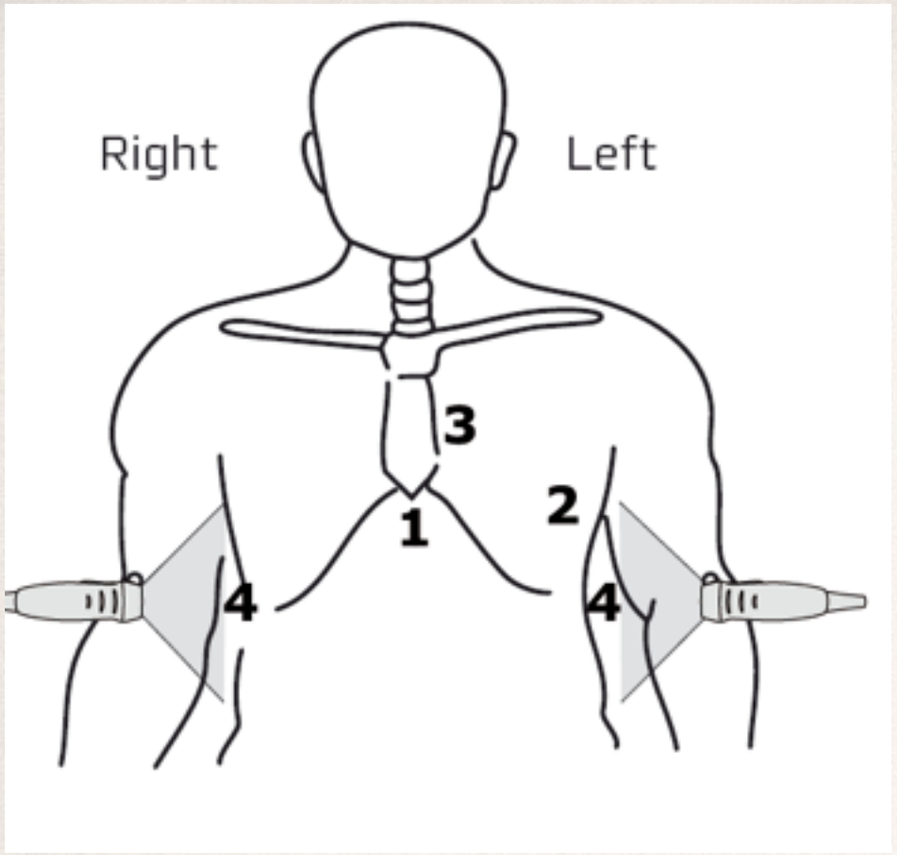

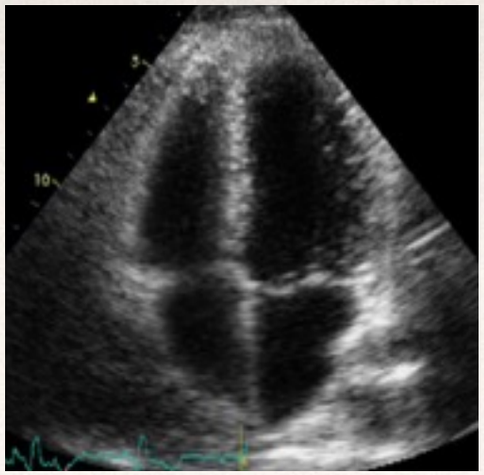

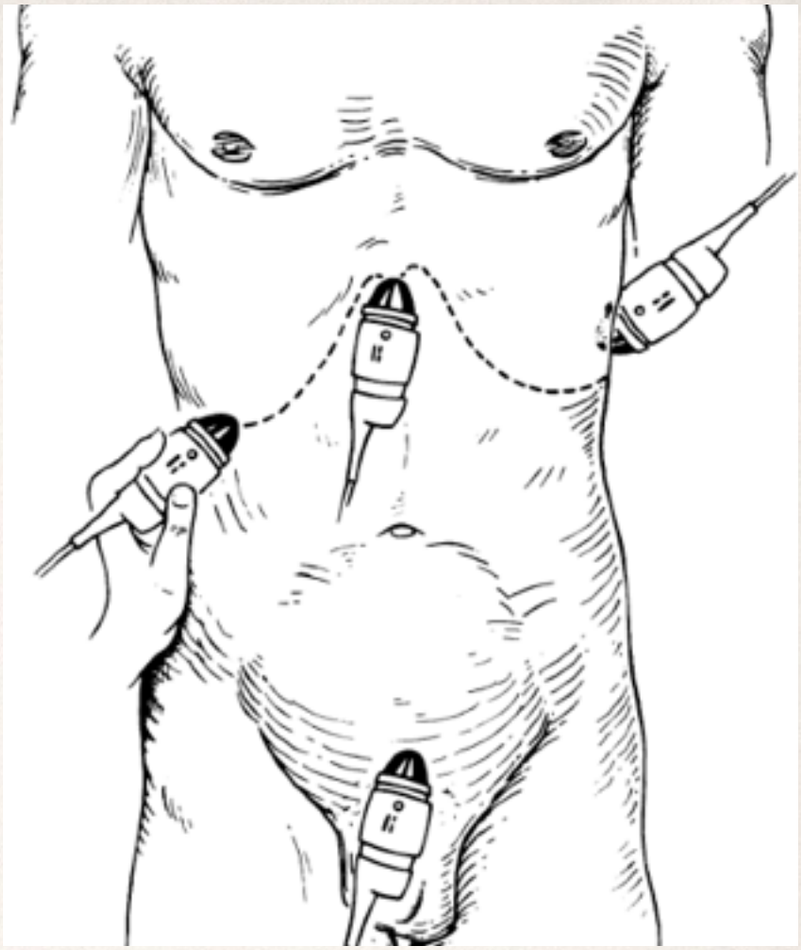

Ultrasound in Shock

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HARVARD MEDICAL SCHOOL TEACHING HOSPITAL

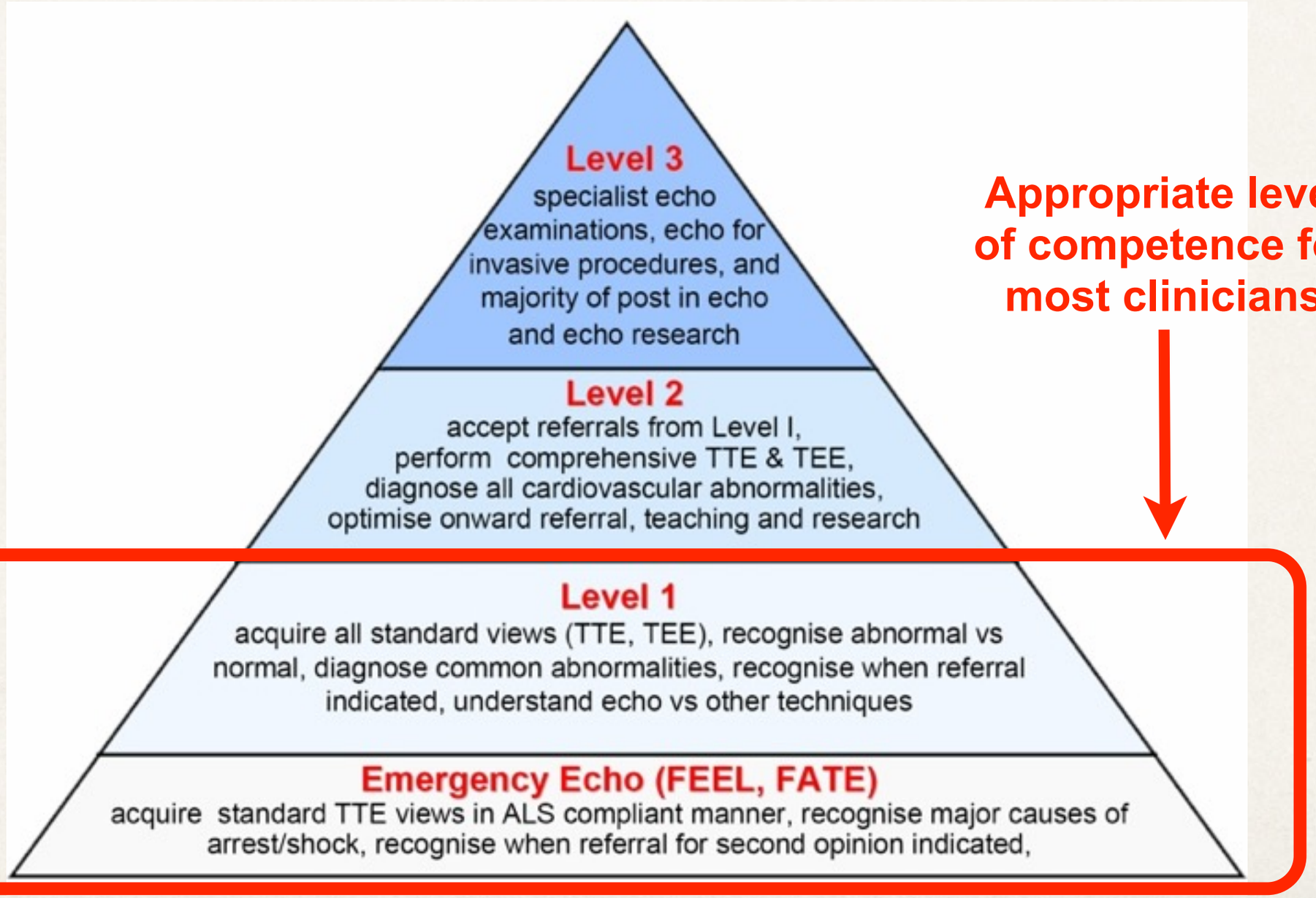
2017 Shock Symposium - The Latest in Resuscitation and Critical Care

May 5th, 2017

Objectives

- Define “Focused Ultrasound” and rationale for use in practice
- Review FATE / FAST / FEEL exams
- Review a diagnostic algorithm for Ultrasound in shock
- Present real clinical case examples

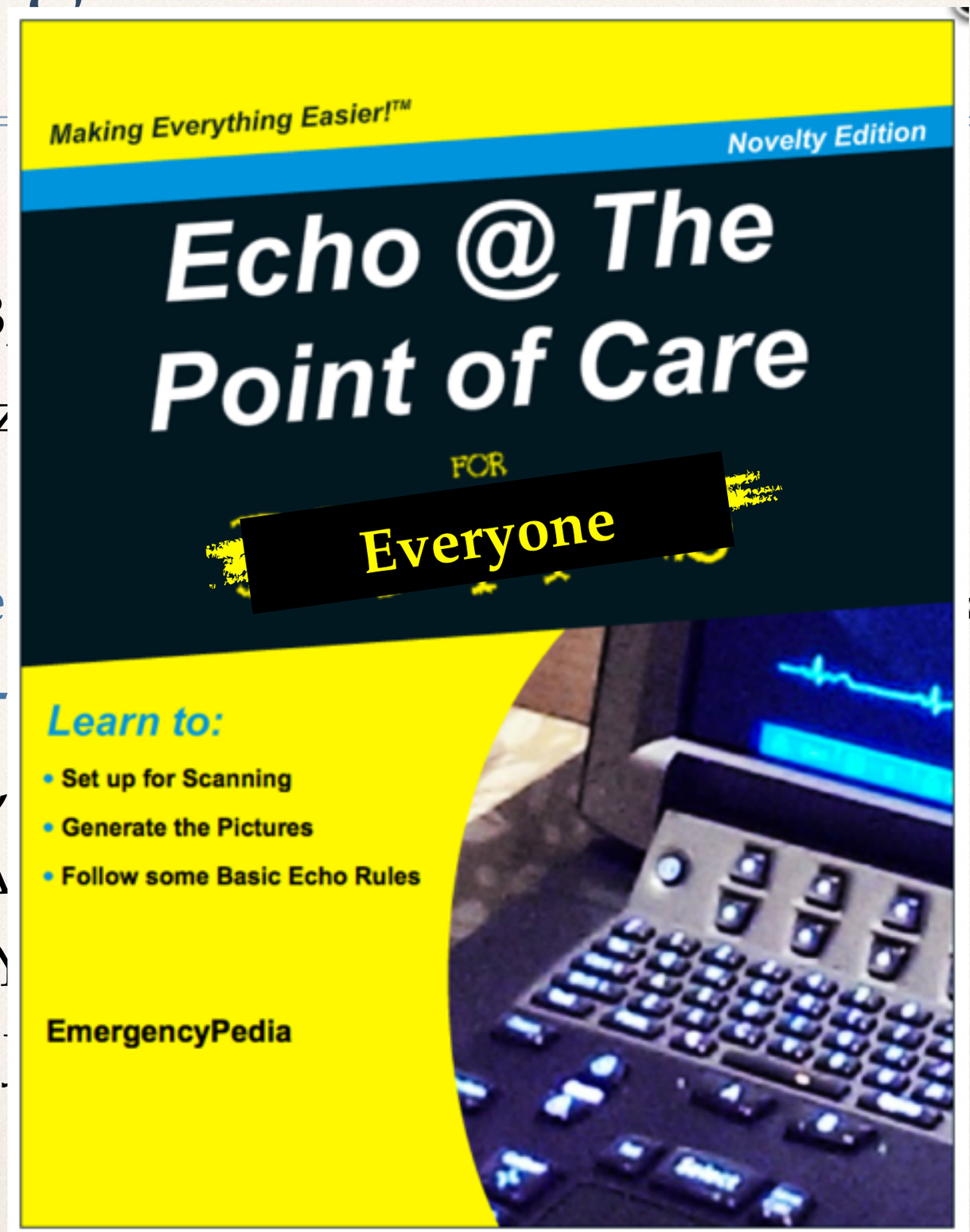
Focused Ultrasound - Levels



Price et al. Cardiovascular Ultrasound 2008

The name game…

- **FATE** (Jensen MB
- **FEEL** (Breitkreutz
- **BLEEP** (Pershad J,
- **Goal-directed limite** c Anesth 2005)
- **Goal-oriented hand-** Med 2007)
- **CLUE** (Kimura B,
- **RACE** (McLean A
- **FOCUS** (Beaulieu Y
- **BEAT** (Gunst M,



FATE - What is it?

FATE - Rationale

- Basic cardiac ultrasound can augment other clinical skills

- Invasive monitors (e.g. Swanz-Ganz catheters) have not been shown to improve outcome

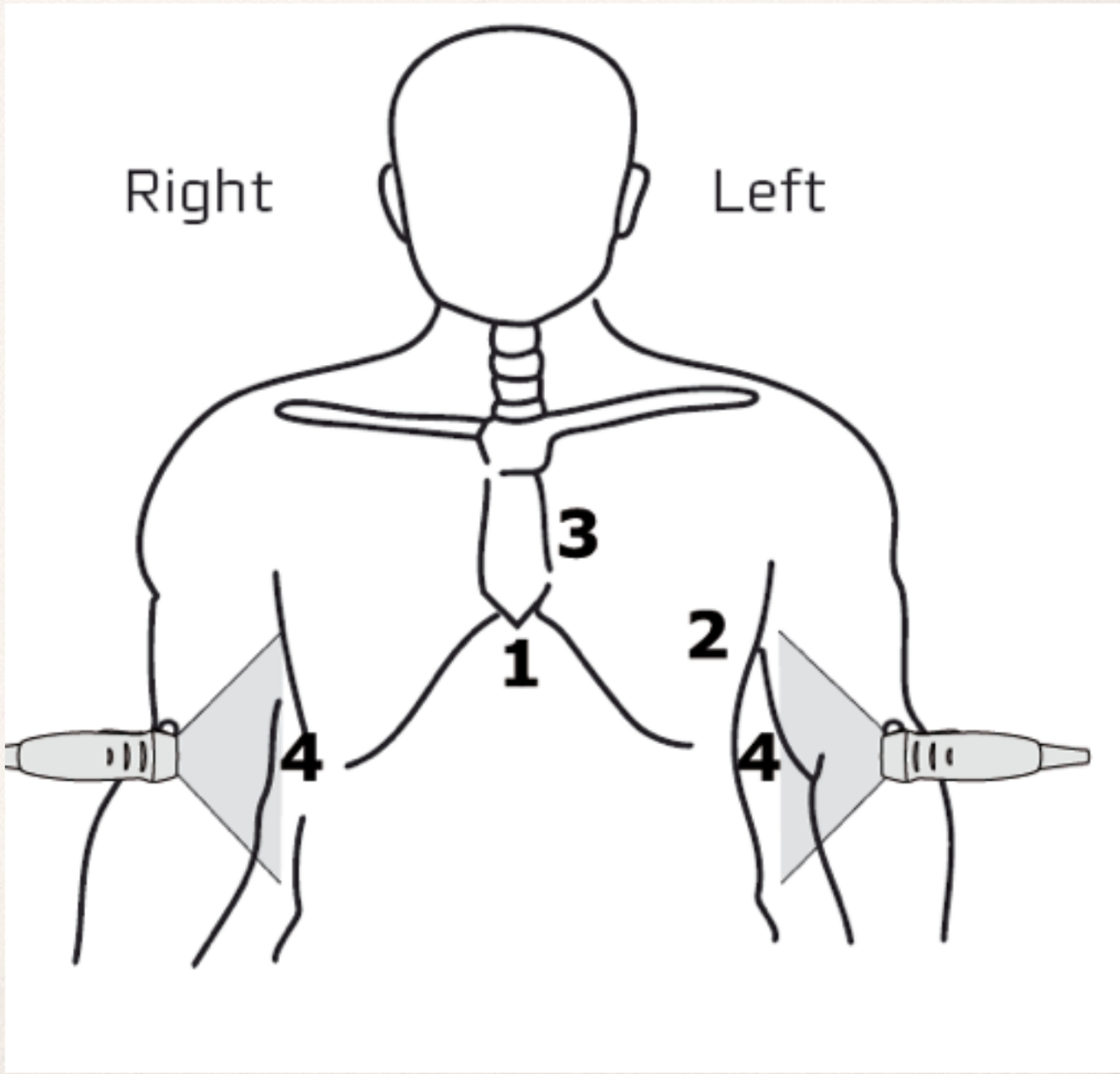
- Ultrasound echo machines are more feasible and portable for use by clinicians at the bedside

- Indicated in any patient with hemodynamic instability or shock.

FATE - Windows

Four Standard Windows:

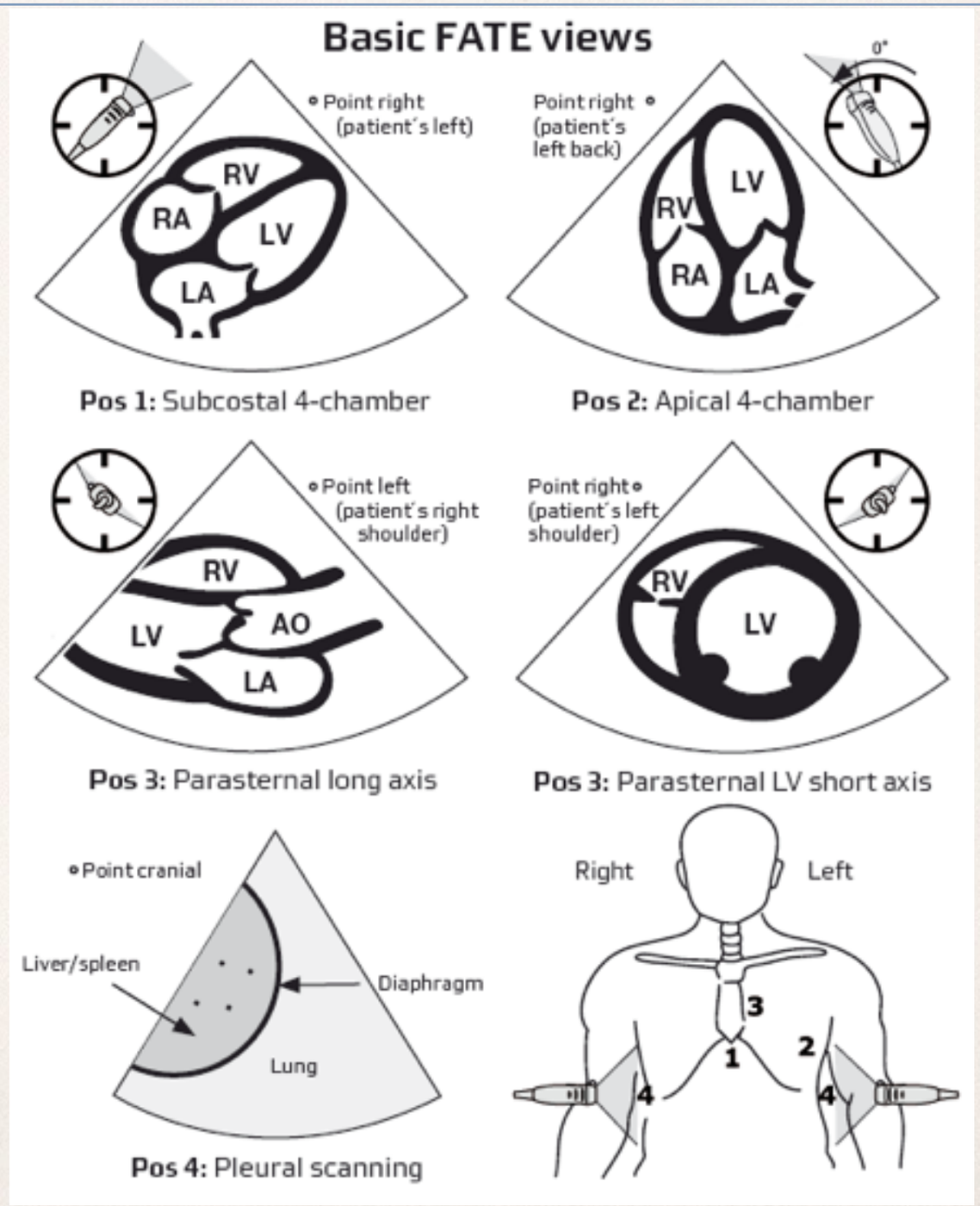
- 1. Subcostal
- 2. Apical
- 3. Para-sternal
  (Long and Short Axis)
- 4. Pleural
  (Left and Right)



FATE - Views

BASIC Views

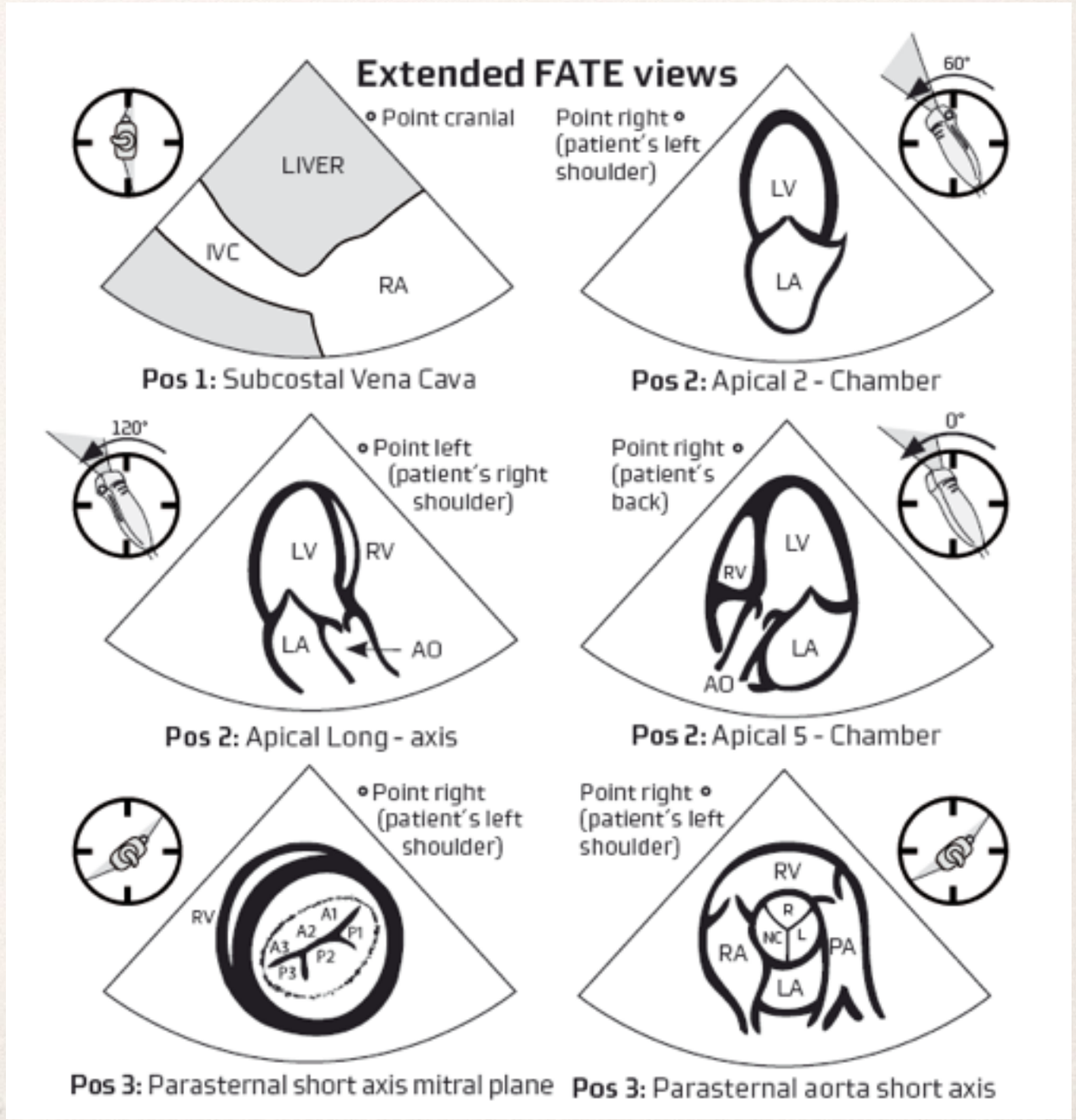
- 1. Subcostal 4-ch
- 2. Apical 4-ch
- 3. Para-sternal
  (Long and Short Axis-mid pap)
- 4. Pleural
  (Left and Right)



FATE - Views

EXTENDED Views

- 1. Subcostal - IVC
- 2. Apical 2 and 3-ch
- 3. Para-sternal
  (Short Axis-mitral and aortic)



FATE - Goals

Focus Assessed Transthoracic Echo (FATE)

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

1. Look for obvious pathology
2. Assess wall thickness + chamber dimensions
3. Assess bi - ventricular function
4. Image pleura on both sides
5. Relate the information to the clinical context
6. Apply additional ultrasound

FATE - Validation

European Journal of Anaesthesiology 2004; **21**: 700–707

ISSN 0265-0215

Original Article

Transthoracic echocardiography for cardiopulmonary monitoring in intensive care

M. B. Jensen, E. Sloth, K. M. Larsen, M. B. Schmidt

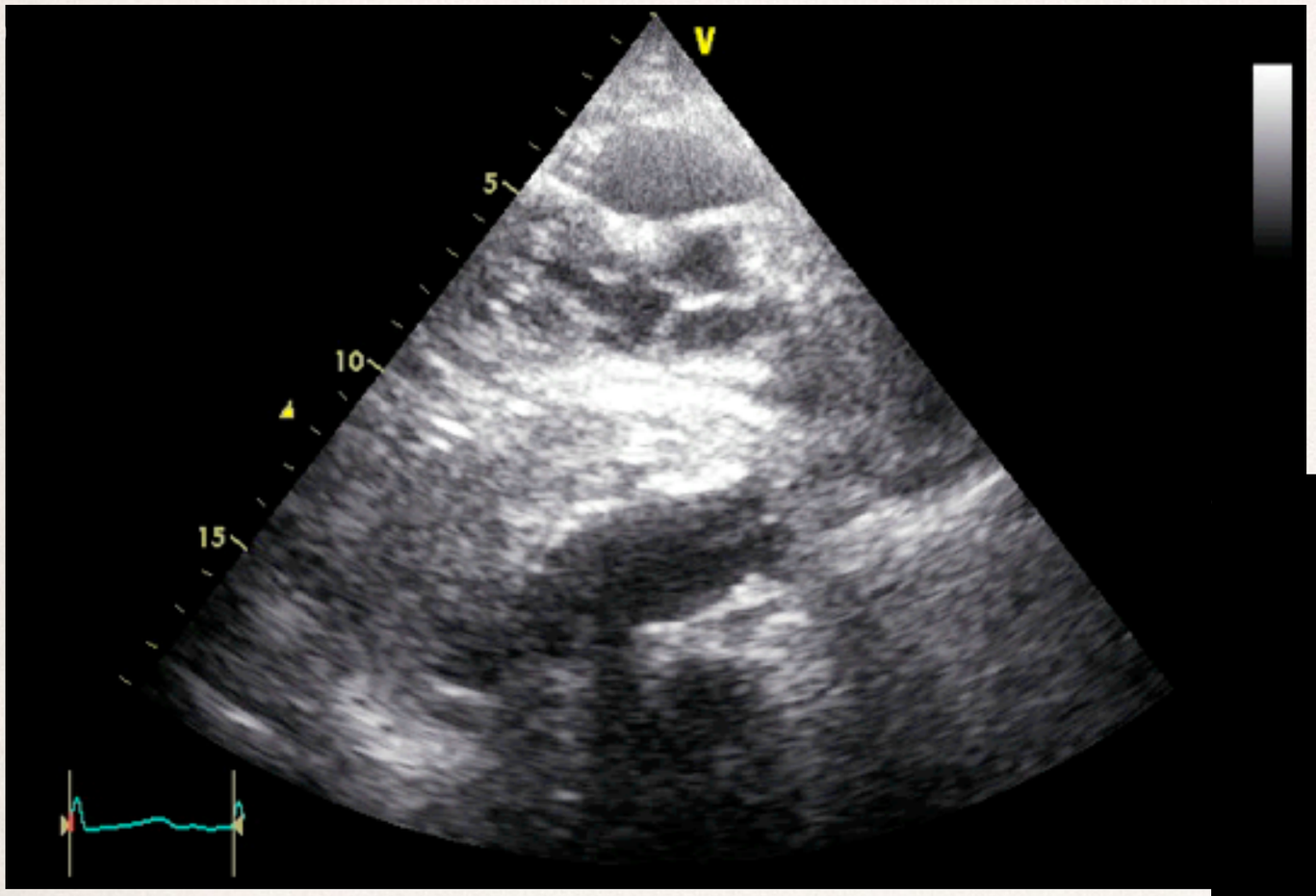
Aarhus University Hospital, Department of Anaesthesiology and Intensive Care, Skejby Sygehus, Denmark

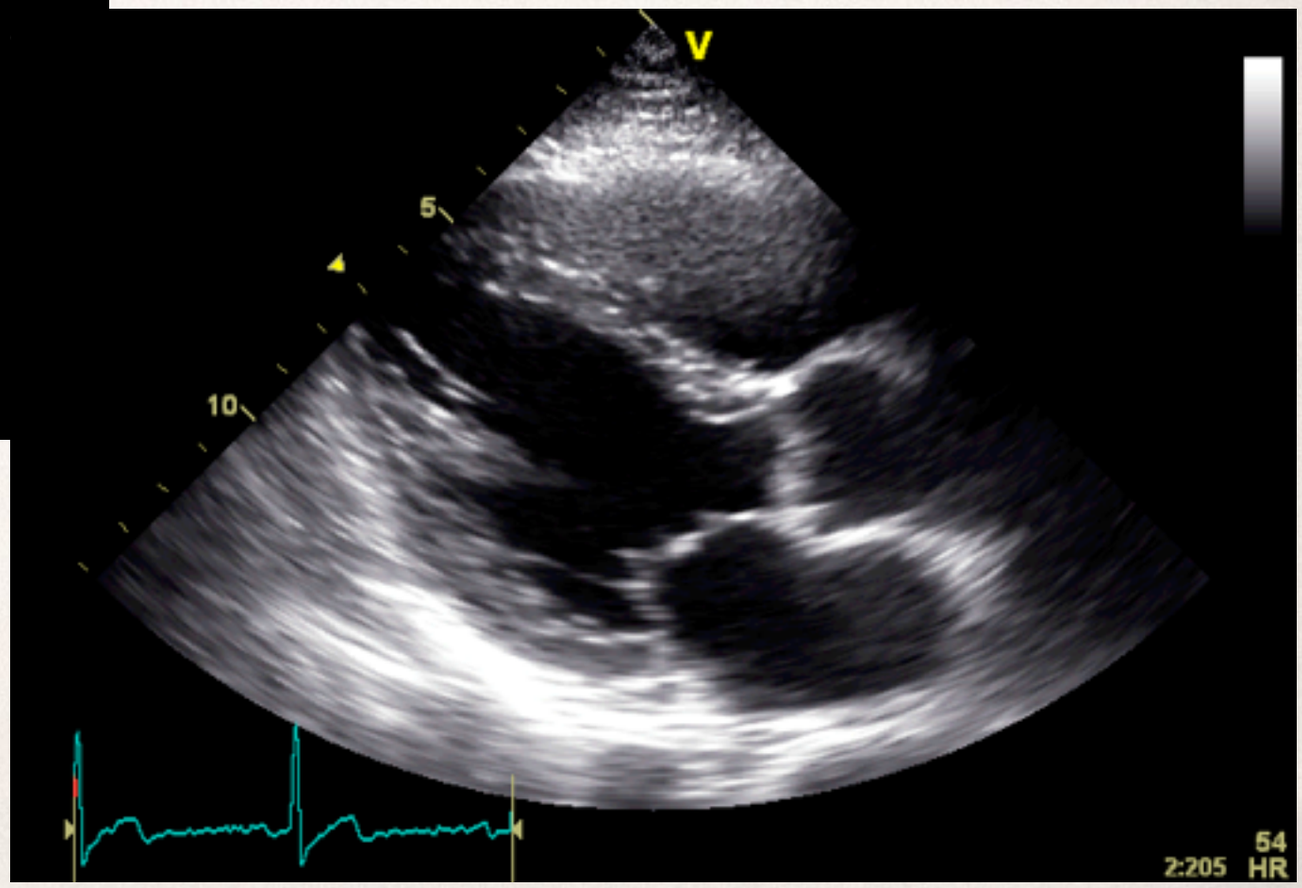
- FATE protocol provided useful images that contributed positively in 227 out of 233 echo studies (97%)
  - ~37% of echo's revealed NEW information and were DECISIVE in ~24%

Clinical Case #1 - History

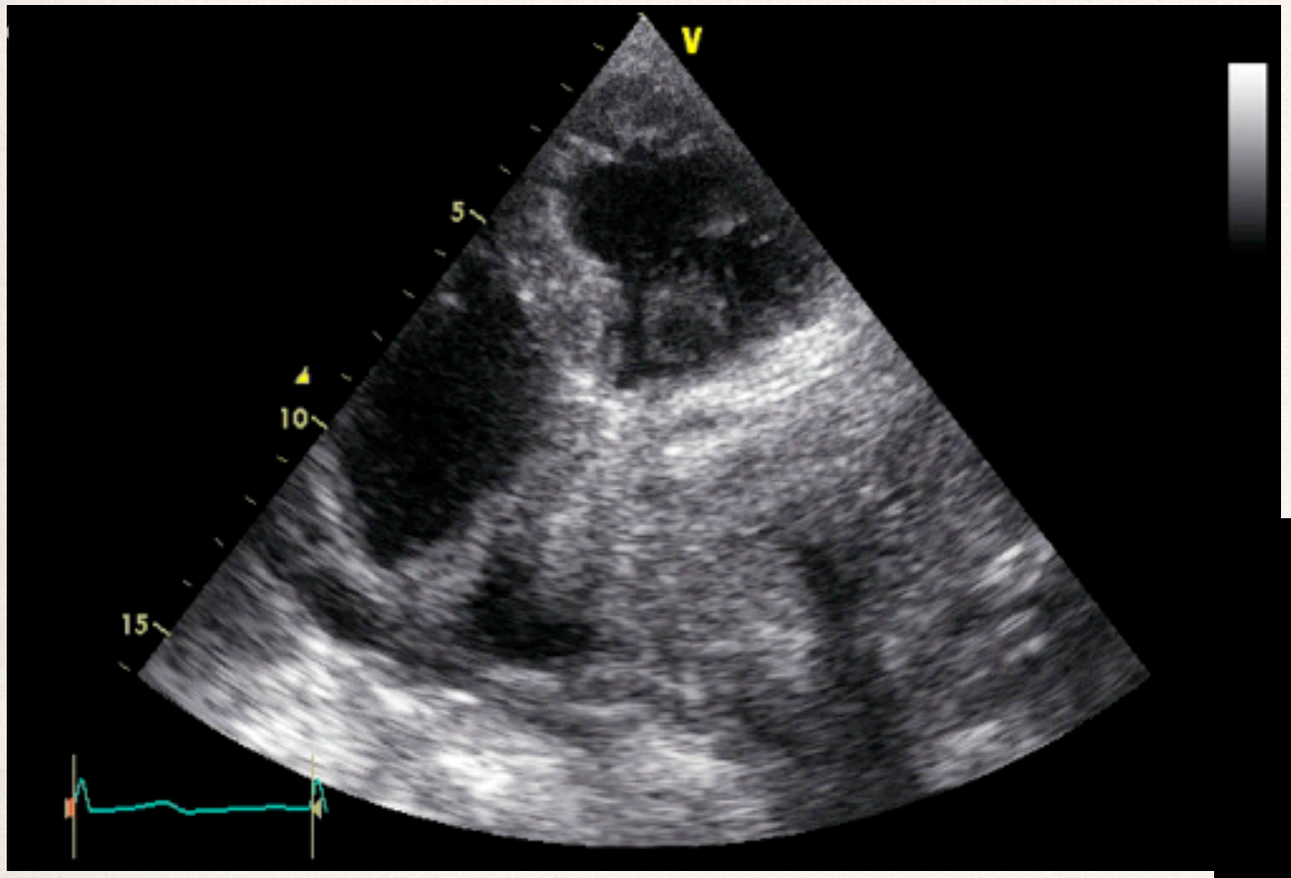
- 87 y.o. F with no PMHx presents with chest pain and found to have contained rupture of large thoraco-abdominal aneurysm
- Underwent emergent endograft of aneurysm
- POD # 3 – develops hypotension and SOB on the floor necessitating tx to the ICU
- Patient intubated and stabilized on pressors and undergoes chest CT revealing left hemothorax
- Thoracic surgery is consulted and plans for a VAT's washout via right chest
- Bedside TTE is performed…

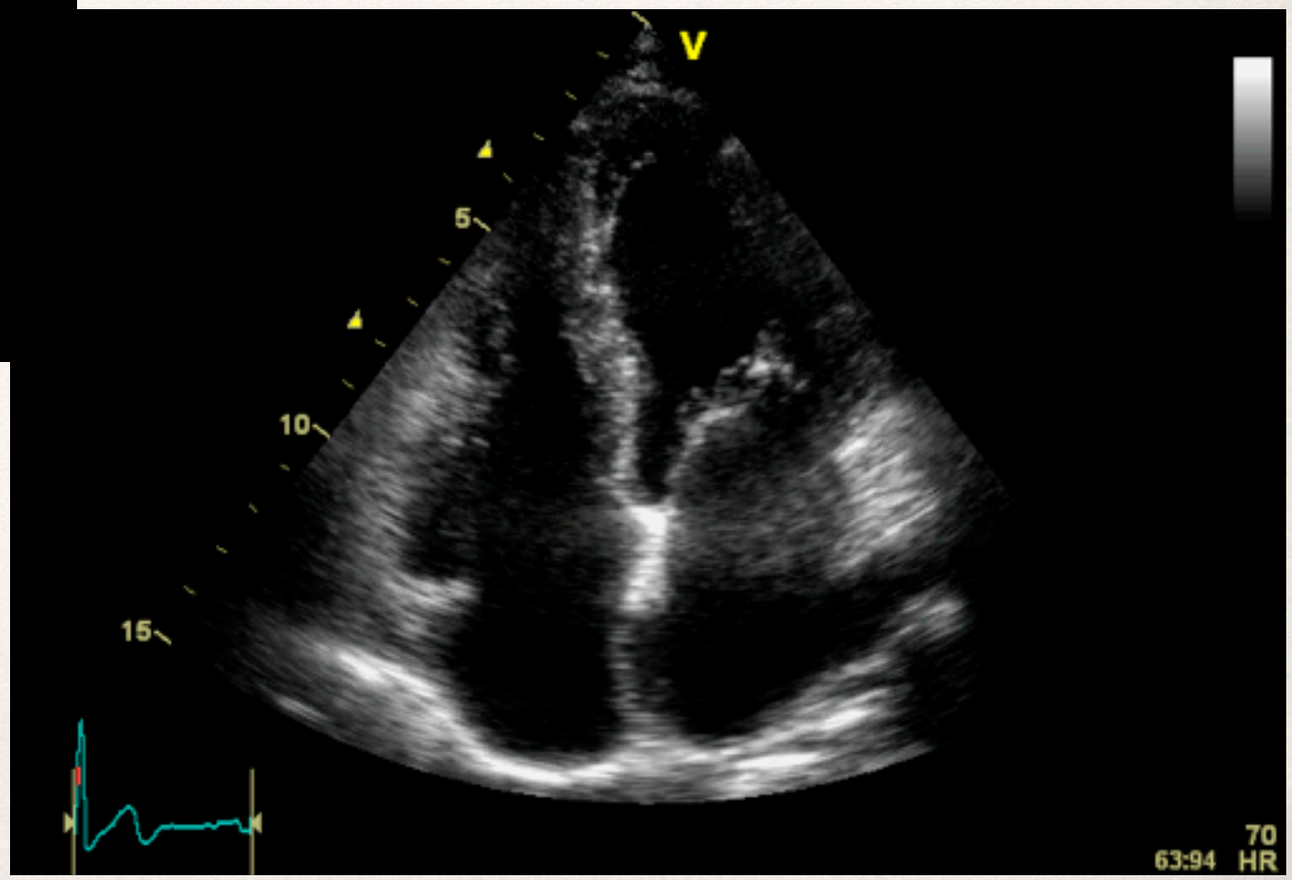
Clinical Case #1 - Bedside TTE



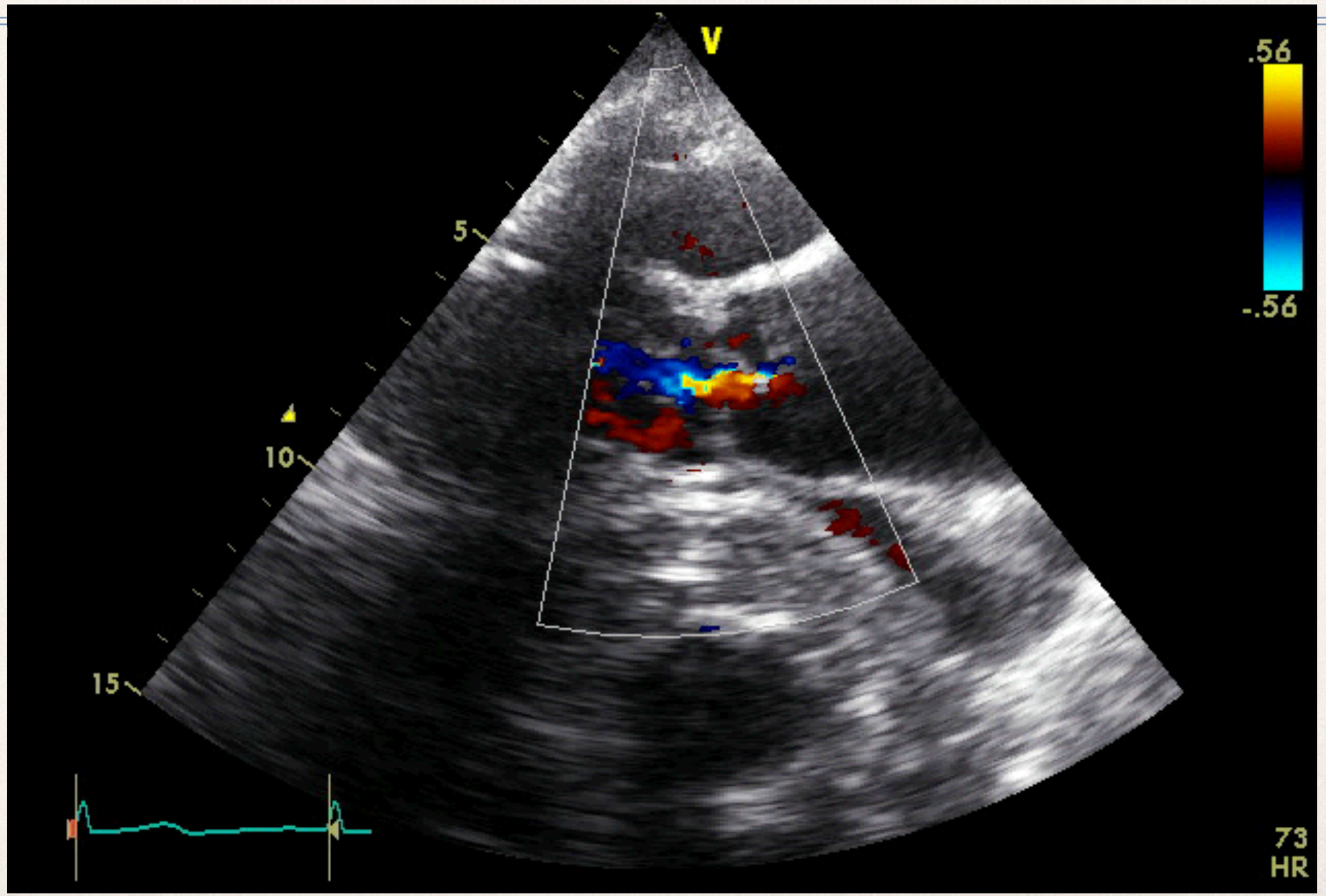


Clinical Case #1 - Bedside TTE

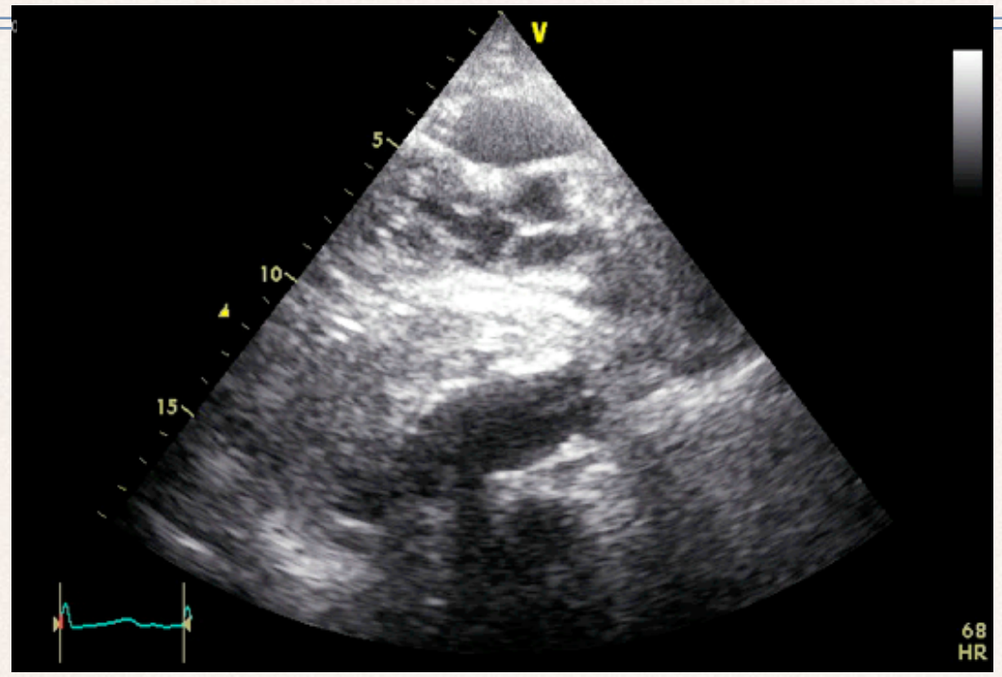


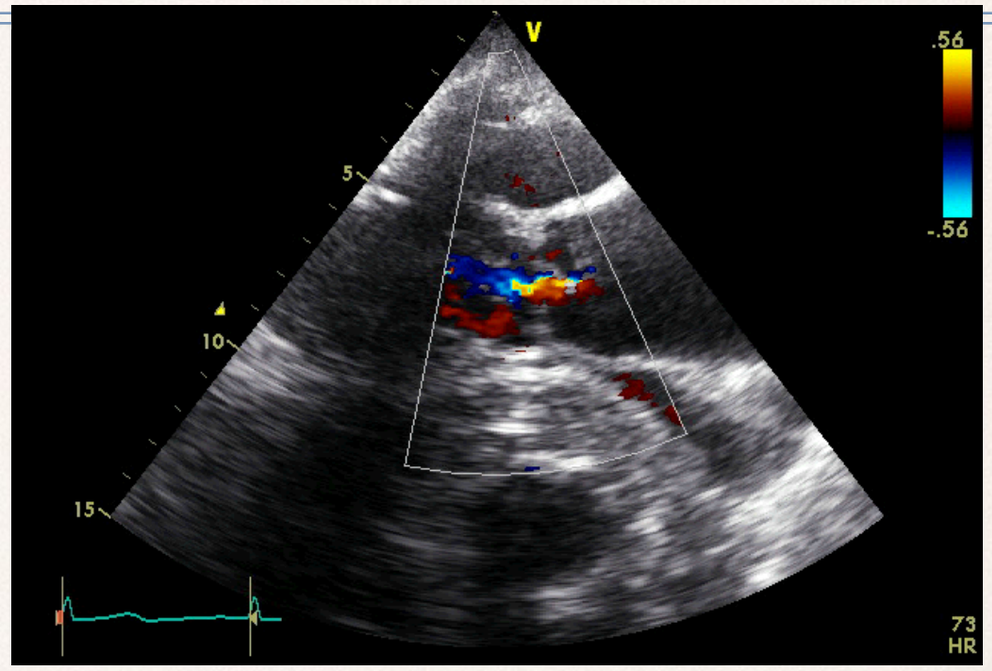


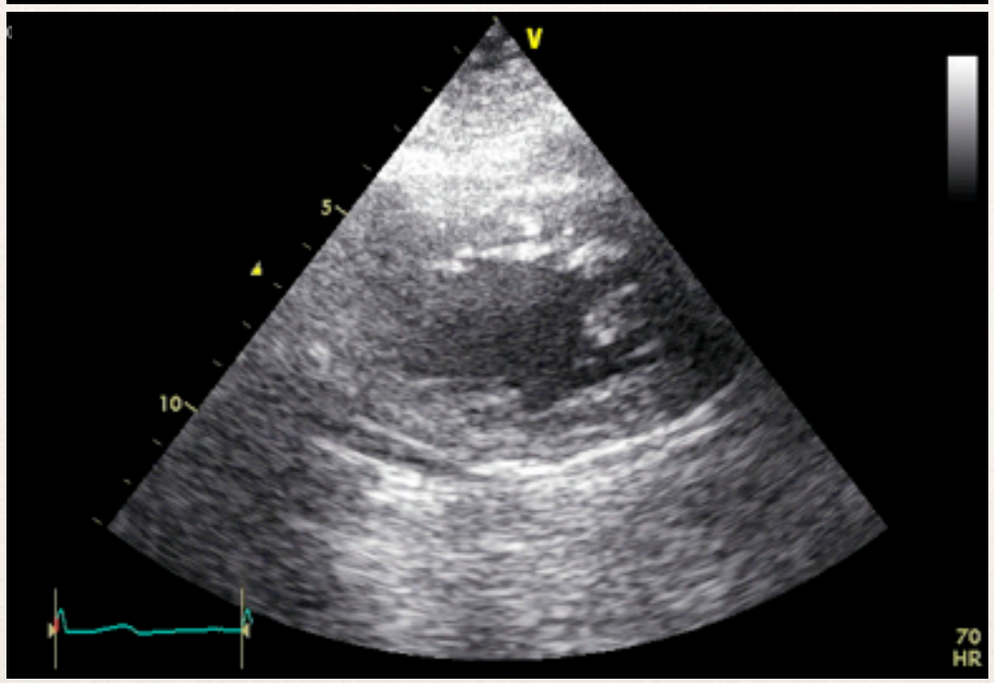
Clinical Case #1 - Bedside TTE

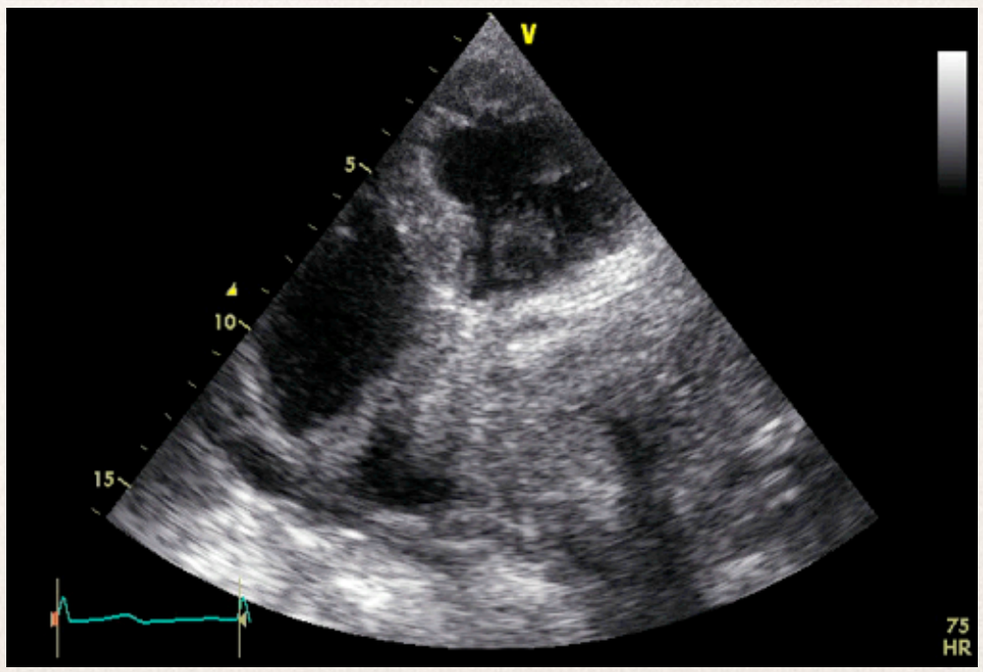


Clinical Case #1 - Bedside TTE

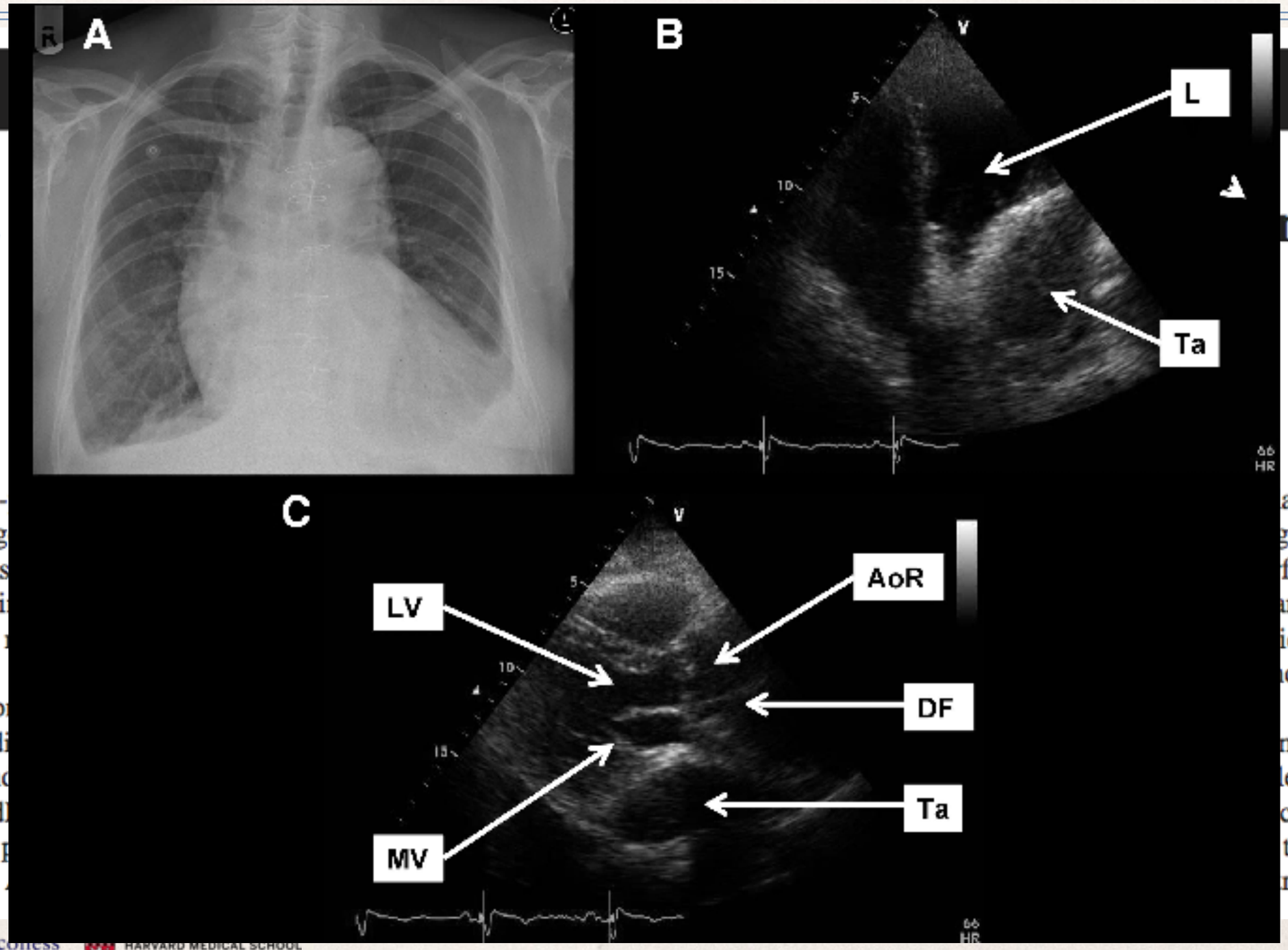








Clinical Case #1 - Diagnosis



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A 71- ar-weight
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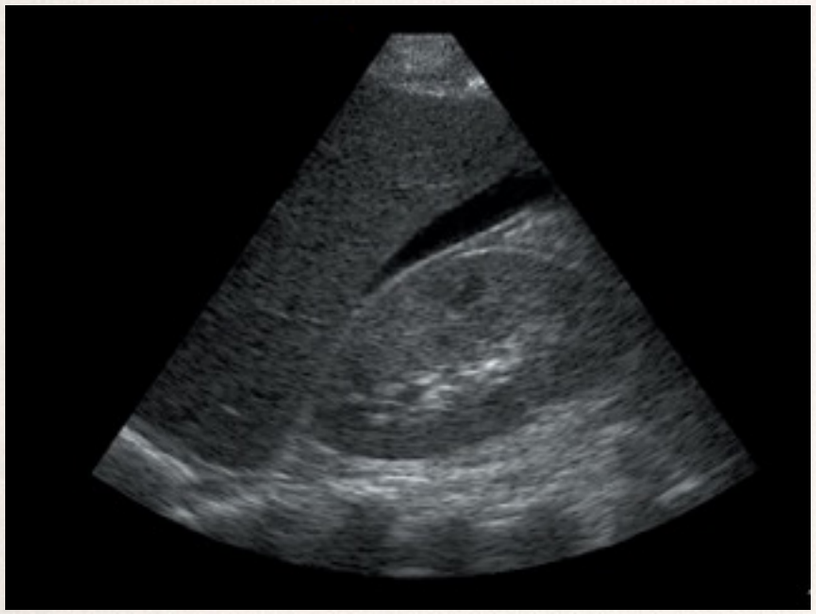
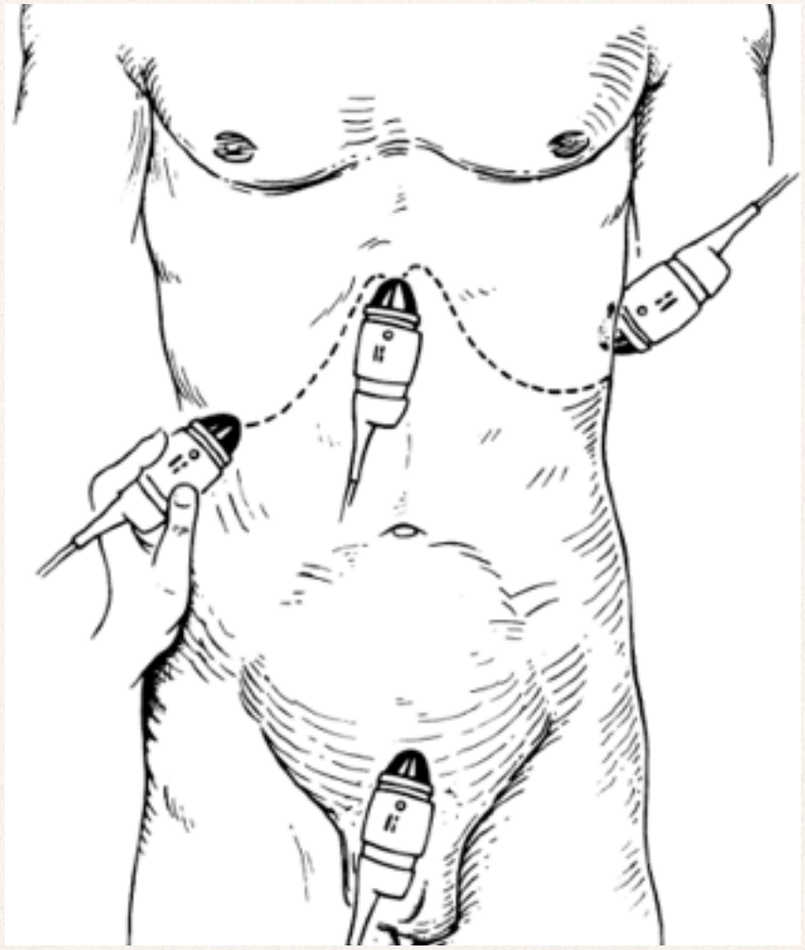
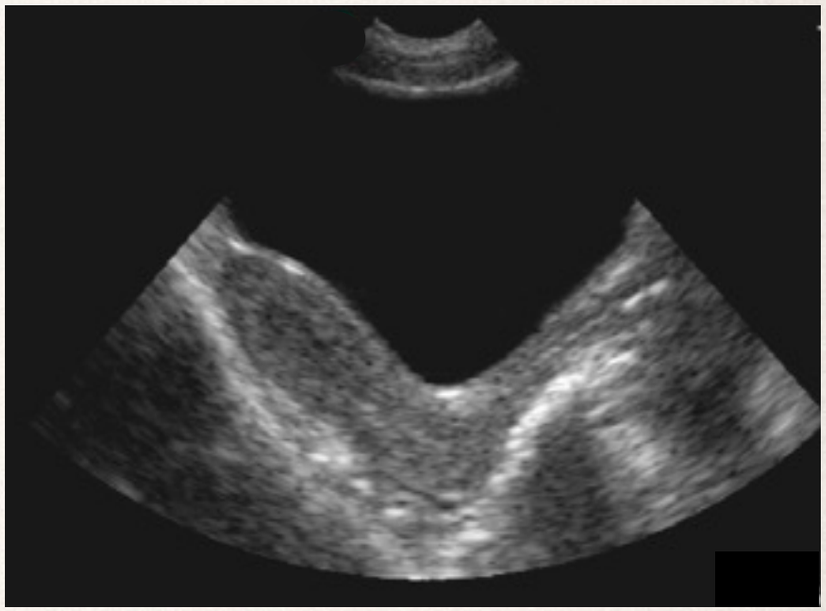
FAST - Exam

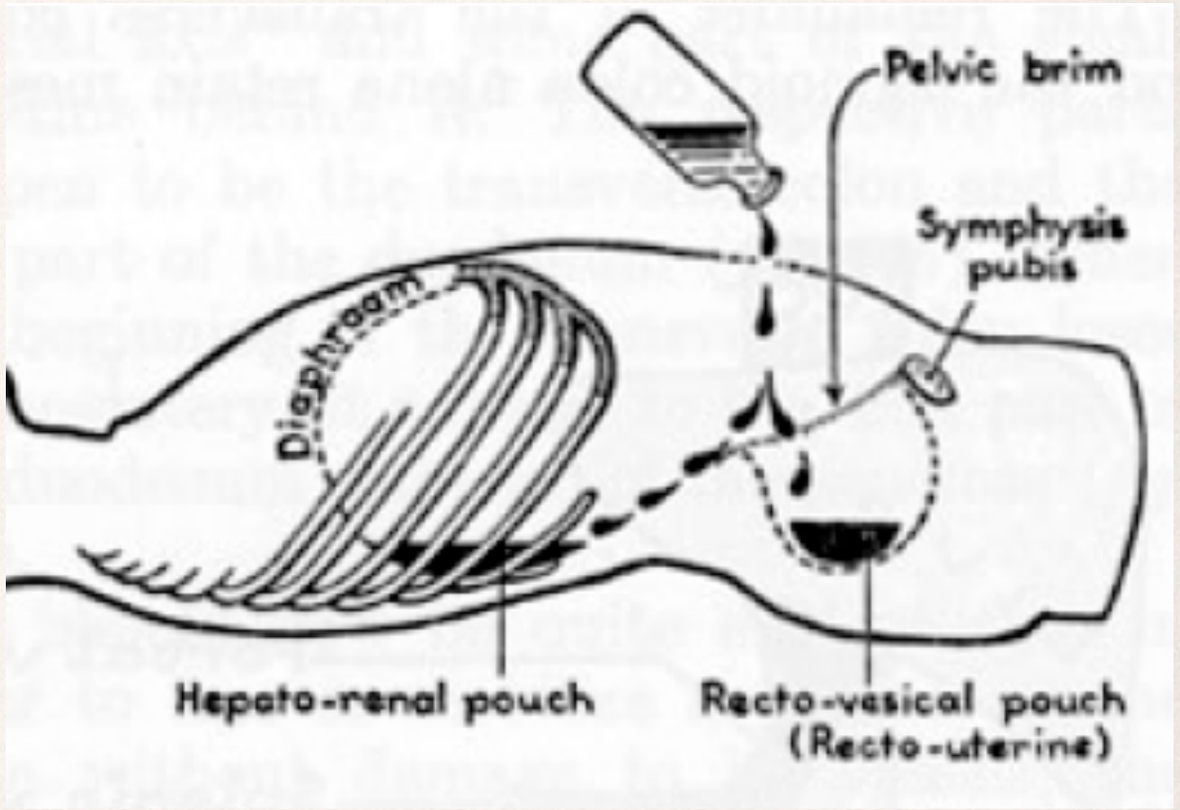






FAST - What is it?

- **F** ocused
- **A** ssessment with
- **S** onagraphy in
- **T** rauma



FAST - Rationale

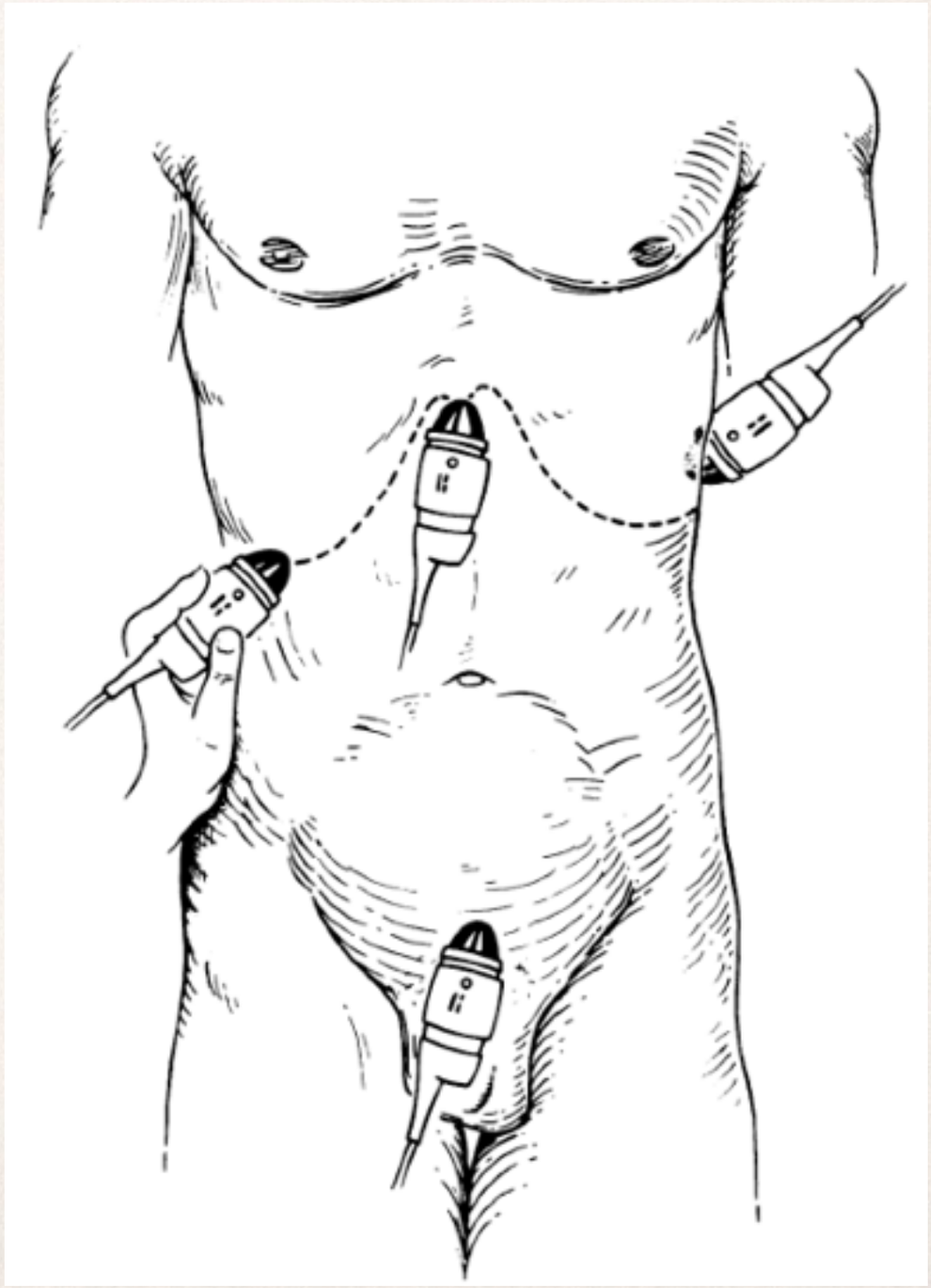
- Bleeding and hemorrhage is the most common cause of hypotension in trauma
- Diagnostic Peritoneal Lavage (DPL) is invasive with associated risk
- Computed Tomography (CT) is time consuming
- Fluid is easily identified by ultrasound as anechoic (jet black) adjacent to hyper-echoic structures (e.g. liver and diaphragm)
- In the proper setting, literature suggest FAST has 70-90% sensitive and nearly 100% specific for detecting clinically significant bleeding

FAST - Advantages

- Ultrasound is portable, repeatable and non-invasive
- Can be performed rapidly at the bedside
- Can be done simultaneously with resuscitation efforts
- Does not require use of contrast or radiation exposure (safe in pregnancy and pediatrics)

FAST Goals

- **Rapid detection of:**
  - Hemoperitoneum
  - Hemopericardium
  - Hemothorax
  - Pneumothorax (eFAST)



FAST Indications / Contraindications

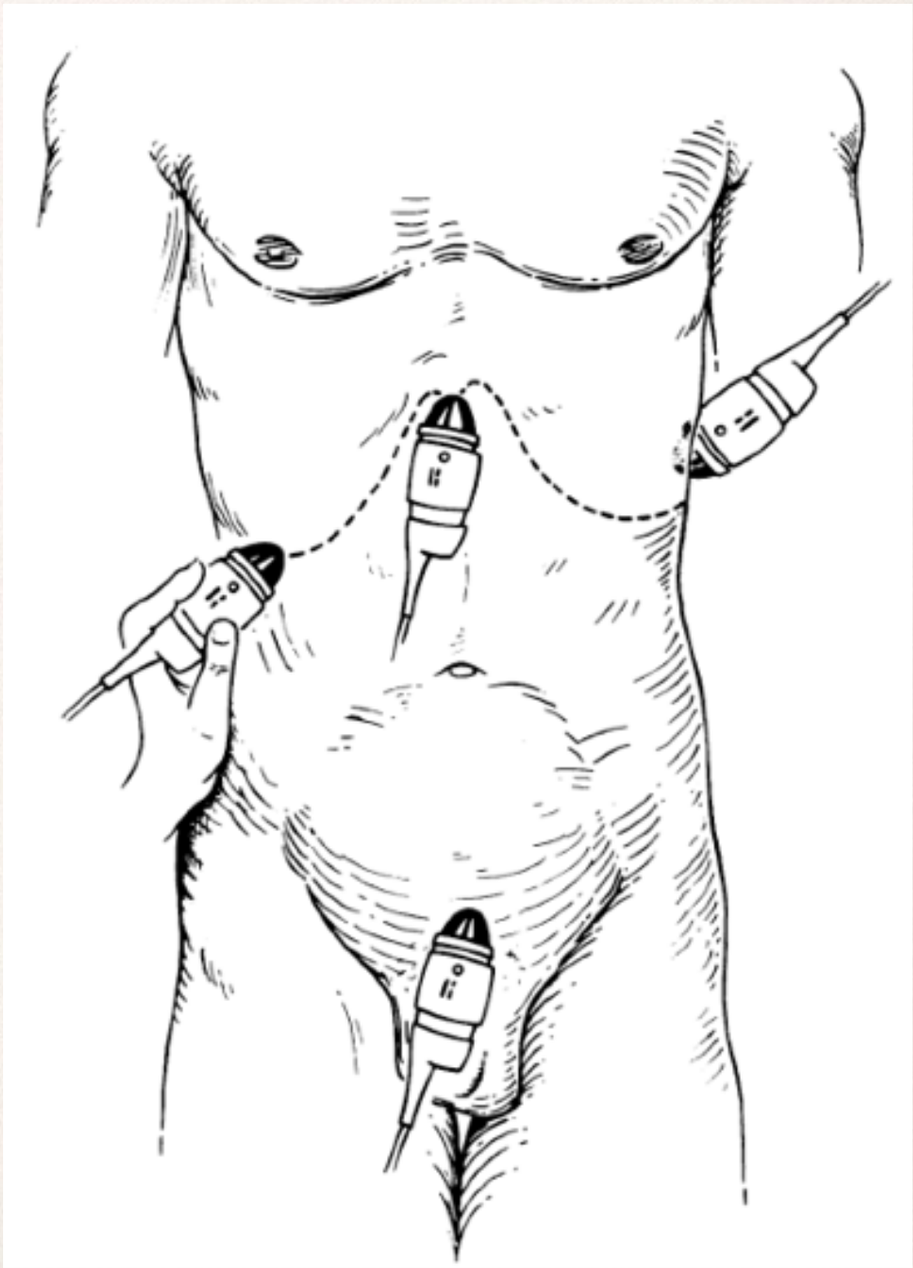
- **INDICATIONS:**
  - Blunt or penetrating thoraco-abdominal trauma
  - Trauma / Abdominal Pain in pregnancy
  - **Unexplained Hypotension in ANY patient**

- **CONTRAINDICATIONS:**
  - Any immediate indication for OR (e.g. evisceration or ruptured diaphragm on outside hospital imaging, etc.)

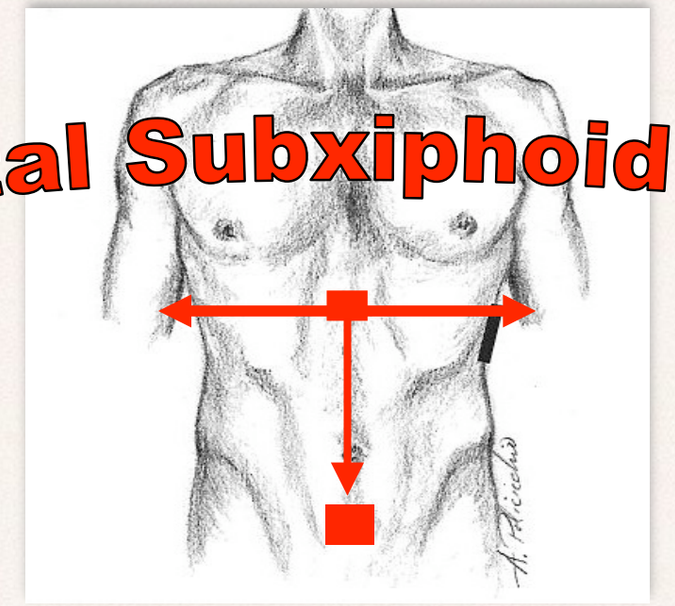
FAST - Views

Four FAST Views:

- Cardiac
- Peri-Hepatic (Right Upper Quadrant)
- Peri-Splenic (Left Upper Quandrant)
- Pelvic



FAST - Where to Begin?

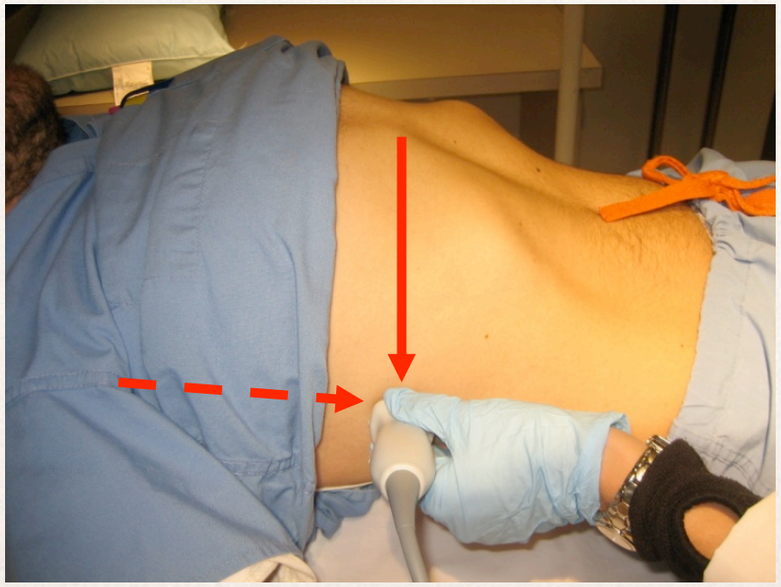


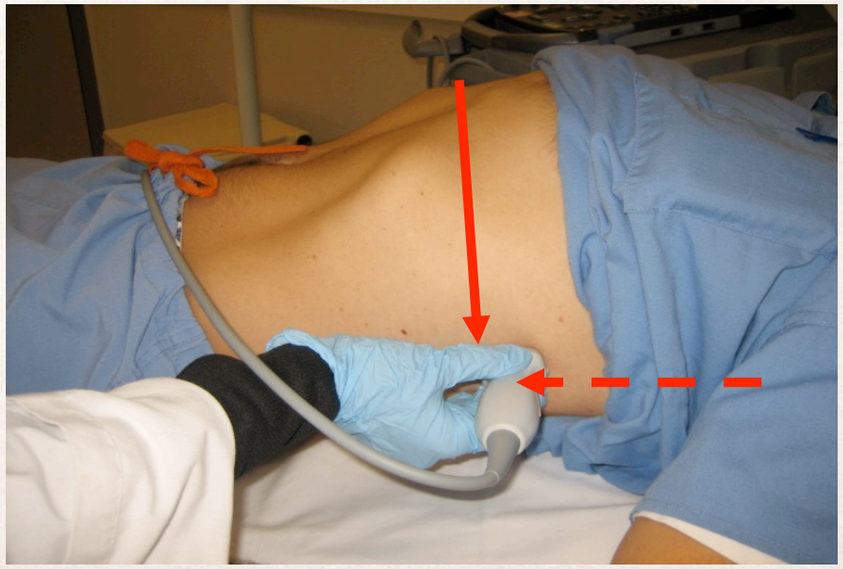
RUQ

MID-AXILLARY LINE

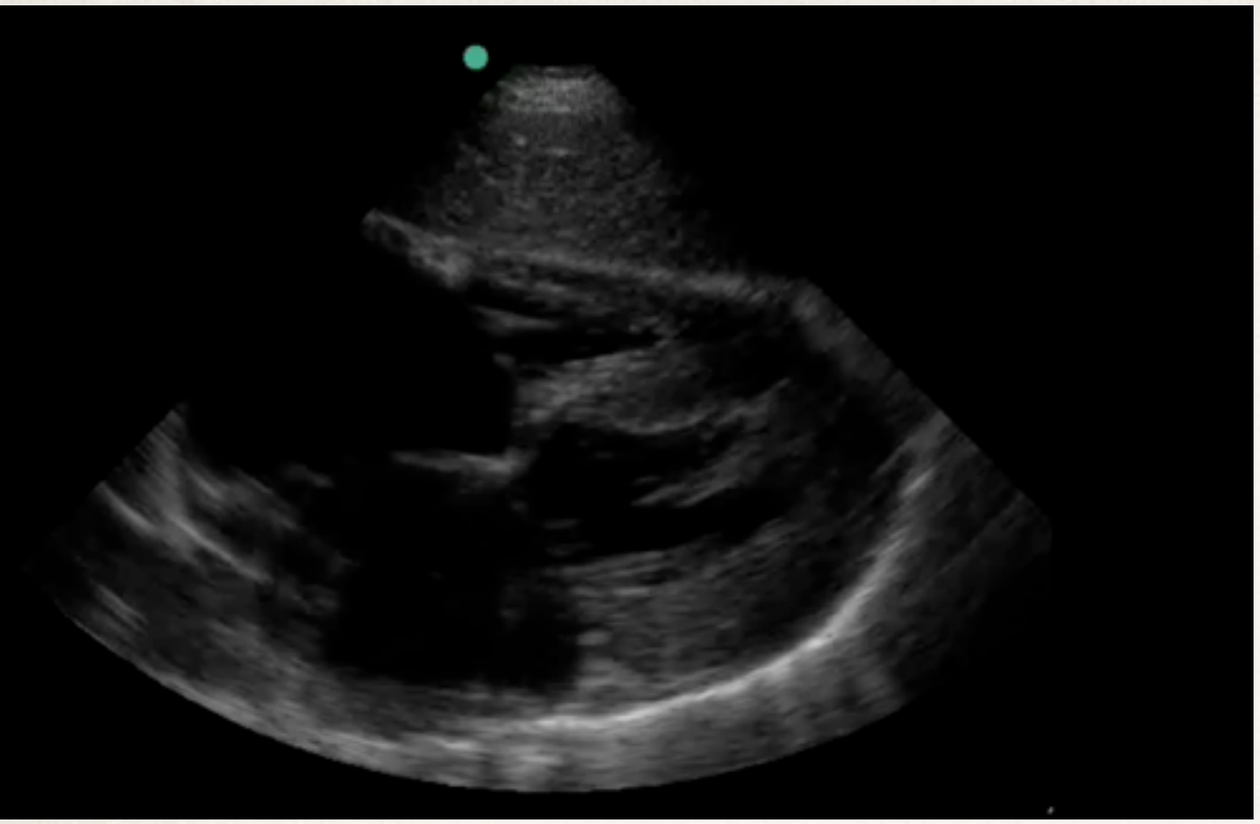
LUQ

POST-AXILLARY LINE

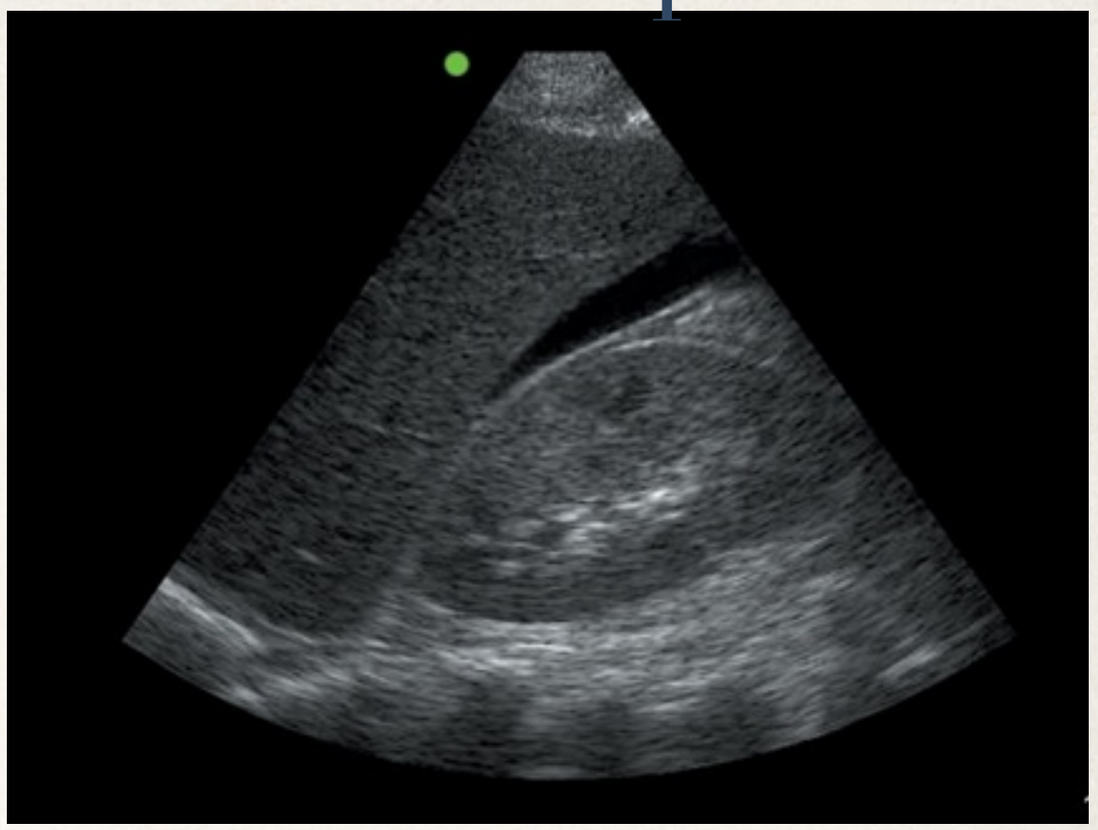




Subcostal / Cardiac

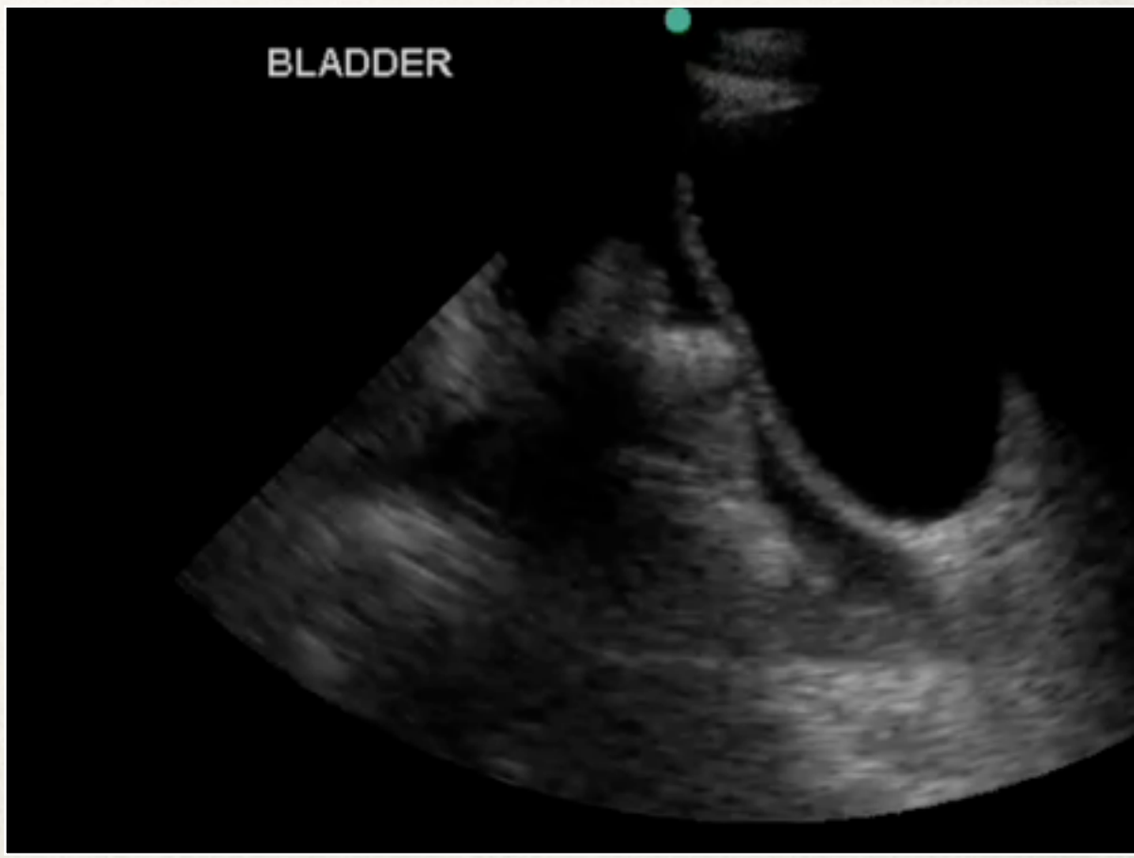


Peri-Hepatic



Peri-Splenic

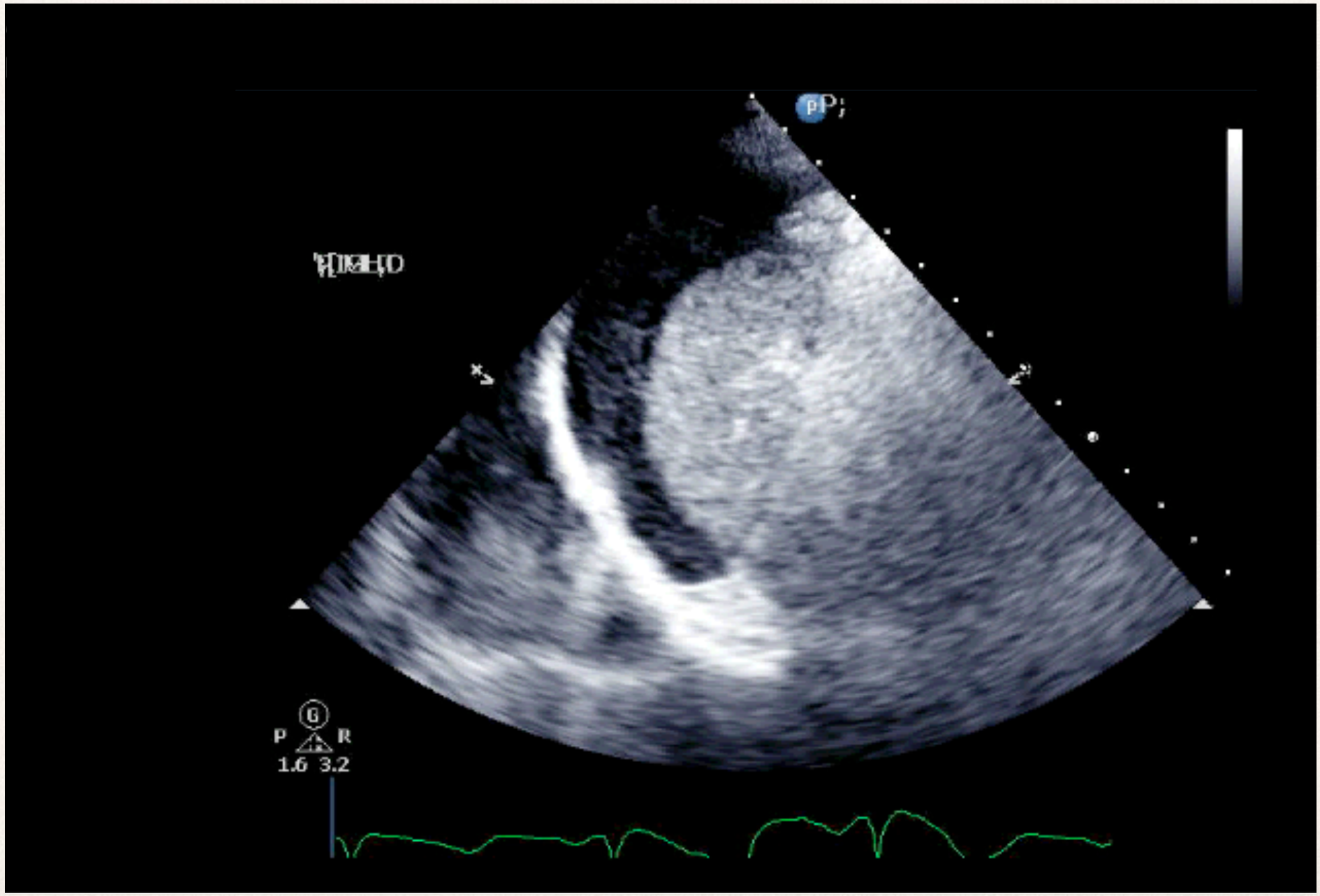
Pelvic



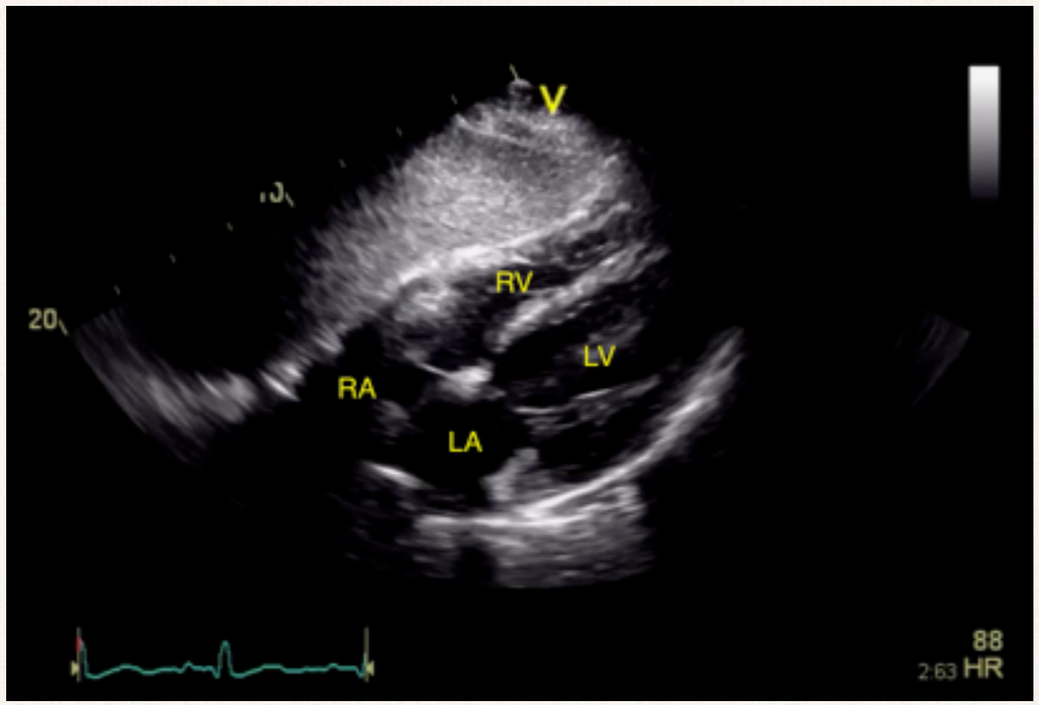
Clinical Case #2

- 71 y.o. female POD #9 from L3-L5 lami awaiting d/c to rehab
- Pt found unresponsive, agonal breathing --> Code Blue called
- Pt appeared pale with a distended abdomen. Hypotensive (SBP 80's)
- Volume initiated and tx to ICU. Poor trans-thoracic windows prompting TEE
- PMHx: Fibrolipoma of spinal cord; DJD Lumbar spine; Chronic Pain syndrome; GERD; Anxiety; Depression

Clinical Case #2



FEEL - Exam



FEEL - What is it?

- **F** ocused
- **E** chocardiographic
- **E** valuation in
- **L** ife Support

LIPPINCOTT WILLIAMS & WILKINS

Critical Care Medicine
OFFICIAL JOURNAL OF THE SOCIETY OF CRITICAL CARE MEDICINE

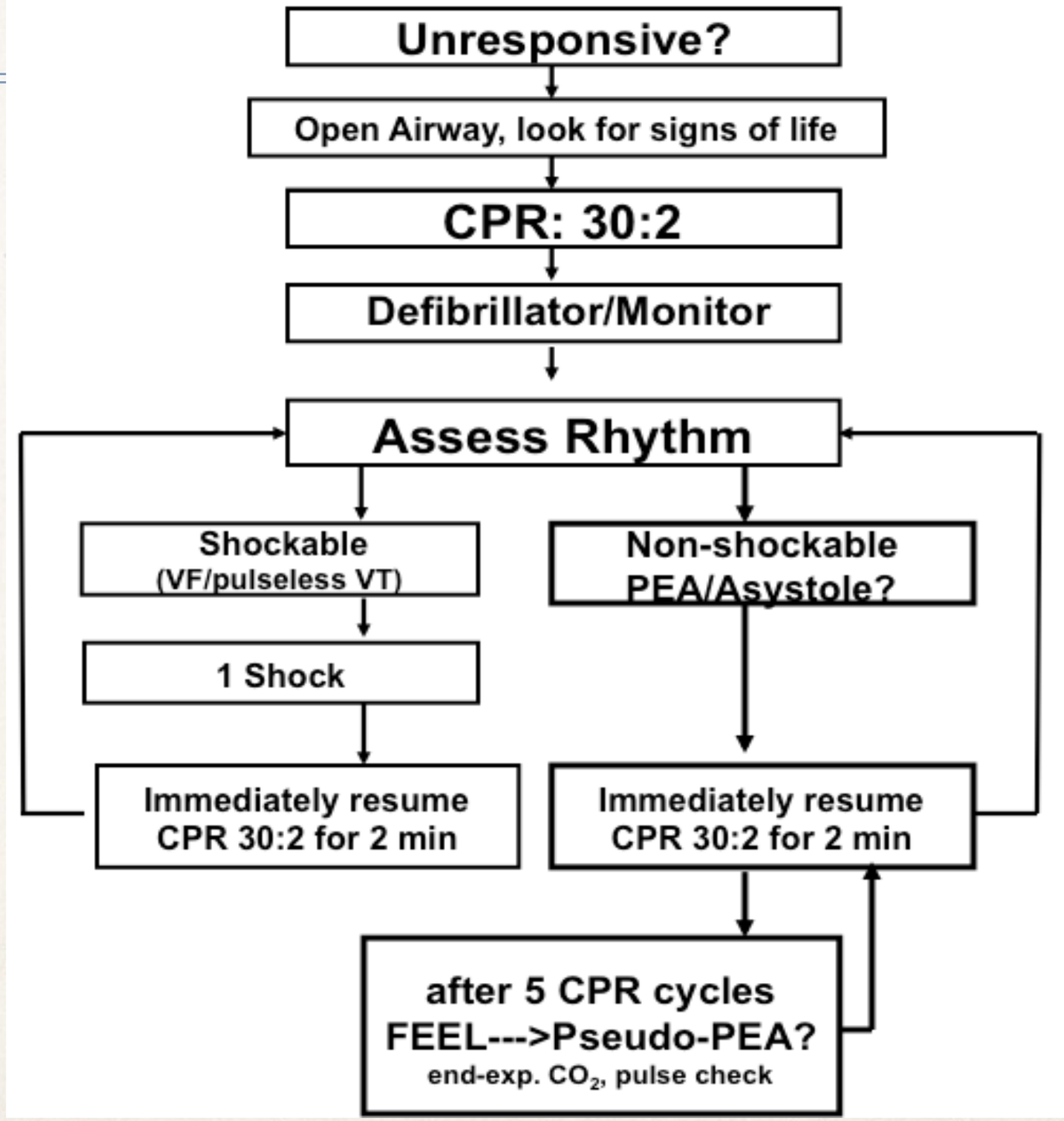
Focused echocardiographic evaluation in resuscitation management: Concept of an advanced life support–conformed algorithm

Raoul Breitkreutz, MD; Felix Walcher, MD, PhD; Florian H. Seeger, MD

Emergency ultrasound is suggested to be an important tool in critical care medicine. Time-dependent scenarios occur during preresuscitation care, during cardiopulmonary resuscitation, and in postresuscitation care. Suspected myocardial insufficiency due to acute global, left, or right heart failure, pericardial tamponade, and hypovolemia should be identified. These diagnoses cannot be made with standard physical examination or the electrocardiogram. Furthermore, the differential diagnosis of pulseless electrical activity is best elucidated with echocardiography. Therefore, we developed an algorithm of focused echocardiographic evaluation in resuscitation management, a structured process of an advanced life support–conformed transthoracic echocardiography protocol to be applied to point-of-care diagnosis. The new 2005 American Heart Association/European Resuscitation Council/International Liaison Committee on Resuscitation guidelines recommended high-quality cardiopulmonary resuscitation with minimal interruptions to reduce the no-flow intervals. However, they also recommended identification and treatment of reversible causes or complicating factors. Therefore, clinicians must be trained to use echocardiography within the brief interruptions of advanced life support, taking into account practical and theoretical considerations. Focused echocardiographic evaluation in resuscitation management was evaluated by emergency physicians with respect to incorporation into the cardiopulmonary resuscitation process, performance, and physicians' ability to recognize characteristic pathology. The aim of the focused echocardiographic evaluation in resuscitation management examination is to improve the outcomes of cardiopulmonary resuscitation. (Crit Care Med 2007; 35[Suppl.]:S150–S161)

KEY WORDS: emergency echocardiography; focused echocardiographic evaluation in resuscitation; resuscitation; cardiopulmonary resuscitation; algorithm; critical care ultrasound

Proposed Integration of a brief Echocardiography (FEEL) into the ALS to identify Reversible Causes



When to apply ➡

Beth Israel Deaconess Medical Center

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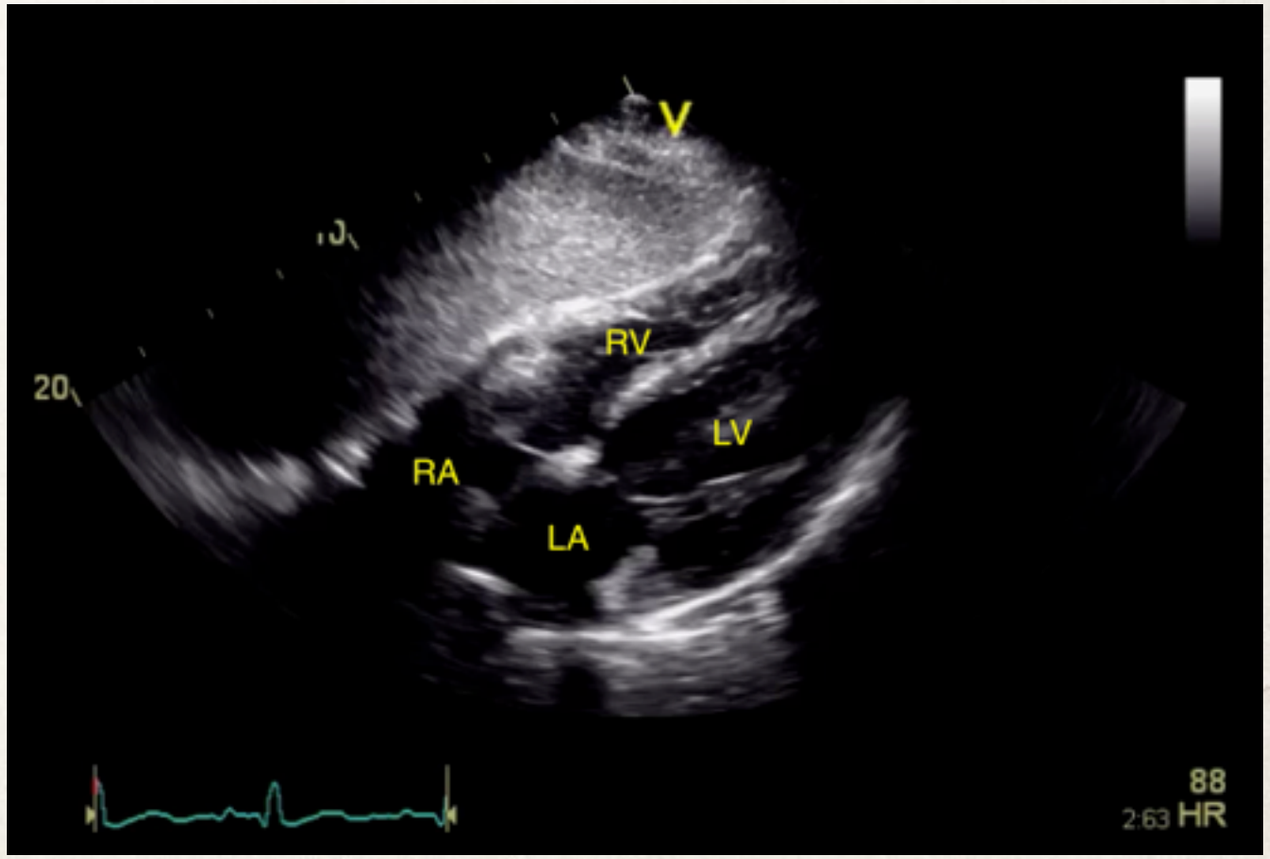
Breitkreutz et al. Crit Care Med 2007;35[supp]:S150-S161

FEEL - Rationale for use

Identify (or rule out) 4 mechanical causes of PEA:

1. Tamponade
2. Hypovolemia
3. Pulmonary Embolism
4. Severe LV Dysfunction (MI)



FEEL - Rationale for avoiding

AHA Consensus Statement

CPR Quality: Improving Cardiac Resuscitation Outcomes Both Inside and Outside the Hospital

A Consensus Statement From the American Heart Association

Endorsed by the American College of Emergency Physicians

Abstract—The "2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" increased the focus on methods to ensure that high-quality cardiopulmonary resuscitation (CPR) is performed in all resuscitation attempts. There are 5 critical components of high-quality CPR: minimize interruptions in chest compressions, provide compressions of adequate rate and depth, avoid leaning between compressions, and avoid excessive ventilation. Although it is clear that high-quality CPR is the primary component in influencing survival from cardiac arrest, there is considerable variation in monitoring, implementation, and quality improvement. As such, CPR quality varies widely between systems and locations. Victims often do not receive high-quality CPR because of provider ambiguity in prioritization of resuscitative efforts during an arrest. This ambiguity also impedes the development of optimal systems of care to increase survival from cardiac arrest. This consensus statement addresses the following key areas of CPR quality for the trained rescuer: metrics of CPR performance; monitoring, feedback, and integration of the patient's response to CPR; team-level logistics to ensure performance of high-quality CPR; and continuous quality improvement on provider, team, and systems levels. Clear definitions of metrics and methods to consistently deliver and improve the quality of CPR will narrow the gap between resuscitation science and the victims, both in and out of the hospital, and lay the foundation for further improvements in the future. (***Circulation***. **2013;128:00-00.**)

Part 7: Adult Advanced Cardiovascular Life Support

2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Mark S. Link, Chair; Lauren C. Berkow; Peter J. Kudenchuk; Henry R. Halperin; Erik P. Hess; Vivek K. Moitra; Robert W. Neumar; Brian J. O'Neil; James H. Paxton; Scott M. Silvers; Roger D. White; Demetris Yannopoulos; Michael W. Donnino

2015 Recommendations—Updated

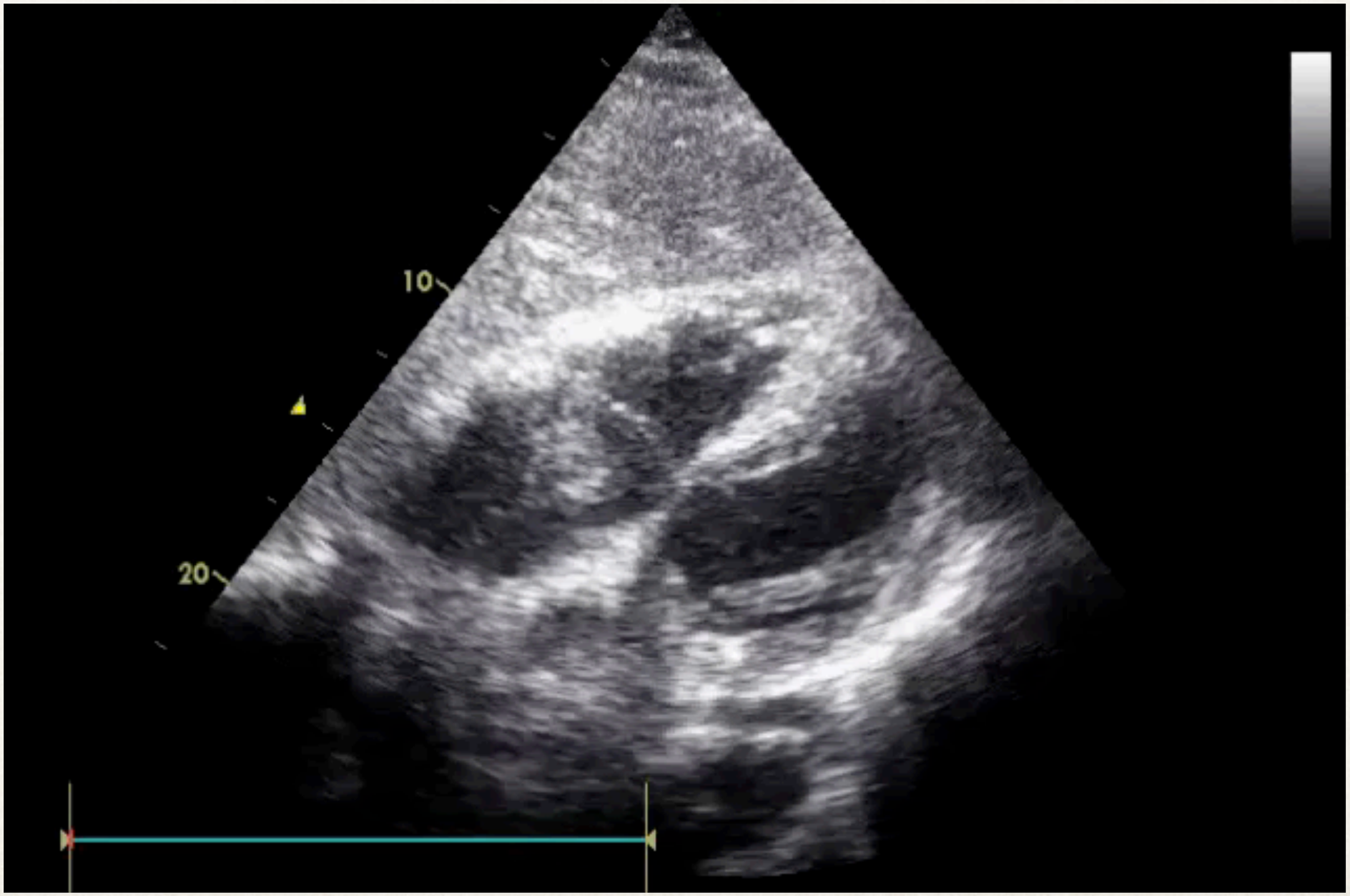
Ultrasound (cardiac or noncardiac) may be considered during the management of cardiac arrest, although its usefulness has not been well established (Class IIb, LOE C-EO).

If a qualified sonographer is present and use of ultrasound does not interfere with the standard cardiac arrest treatment protocol, then ultrasound may be considered as an adjunct to standard patient evaluation (Class IIb, LOE C-EO).

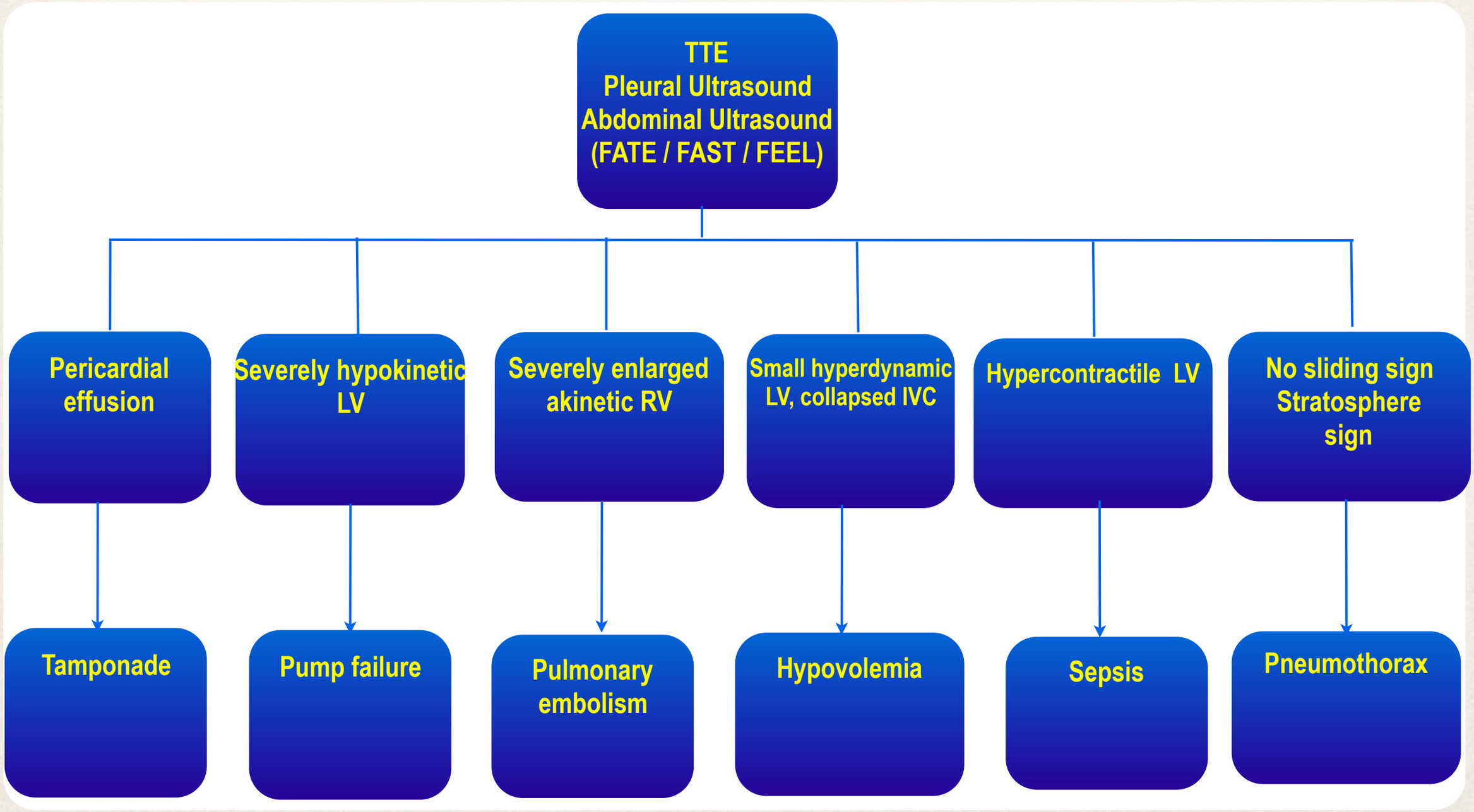
Clinical Case #3

- 67 y.o. male POD #3 from toe amputation
- Pt found unresponsive without palpable pulse - CPR initiated
- Ultrasound performed during CPR
- PMHx: Peripheral Vascular Disease; HTN; GERD

Clinical Case #3



Ultrasound Shock Algorithm



Courtesy of Sajid Shahul, MD

THANK YOU!

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