

Extra-Cardiac Echo
(tying things together)

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Disclosures

- None related to this presentation.

Agenda

The agenda diagram features a central image of a heart scan. Four arrows point from this central image to four surrounding boxes, each containing a different ultrasound modality: TOE (Transesophageal Echocardiography), Lung Ultrasound, DVT Scan (Deep Vein Thrombosis Scan), and Pleural Ultrasound.

Patient 1

History

60 / M
Ischaemic CMP, EF 35%
SOB x 3/7

O/E

T 37.1, BP 160/90, HR 113
RR 32, SpO₂ 88% (FIO₂ 40%)
H - S₁S₂, L - basal creps

Inx

TW 12K, Hb 10, Plt 150
Urea 11, Cr 130, Na 128, K 4.5, hsTrop 100

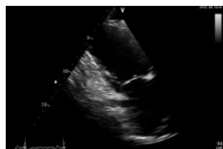
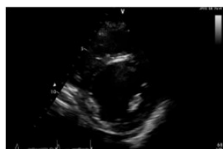


Immediate Management

Rx

1. IV Frusemide
2. IV GTN infusion
3. Oral Hydralazine

Echocardiography

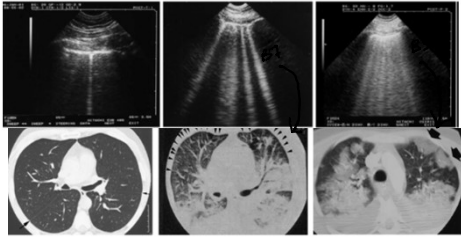


Lung Ultrasound in Acute Breathlessness

Lung Sliding

A lines vs B lines

B7 lines vs B3 lines



- Interlobular septal thickening/oedema
 - > 3 lung rockets spaced around 7mm apart (B7 lines)
- Alveolar filling/oedema
 - > 3 lung rockets spaced around 3mm apart (B3 lines)

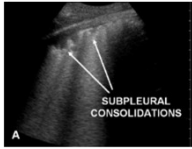
Differentiating APO from ARDS



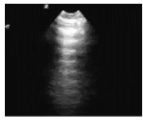
Cardiovascular Ultrasound
 Research
Chest sonography: a useful tool to differentiate acute cardiogenic pulmonary edema from acute respiratory distress syndrome
 Roberto Copetti¹, Gino Soldati² and Paolo Copetti¹

↓ APO

↓ ARDS

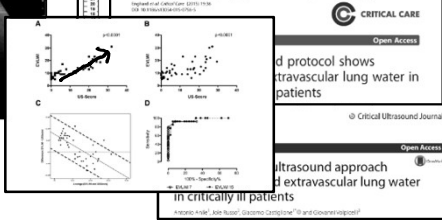


A/B lines correlate with Lung Water



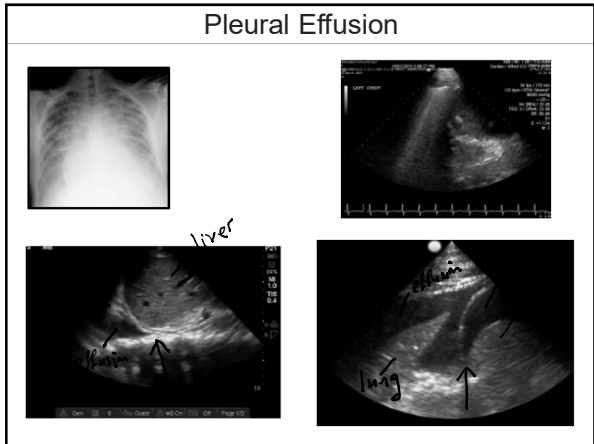
CHEST Original Research
 CRITICAL CARE MEDICINE
A-Lines and B-Lines
 Lung Ultrasound as a Bedside Tool for Predicting Pulmonary Artery Occlusion Pressure in the Critically Ill

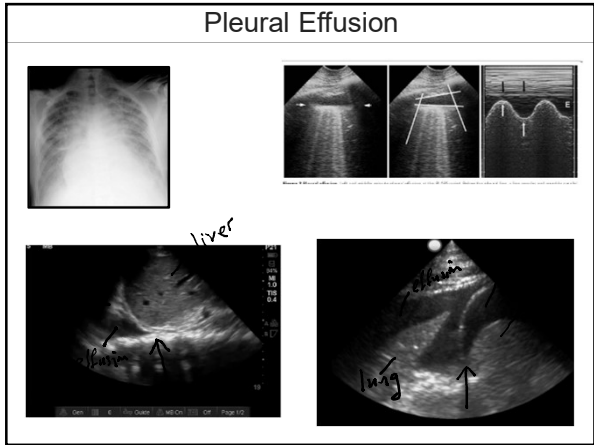
Apnea/Spontaneous	Spontaneous	Apnea/Spontaneous	Spontaneous
A	B	A	B
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10



and protocol shows extravascular lung water in patients

ultrasound approach of extravascular lung water in critically ill patients





Quantifying Pleural Effusion

$mls) = Sep (mm) \times 20$

Usefulness of Ultrasonography in Predicting Pleural Effusions > 500 mL in Patients Receiving Mechanical Ventilation*

Quantitative by means of


pleural effusion at the

volume of pleural effusion

$y = 0.022x + 132$
 $r = 0.98$

Fig 2 The relationship between volume of pleural fluid (mL) and maximum separation of pleural lines (cm). Each dot represents 100 mL of pleural fluid.

Nature of Pleural Effusion



Value of Sonography in Determining the Nature of Pleural Effusion: Analysis of 320 Cases

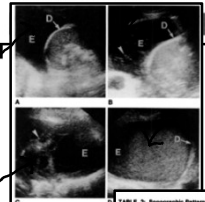



TABLE 2. Sonographic Patterns and Nature of Pleural Effusion in 320 Patients

Effusion	Nature of Effusion				Tuberculous Pleural Effusion		Non-tuberculous Pleural Effusion	
	Simple	Complex	Loculated	Hemothorax	Yes (n=15)	No (n=13)	Yes (n=15)	No (n=13)
Total (n=320)	195	67	67	9	3	0	3	0
Transudate (n=195)	195	0	0	0	0	0	0	0
Exudate (n=125)	0	67	67	9	3	0	3	0
Normal (n=111)	30	27	40	14	42	0	38	0
Malignant (n=14)	0	0	0	0	0	0	0	0
Septic (n=10)	0	0	0	0	0	0	0	0

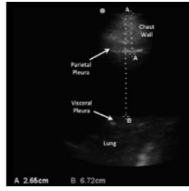
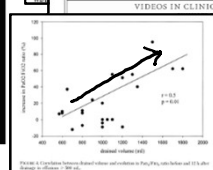
Pleural Drainage



Feasibility and safety of ultrasound-aided thoracentesis in mechanically ventilated patients

Safety of Ultrasound-Guided Thoracentesis in Patients Receiving Mechanical Ventilation

Application of ultrasound-guided pigtail catheter for drainage of pleural effusions

VIDEOS IN CLINICAL MEDICINE

Ultrasound-Guided Pigtail Catheter for Pleural-Catheter Drainage

Dr. Giovanni Ciardi, M.D., et al.

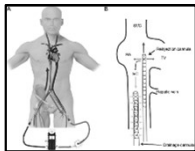
Patient 1 - Summary

- Patient had acute decompensated heart failure
- Despite IV diuresis, GTN and oral vasodilators, patient remained dyspnoeic
- Lung ultrasound revealed significant pulmonary congestion (bilateral B profile) with estimated ELWI > 10 ml/kg and pleural ultrasound revealed a moderate pleural effusion causing adjacent compressive atelectasis
- Patient symptomatically better after institution of both non-invasive positive pressure ventilation and pleural drainage (under ultrasound guidance)

Patient 2

History

33 / M
Severe ARDS after smoking "ice"
D11 VV ECMO



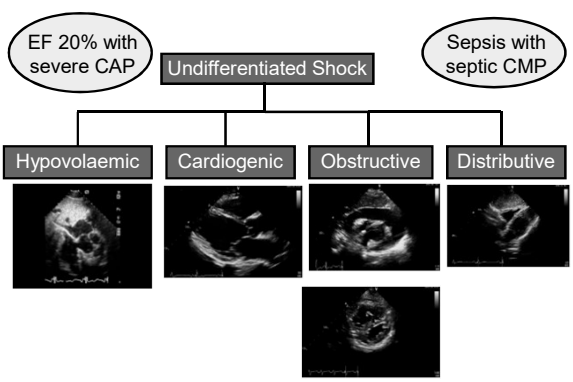
O/E

T 37.9, BP 86/60, HR 130 (NorA, Vaso)
RR 28, SpO₂ 88% (FiO₂ 80%, PEEP 10)
H - S₁S₂, L - bronchial breathing

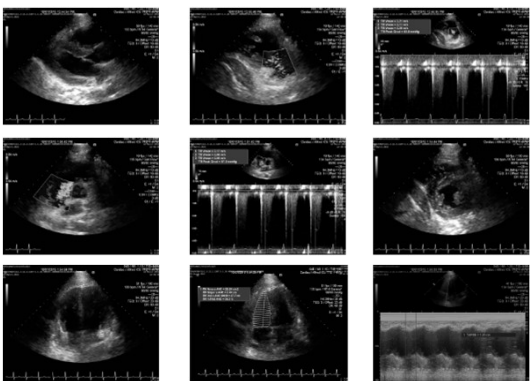
Inx

TW 18K Hb 11, Plt 180
Urea 13, Cr 120, Na 135, K 4.0

Hemodynamic Compromise in ICU



TTE



Venous Ultrasound for DVT

THE NEW ENGLAND JOURNAL OF MEDICINE Feb. 9, 2011

DETECTION OF DEEP-VEIN THROMBOSIS BY REAL-TIME B-MODE ULTRASONOGRAPHY

Table 1. Comparison of Ultrasonographic and Venographic Results in 142 Patients with Potential Venous Thrombosis and 142 Patients without Venous Thrombosis.*

J. DICK BEAUGIE, M.D., Peter M. HERRMAN, M.D.,
JACQUES M.D., JENNIFER KEENE, M.D.,
MUNDO V. HERRMAN, M.D., Ph.D.,
LARK, M.D., Ph.D.

CHEST Original Research
OFFICIAL JOURNAL

Accuracy of Ultrasonography Performed by Critical Care Physicians for the Diagnosis of DVT

Peter D. Ross, MD, MPH, University of Pittsburgh Medical Center, Pittsburgh, Pa.; David A. Clark, MD, MPH, University of Pittsburgh Medical Center, Pittsburgh, Pa.; J. Dick Beaugie, M.D., Peter M. Herrman, M.D., Jacques M.D., Jennifer Keene, M.D., MunDO V. Herrman, M.D., Ph.D., Lark, M.D., Ph.D.

Venous Ultrasound for DVT

Utility of an Integrated Clinical, Echocardiographic, and Venous Ultrasonographic Approach for Triage of Patients With Suspected Pulmonary Embolism

Stefano, *N Engl J Med* 2010; 362:207-214
<http://dx.doi.org/10.1056/NEJMoa0908141>

EM - ORIGINAL

Diagnostic accuracy of focused cardiac and venous ultrasound examinations in patients with shock and suspected pulmonary embolism

Primary: Number of Patients Cardiac*

	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	+LR (95% CI)	-LR (95% CI)
Cardiac US	97% (88-97)	87% (80-92)	83% (74-90)	97% (86-99)	7.03 (4.61-10.99)	0.11 (0.08-0.20)
Venous US	96% (88-98)	87% (80-92)	89% (77-97)	96% (86-99)	11.04 (7.36-16.95)	0.08 (0.04-0.15)
Both tests	95% (85-99)	79% (72-85)	76% (66-79)	95% (88-99)	4.98 (3.06-8.41)	0.08 (0.05-0.20)
Both tests and clinical criteria	97% (85-97)	100% (94-100)	100% (85-100)	75% (70-77)	Inf (2.25-Inf)	0.08 (0.04-0.15)

*The two tests were not run together, and hence the both tests were positive.

US, ultrasonography; PPV, positive predictive value; NPV, negative predictive value; +LR, positive likelihood ratio; -LR, negative likelihood ratio; 95% CI, 95% confidence interval.

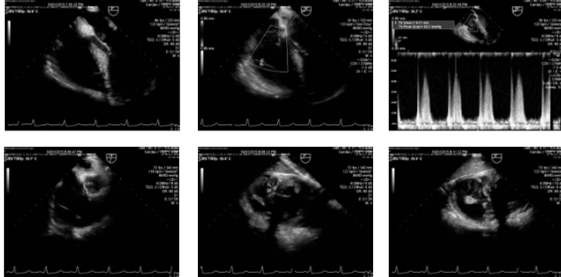
Lung Ultrasound

Bedside Lung Ultrasound in Emergency (BLUE Protocol) Probe Positions

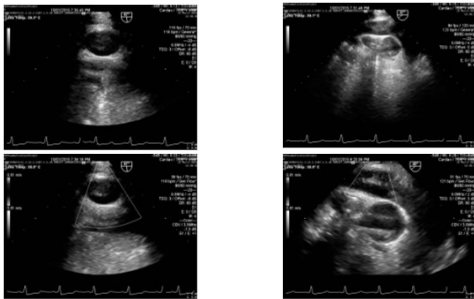
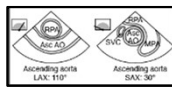
TOE

Diagnostic value of transoesophageal echocardiography in suspected haemodynamically significant pulmonary embolism
P Pruszczyk, A Torbicki, A Kuch-Wociał, M Szulc and R Pachó
Heart 85:6 (June 2001) p628
Copyright: COPYRIGHT 2001 BMJ Publishing Group Ltd

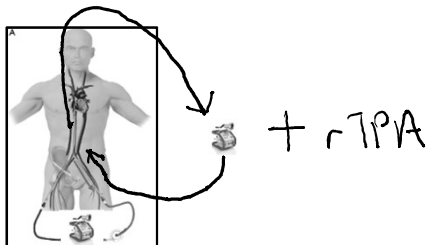
*Sensitivity 80.5%
Specificity 97.2%*



TOE



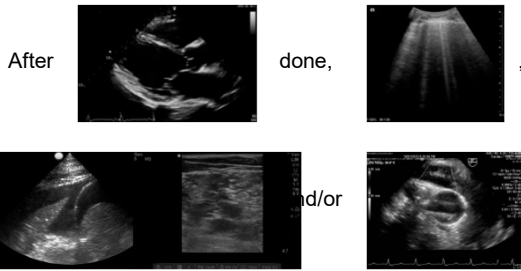
Immediate Management



Patient 2 - Summary

- Patient has severe ARDS on VV ECMO
- Developed worsening hypotension requiring increasing dose of vasopressors
- TTE showed RV dilatation with RV dysfunction compared with TTE done 1 week ago
- Venous ultrasound of lower limbs revealed extensive bilateral DVT
- TOE performed demonstrated embolus in right pulmonary artery
- VA ECMO was initiated followed by thrombolytic therapy
- Hemodynamics improved and VA ECMO weaned off the following day

Summary



may provide incremental information for the diagnosis of breathlessness and shock, contributing to the management of our critically ill patients.

The End