Eco polmonare: Congestione emodinamica o congestione clinica?

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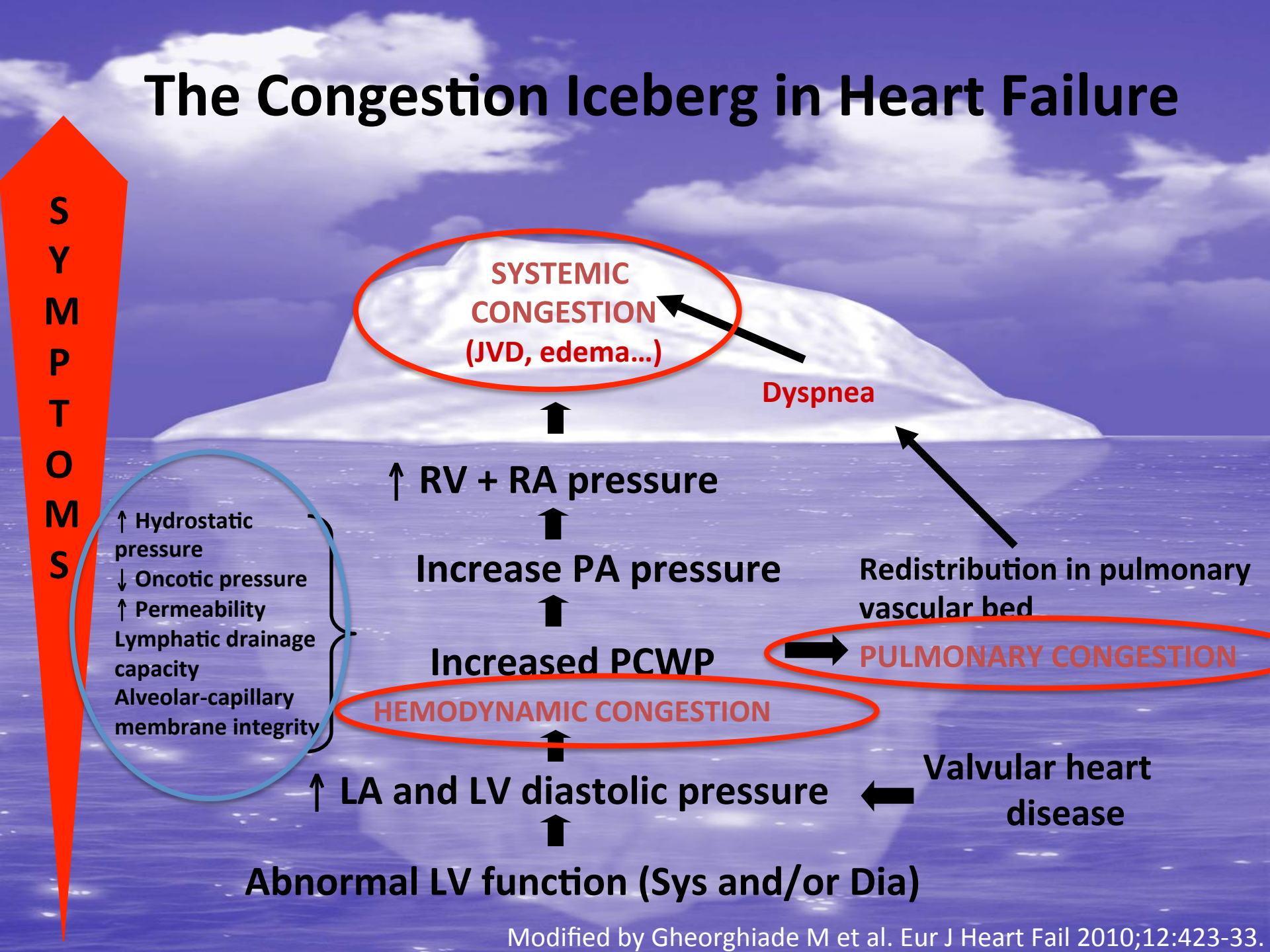
Istituto di Fisiologia Clinica
Consiglio Nazionale delle Ricerche, Pisa

Napoli, 17 Aprile 2015

Nessun conflitto di interesse da dichiarare



Modified by Gheorghiade M et al. Eur J Heart Fail 2010;12:423-33.

Assessing and grading congestion

European Journal of Heart Failure (2010) **12**, 423–433
doi:10.1093/eurjhf/hfq045

REVIEW

Assessing and grading congestion in acute heart failure: a scientific statement from the Acute Heart Failure Committee of the Heart Failure Association of the European Society of Cardiology and endorsed by the European Society of Intensive Care Medicine

volume status prior to discharge; however, there is no established algorithm for the assessment of congestion.[16] Currently, the gold standard for evaluating haemodynamic congestion in HF patients is cardiac catheterization to measure right atrial pressure and PCWP.[50] However, the invasive nature of catheterization limits

Gheorghiade M et al. Eur J Heart Fail 2010;12:423-33.

Assessing and grading congestion

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REVIEW

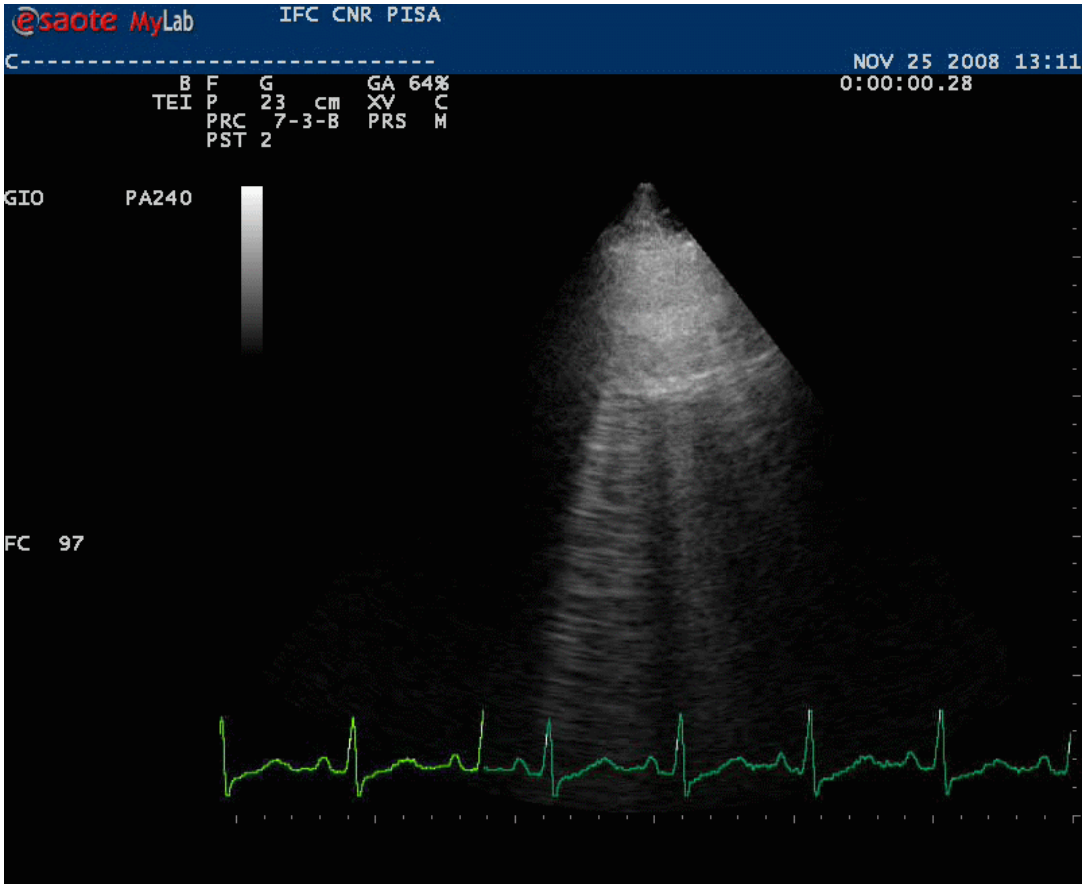
Assessing and grading congestion in acute heart failure: a scientific statement from the Acute Heart Failure Committee of the Heart Failure Association of the European Society of Cardiology and endorsed by the European Society of Intensive Care Medicine

Ultrasonography of the lungs using an echocardiographic probe is another potentially useful way to assess pulmonary congestion. In patients with pulmonary congestion, images defined as 'ultrasound lung comets' can be visualized by scanning with cardiac probes along the intercostal spaces.[97] A correlation exists between the number of 'ultrasound lung comets,' pulmonary congestion demonstrated by radiographic signs, interstitial oedema documented by computed tomography, extravascular lung water measured by the indicator dilution technique, and PCWP.[98,99]

Gheorghiade M et al. Eur J Heart Fail 2010;12:423-33.

Linee B: definizione

Artefatti di riverberazione verticali ed iperecogeni, che originano dalla pleura



Intensive Care Med
DOI 10.1007/s00134-012-2513-4

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

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Tomislav Petrovic
International Liaison Committee on Lung Ultrasound (ILC-LUS) for the International Consensus Conference on Lung Ultrasound (ICC-LUS)

International Evidenced-based Recommendations for Point-of-Care Lung Ultrasound

Endorsed by the World Interactive Network Focused on Critical Ultrasound (WINFOCUS)

Writing Committee:
Giovanni Volpicelli (Chairperson)*, Daniel Lichtenstein, Gebhard Mathis, Andrew Kirkpatrick, Luna Gargani, Vicki Noble, Gino Soldati, Roberto Copetti, Belaid Bouhemad, Angelika Reissig.

Scanning and training methodology

B-D2-S1 (strong: level A)

- Multiple B-lines are the sonographic sign of lung interstitial syndrome.

Sindrome interstiziale polmonare

Intensive Care Med
DOI 10.1007/s00134-012-2513-4

CONFERENCE REPORTS AND EXPERT PANEL

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

- The presence of multiple diffuse bilateral B-lines indicates interstitial syndrome. Causes of interstitial syndrome include the following conditions:
  - Pulmonary edema of various causes
  - Interstitial pneumonia or pneumonitis
  - Diffuse parenchymal lung disease (pulmonary fibrosis)

When to assess pulmonary congestion

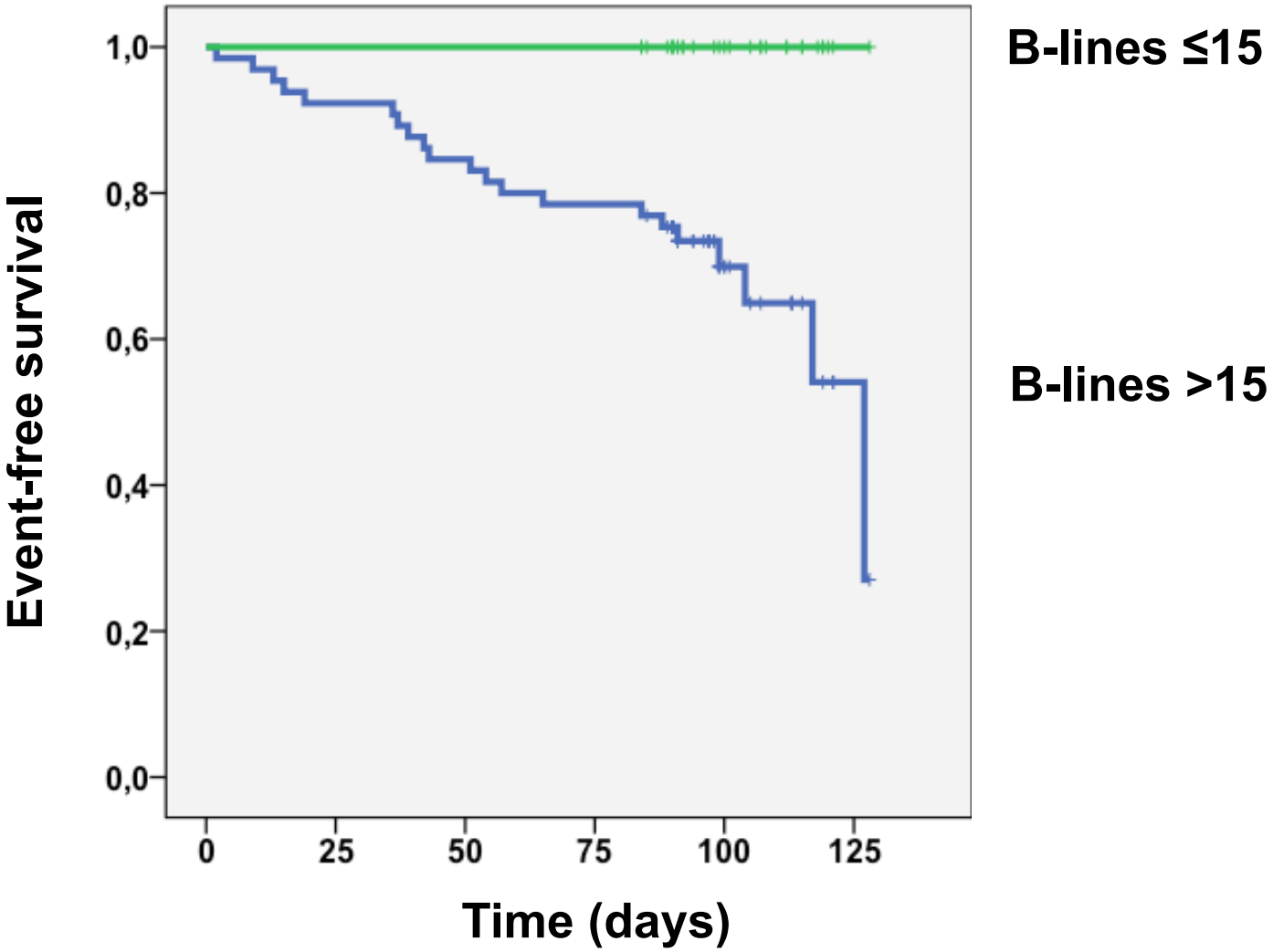
When	Diagnostic target
Outpatient	Exclude impending instabilization
ER	AHF diagnosis
Ward	Therapy titration
Pre-discharge	Risk stratification

Picano E, Gargani L, Gheorghiade M Heart Fail Rev. 2010;15:63-72.

Heart failure out-patients

21 ri-ospedalizzazioni per scompenso

n=97



Miglioranza M, Gargani L et al. ESC 2013

When to assess pulmonary congestion

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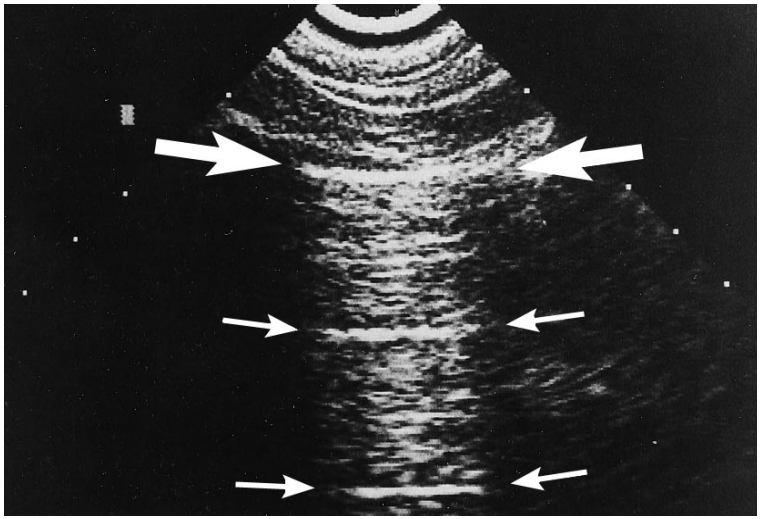
Intensive Care Med (1998) 24: 1331–1334

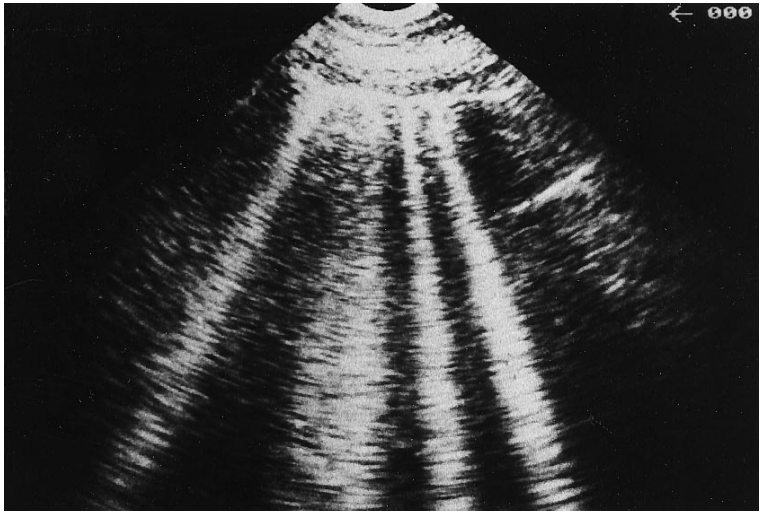
BRIEF REPORT

D. Lichtenstein
G. Mezière

A lung ultrasound sign allowing bedside distinction between pulmonary edema and COPD: the comet-tail artifact



Exacerbation of COPD



Acute pulmonary oedema

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BRIEF REPORT

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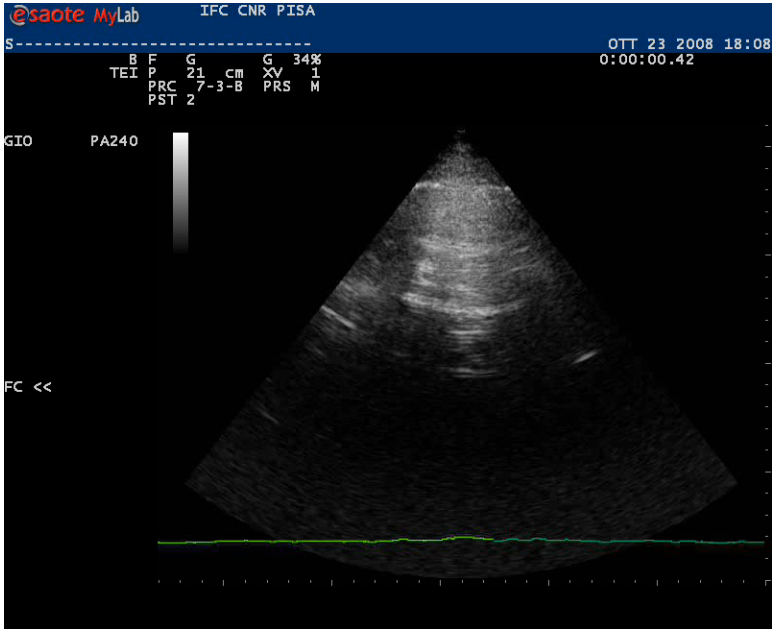
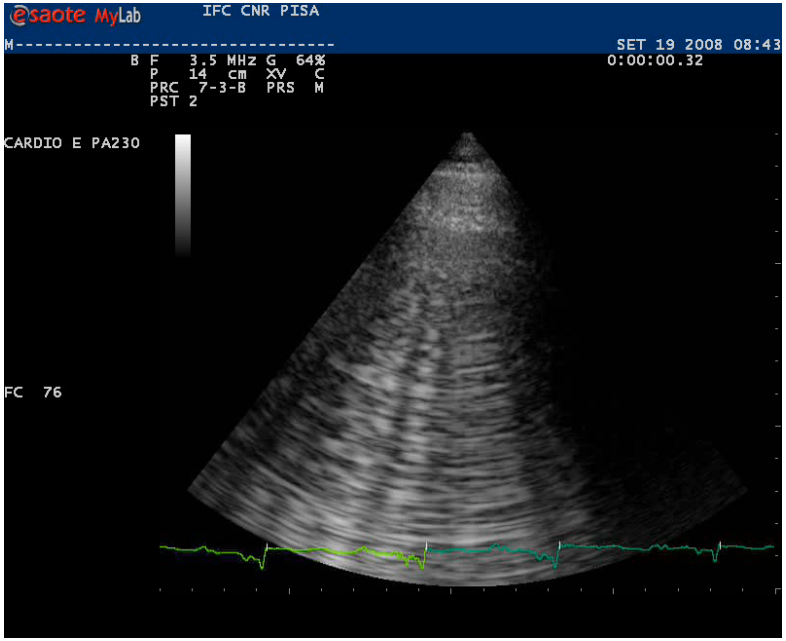


Exacerbation of COPD



Acute pulmonary oedema

European Heart Journal – Cardiovascular Imaging (2013) **14**, 1–11
doi:10.1093/ehjci/jes193

Emergency echocardiography: the European Association of Cardiovascular Imaging recommendations

Aleksandar N. Neskovic[1]*, Andreas Hagendorff[2], Patrizio Lancellotti[3], Fabio Guarracino[4], Albert Varga[5], Bernard Cosyns[6], Frank A. Flachskampf[7], Bogdan A. Popescu[8], Luna Gargani[9], Jose Luis Zamorano[10], and Luigi P. Badano[11], on behalf of the European Association of Cardiovascular Imaging[†]

Lung ultrasound examination

In recent years, lung ultrasound (LUS) has been proposed as a useful point-of-care tool in emergency.[25]

The LUS examination can be performed with any commercially available 2-D scanner, including pocket-size devices, by using a cardiac, convex or microconvex transducer, with the patient in the near-supine, supine, sitting, or even standing position.

In addition to the detection of pleural effusion, LUS may help in the diagnosis of acute dyspnoea, allowing the differential identification of pneumothorax, pulmonary consolidations, acute respiratory distress syndrome, and cardiogenic pulmonary oedema.[25]

The absence of multiple bilateral B-lines, a sign of increased extravascular lung water, excludes cardiogenic pulmonary oedema with a negative predictive value close to 100%.[26]

When to assess pulmonary congestion

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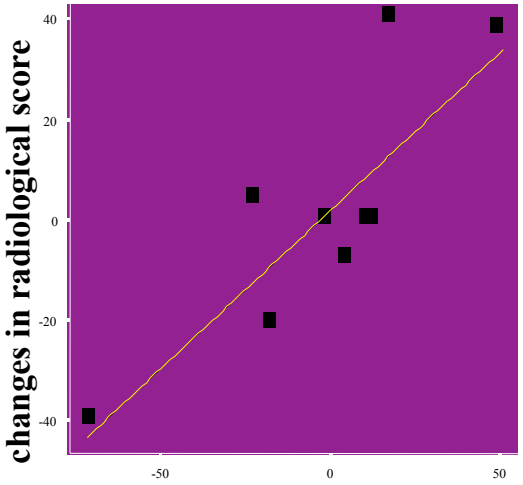
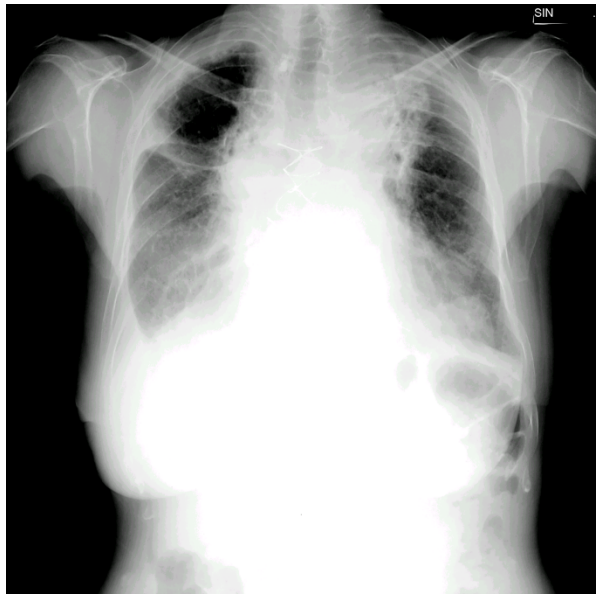
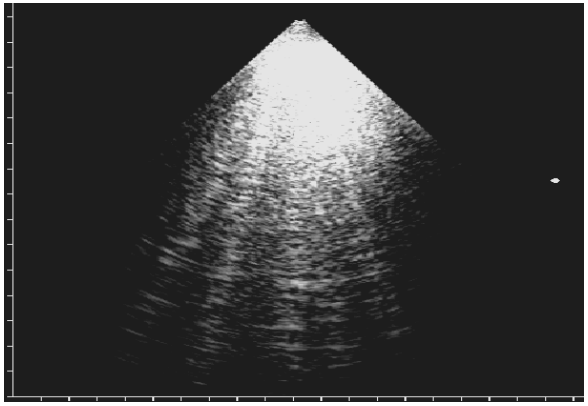
Outpatient	Exclude impending instabilization
ER	AHF diagnosis
Ward	Therapy titration
Pre-discharge	Risk stratification

Picano E, Gargani L, Gheorghiade M Heart Fail Rev. 2010;15:63-72.

Prima e dopo terapia



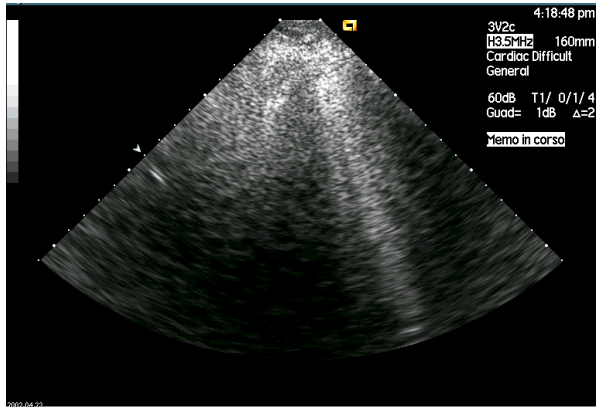




n = 9

r = 0.84

p < 0.01



Chest X-ray and B-lines at admission

Chest X-ray and B-lines after 3 days

Jambrik Z, Picano E et al. *Am J Cardiol.* 2004;93:1265-1270

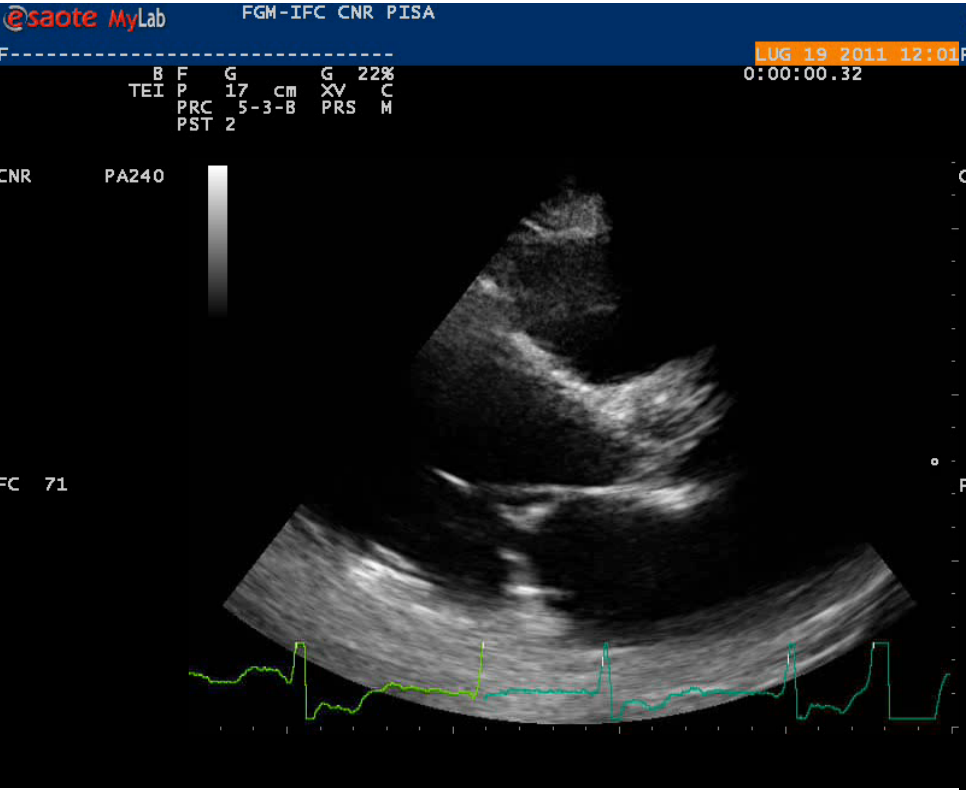
AF, 81 anni, CMD, FE 18%

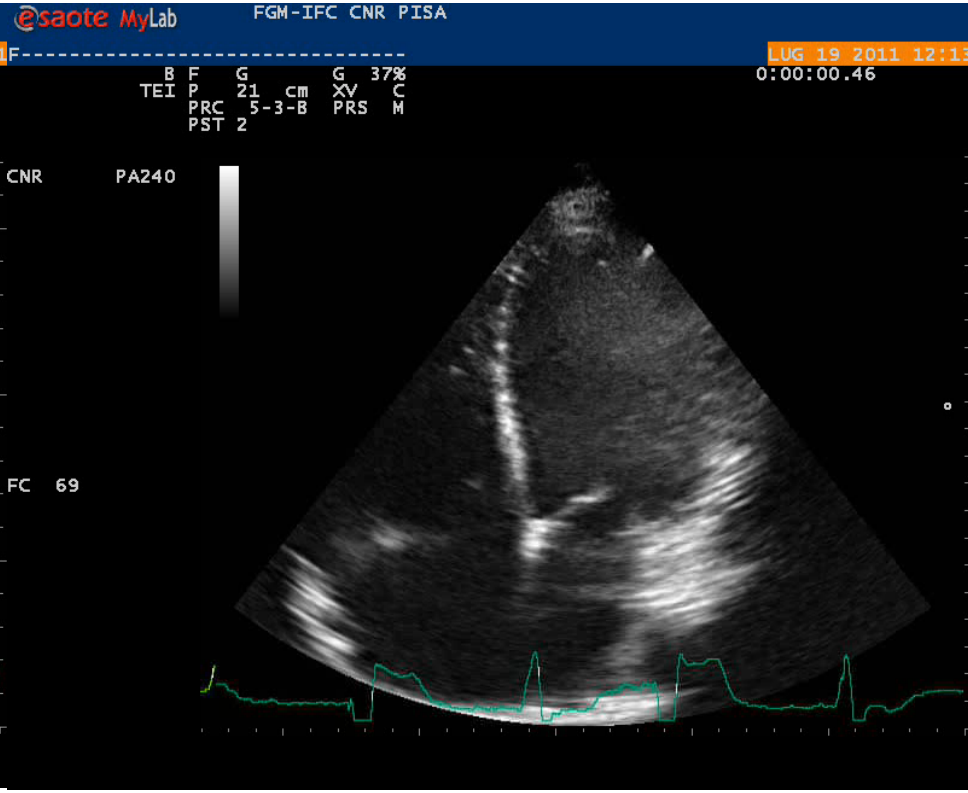
- Ammesso per scompenso cardiaco acuto
- In terapia con ACEi, beta-bloccanti, anti-aldosteronici, furosemide

Esame obiettivo all'ingresso

Azione cardiaca aritmica. Toni parafonici. Soffio sistolico mitralico 2/6 L.
Edema sottopalpebrale bilateralmente. Segni di glossite. Subittero sclerale.
Polsi arteriosi presenti a sede poplitea e femorale, normosfigmici e simmetrici; non valutabili in sede pedidia e tibiale posteriore.
Non soffi vascolari. Lieve turgore giugulare con riflesso epato-giugulare presente. Presenza di elettrostimolatore a sede prepettorale sinistra.
Rumore respiratorio ridotto a sede bibasilare. Lieve imbibizione del pannicolo sottuocutaneo a livello del dorso e del sacro.
Addome trattabile alla palpazione superficiale e profonda; margine inferiore del fegato debordante due dita trasverse dall'arcata costale in inspirazione profonda. Esiti chirurgici addominali.
Edemi declivi improntabili a livello di gamba bilateralmente. Segni di flebopatia cronica agli arti inferiori.
Peso 86,3 Kg; altezza 184 cm. BMI 25,49. Sup. corporea 2,09. Pressione arteriosa 110/80 mmHg. Polso 70 b.p.m.

Ecocardiogramma



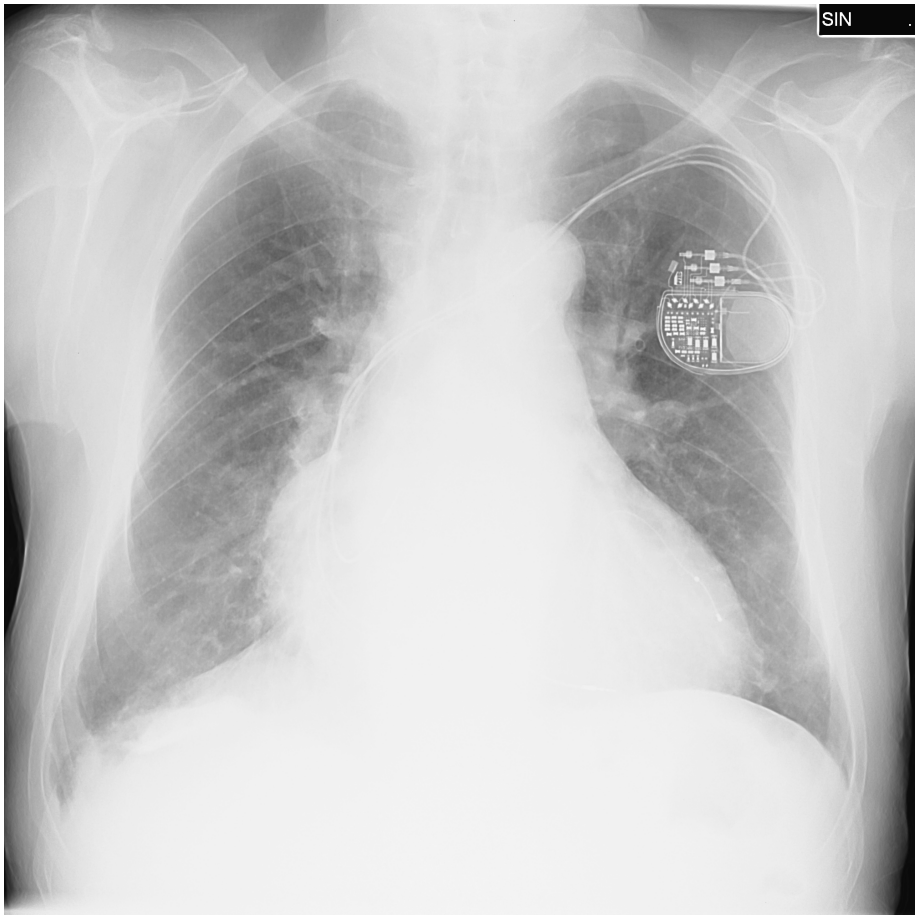


FE 18%
E/A 2.8
E/e’ 17
IM moderata
TAPSE 14 mm
PASP 42 mmHg

Dispnea in EF 18%

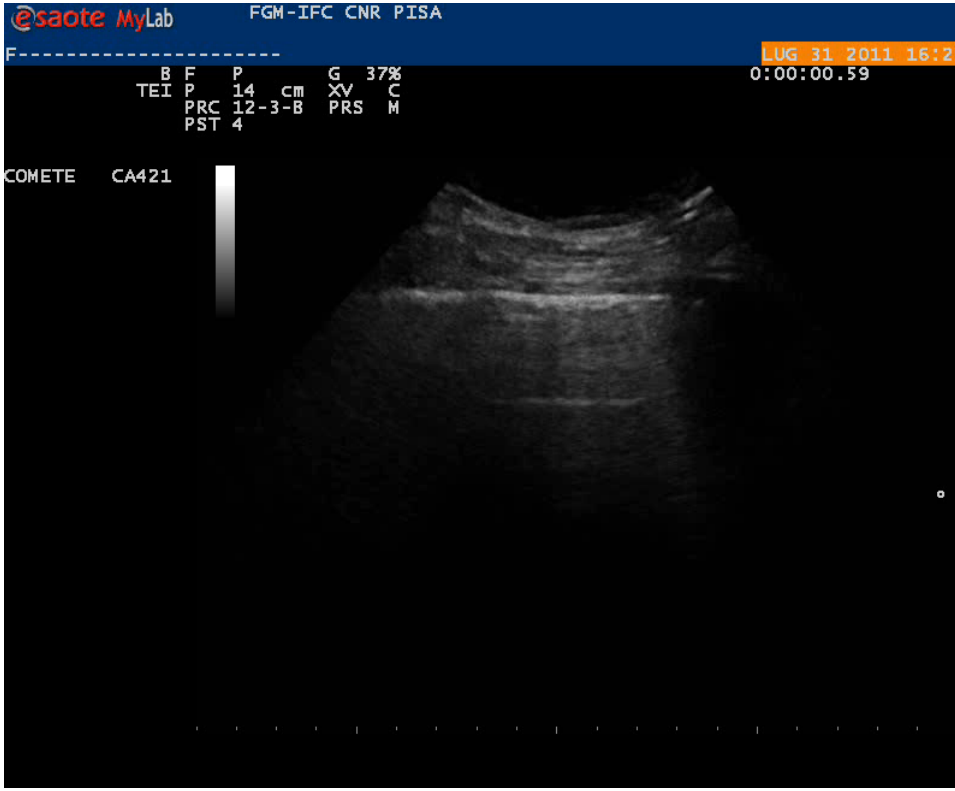
Diario
Il paziente lamenta dispnea. Obiettività: crepitii bibasilari. Sat 02=96% in aria ambiente. Si aumenta infusione di lasix da 10 a 15 cc (PA=105/70 mmHg). La dispnea, alla luce anche del dato emogasanalitico e clinico potrebbe essere dovuta ad respiro periodico centrale. Inizia 02 terapia con occhialini a 2 l

Radiografia del torace



Radiografia Torace a letto
ombra cardiaca ingrandita in toto, peduncolo vascolare slargato, diffuso rinforzo della trama, sollevamento dell'emidiaframma di sinistra.

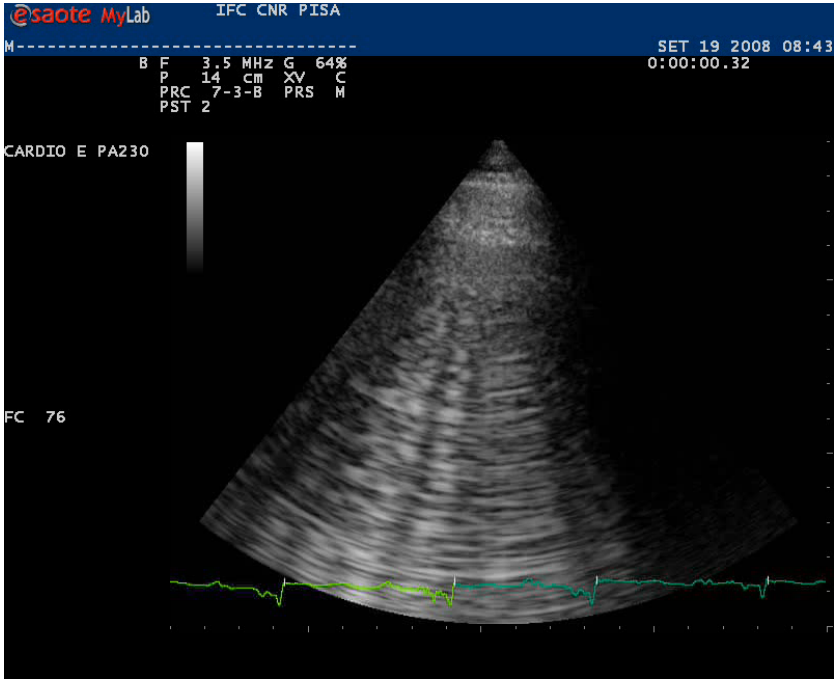
Ecografia polmonare



Dispnea in EF 18%

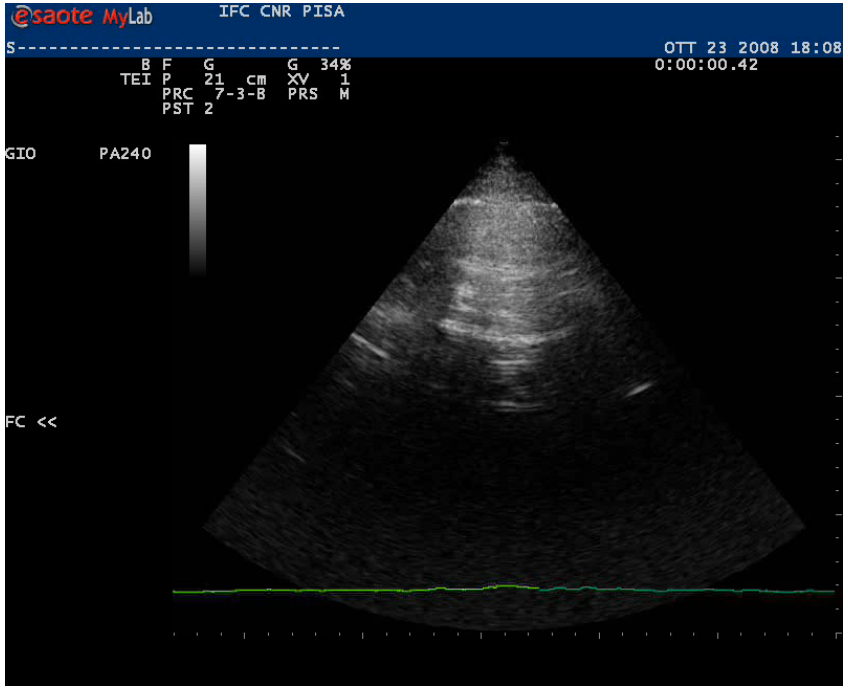
Diario
Paziente scarsamente responsivo. Diuresi 24 ore 2000 ml. Agli esami bioumorali severa emoconcentrazione (Hb 20.1 g/dL, Hc 57.6%), persistente aumento di azotemia e creatininemia. L' EGA mostra ipossiemia lieve e lieve acidosi. Si decide per idratazione (1ml/Kg/ora) 1000 ml di SF in 24 ore + 500 ml di aminoacidi in 24 ore. Non diuretico. Si posiziona urometro per diuresi oraria e si richiede bilancio idrico delle 24 ore.

Take-home message



AM, maschio, 57 anni
FE circa 20%, CMD

Non invasive PCWP = 23 mmHg
PASP = 40 mmHg

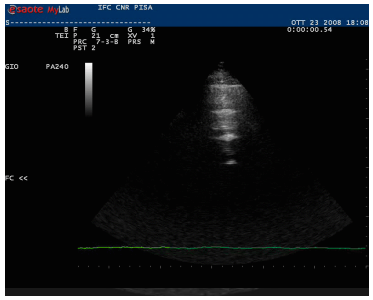


CM, maschio, 32 anni
FE circa 20%, CMD

Non invasive PCWP = 21 mmHg
PASP = 38 mmHg

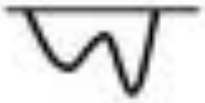
Congestione emodinamica vs congestione polmonare

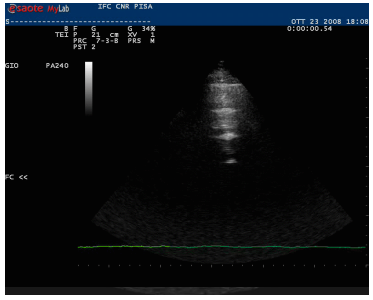
normal



no congestion

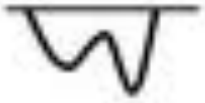
elevated

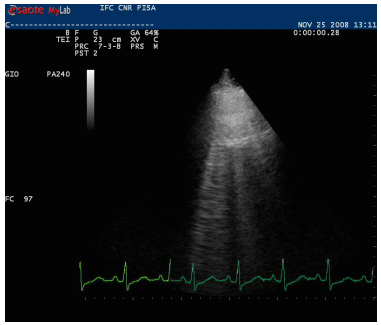




hemodynamic congestion

elevated





pulmonary congestion

Gargani L. *Cardiovascular Ultrasound* 2011;9:6.

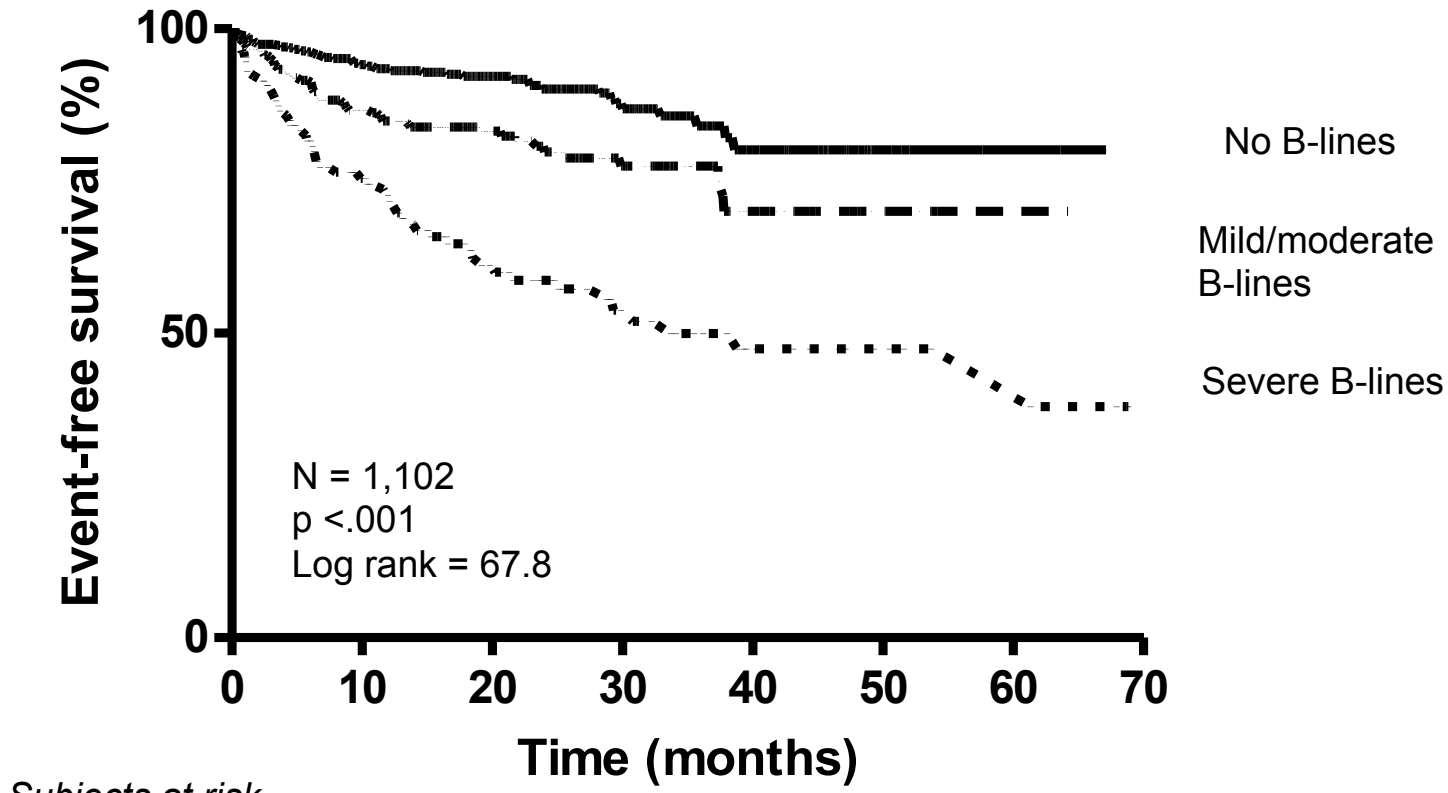
When to assess pulmonary congestion

When	Diagnostic target
Outpatient	Exclude impending instabilization
ER	AHF diagnosis
Ward	Therapy titration
Pre-discharge	Risk stratification

Picano E, Gargani L, Gheorghiade M Heart Fail Rev. 2010;15:63-72.

Prognosi in pazienti cardiopatici

206 events (death, AMI, decompensated heart failure)

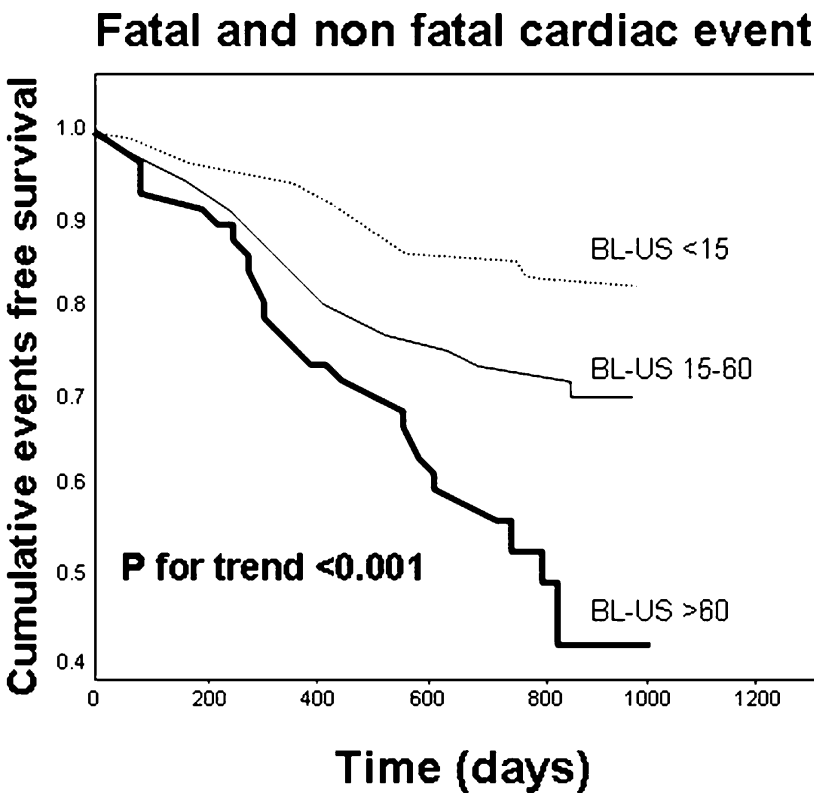


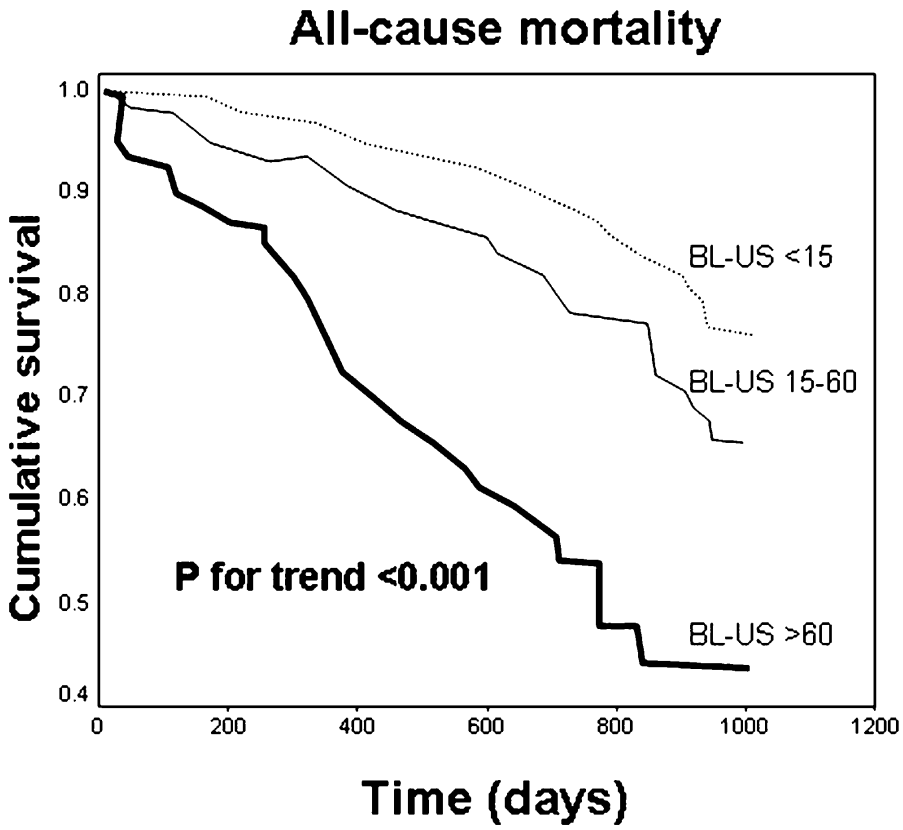
Subjects at risk

———	616	483	462	437
– – –	342	291	267	249
·····	144	117	106	96

Gargani L, Picano E et al. ESC Congress 2010

Prognosi in pazienti in dialisi





Zoccali C et al. JASN 2013

Come fare?

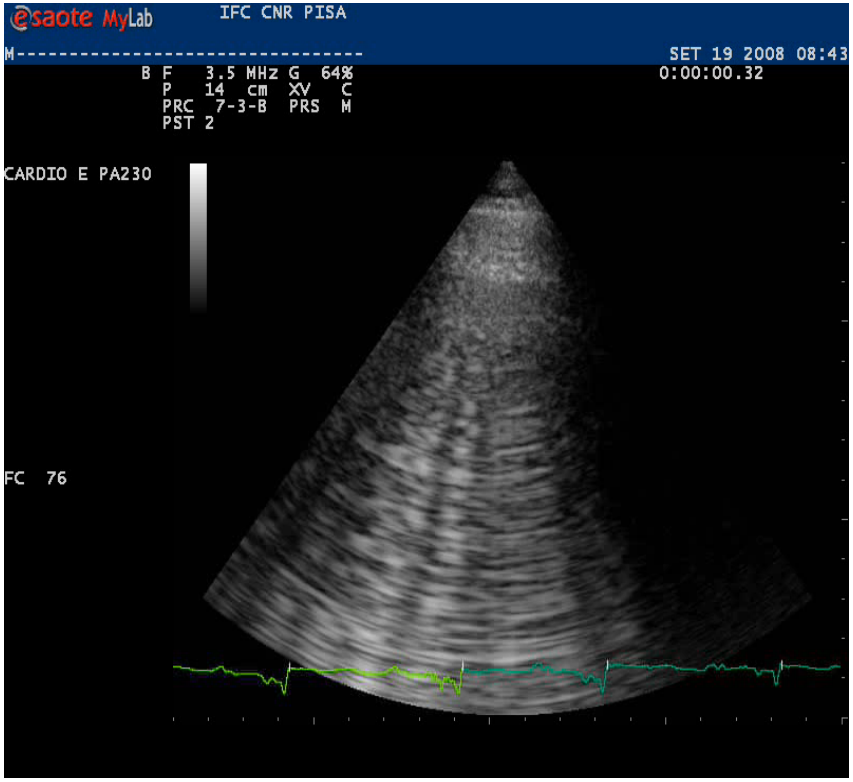
Limiti

- **Operatore-dipendenza**

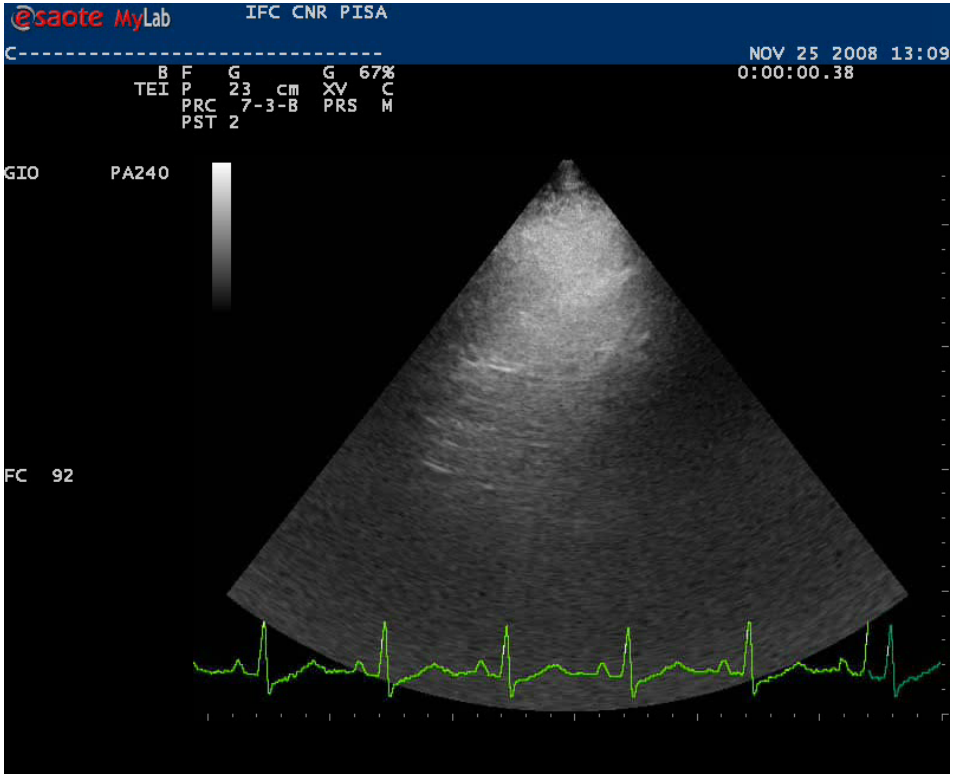
Limiti

- **Operatore-dipendenza**
- **Quantificazione**

Come contare le linee B?



About 100% = 10 B-lines



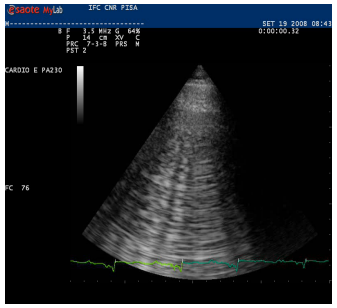
About 50% = 5 B-lines

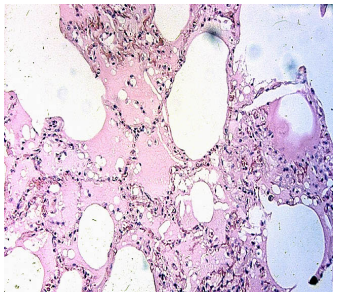
Limiti

- **Operatore-dipendenza**
- **Quantificazione**
- **Specificità**

Linee B: un segno non specifico di sd interstiziale polmonare

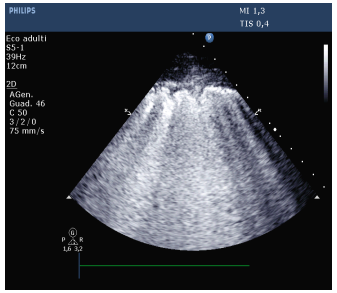
Edema polmonare cardiogeno

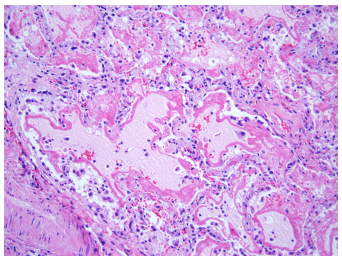




Trasudato

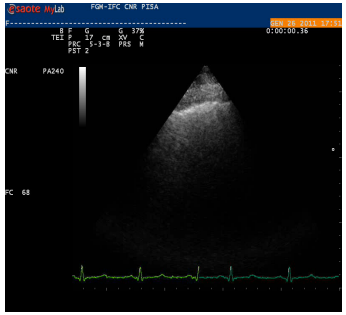
Edema polmonare non cardiogeno

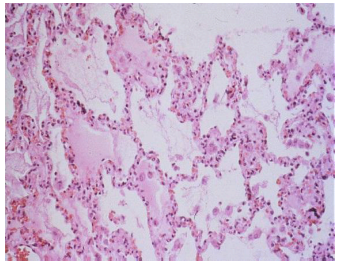




Essudato

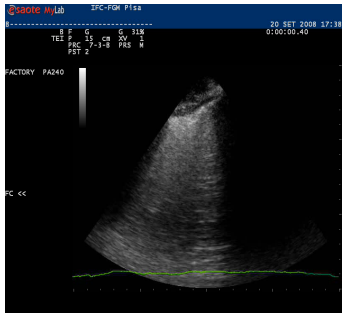
Polmonite interstiziale

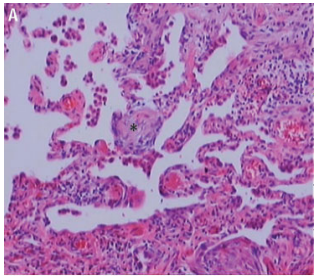




Essudato

Fibrosi polmonare

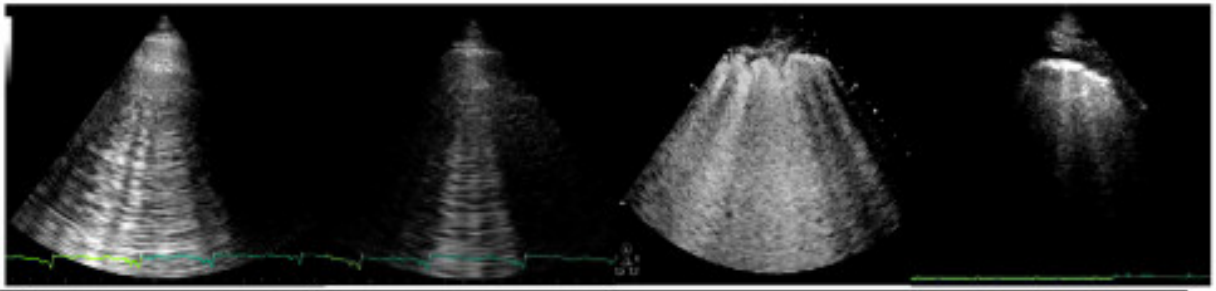




Collagene

REVIEW Open Access

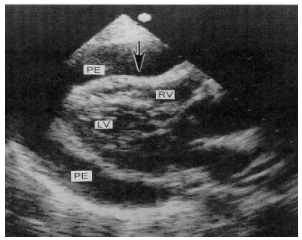
Lung ultrasound: a new tool for the cardiologist



	Acute cardiogenic pulmonary edema	Chronic heart failure	ALI/ARDS	Pulmonary fibrosis
Clinical setting	acute	chronic	acute	chronic
B-lines number	++++	+/++/+++	++++	+/++/+++
B-lines distribution	multiple, diffuse, bilateral (white lung)	multiple, diffuse, bilateral, following decubitant regions (black and white lung)	non-homogeneous distribution, presence of spared areas	more frequently posterior at lung basis
Other LUS signs	pleural effusion	pleural effusion	pleural effusion, pleural alterations, parenchymal consolidations of various size	pleural thickening
Echocardiogram	abnormal	abnormal	likely normal	likely normal

ALI = acute lung injury; ARDS = acute respiratory distress syndrome; LUS = lung ultrasound.

Gargani L. *Cardiovascular Ultrasound* 2011;9:6.



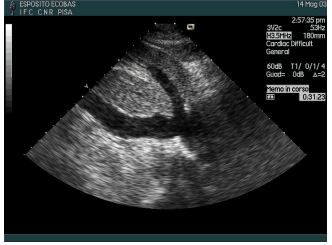
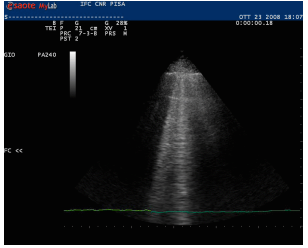
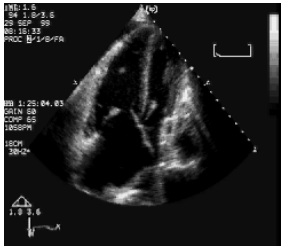





Table 2 The list of nine possible ultrasound patterns diagnosed in patients admitted for undifferentiated hypotension and the corresponding combination of findings detected at multiorgan point-of-care ultrasonographic evaluation

Ultrasound pattern	Organ evaluation	Corresponding signs
Hypovolemic	Heart	Hyperkinetic LV[a]
	Inferior vena cava	Diam. <2 cm + Resp. collapse >50 %[a]
	Lungs	A pattern[a]
	Abdomen	Free fluids/Aortic aneurysm[a]
Distributive	Heart	Hyperkinetic LV
	Inferior vena cava	Diam. <2 cm + Resp. collapse >50 %
	Lungs	B pattern with consolidation or consolidation with air bronchograms[b]
Hypovolemic/distributive	Heart	Hyperkinetic LV[a]
	Inferior vena cava	Diam. <2 cm + Resp. collapse > 50 %[a]
	Lungs	A/B pattern[a]
	Abdomen	Free fluids[a]
Obstructive cardiac tamponade	Heart	Pericard. effusion with tamponade
Obstructive pulmonary embolism	Heart	Dilated/Hypokinetic RV[a]
	Inferior vena cava	Sludge or no respiratory collapse and max. diam. >2 cm[a]
	Lungs	A pattern[a]
	Peripheral veins	Deep vein thrombosis[a]
Obstructive tension pneumothorax	Heart	Dilated/Hypokinetic RV
	Inferior vena cava	Sludge or no respiratory collapse and max. diam. >2 cm
	Lungs	No sliding and pulse, no B-lines, no consolidation[b]
Cardiogenic	Heart	Hypokinetic left ventricle
	Lungs	B pattern[b]
Mixed	Pattern where criteria for more than a single diagnosis are satisfied (other than hypovolemic/distributive)	
Indefinite	Pattern where criteria for a single diagnosis are not satisfied or uncertain	

LV left ventricle, *RV* right ventricle

[a] At least two of these signs

[b] Necessarily present

RESEARCH Open Access

Rapid evaluation by lung-cardiac-inferior vena cava (LCI) integrated ultrasound for differentiating heart failure from pulmonary disease as the cause of acute dyspnea in the emergency setting

Katsuya Kajimoto[1*], Keiko Madeen[1], Tomoko Nakayama[2], Hiroki Tsudo[3], Tadahide Kuroda[1] and Takashi Abe[3]

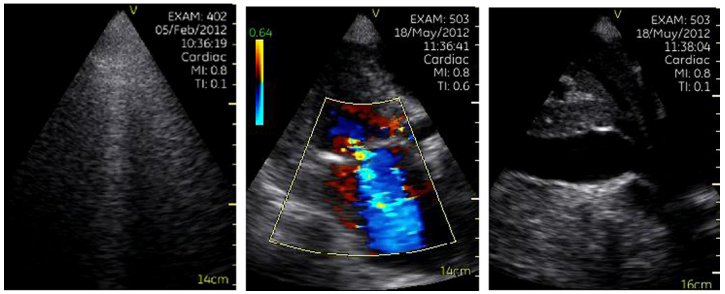
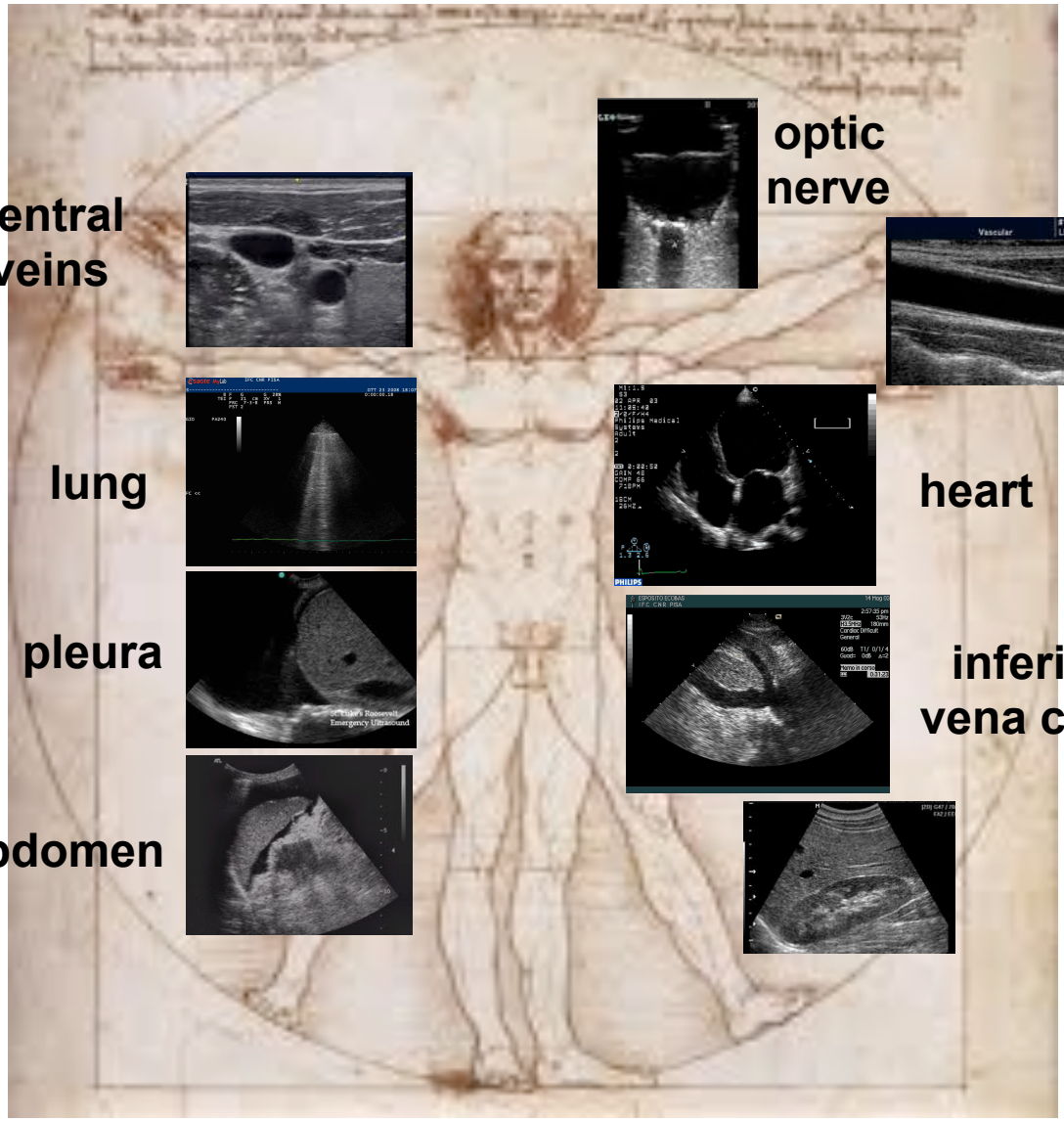


Table 2 Plasma BNP, lung ultrasound alone or combined with BNP, cardiac findings, and the LCI integrated ultrasound for diagnosis of AHFS

	Sensitivity (%)	Specificity (%)	NPV (%)	PPV (%)	Accuracy (%)
BNP ≥100 pg/ml	92.4	35.1	76.4	67.1	68.8
Framingham criteria*	79.2	56.7	65.6	64.6	70.0
Lung ultrasound alone	96.2	54.0	90.9	75.0	78.8
Both Lung ultrasound and BNP (≥100 pg/ml)	88.6	67.6	80.6	79.8	80.0
Reduced EF (LVEF <40%)	26.4	86.5	45.1	73.7	51.1
MR or TR ≥ moderate	92.4	81.0	88.2	87.5	87.7
IVC collapsibility <50%	83.0	81.1	76.9	86.3	82.2
Both preserved EF and MR ≥ moderate	56.7	100.0	61.6	100.0	67.0
Both reduced EF and either MR or TR ≥ moderate	30.1	94.5	48.6	88.9	56.7
Lung-cardiac-inferior vena cava (LCI) integrated ultrasound	94.3	91.9	91.9	94.3	93.3

Toward an integrated ultrasound approach

Point-of-care, focused whole-body ultrasound



Eco polmonare:
congestione emodinamica o congestione clinica?

EUROPEAN SOCIETY OF CARDIOLOGY®

European Journal of Heart Failure (2012) **14**, 1194–1196
doi:10.1093/eurjhf/hfs157

EDITORIAL

Ultrasound lung comets: the shape of lung water

Eugenio Picano* and Luna Gargani

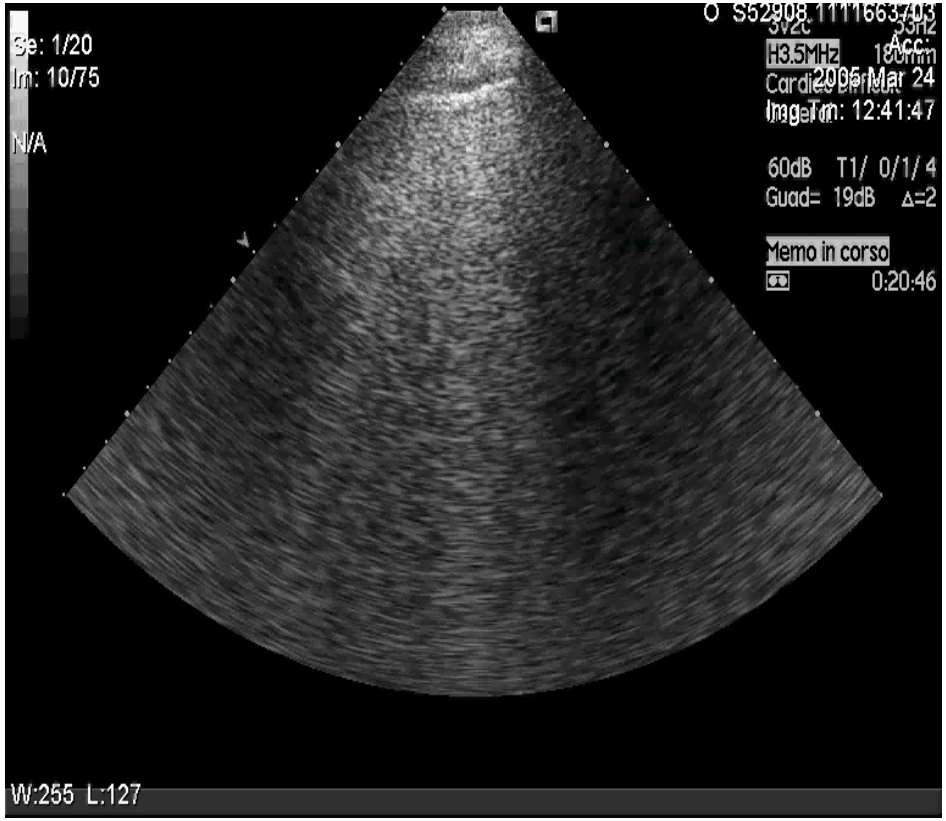
CNR, Institute of Clinical Physiology, 56124 Pisa, Italy

Congestione polmonare

FG, 74 aa, ambulatorio eco

- Maschio
- Cardiopatia ischemica, FE 30%
- Terapia: ASA, Ramipril, Carvedilolo, furosemide
- NYHA II
- Ecocardiogramma annuale di routine: invariato

FG, 74 aa, ambulatorio eco

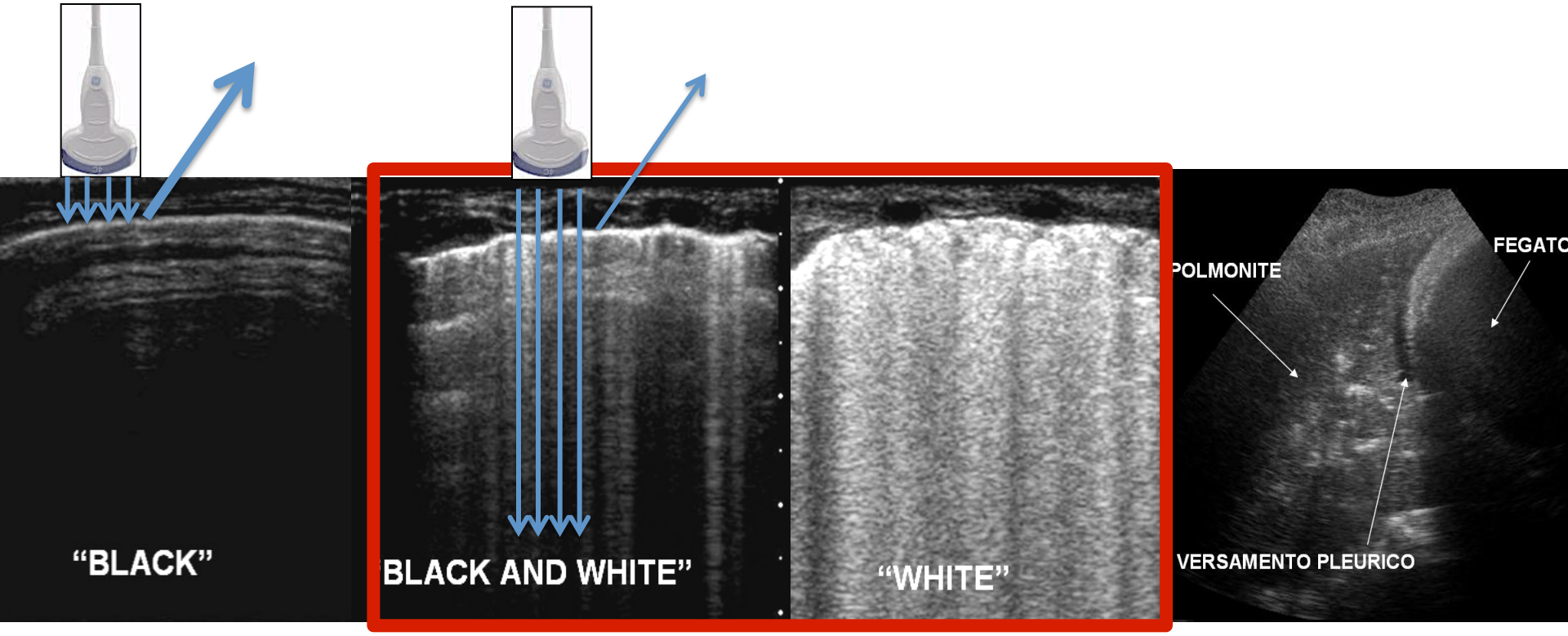


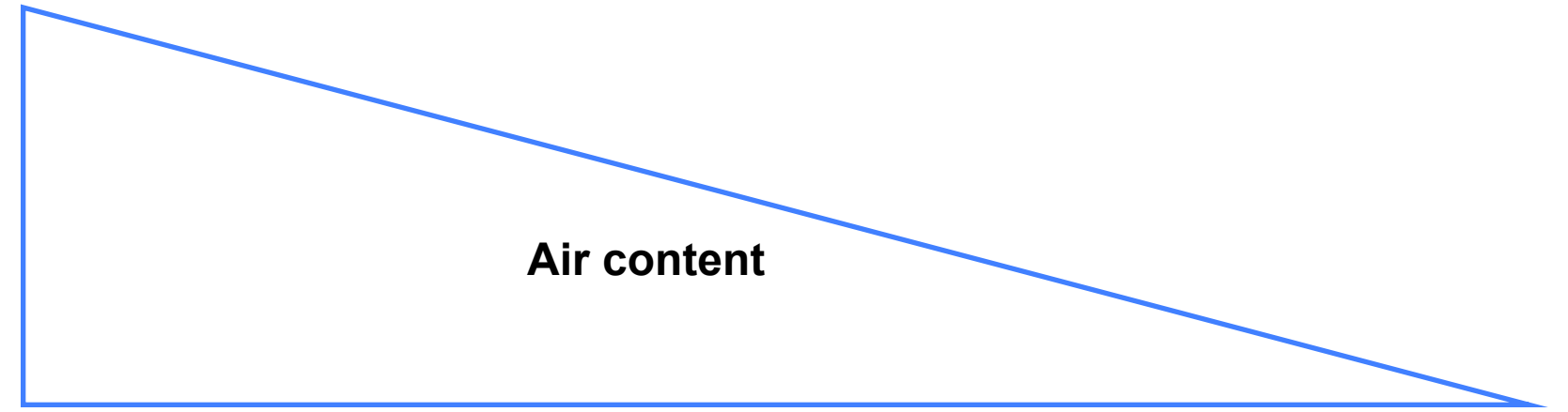
Destra

Sinistra

Impending decompensation

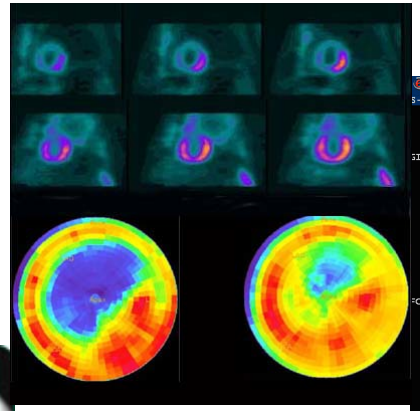
Ecografia polmonare

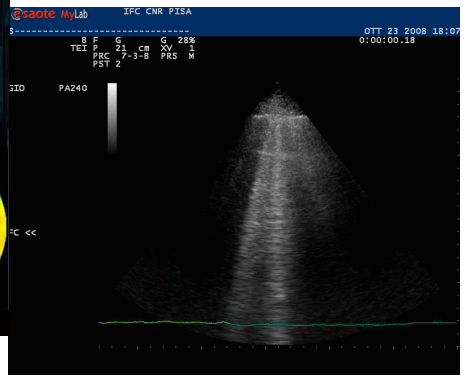


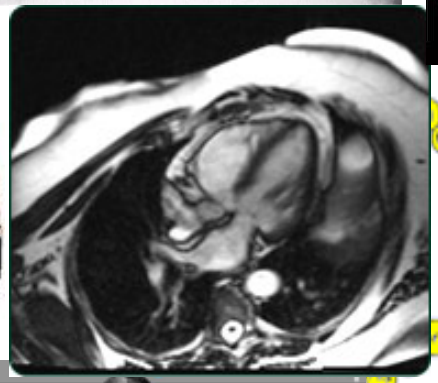


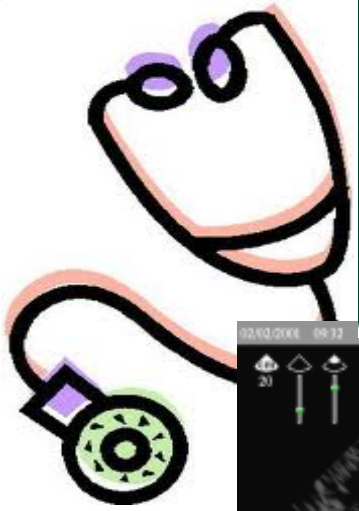
Soldati G, Copetti R. Ecografia del torace 2006.

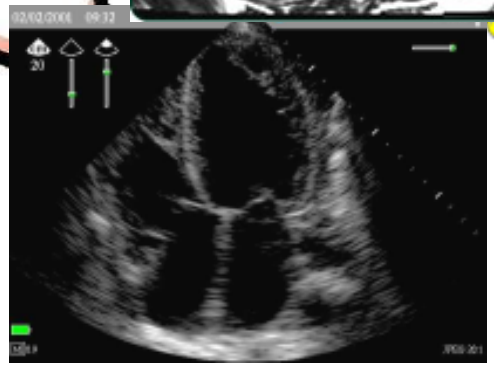
No man is an island

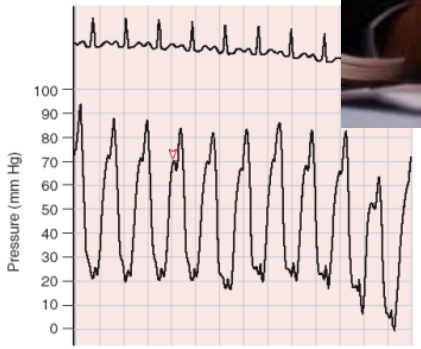




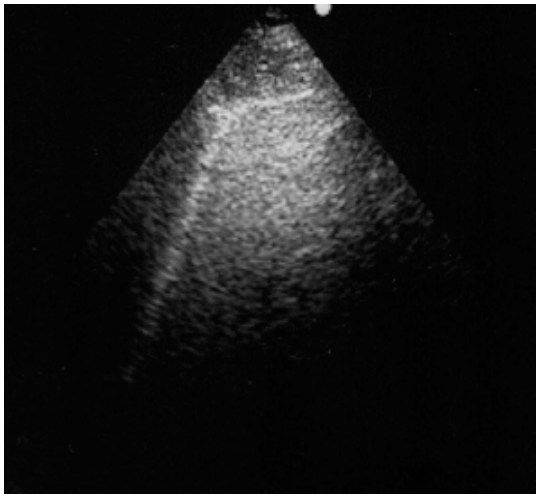




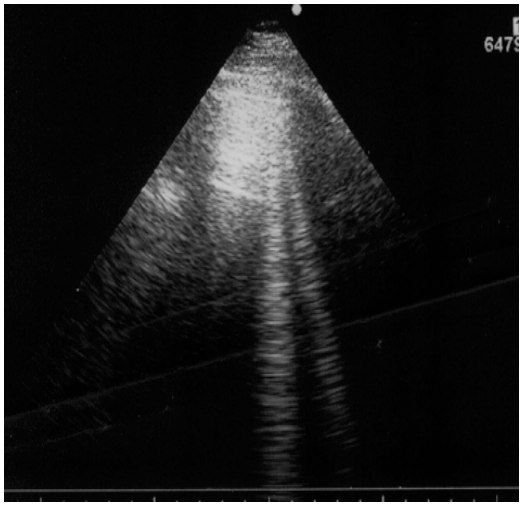




How to count B-lines



1



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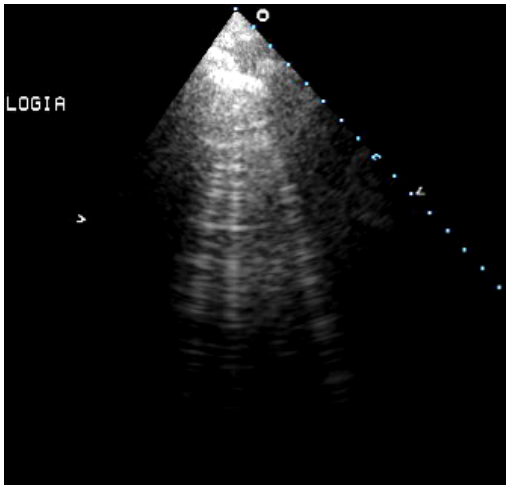

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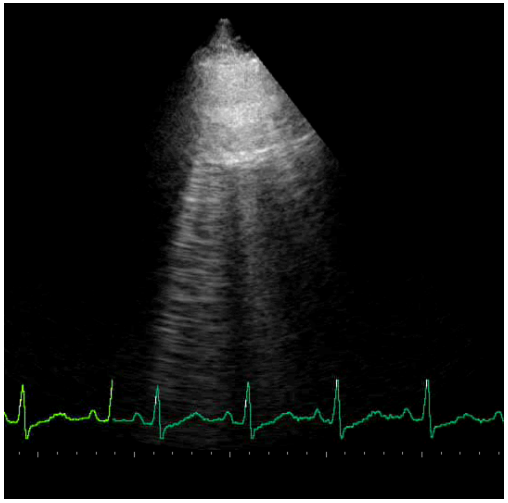

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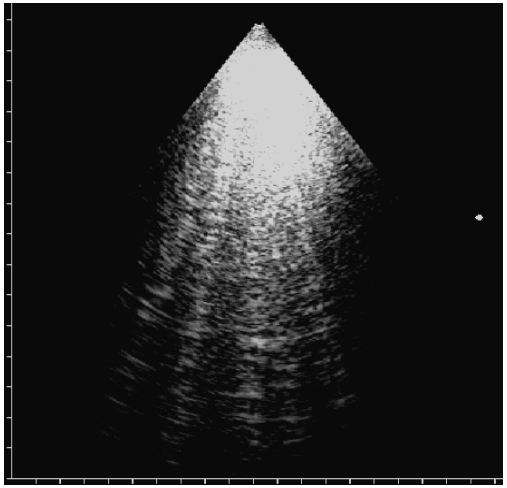

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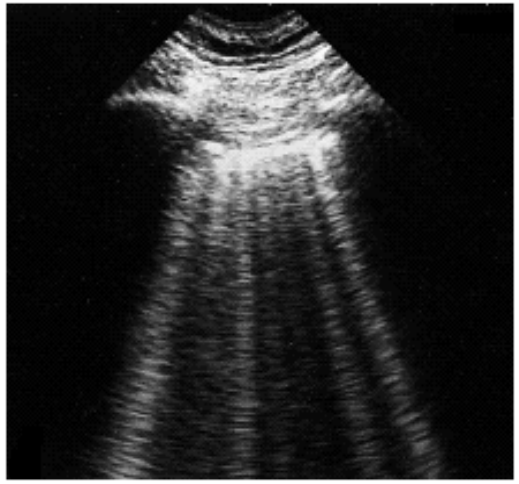


7

Lung ultrasound and chest X-ray

European Journal of Echocardiography (2011) **12**, 85–87
doi:10.1093/ejechocard/jeq184

The use of pocket-size imaging devices: a position statement of the European Association of Echocardiography

Rosa Sicari*, Maurizio Galderisi, Jens-Uwe Voigt, Gilbert Habib, Jose L. Zamorano, Patrizio Lancellotti, and Luigi P. Badano

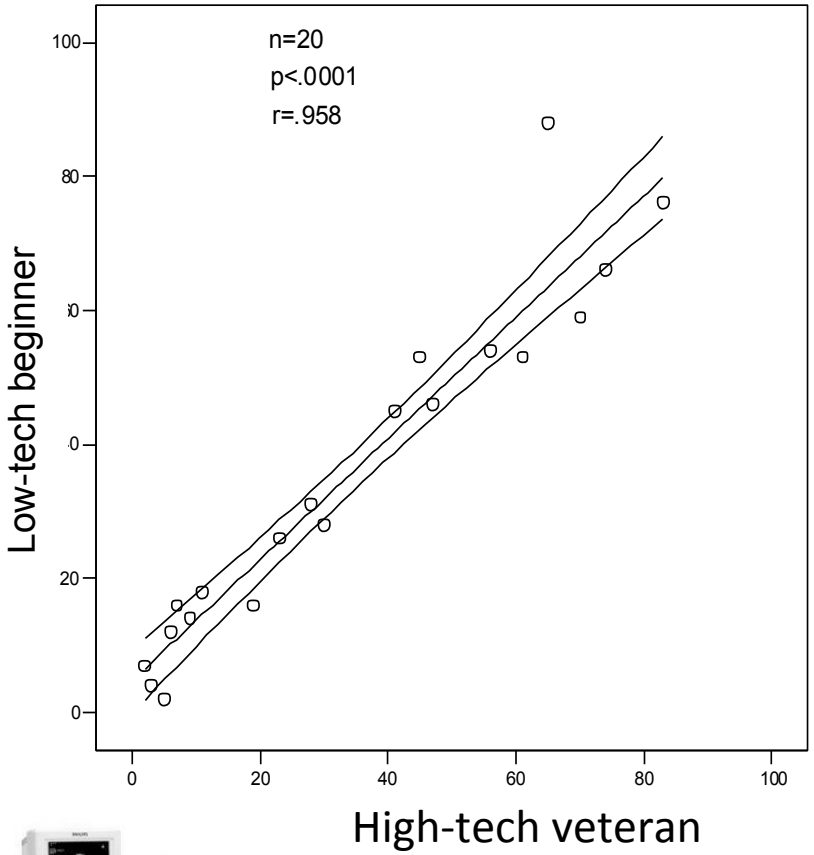
CNR, Institute of Clinical Physiology, Italy

Table 2 Summary of indications for pocket-size devices

1. Complement to a physical examination in the coronary and intensive care unit
2. Tool for a fast initial screening in an emergency setting
3. Cardiologic counselling in- or outside health-care facilities and hospitals
4. First cardiac evaluation in ambulances
5. Screening programmes in schools, industry, and community activities
6. Triaging candidates for a complete echocardiographic examination
7. Teaching tool
8. Semi-quantification of extravascular lung water

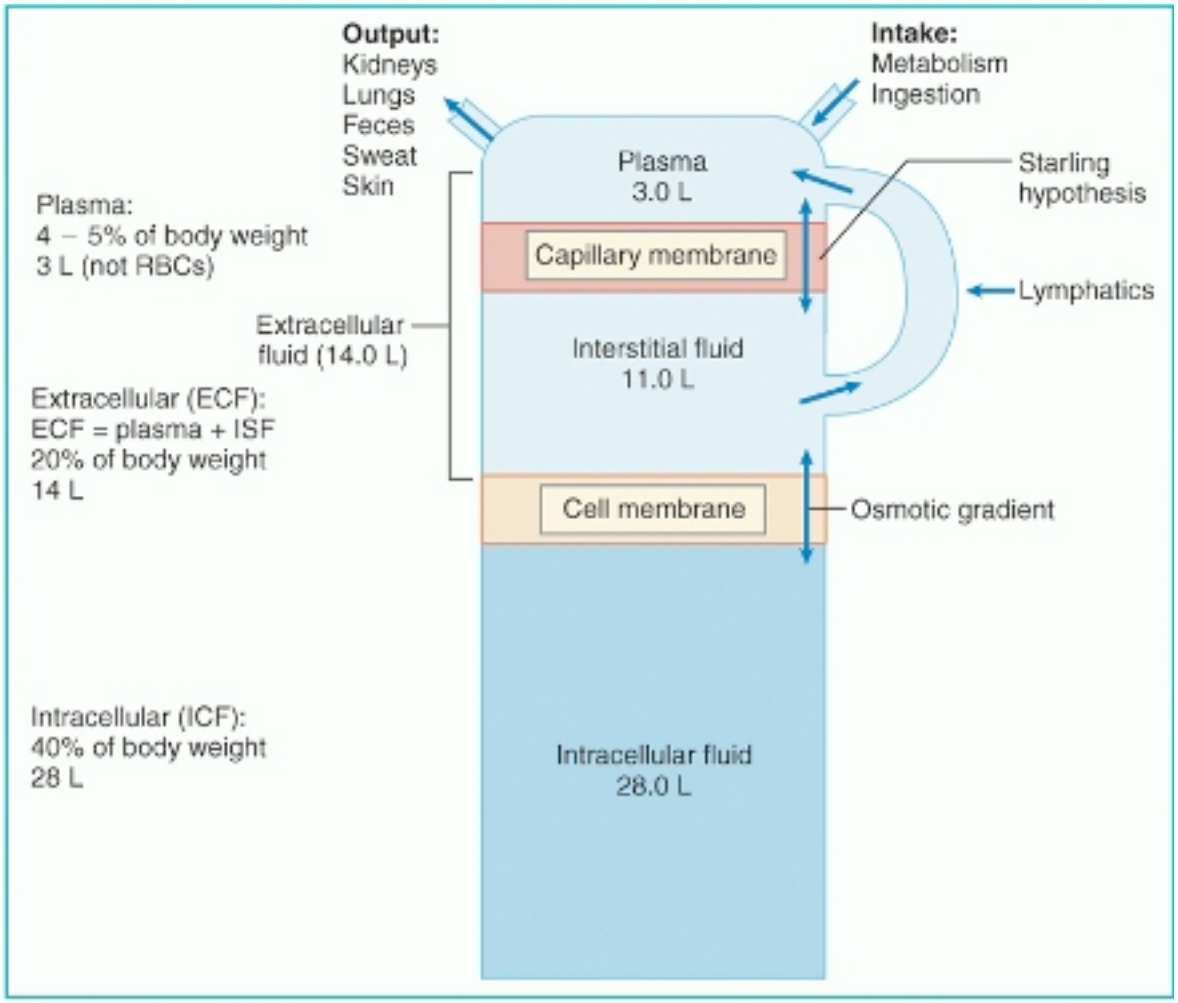
Operator-dependency

(<1 hour experience)

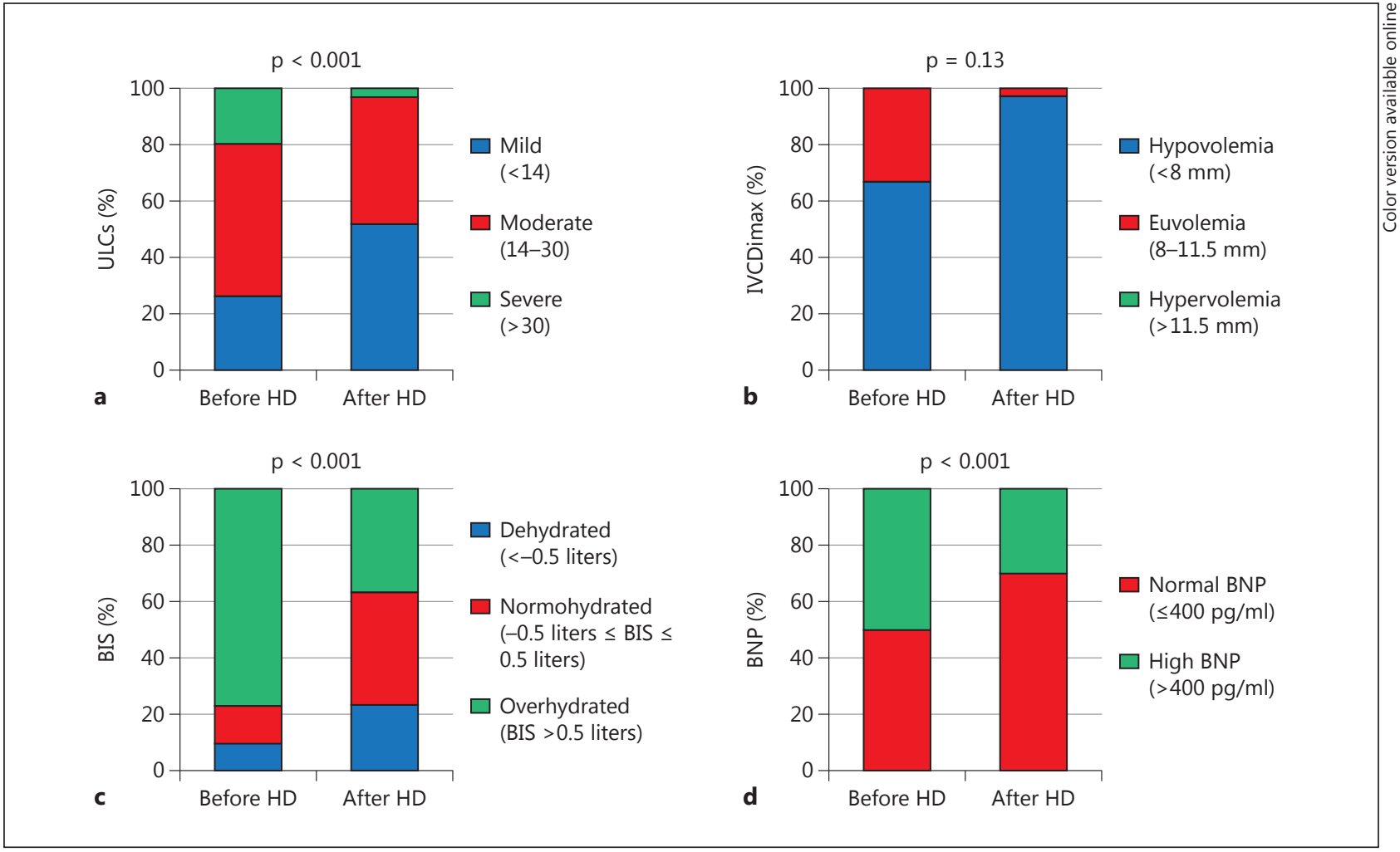


(>2 years experience)

Bedetti G, Gargani L, et al. *Cardiovasc Ultrasound*. 2006;4:34

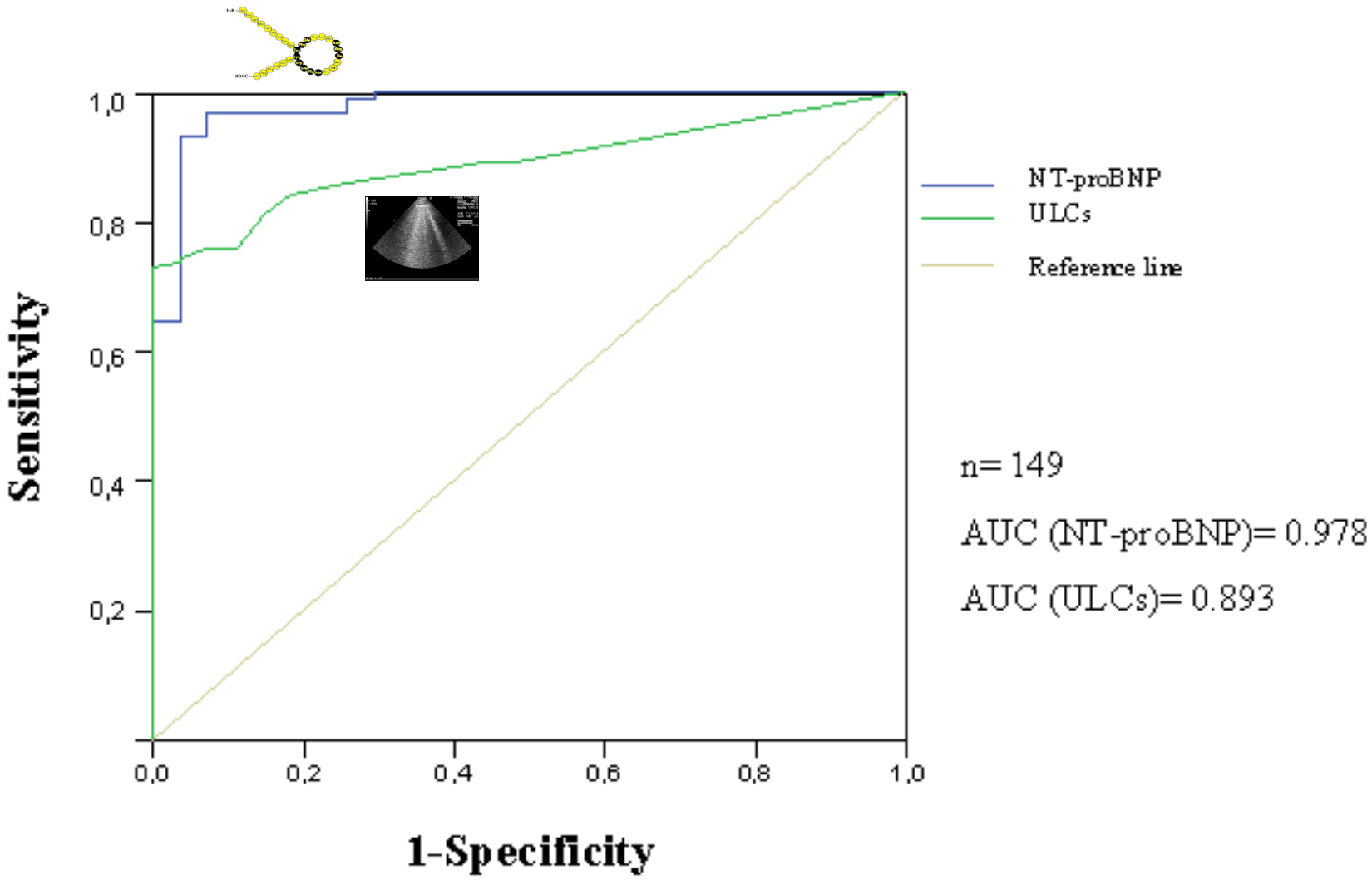


Comparison and Reproducibility of Techniques for Fluid Status Assessment in Chronic Hemodialysis Patients



Color version available online

B-lines and natriuretic peptides



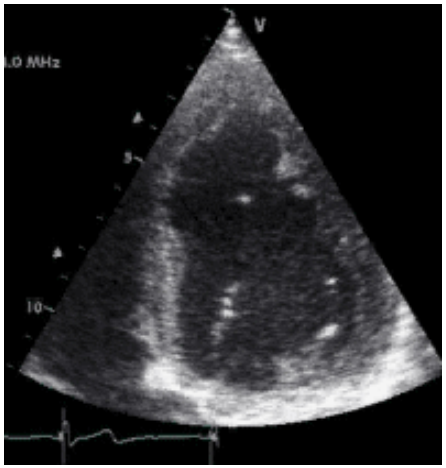
Gargani L, Picano E. *Eur J Heart Fail* 2008;10:70-7.

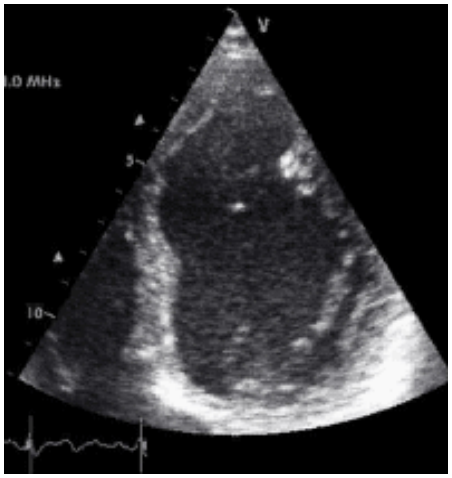
Pulmonary congestion stress-echo

Baseline

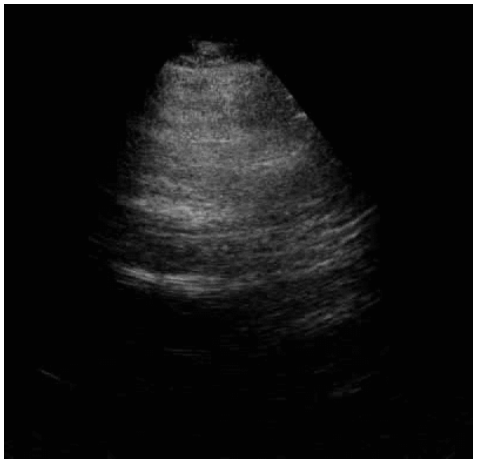
Peak stress

WMSI



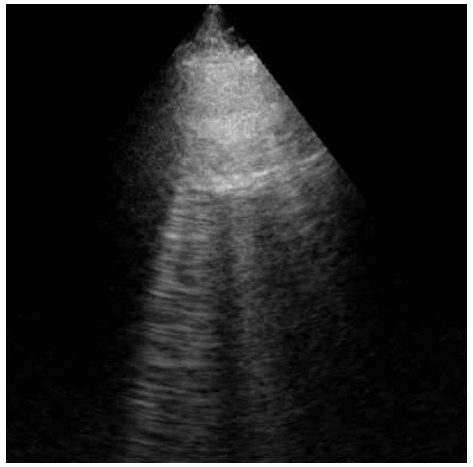


B-lines



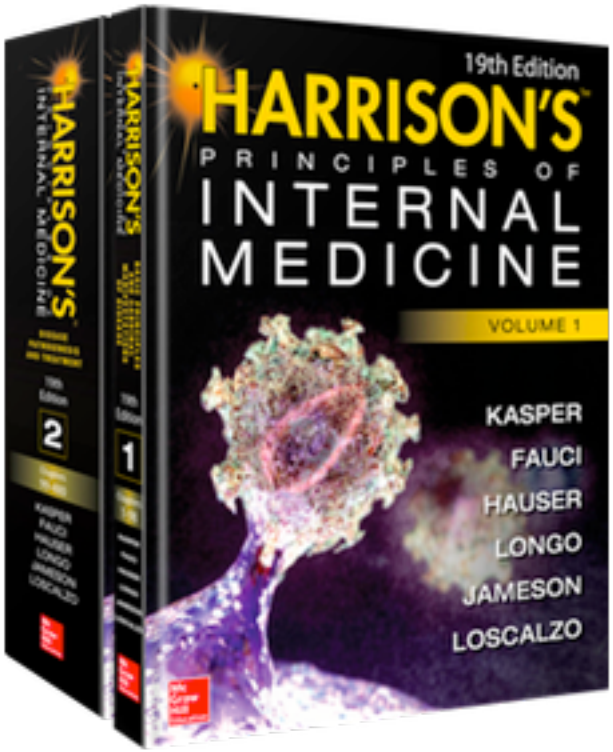
n = 72

p = .0001



Agricola E, Picano E et al. *J Am Soc Echocardiogr* 2006;19:457

Air: an insurmountable obstacle?



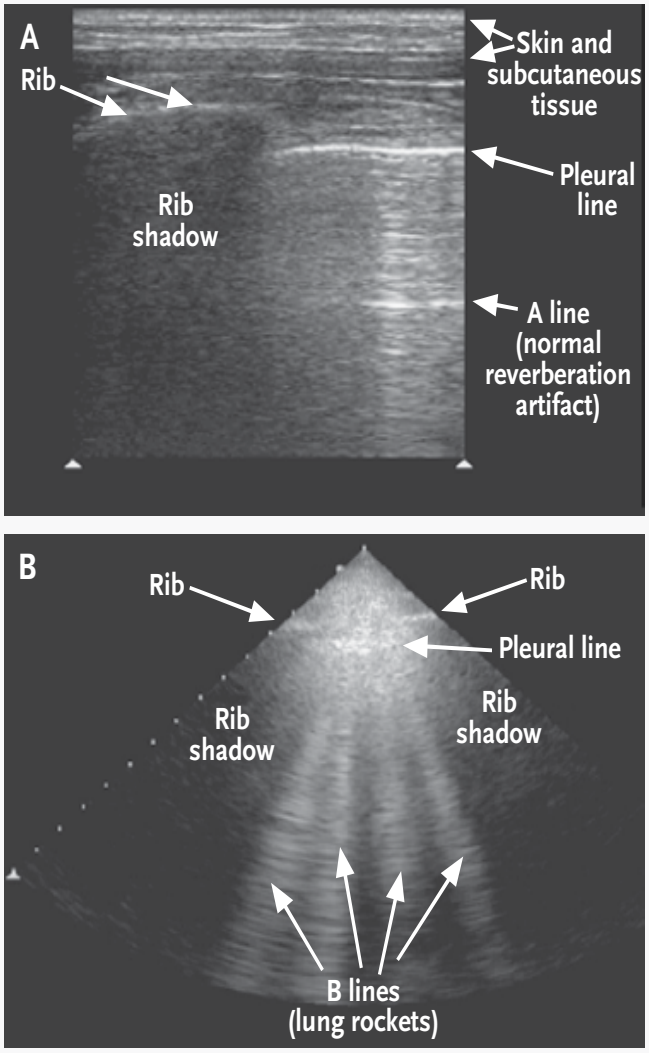
«Because ultrasound energy

is rapidly dissipated in air,

ultrasound imaging is not useful

for evaluation of the pulmonary parenchyma.»

19ª edizione, 2015



CURRENT CONCEPTS

Point-of-Care Ultrasonography

Recently, lung ultrasound
has emerged as a
new sonographic technique
to evaluate
many pulmonary conditions.

Moore CL, Copel JA. Point-of-care ultrasonography. *N Engl J Med*. 2011;364:749-57.

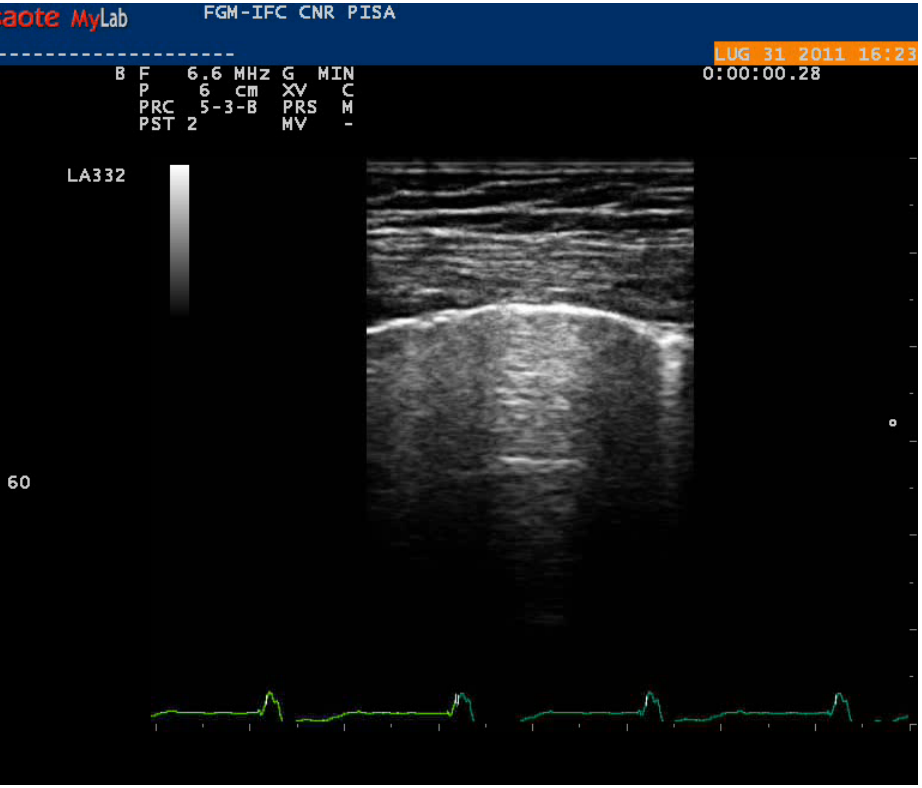
Acute heart failure

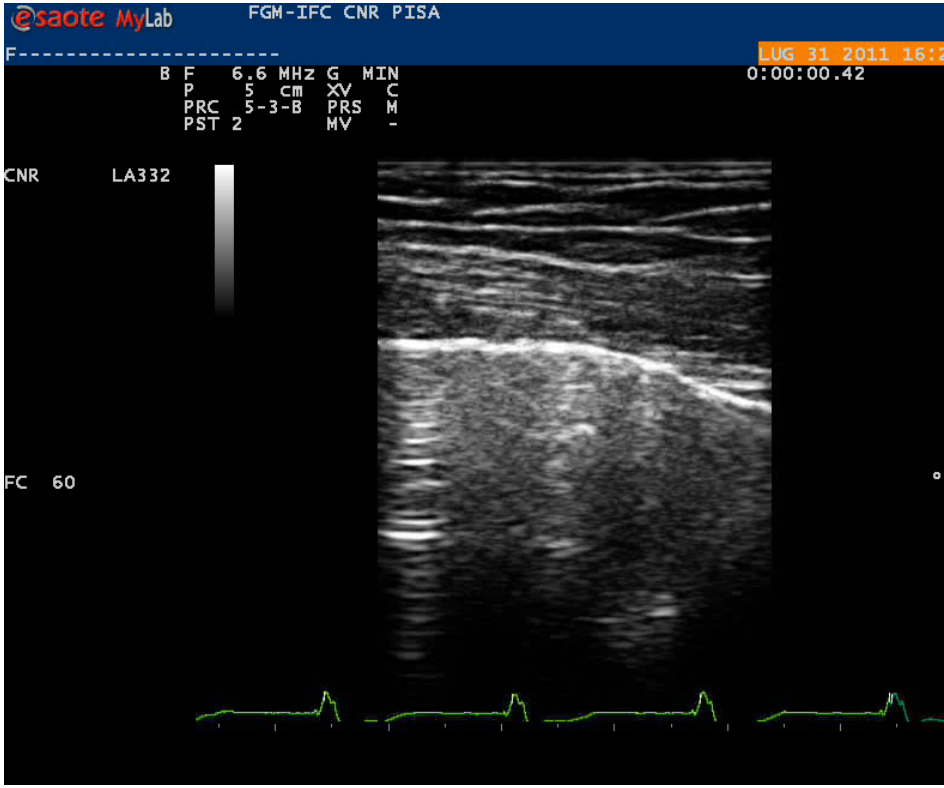
Table 4 Positive ultrasound lung scans in the 11 individualizable thoracic areas at admission (phase 1) and control (phase 2) in 70 patients admitted for ADHF

Thoracic area	Phase 1 [a]	Phase 2 [a]	*P* (*W*)
Anterior superior right	51 (73%)	3 (4.3%)	<.001
Anterior medium right	54 (77%)	2 (2.9%)	<.001
Anterior basal right	65 (93%)	4 (5.7%)	<.001
Lateral superior right	64 (91%)	5 (7.1%)	<.001
Lateral medium right	67 (96%)	10 (14%)	<.001
Lateral basal right	68 (97%)	21 (30%)	<.001
Anterior superior left	52 (74%)	6 (8.6%)	<.001
Anterior medium left	58 (83%)	6 (8.6%)	<.001
Lateral superior left	63 (90%)	6 (8.6%)	<.001
Lateral medium left	70 (100%)	11 (16%)	<.001
Lateral basal left	70 (100%)	20 (29%)	<.001

Volpicelli G et al. American Journal of Emergency Medicine 2008;26, 585–591

Ecografia polmonare

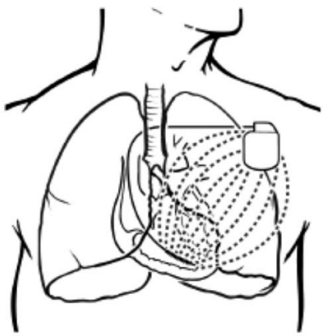




Diario

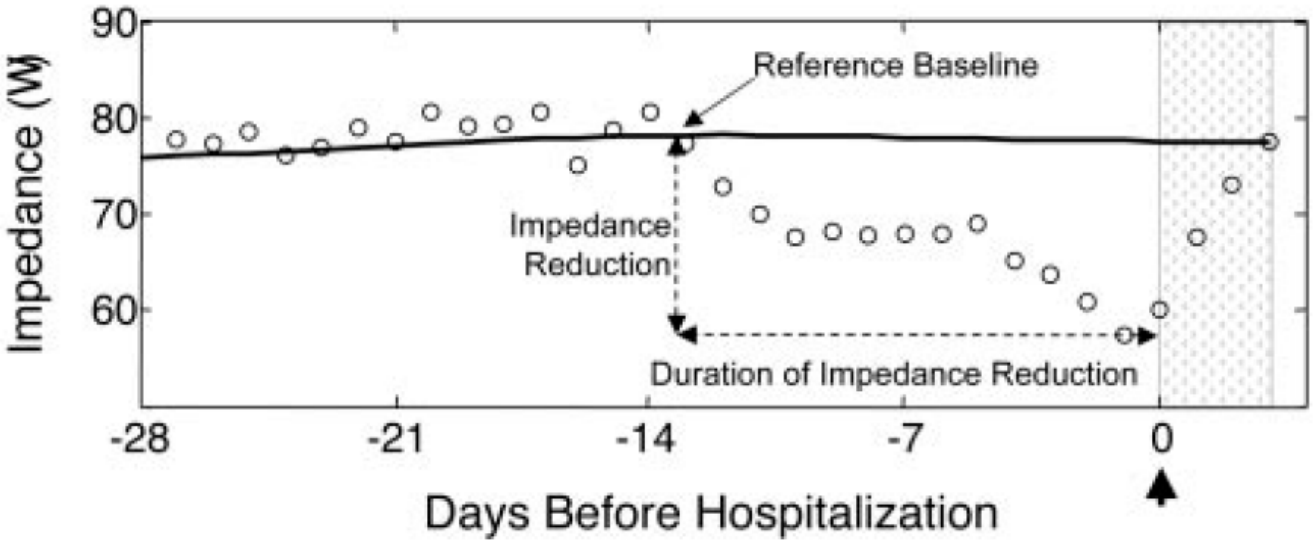
Il paziente lamenta dispnea ingravescente. EO: presenza di fini crepitii diffusi. Tachipnea. Si esegue EGA con riscontro di iponatriemia (sodio 129 mEq/L). All'Rx torace quadro compatibile con edema polmonare. Si sospende infusione in corso e si applica Sol Fis 100 cc + NaCl 40 mEq in 1 ora, a metà infusione applica Lasix 250 mg in pompa siringa in 5 ore. Si posiziona catetere vescicale per il monitoraggio della diuresi.

Congestion precedes hospitalization



Intrathoracic Impedance Monitoring in Patients With Heart Failure

Correlation With Fluid Status and Feasibility of Early Warning Preceding Hospitalization



Yu CM et al. *Circulation* 2005;112:841-848

Lung ultrasound in the ED

201 pts admitted with acute dyspnoea

	Specificity	Sensitivity	Positive predictive value	Negative predictive value
Chest X-ray	96%	69%	91%	85%
Lung ultrasound	90%	97%	78%	99%

cardiogenic origin of acute dyspnea

Gargani L et al. EUROECHO and other imaging modalities 2011

Imaging congestion with a pocket ultrasound device - prognostic implications in patients with chronic heart failure

Gustafsson Mikael, MD, PhD, Alehagen Urban MD, PhD. Johansson Peter, PhD

Department of Cardiology and Department of Medicine and Health Sciences. Linköping University,

	Hazard ratio (CI 95%), p Unadjusted	Hazard ratio (CI 95%), p Adjusted model 1	Hazard ratio (CI 95%), p Adjusted model 2
CTA (>3)	3.0 (1.4-6.7), 0.007	3.5 (1.5-7-9), 0.003	2.9 (1.3-6.6), 0.011
PE	3.3 (1.2-8.9), 0.017	3.9 (1.4-10.8), 0.008	1.9 (0.6-6.2), 0.23
CTA or PE	3.1 (1.4-7.1), 0.005	3.7 (1.6-8.5), 0.002	4.9 (1.2-20.1), 0.01

Age >72 years

LV <40%

NT-proBNP (log ^{10})

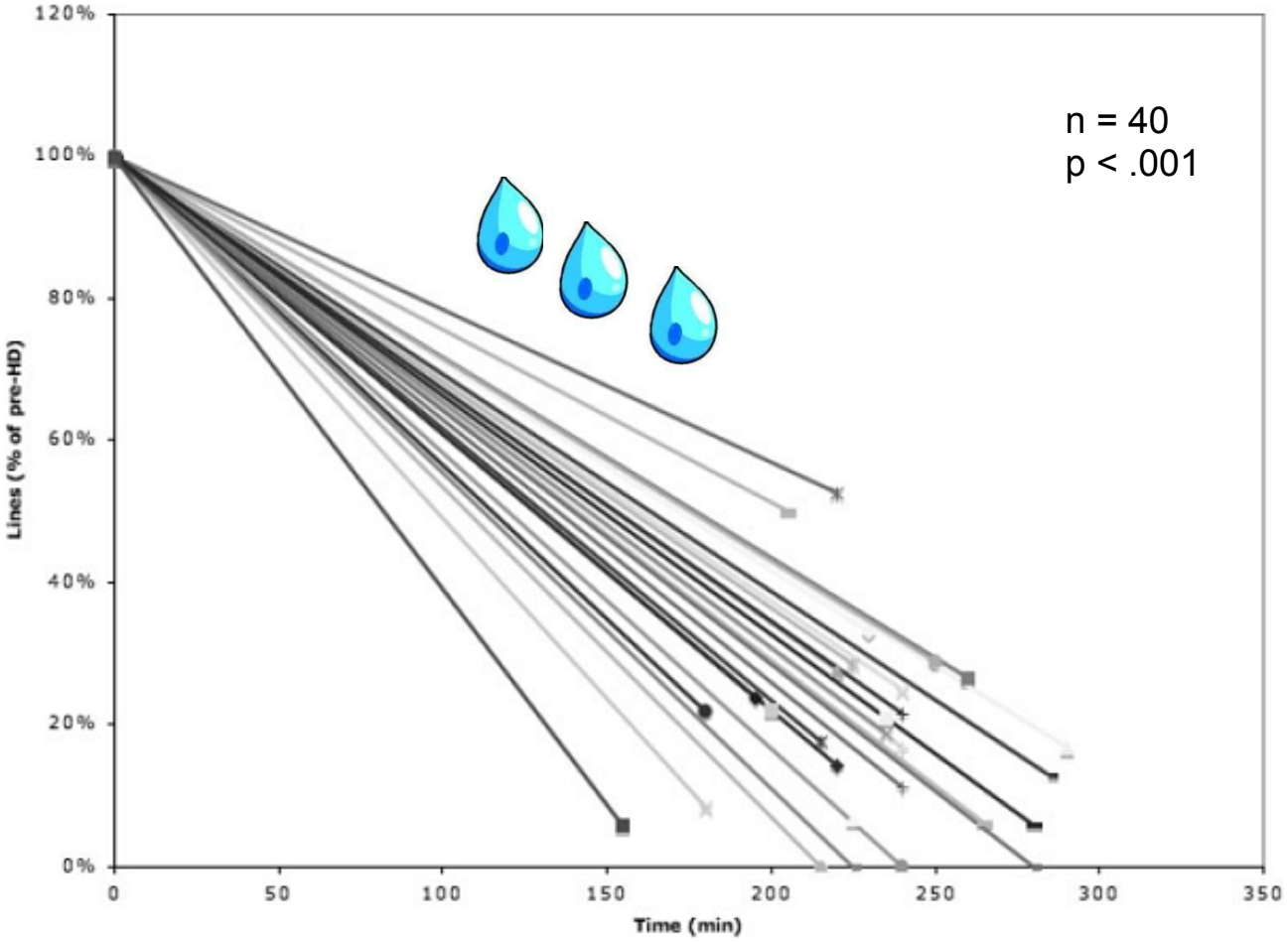
evaluate clinically when right-sided HF is predominant, but a dilated VCI, a marker of elevated right atrial filling pressures, was not significantly associated with a bad outcome in our study. According to a report by de Lorenzo et al.[22] most of the patients with VCI diameter

Ultrasound Assessment for Extravascular Lung Water in Patients Undergoing Hemodialysis*

Time Course for Resolution

microconvex probe

feasibility = 100%
10-15 mins

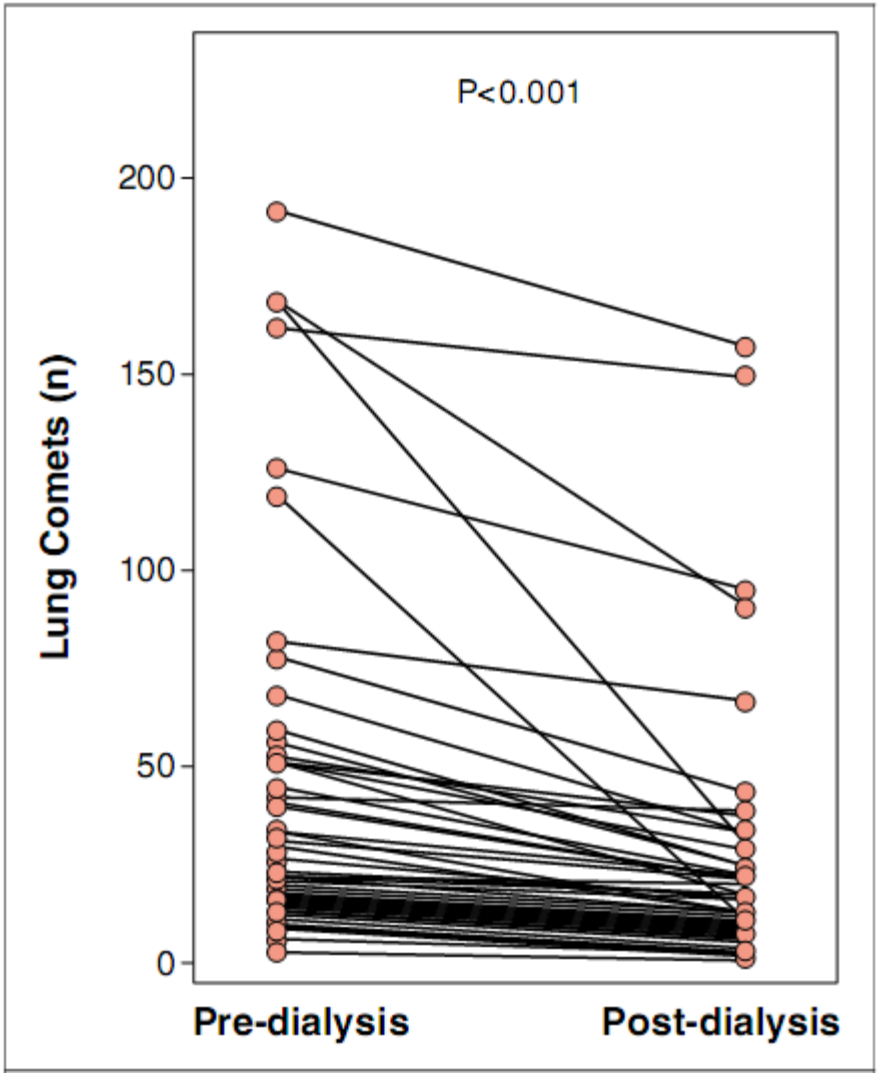


Noble VE et al. Chest 2009; 135:1433–1439.

Detection of Pulmonary Congestion by Chest Ultrasound in Dialysis Patients

Francesca Mallamaci, MD,*† Francesco A. Benedetto, MD,‡ Rocco Tripepi,†
Stefania Rastelli, MD,§ Pietro Castellino, MD Prof.,§ Giovanni Tripepi, Stat. Dr.,†
Eugenio Picano, MD Prof.,‖ Carmine Zoccali, MD Prof.*†

cardiac probe



- n = 75
- feasibility = 100%
- mean time needed = 4 mins (range 3-6)

Mallamaci F et al. *JACC Cardiovascular Imaging* 2010

Future directions

EUROPEAN RENAL ASSOCIATION

EURECA-m

EUropean REnal and CArdiovascular Medicine
Working Group

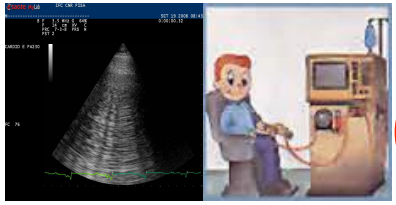
Lung water by Ultra-Sound-guided Treatment to prevent death and cardiovascular complications in high risk end-stage renal disease patients with cardiomyopathy

IFC CNR

LUST

EURECA-m LUST

500 patients
with MI or HF



250 patients

US guided UF regimen
& drug treatment

250 patients

Control Group, standard
care

>15 lung comets

UF intensification
(longer and/or additional
dialyses)

Monitoring
Lung US at least 1/w until
the goal is achieved

Then, lung US 1 /month

<15 lung comets

No UF intensification.
No change in drug
treatment.

Monitoring (monthly Lung US)

>15 lung comets

<15 lung comets

(continue monthly
lung US monitoring)

Lung ultrasound in the ED

Emergency Thoracic Ultrasound in the Differentiation of the Etiology of Shortness of Breath (ETUDES): Sonographic B-lines and N-terminal Pro-brain-type Natriuretic Peptide in Diagnosing Congestive Heart Failure

Andrew S. Liteplo, MD, RDMS, Keith A. Marill, MD, Tomas Villen, MD, Robert M. Miller, MD, Alice F. Murray, MBChB, Peter E. Croft, BS, Roberta Capp, MD, and Vicki E. Noble, MD, RDMS

Intern Emerg Med
DOI 10.1007/s11739-011-0709-1

CRITICAL CARE

RESEARCH Open Access

Combination of lung ultrasound (a comet-tail sign) and N-terminal pro-brain natriuretic peptide in differentiating acute heart failure from chronic obstructive pulmonary disease and asthma as cause of acute dyspnea in prehospital emergency setting

Gregor Prosen[1,2], Petra Klemen[1,2,3], Matej Strnad[1,2] and Štefek Grmec[1,2,3,4*]

EM - ORIGINAL

Diagnostic accuracy and reproducibility of pleural and lung ultrasound in discriminating cardiogenic causes of acute dyspnea in the Emergency Department

Gian Alfonso Cibinel · Giovanna Casoli · Fabrizio Elia · Monica Padoan · Emanuele Pivetta · Enrico Lupia · Alberto Goffi

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

Lung ultrasound by emergency nursing as an aid for rapid triage of dyspneic patients: a pilot study

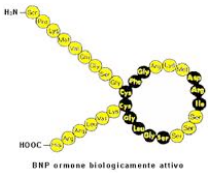
Erden Erol Ünlüer[a*], Arif Karagöz[a], Orhan Oyar[b], Nergiz Vandenberk[a], Sevda Kiyançiçek[a], Figen Budak[a]

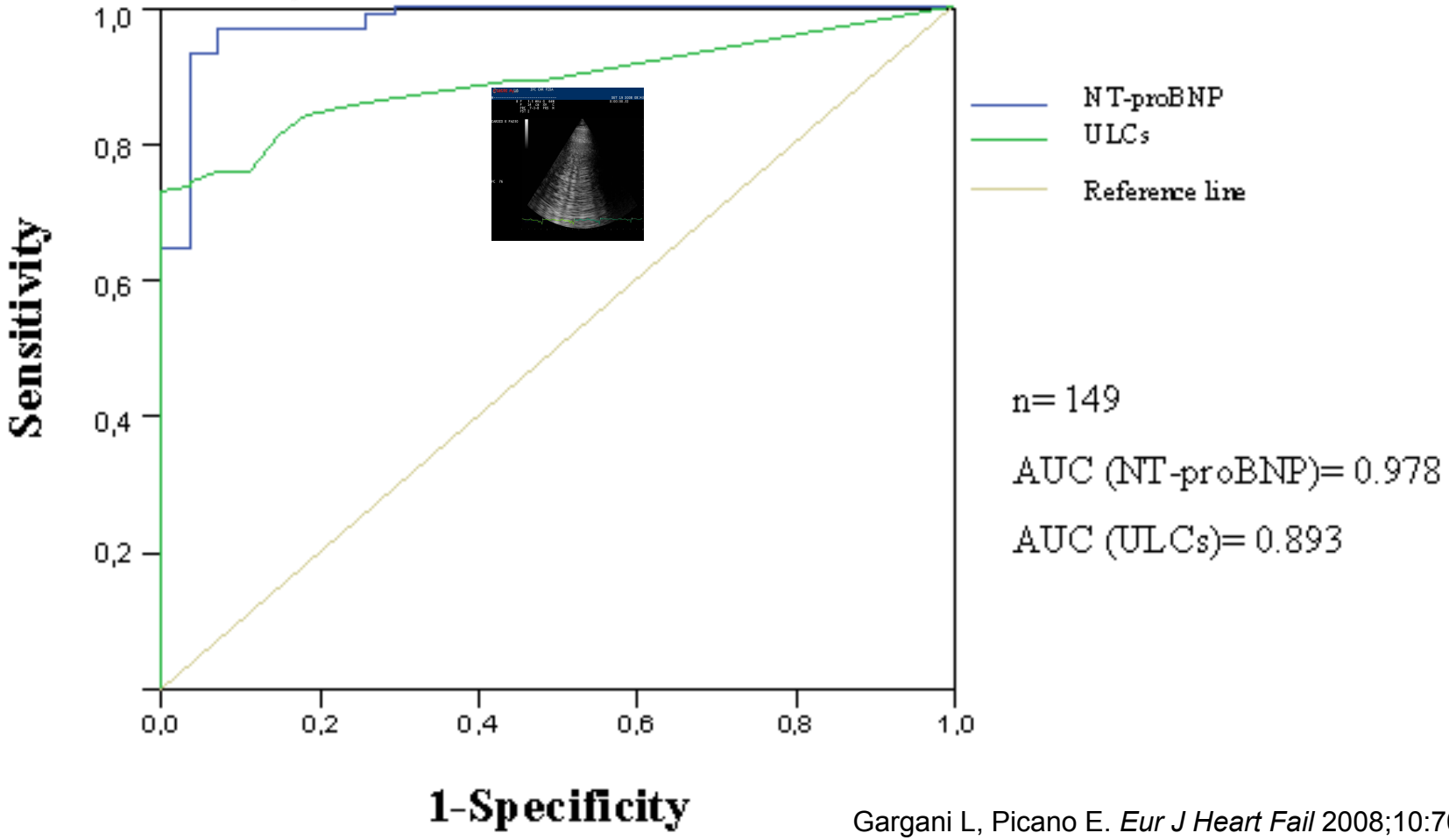
SAEM Academic Emergency Medicine
Official Journal of the Society for Academic Emergency Medicine

Progressive Clinical Practice

Point-of-care Ultrasonography for the Diagnosis of Acute Cardiogenic Pulmonary Edema in Patients Presenting With Acute Dyspnea: A Systematic Review and Meta-analysis

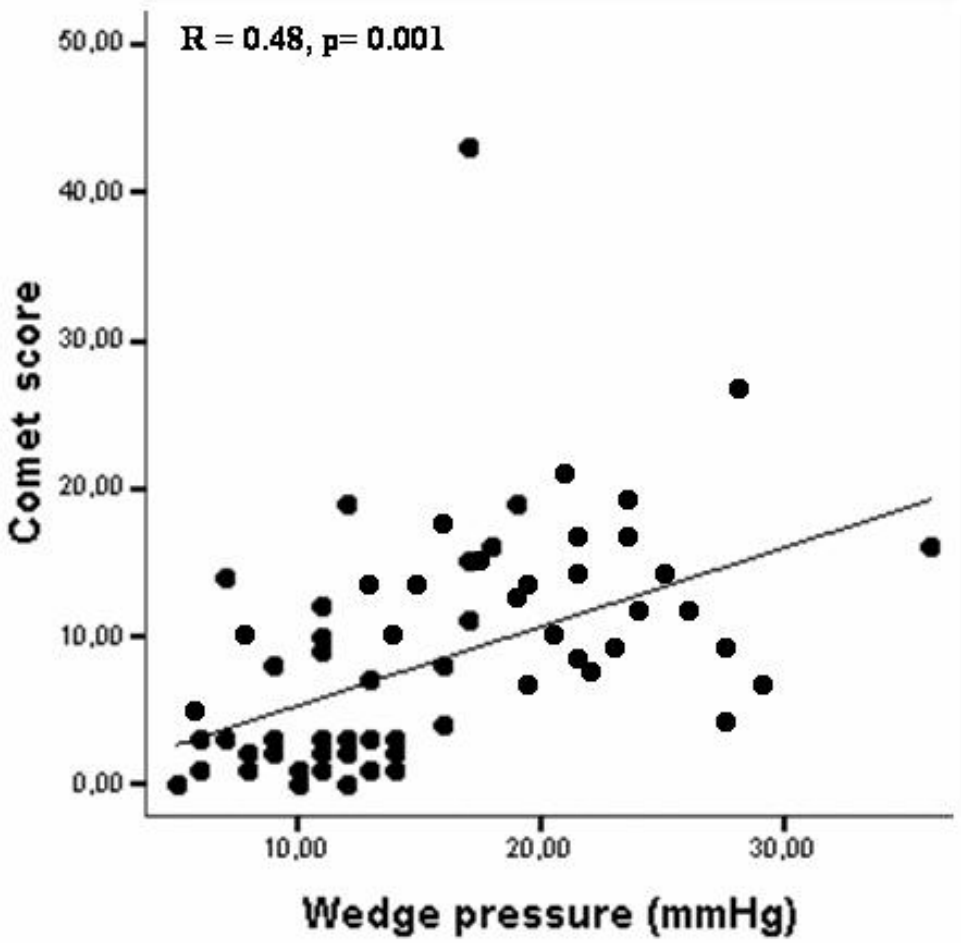
B-lines and natriuretic peptides





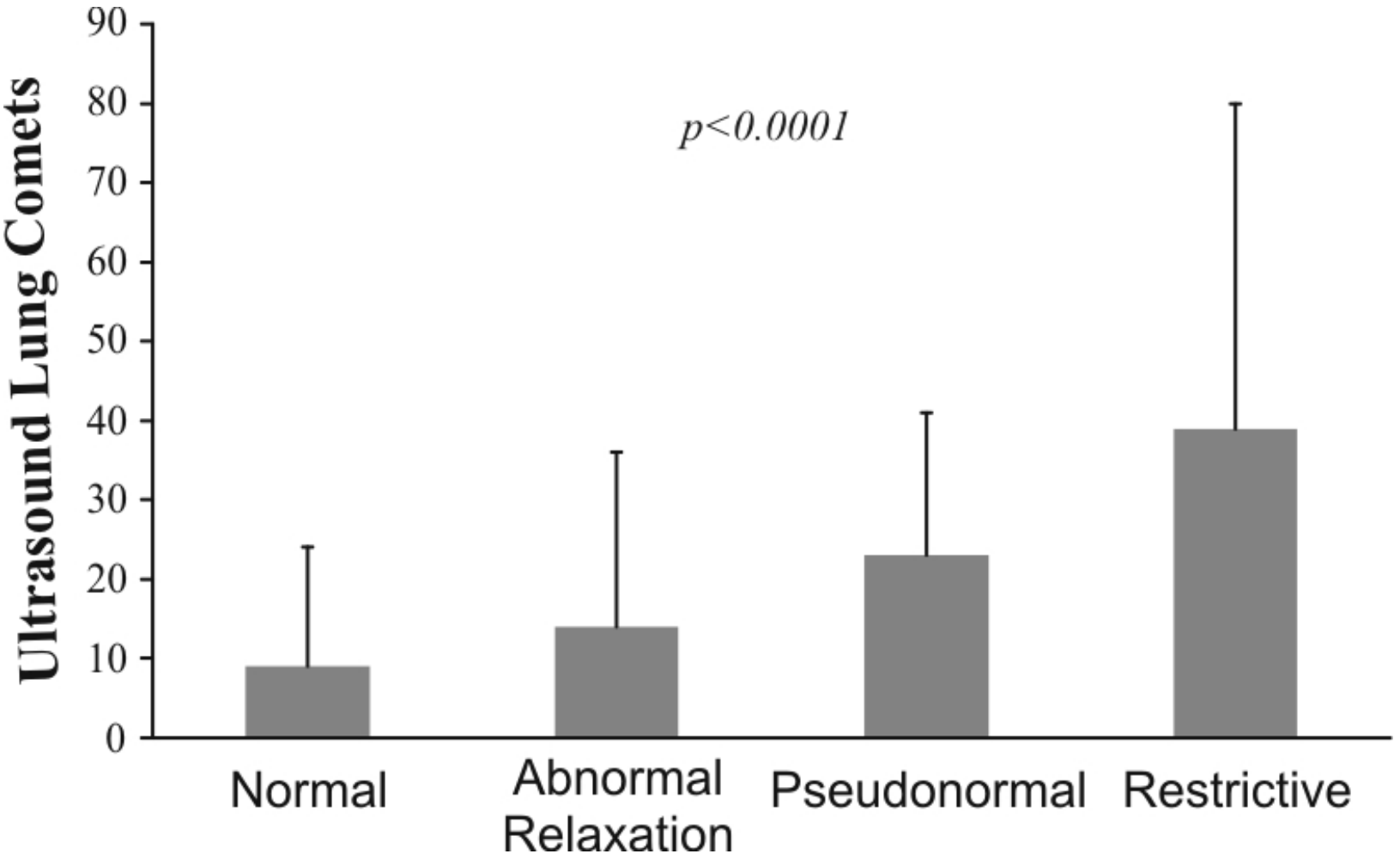
Gargani L, Picano E. *Eur J Heart Fail* 2008;10:70-7.

B-lines and PCWP



Agricola E, Picano E et al. *Chest* 2005; 127:1690

B-lines and diastolic dysfunction

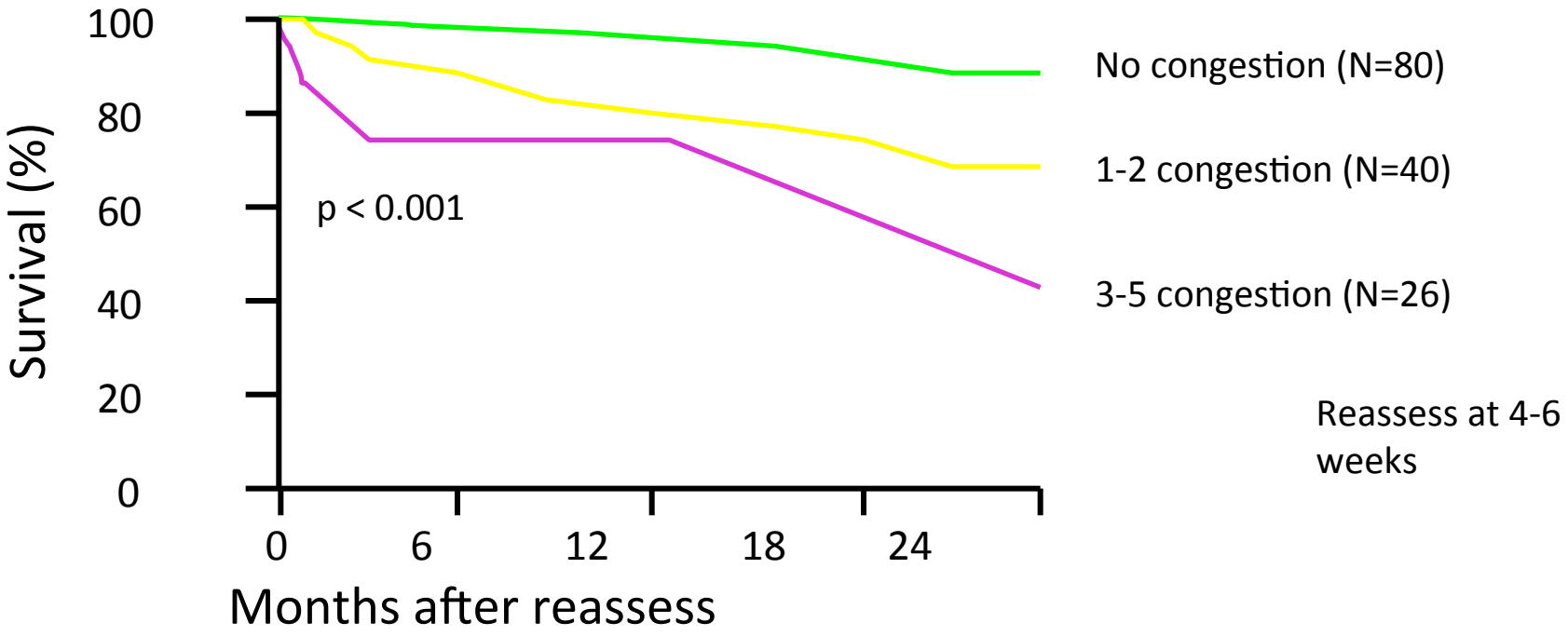


Frassi F, Gargani L, Ciampi Q, Picano E, *Eur J Echocardiogr* 2007;8:474

La congestione nello scompenso cardiaco

1. Why
2. When
3. How

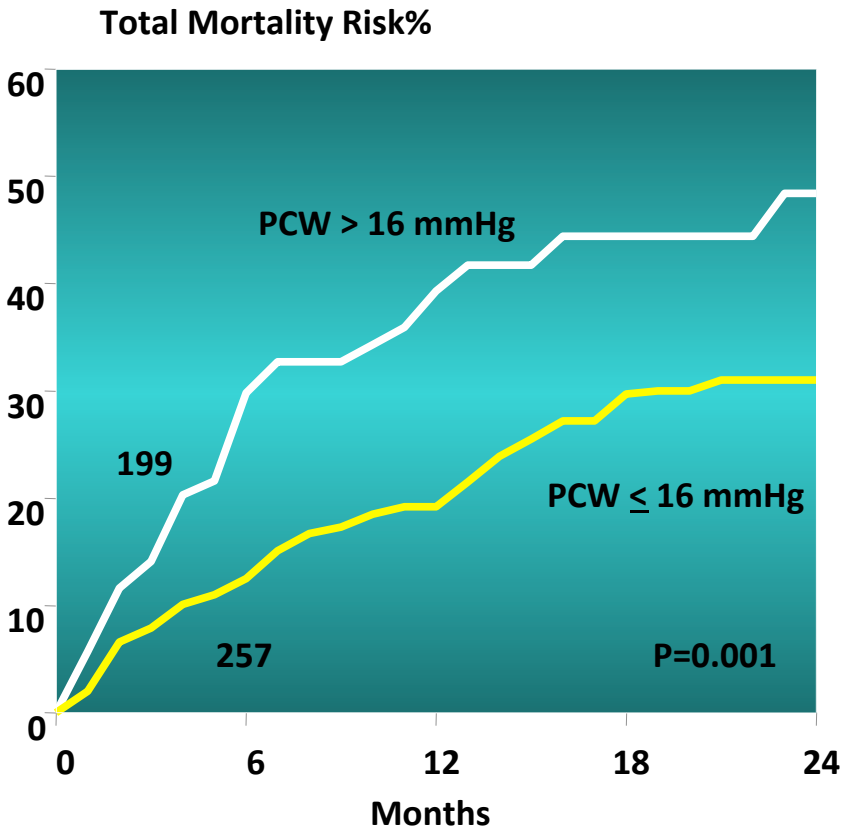
Prognostic implications: clinical congestion

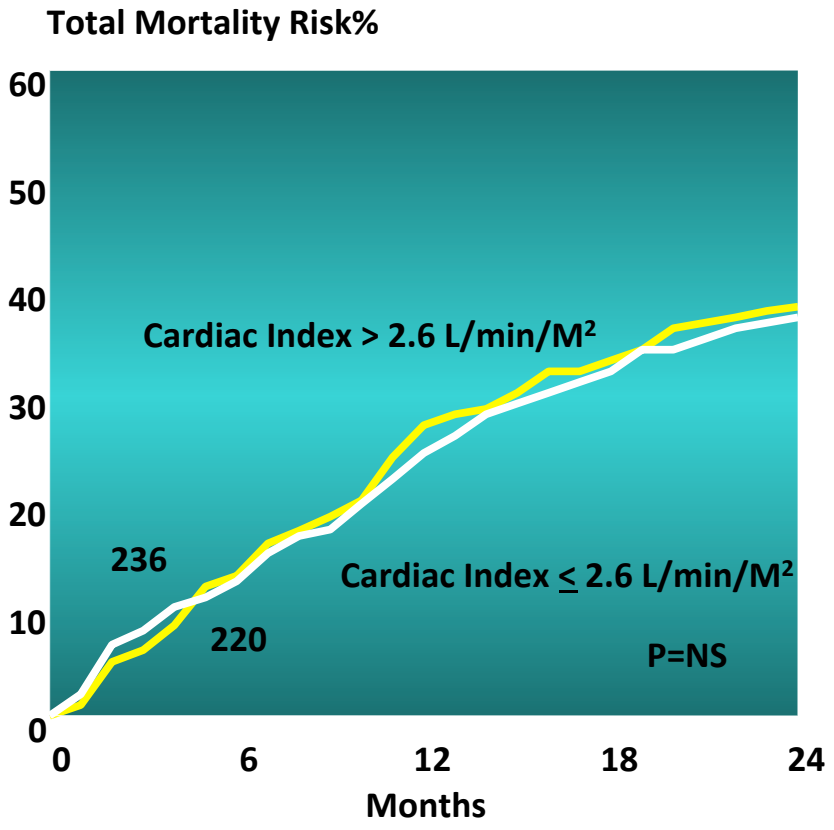


Criteria for congestion: Orthopnea, JVD, wt. gain ≥ 2 lb. in a week, need to increase diuretic dose, leg edema.

Lucas C et al. Am Heart J. 2000; 140: 840

Prognostic implications: hemodynamic congestion





Final hemodynamics measurement in 456 advanced HF patients after tailored therapy

Fonarow et al., *Circulation* 1994;90:I-488

La congestione nello scompenso cardiaco

1. Why
2. When
3. How

When to assess pulmonary congestion

When	Diagnostic target
Outpatient	Exclude impending instabilization
ER	AHF diagnosis
Ward	Therapy titration
Pre-discharge	Risk stratification

Picano E, Gargani L, Gheorghiade M Heart Fail Rev. 2010;15:63-72.

La congestione nello scompenso cardiaco

1. Why
2. When
3. How

Conventional tools to assess changes in pulmonary congestion

- Signs and symptoms
- Daily weights
- CXR
- Natriuretic peptides (BNP and NT-proBNP)
- Right heart catheterization

Hystory and physical examination

Variable	Sensitivity (%)	Specificity (%)	Accuracy (%)
Hx of HF	62	94	80
Dyspnea	56	53	54
Orthopnea	47	88	72
Rales	56	80	70
S3	20	99	66
JVD	39	94	72
Edema	67	68	68

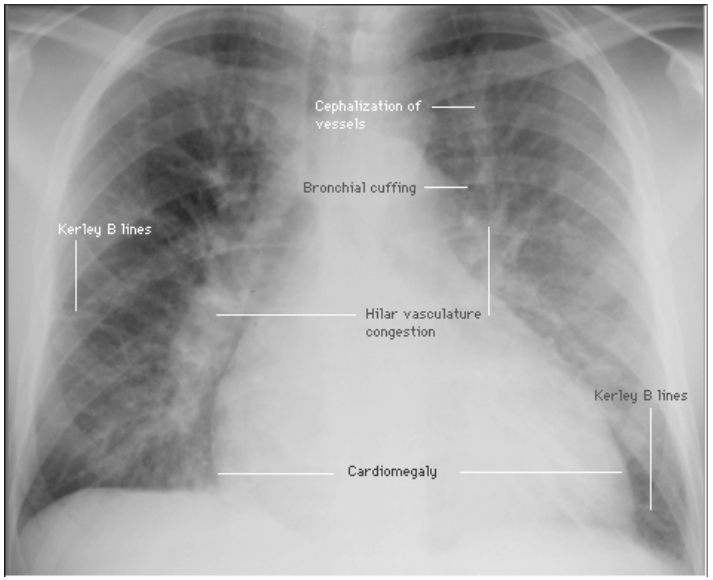
Dao, Q., Maisel, A. et al. *J. American College of Cardiology*, Vol 37, No. 2, 2001

Adapted from Chakko S. et al. Am J Med. 1991; 90: 353

Adapted from Butman SM. Et al. J Am Coll Cardiol. 1993; 22: 968

How good is CXR in diagnosing heart failure?

- Misses 20% of echo proven cardiomegaly
- Detection of pleural effusion if supine
  - 67% sensitivity
  - 70% specificity
- Even worse if done portable



Kono T, et al. Jpn Circ J. 1992 Apr;56(4):359-65.
Ruskin JA, et al. AJR Am J Roentgenol. 1987 Apr;148(4):681-3.

Dyspnea in ejection fraction 18%

Diario

Il paziente presenta dispnea. EO: tachipnea, parziale disorientamento ST, rumori umidi diffusi su tutto l'ambito. PA 105/85 mmHg, Sat O2 95% in O2 con cannule nasali a 5 l/min. Diuresi 900 cc. Si incrementa la velocità del diuretico a 4 cc/ora e si applica telemetrico.

Diario

Il paziente e' scarsamente responsivo e disorientato. Presenta evidente respiro periodico che non era presente ieri. PA 100/75 mmHg, al monitor ritmo indotto da PM. EGA pH 7.43, pCO2 41, pO2 70, B 2.5, HCO3- 26.6. La variazione del quadro neurologico potrebbe dipendere da emoconcentrazione (Hb 20) per cui si idrata il paziente con SF 1L in 24 h e Lasix 125 mg, si richiede inoltre TC cranio urgente senza mdc per escludere possibile sanguinamento. Si richiede infine monitoraggio del respiro.

Diario

Incremento della creatininemia, si aggiunge idratazione (Sol Fis 1000 cc + aminoacidi 500 cc). Si somministra Lasix 250 mg in 8 ore. Crepitii alle basi. Risponde agli stimoli verbali.