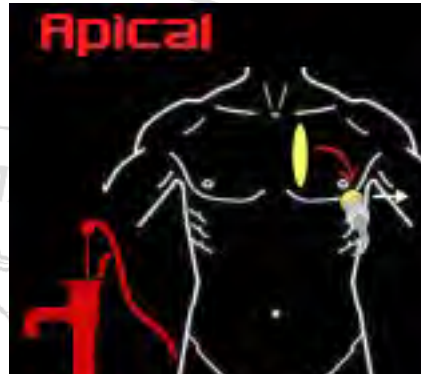


**Parasternal Short-Axis (PSAX) Views**

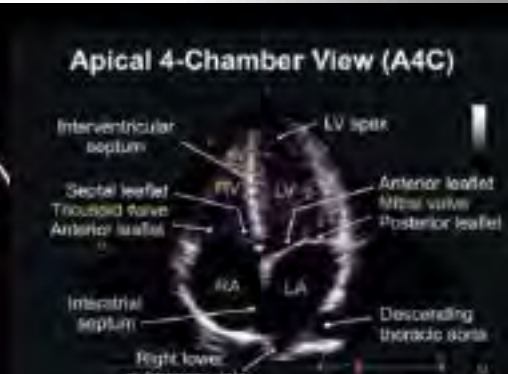


**LV size - Failure / Cardiogenic shock?**

**Apical**




**Apical 4-Chamber View (A4C)**

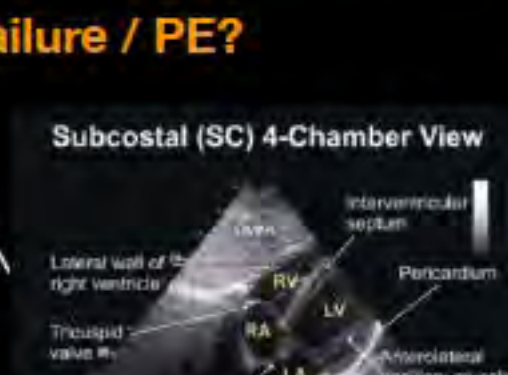


**RV size - Failure / PE?**

**Subcost**



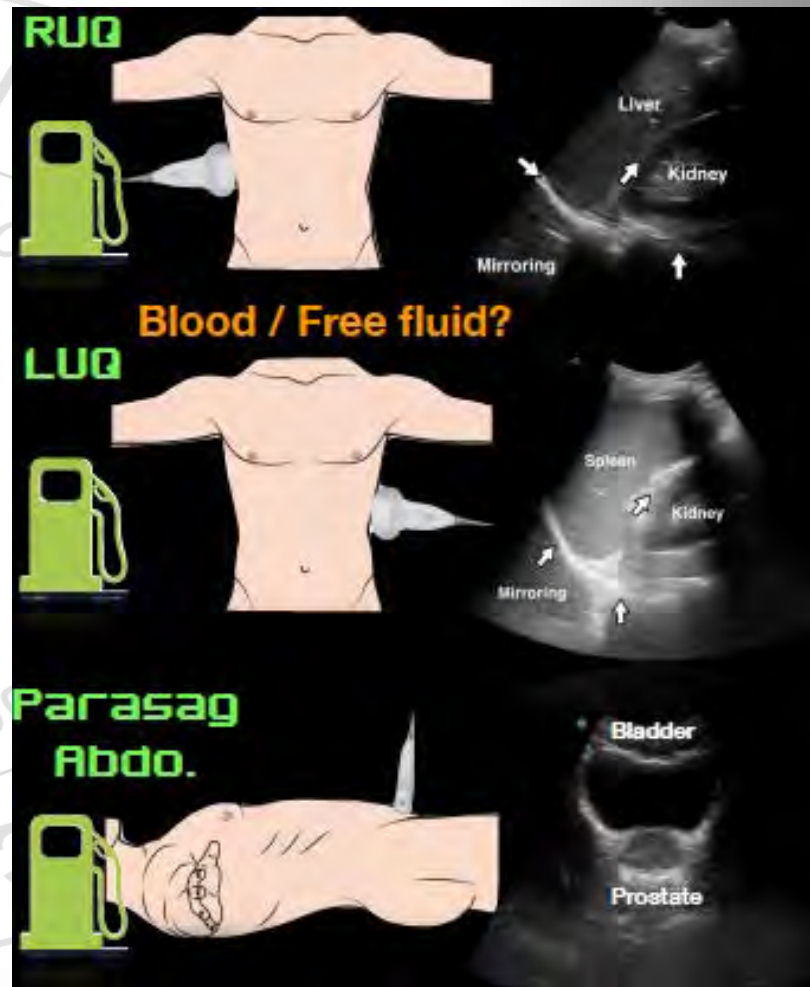
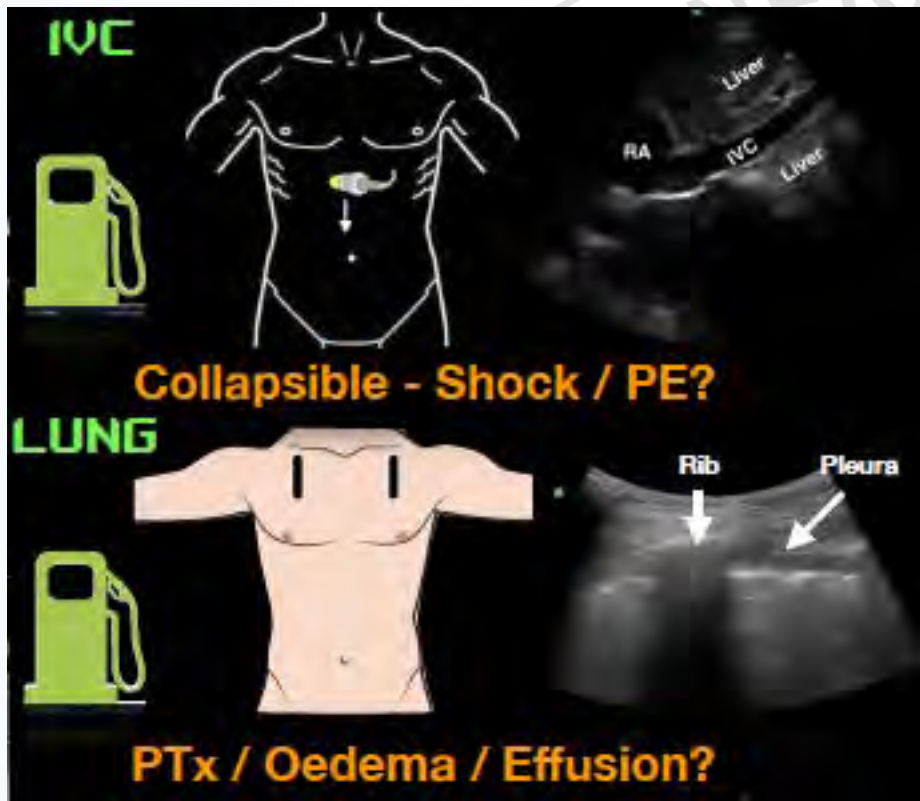
**Subcostal (SC) 4-Chamber View**




# RUSH Protocol

Ultrasound Cheats

## 2. TANK!

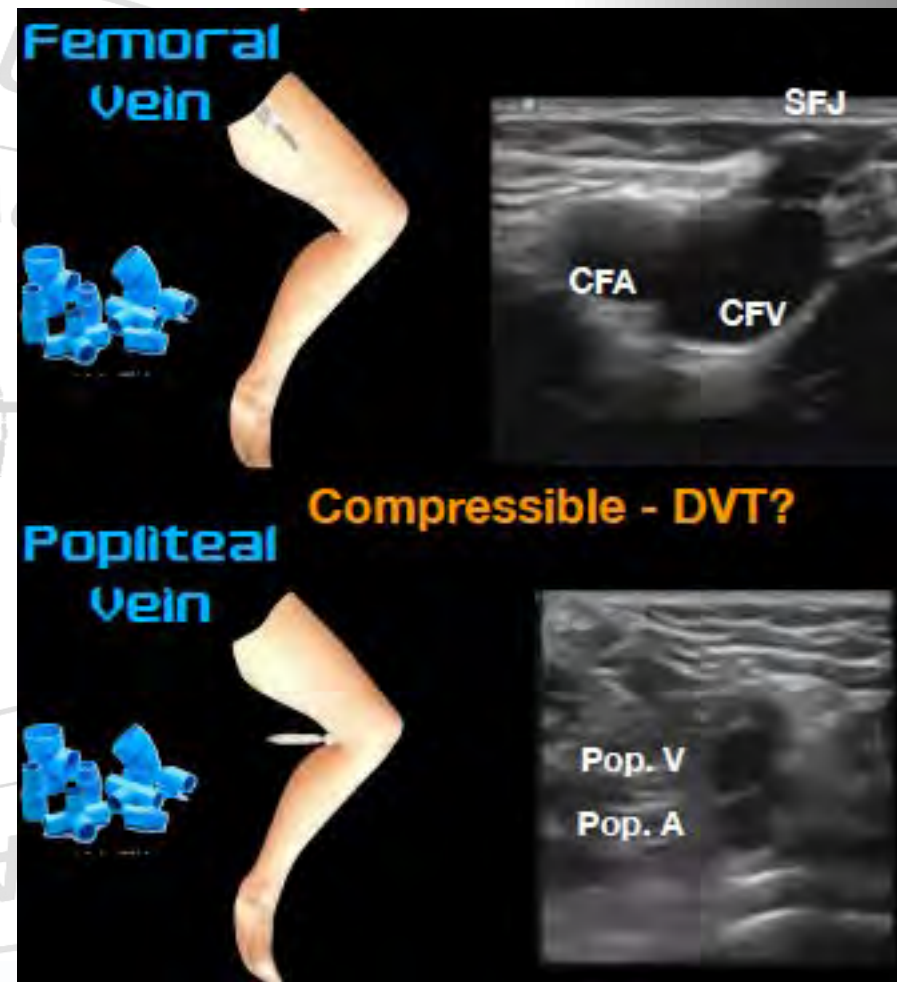
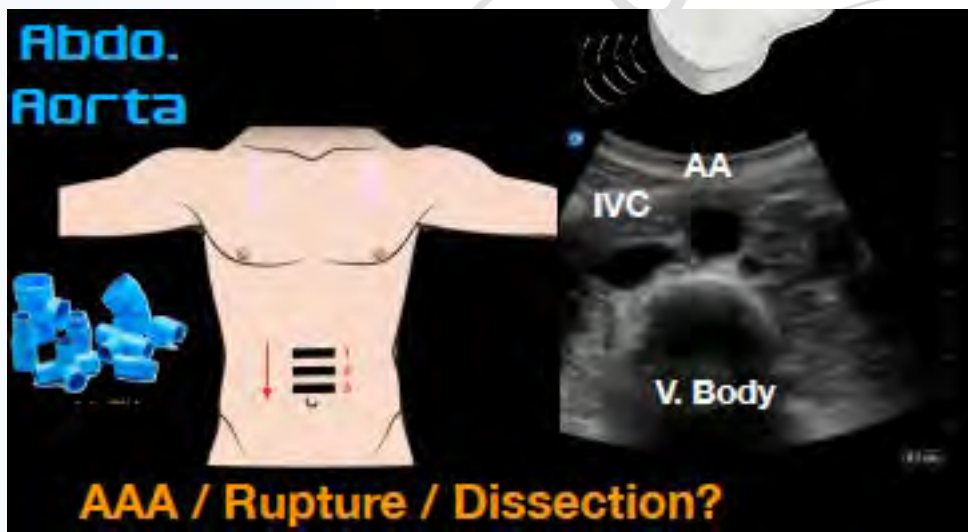




# RUSH Protocol

Ultrasound Cheats

## 3. PIPES!



The  
**BLUE**  
protocol

## Focus Assessed Transthoracic Echo (FATE)

(European Journal of Anaesthesiology 2004; 21: 700-707)

# FoCUS

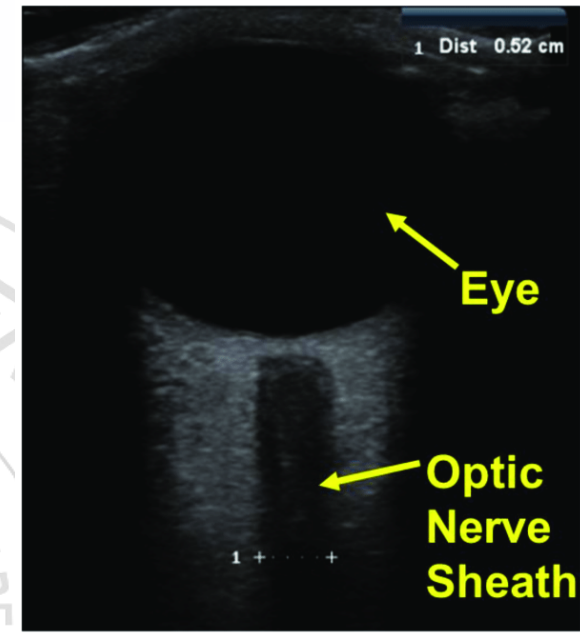
**RUSH**  
**Protocol**  
Ultrasound Cheats

**Eco Fast**



# OTROS ESCENARIOS

## Nervio óptico



Sonography of the Optic Nerve Sheath Diameter for Detection of Raised Intracranial Pressure Compared to Computed Tomography

A Systematic Review and Meta-analysis

Robert Ohle, MD, Sarah M. McIsaac, MD, Michael Y. Woo, MD, Jeffrey J. Perry, MD, MSc

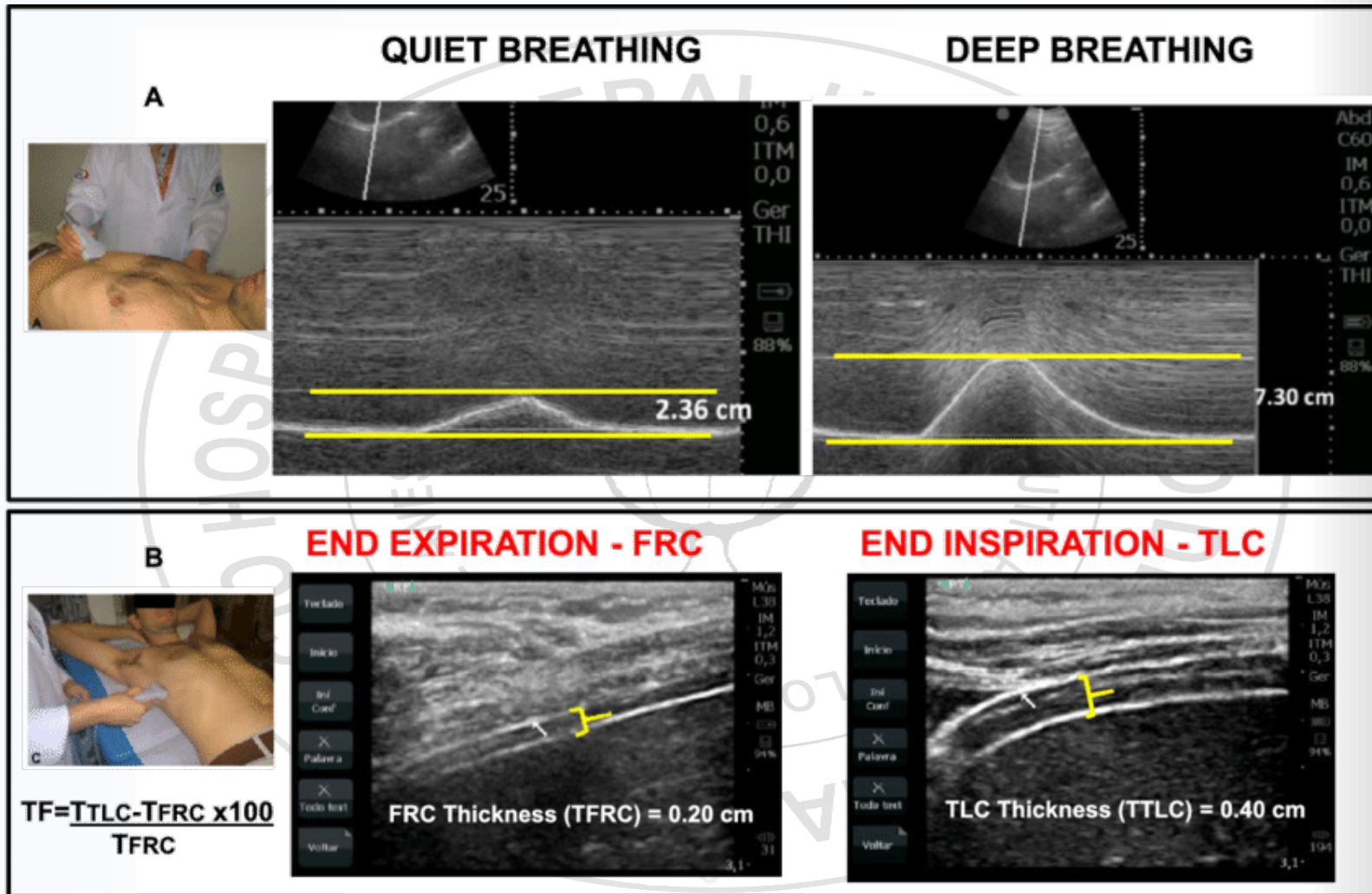


Increased Intracranial Pressure	
Optic Nerve Sheath Diameter > 5mm	
Sensitivity	95
Specificity	92
Positive LR	12.4
Negative LR	0.05



# OTROS ESCENARIOS

## Diafragma





# OTROS ESCENARIOS

## Diafragma

Permite confirmar o descartar una parálisis  
yatrógena por lesión o por bloqueo del nervio  
frénico.

Podría prevenir complicaciones postoperatorias  
valorando la capacidad funcional del contralateral  
en cirugías en las que se realice un ISB o SCB.

*Rev Esp Anesthesiol Reanim.* 2018 Dec;65(10):593-596. doi: 10.1016/j.redar.2018.05.008. Epub 2018 Jul 19.

**Usefulness of diaphragmatic ultrasound in the early diagnosis of phrenic nerve palsy after shoulder surgery in the prevention of post-operative respiratory complications.**

[Article in English, Spanish]

Kot Baixauli P<sup>1</sup>, Rodriguez Gimillo P<sup>2</sup>, Baldo Gosálvez J<sup>2</sup>, de Andrés Ibáñez J<sup>2</sup>.

*J Cardiothorac Vasc Anesth.* 2018 Dec;32(6):e7-e8. doi: 10.1053/j.jvca.2018.06.024. Epub 2018 Jul 3.

**Diaphragmatic Ultrasound: Early Diagnosis When Phrenic Injury in Thoracic Surgery Is Suspected.**

Kot P<sup>1</sup>, Granell M<sup>1</sup>, Rodriguez P<sup>1</sup>, Rovira L<sup>1</sup>, De Andrés J<sup>1</sup>.



**Diaphragm ultrasound as a predictor of patients at risk of pulmonary postoperative complications after phrenic nerve compromise**

Rovira Soriano L<sup>1</sup>, Kot P<sup>1</sup>, Leon I<sup>1</sup>, Hernandez J<sup>1</sup>, Pozo S. <sup>1</sup>, De Andres J<sup>1</sup>

<sup>1</sup>Hospital General Universitario de Valencia - Valencia (Spain)



# OTROS ESCENARIOS

Can J Anesth/Can Anesth (2017) 64:489–496  
DOI 10.1007/s12630-017-0819-y



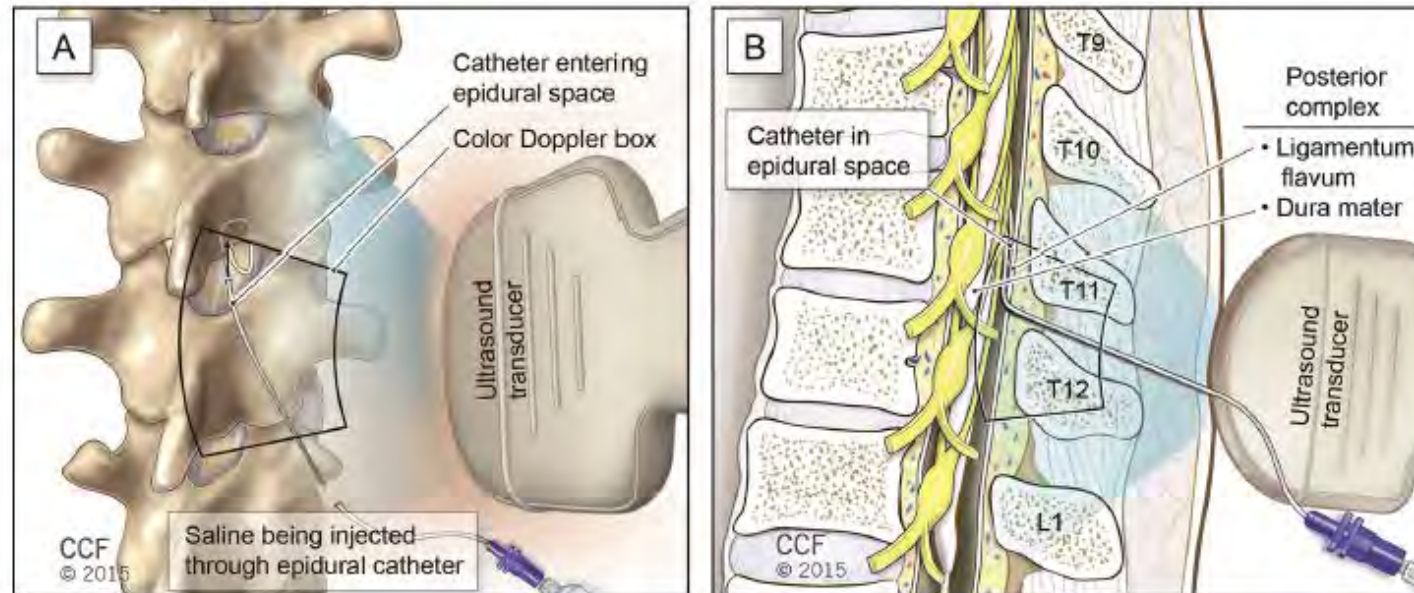
## Epidural

REPORTS OF ORIGINAL INVESTIGATIONS

Use of colour Doppler and M-mode ultrasonography to confirm the location of an epidural catheter - a retrospective case series  
L'utilisation du Doppler couleur et de l'échographie en mode M afin de confirmer l'emplacement d'un cathéter péridural – une série de cas rétrospective

Hesham Elsharkawy, MD, MSc · Abraham Sonny, MD ·  
Srinivasa Raghavan Govindarajan, MD · Vincent Chan, MD, FRCPC, FRCA

Received: 25 May 2016 / Revised: 27 November 2016 / Accepted: 4 January 2017 / Published online: 10 January 2017  
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# OTROS ESCENARIOS

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## Epidural

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# OTROS ESCENARIOS

## RCP



Contents lists available at ScienceDirect

# Resuscitation

journal homepage: [www.elsevier.com/locate/resuscitation](http://www.elsevier.com/locate/resuscitation)

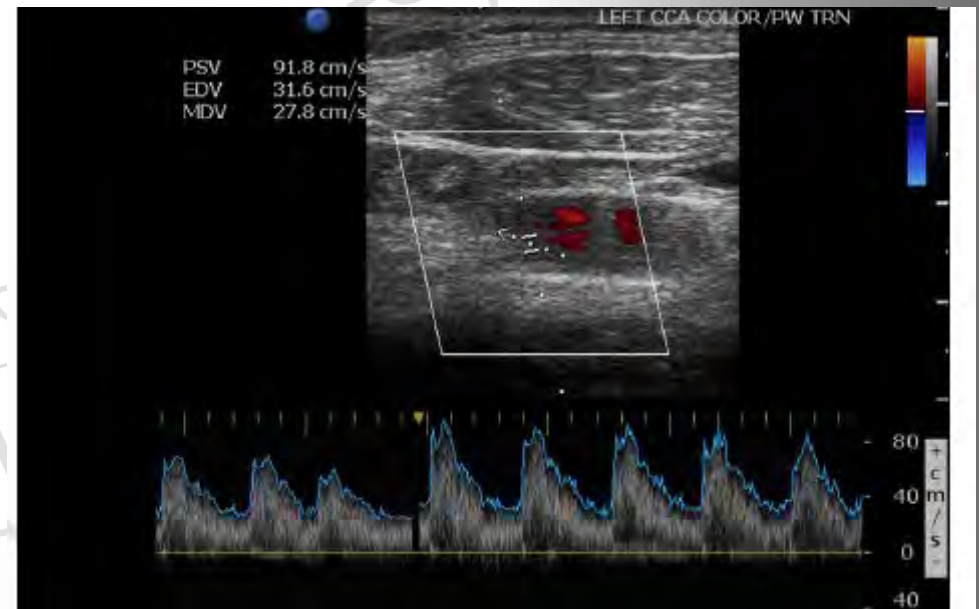


Clinical paper

### Carotid Doppler blood flow measurement during cardiopulmonary resuscitation is feasible: A first in man study<sup>☆</sup>

Adeyinka A. Adedipe<sup>a,b,\*</sup>, Deborah L. Fly<sup>b</sup>, Scott D. Schwitz<sup>a</sup>, Dawn B. Jorgenson<sup>c</sup>, Haris Duric<sup>c</sup>, Michael R. Sayre<sup>a,b</sup>, Graham Nichol<sup>a,b</sup>

La ecografía podría reducir el tiempo en confirmar o descartar presencia de pulso en una RCP con mayor certeza que la palpación





# CASO 1

Varón 42 años.

AP: Sd Down severo (institucionalizado)

Fractura de cadera tras caída en la residencia

Programado como urgencia diferida para clavo gamma

Entra al quirófano con leve taquipnea.

Se monitoriza y se objetiva SpO2 84% AA



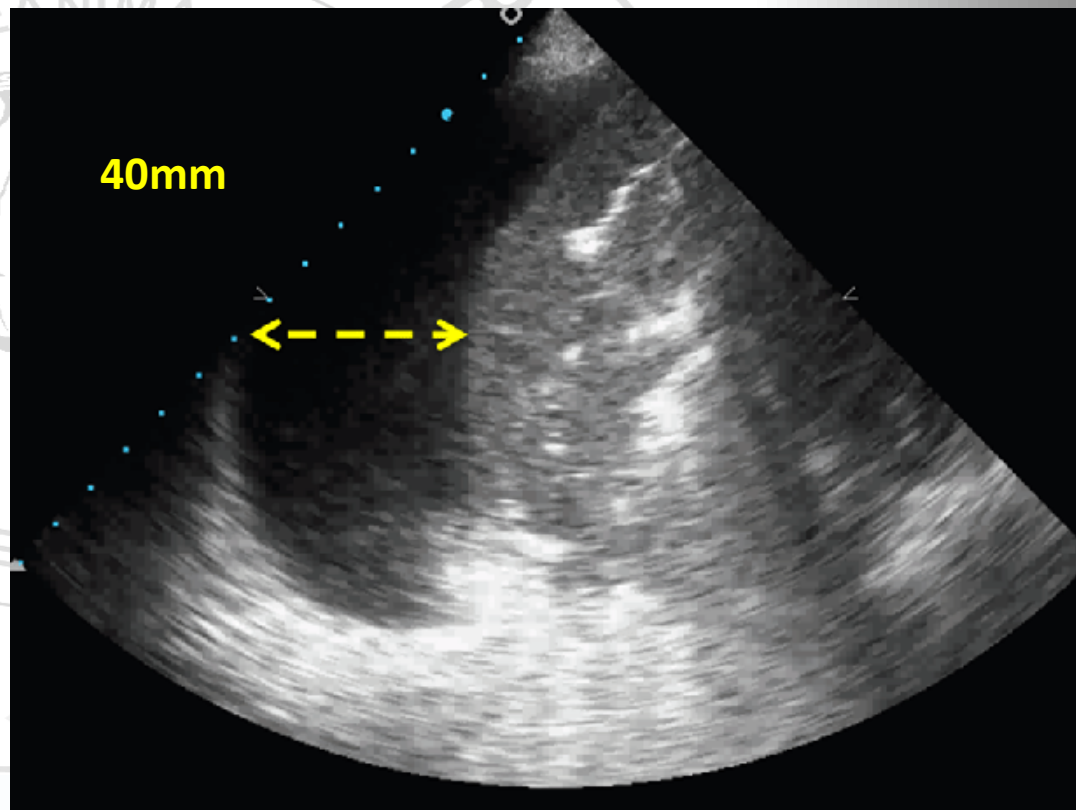
# CASO 1

Ante la situación clínica realizamos POCUS cardiopulmonar

FoCUS cardiaco NORMAL

Pulmón NORMAL

Medición estimada 800cc



# CASO 1

POCUS nos permitió:

- Diagnosticar el DP como causa de la hipoxemia
- Cuantificarlo y decidir realizar drenaje
- Guiar la punción

Tras la toracocentesis y colocación del tubo de drenaje mejoró la clínica y la saturación





## CASO 2

Varón de 38 años

AP: Fumador 5 cig/día

Sd subacromial izdo

Programado para artroscopia de hombro izdo

Ctes: SpO2 98% AA - FC 63 lpm - TA 132/82 mmHg

Preanestesia: AS OK, ECG OK, No realizada RX



## CASO 2

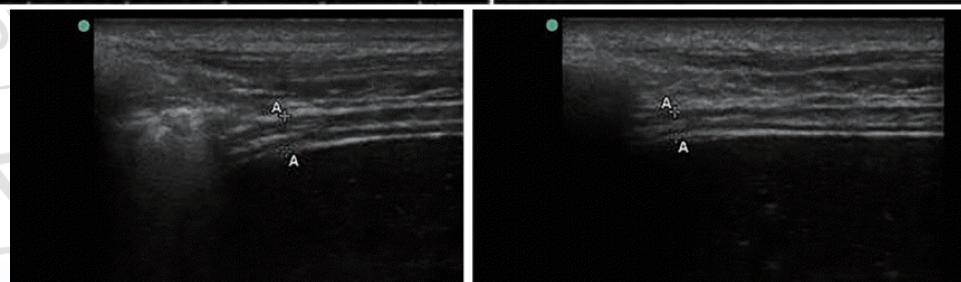
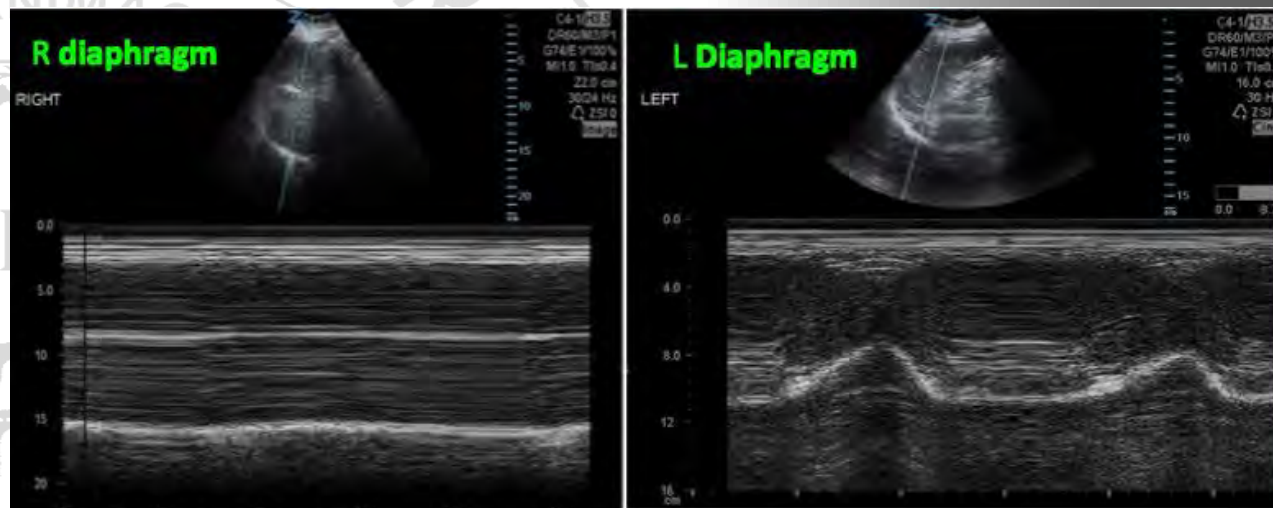
Entramos el ecógrafo al Qx para realizar ISB

Antes hacemos POCUS diafragmático

ED < 10 mm

FA < 10%

Disfunción diafragmática  
contralateral significativa

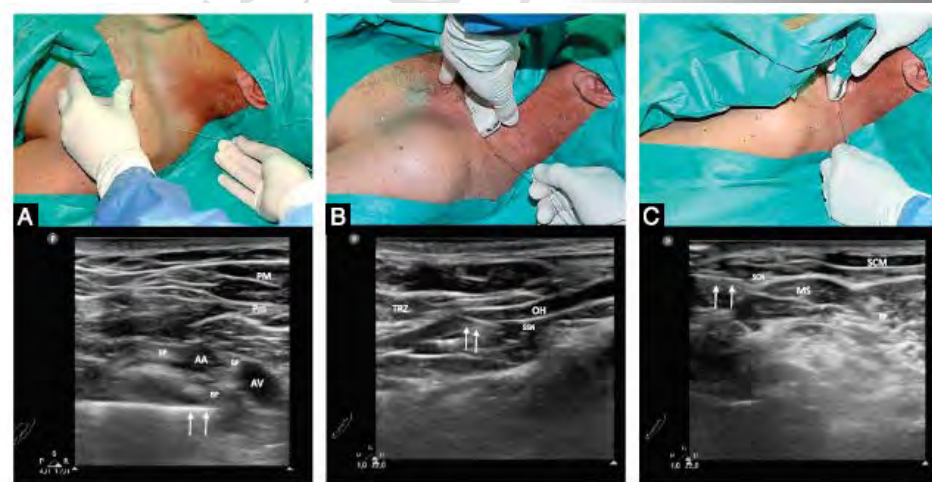


## CASO 2

POCUS nos permitió:

- Diagnosticar una disfunción diafrmática no conocida
- Elegir un bloqueo “ahorrador del diafragma” para evitar posibles complicaciones respiratoria postoperatorias

Realizamos un bloqueo combinado retroclavicular para analgesia, transcurriendo el proceso quirúrgico sin incidencias



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# CONCLUSIONES

POCUS utilizado por el anestesista permite guiar múltiples procedimientos así como responder preguntas que incidirán en la conducta de manejo del paciente.

Es necesaria la practica frecuente de los procedimientos para optimizar los resultados.

La evolución de la ecografía POCUS está siendo tan relevante que en muchos países se describe como competencia central en la formación de residentes, además del desarrollo de múltiples programas formativos al respecto.



# CONCLUSIONES

Desde avances como la pulsioximetría, la capnografía y los dispositivos de evaluación del gasto cardíaco, los anestesiólogos han cambiado constantemente los estándares de atención utilizando la tecnología para mejorar la seguridad del paciente. Ya es hora de que nuestra especialidad haga lo mismo con POCUS.



# CONCLUSIONES



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