Non Invasive Hemodynamic Monitoring

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- Fluid
- Pressors
- Ionotrope
- Intervention

Complications Following CVP Line Insertion

- Malposition of the catheter
- Hematoma
- Arterial puncture
- Pneumothorax
- Hemorrhage
- Sepsis
- Catheter embolism
- Thrombosis
- Hemothorax
- Cardiac tamponade
- Cardiac arrhythmias
- Air emboli

Central Vein Catheterization

Failure and Complication Rates by Three Percutaneous Approaches

J. Iasha Sznajder, MD; Fabio R. Zveibil, MD; Haim Bitterman, MD; Paltiel Weiner, MD; Simon Bursztein, MD

CHEST Special Feature

Does Central Venous Pressure Predict Fluid Responsiveness?*

A Systematic Review of the Literature and the Tale of Seven Mares

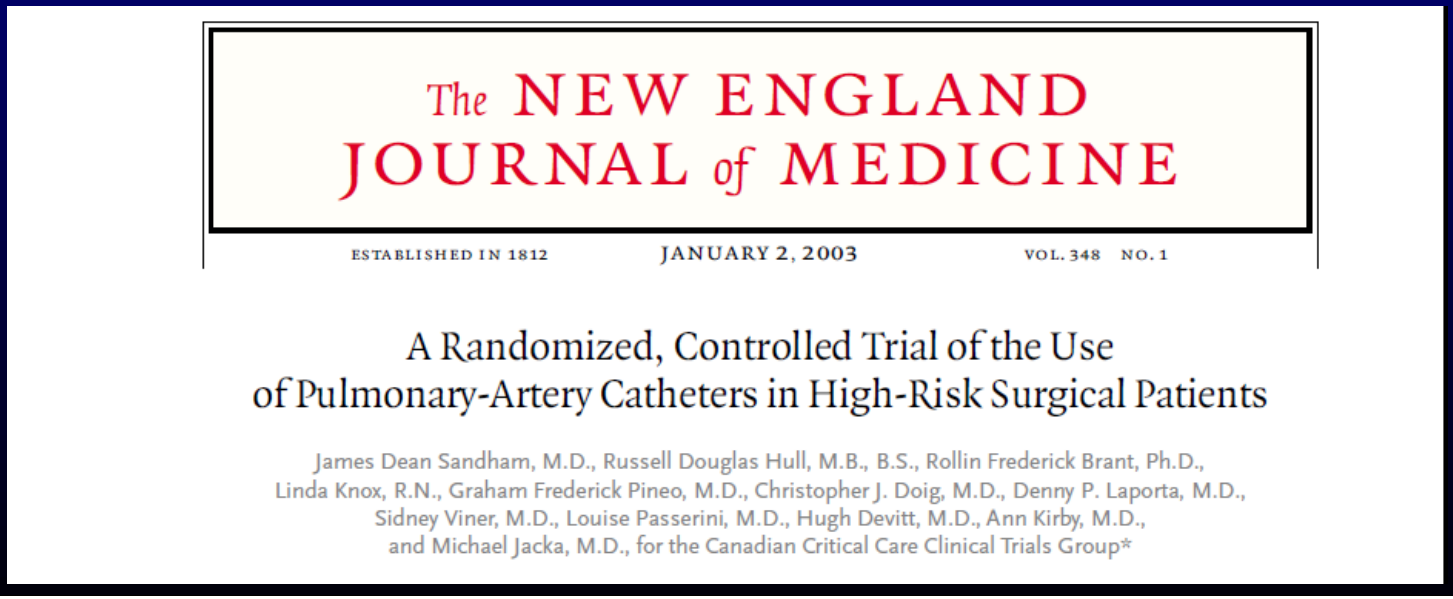
Paul E. Marik, MD, FCCP; Michael Baram, MD, FCCP; and Bobbak Vahid, MD

- 24 studies included 803 patients
- Baseline CVP was 8.7 ± 2.32 mm Hg [mean ± SD] in the responders
- As compared to 9.7 ± 2.2 mm Hg in non responders (not significant).

• Very poor relationship between CVP and blood volume

Pulmonary-Artery Catheters

- 1994 high-risk surgical patients underwent randomization for PA catheters
- Preop placement, for elective or urgent surgery
- Looked at 6mo and 12 mo mortality
- No difference = mortality and length of hospitalization
- **Increased risk of PE in the catheter group**



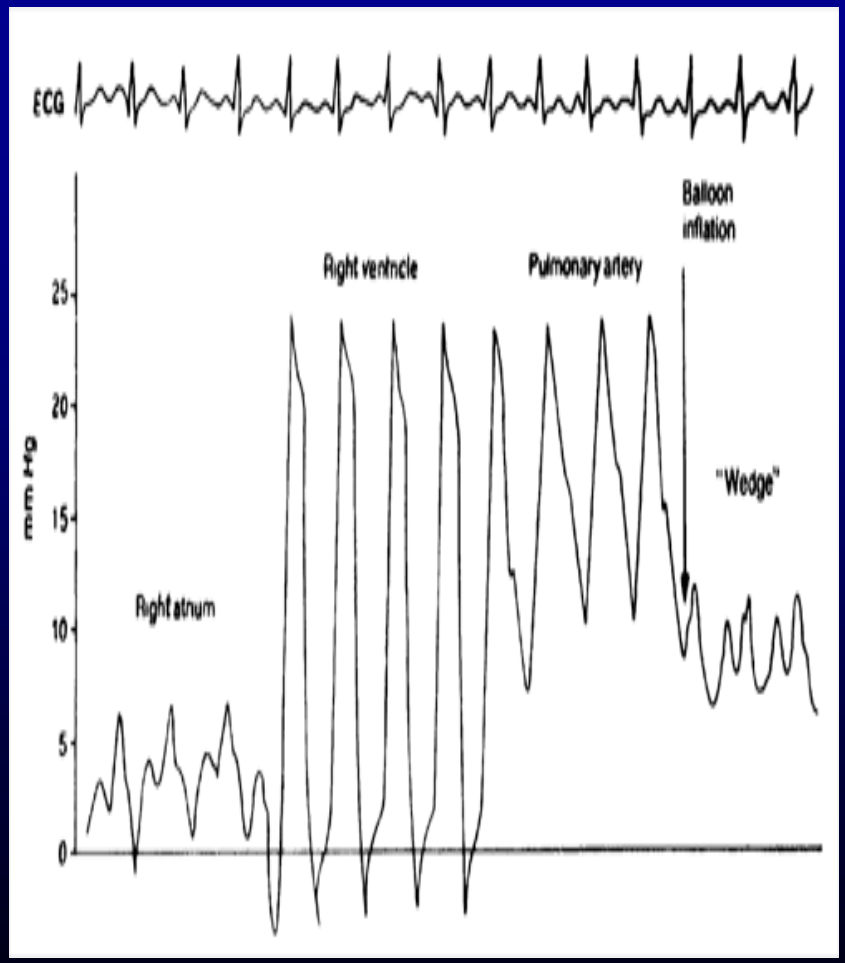
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 2, 2003 VOL. 348 NO. 1

A Randomized, Controlled Trial of the Use of Pulmonary-Artery Catheters in High-Risk Surgical Patients

James Dean Sandham, M.D., Russell Douglas Hull, M.B., B.S., Rollin Frederick Brant, Ph.D., Linda Knox, R.N., Graham Frederick Pineo, M.D., Christopher J. Doig, M.D., Denny P. Laporta, M.D., Sidney Viner, M.D., Louise Passerini, M.D., Hugh Devitt, M.D., Ann Kirby, M.D., and Michael Jacka, M.D., for the Canadian Critical Care Clinical Trials Group*

Pulmonary-Artery Catheters



- 1095 surveys
- 1/3 incorrectly identified PA occlusion pressure

New Horiz 1997, 5:201-206.

Vigileo

Dynamic changes in arterial waveform derived variables and fluid responsiveness in mechanically ventilated patients: A systematic review of the literature*

Paul E. Marik, MD, FCCM; Rodrigo Cavallazzi, MD; Tajender Vasu, MD; Amyn Hirani, MD

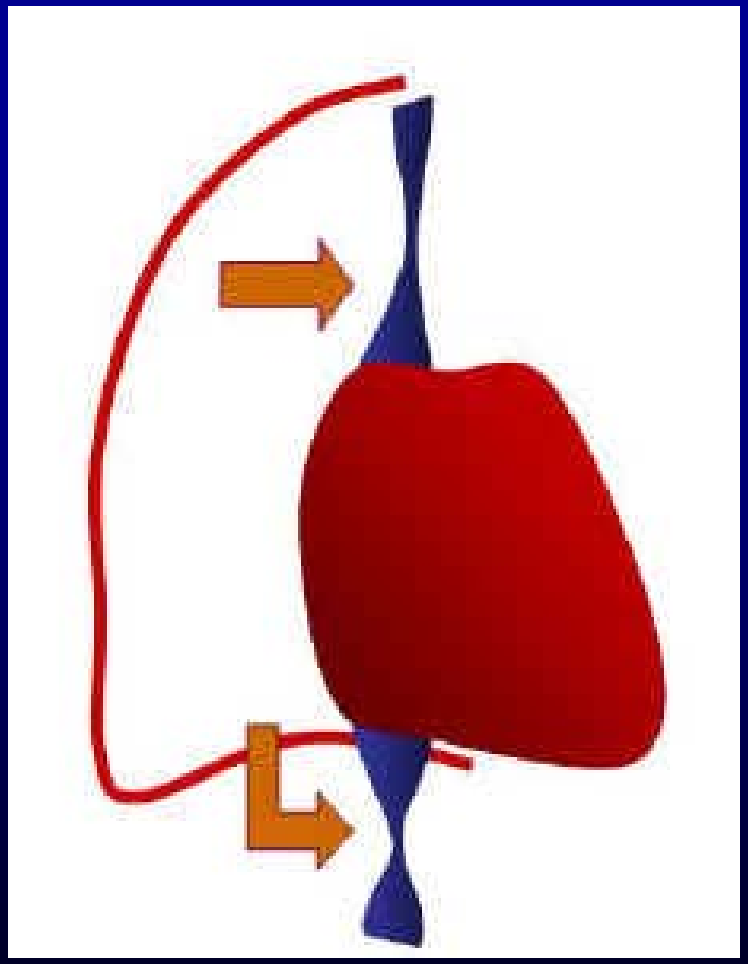
- Twenty-nine studies
- 685 patients
- Good correlation **in patients receiving mechanical ventilation**

Vigileo

N= 685

- **Poor correlation:**
  - Arrhythmias
  - Obesity
  - Spontaneously Breathing

Fluid Responsive



- IVC collapse
- Decrease in :
- Venous return
- RV stroke volume
- LV preload
- Cardiac output

Intensive Care Med (2004) 30:1834–1837
DOI 10.1007/s00134-004-2233-5

Marc Feissel
Frédéric Michard
Jean-Pierre Faller
Jean-Louis Teboul

The respiratory variation in inferior vena cava diameter as a guide to fluid therapy

Use of Bedside Ultrasound to Assess Degree of Dehydration in Children With Gastroenteritis

Lei Chen, MD, Allen Hsiao, MD, Melissa Langhan, MD, Antonio Riera, MD,

Qualitative Assessment of the Inferior Vena Cava. Useful Tool for the Evaluation of Fluid Status in Critically Ill Patients

PAULA FERRADA, M.D., RAHUL J. ANAND, M.D., JAMES WHELAN, M.D., MICHEL A. ABOUTANOS, M.D., THERESE DUANE, M.D., AJAI MALHOTRA, M.D., RAO IVATURY

From the Virginia Commonwealth University, Richmond, Virginia

Role of inferior vena cava diameter in assessment of volume status: a meta-analysis

Agarwal Dipti MBBS[a], Zachary Soucy DO[a], Alok Surana MD[b], Subhash Chandra MD[c,*]

[a]*Department of Emergency Medicine, Mayo Clinic College of Medicine, Rochester, MN 55905*
[b]*S N Medical College, Jodhpur, 342001 India*
[c]*Internal Medicine, Greater Baltimore Medical Center, Towson, MD 21204, USA*

- Prospectively conducted
- Patients under spontaneous ventilation
- Reported IVC diameter measurement with volume status or shock
- 275 patients
- Useful for fluid status estimation

Intensive Care Med (2008) 34:243–249
DOI 10.1007/s00134-007-0923-5

Antoine Vieillard-Baron
Michel Slama
Bernard Cholley
Gérard Janvier
Philippe Vignon

Echocardiography in the intensive care unit: from evolution to revolution?

- Allows for dynamic assessment of volume not pressure
- Provides detailed information on both sides of the heart
- Measurement of IVC diameter and collapsibility


12
11

Surgeon Performed Echo

- Available
- Real time physiologic information about volume status and cardiac function
- Real time interpretation and therapy

Echo data in Trauma/SICU

Author	Year	N	Measurements
Yanagawa	2005	35	Preload
Sefidbankt	2007	88	Preload
Yanagawa	2007	30	Preload
Carr	2007	70	Preload
Gunst	2008	68	Preload/ cardiac function
Stawiki	2009	83	Preload
Ferrada	2011	53	Preload/ cardiac function

Accuracy of Cardiac Function and Volume Status Estimates Using the Bedside Echocardiographic Assessment in Trauma/Critical Care

Mark Gunst, MD, Vafa Ghaemmaghami, MD, Jason Sperry, MD, Melissa Robinson, MD, Terence O'Keeffe, MD, Randall Friese, MD, and Heidi Frankel, MD

- 85 BEAT examinations performed
- 57% on Trauma
- 37% on general surgery patients
- 97% of the IVC examinations contained images of good quality

Transthoracic Focused Rapid Echocardiographic Examination: Real-Time Evaluation of Fluid Status in Critically Ill Trauma Patients

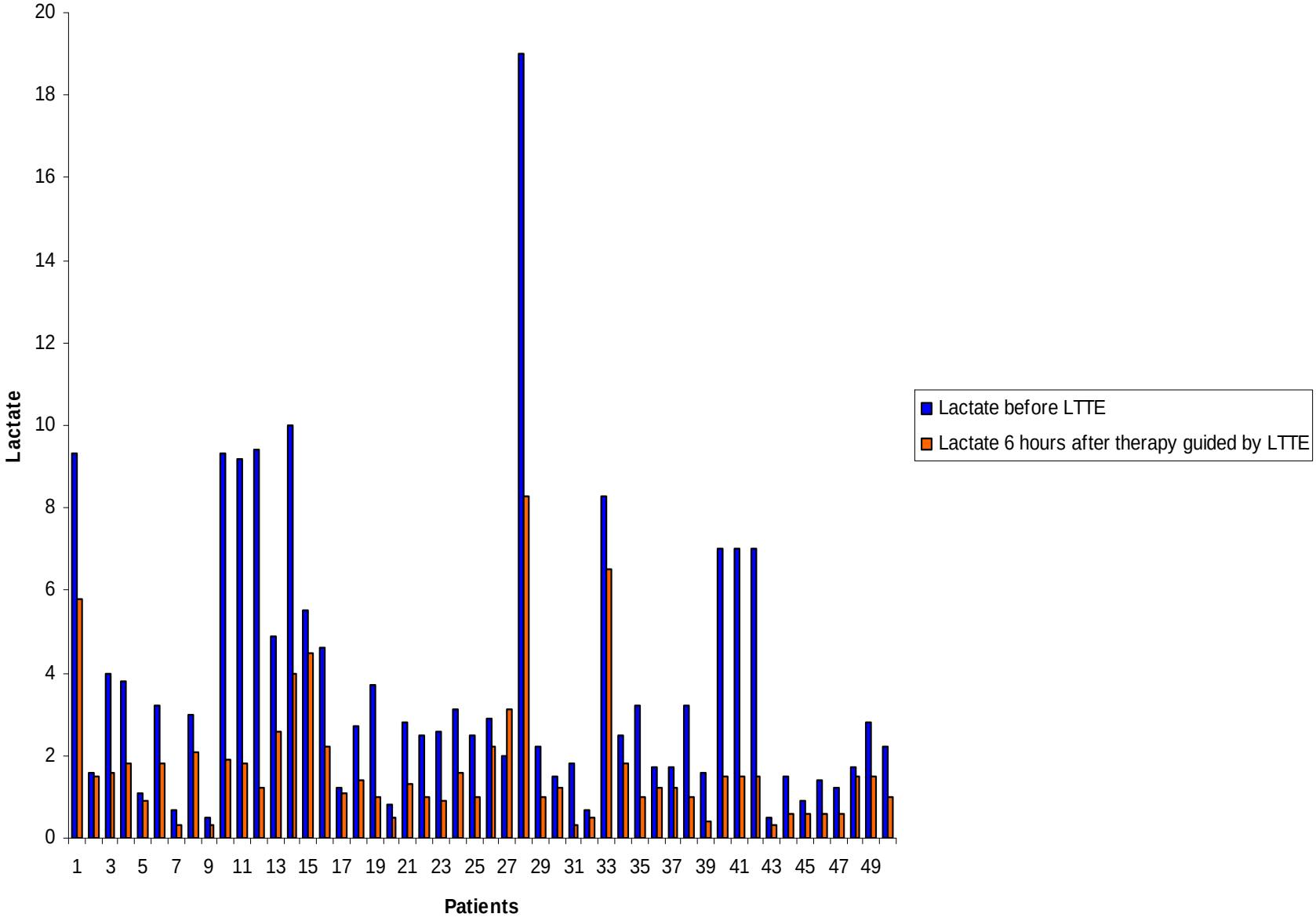
Paula Ferrada, MD, Sarah Murthi, MD, Rahul J. Anand, MD, Grant V. Bochicchio, MD, and Thomas Scalea, MD

- 80% EF.
- LVD 56%
- IVC 80%
- In 87% able to answer the clinical question asked by the primary team.
- 54% the plan of care was modified

Limited Transthoracic Echocardiogram: So Easy Any Trauma Attending Can Do It

Paula Ferrada, MD, Rahul J. Anand, MD, James Whelan, MD, Michel A. Aboutanos, MD, Therese Duane, MD, Ajai Malhotra, MD, and Rao Ivatury, MD

- 1 year to 29 years.
- Teaching :70 minutes of didactics and 25 minutes of hands-on.
- Average =4 min
- Cardiology-performed TTE **correlation was 100%.**
- Lactate reduction in all patients **($p < 0.00001$).**
- Attendings scored a mean of 88% in a written test after training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1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Patients
Lactate before LTTE
Lactate 6 hours after therapy guided by LTTE

LTTE In Trauma Bay

- Hypotensive patients
- Contractility (good vs. poor)
- Fluid status (flat IVC=hypovolemia vs. fat IVC=euvolemia)
- Pericardial effusion (present vs. absent).
- Need for surgery
- ICU admission
- FAST exam results
- Change in therapy as a consequence of LTTE findings were examined.

LTTE In Trauma Bay

- 148 LTTEs were performed in consecutive patients from January to December 2011.
- Windows:
  - SX window was obtained in all patients.
  - PS 96.5%
  - Apical 11%

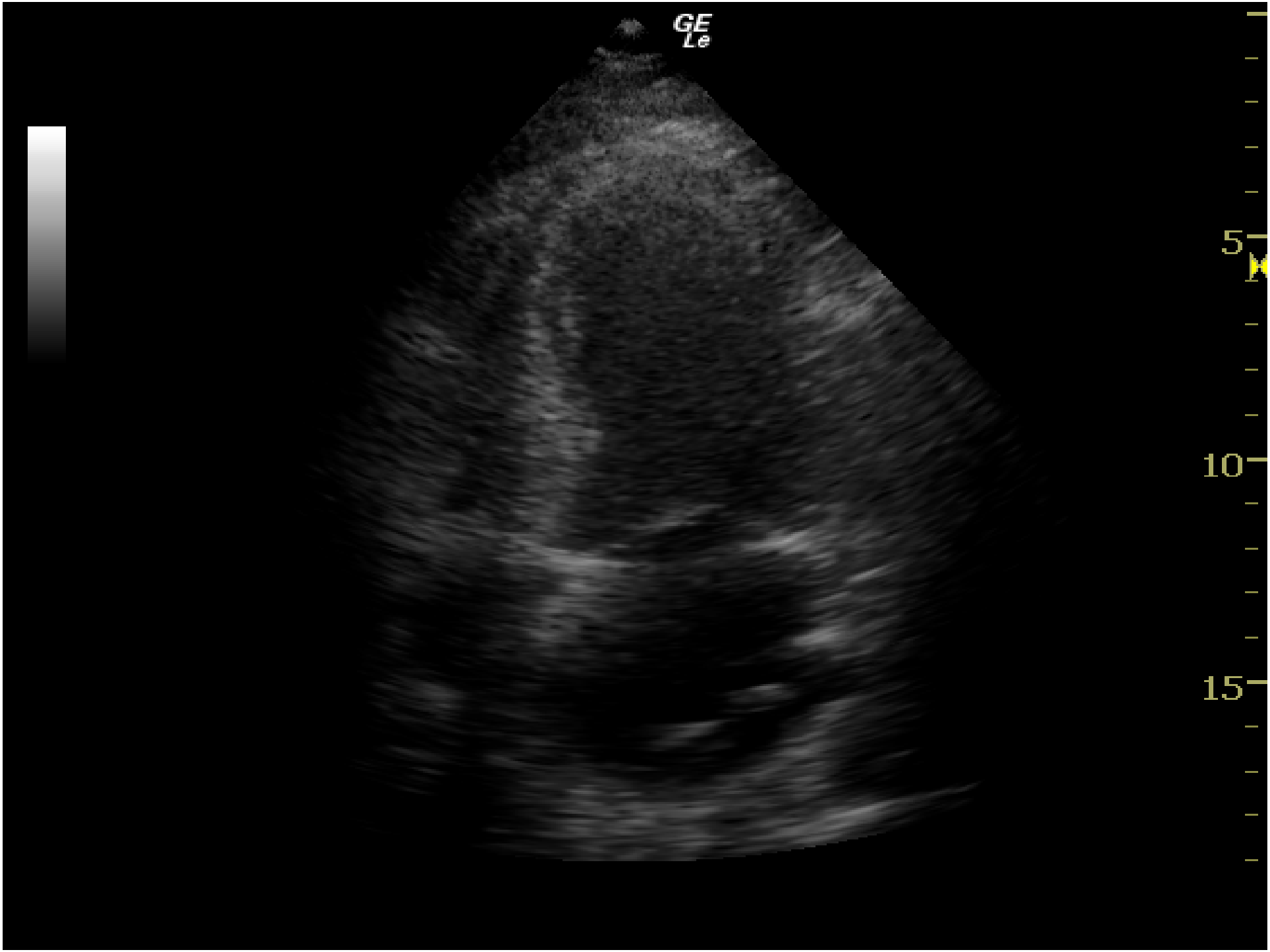
LTTE In Trauma Bay

- Flat IVC was associated with:
  - Increased incidence of ICU admission ($p<0.0076$)
  - Therapeutic operation ($p<.0001$).
- 27/148 (18%) of patients had LTTE results indicating absence of hypovolemia
  - head injury (n=14)
  - Cardiac (n=5)
  - Spinal shock (n=4)
  - Pulmonary embolism (n=3)
  - Stroke (n=1)

LTTE In Trauma Bay

- 28 hypovolemic patients had a negative or inconclusive FAST exam
- 60% + blood in the abdomen confirmed by surgery
- Therapy was modified as a result of LTTE in 41% of cases.
- Patients older than 65, LTTE changed therapy in 96% of cases

- Fluid
- Pressors
- Ionotrope
- Intervention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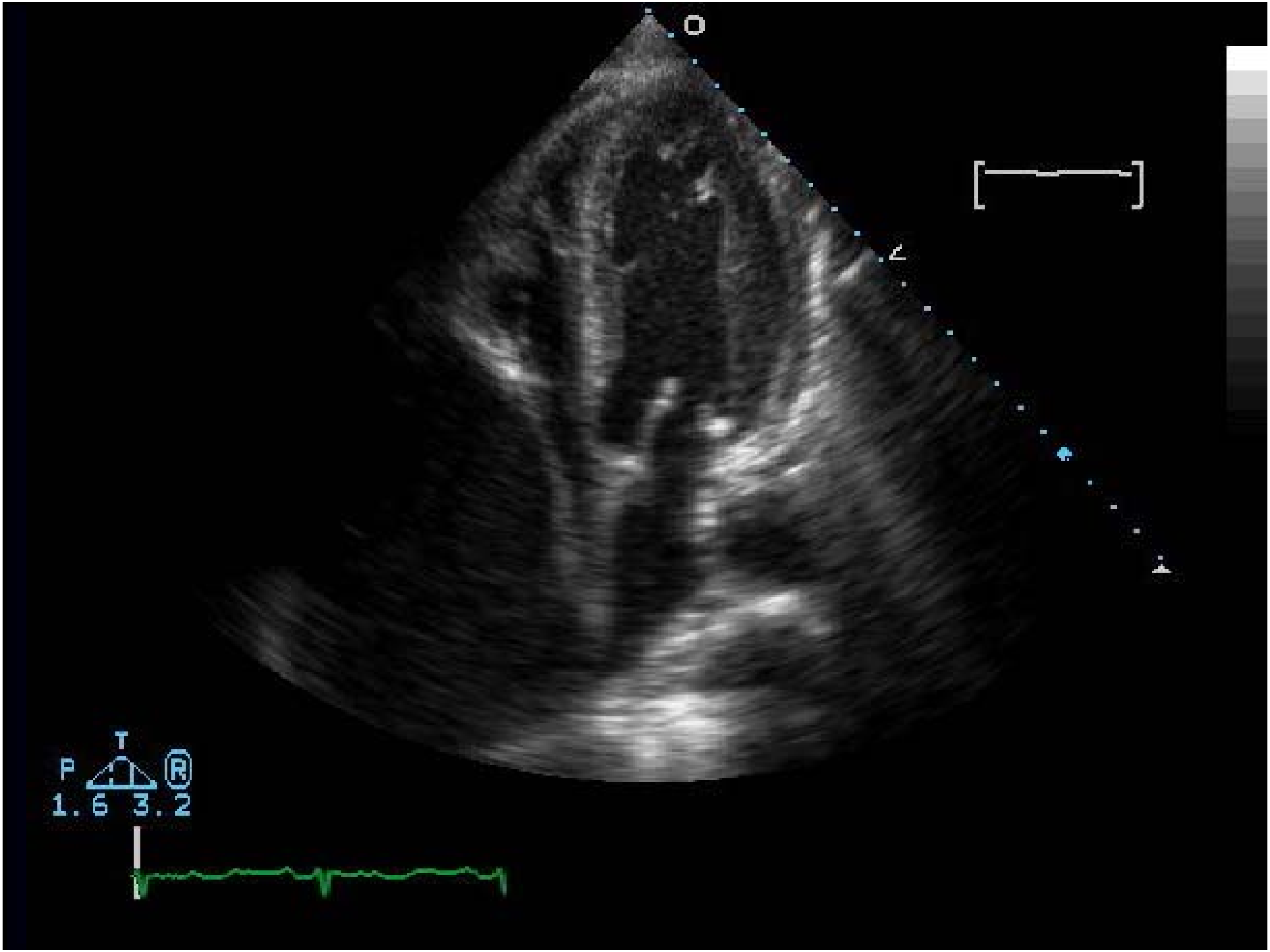
1. Question

- Fluids
- Pressors
- Ionotropes
- Surgical Intervention
- Anticoagulation- Fibrinolysis
- Not able to take a therapeutic decision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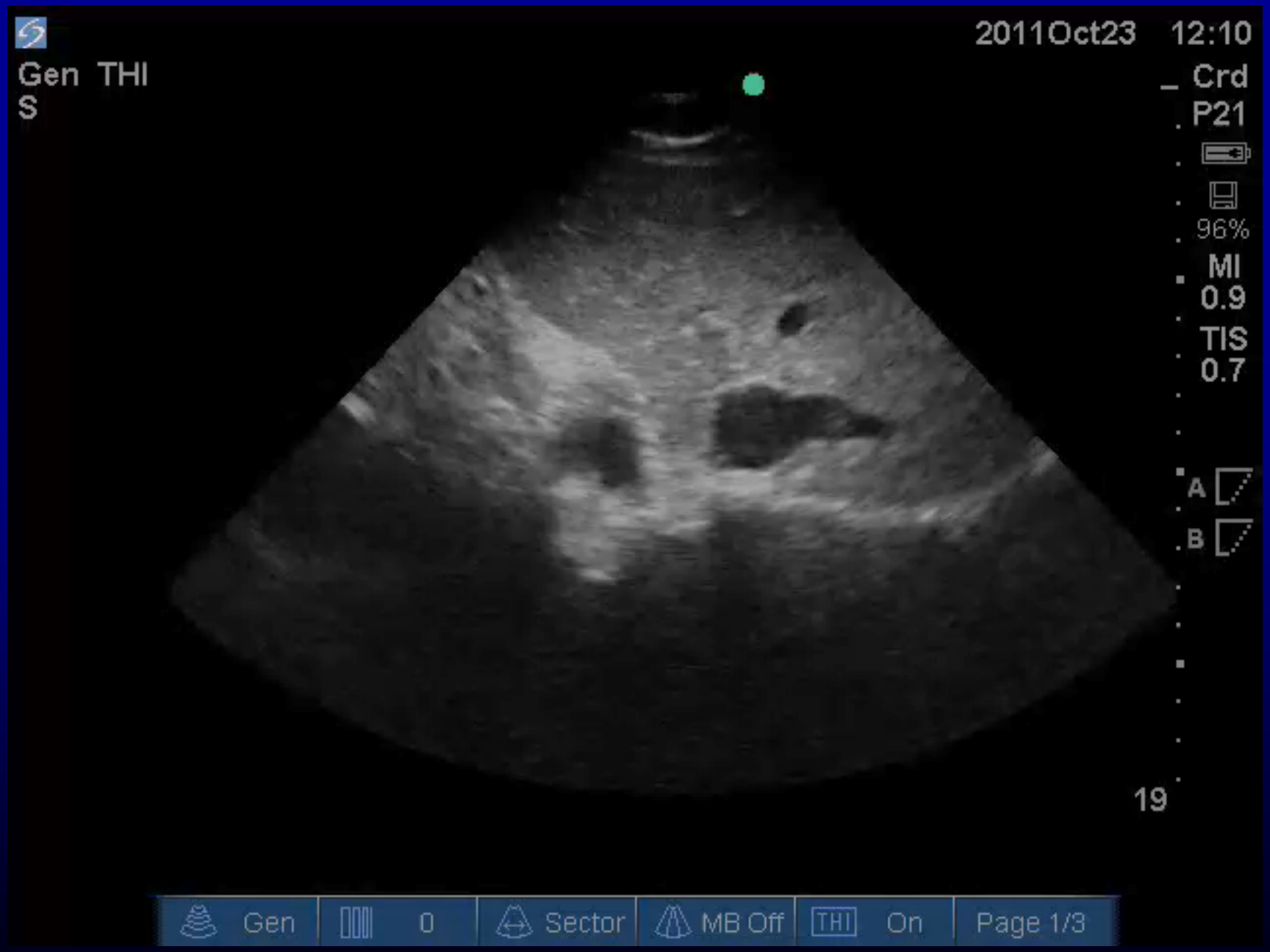
2. Question

- Hypovolemia
- Poor cardiac function
- Tamponade physiology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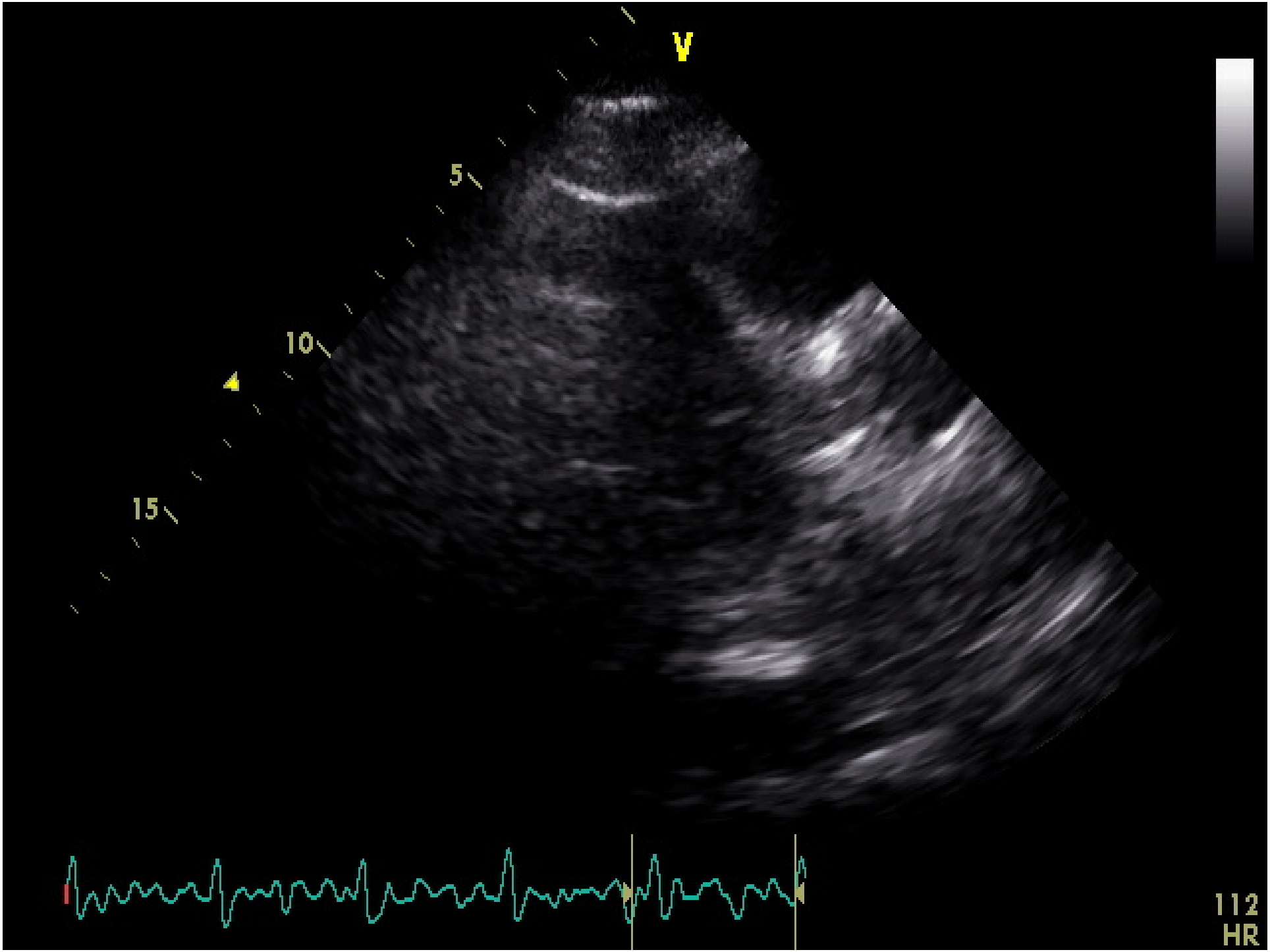
3. Question

- Fluids
- Pressors
- Ionotropes
- Surgical Intervention
- Anticoagulation- Fibrinolysis
- Not able to take a therapeutic decision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4. Question

- Hypovolmemia
- Poor cardiac function
- Pericardial Effusion

Answers

- 1. Ionotropes
- 2.Tamponade
- 3. Anticoagulation-Fibrilolysis
- 4.Hypovolemia