25/05/2018

SEPSI: COSA,COME MONITORIAMO?

Paolo Onorato, S.O.C. Pronto Soccorso e Medicina d'Urgenza
ASUIUD S. Maria della Misericordia di Udine

SIMEU società italiana medicina d'emergenza-urgenza
FRIULI VENEZIA GIULIA

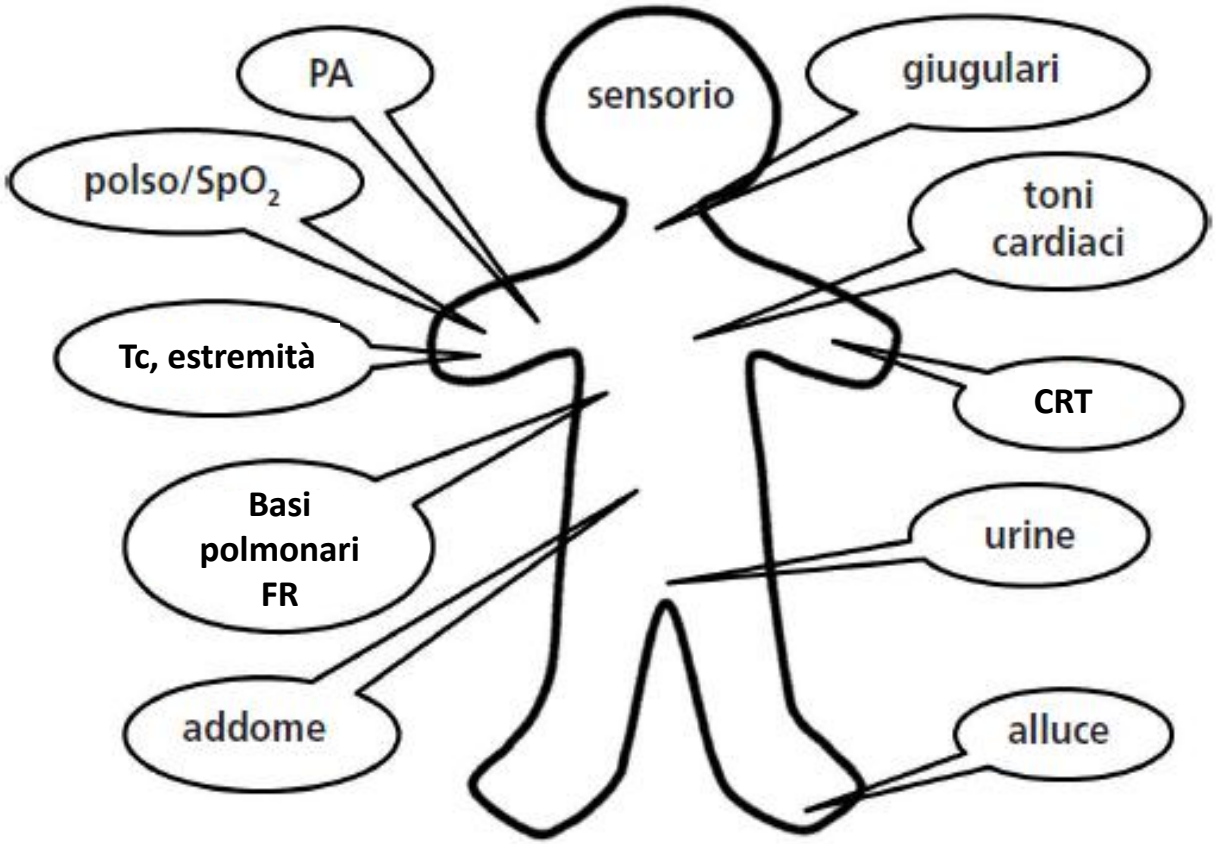
XI congresso nazionale
simeu
ROMA 24-26 MAGGIO 2018

AZIENDA OSPEDALIERO UNIVERSITARIA
Santa Maria della Misericordia di Udine

Monitoraggio: osservazione, a scopo di controllo, di una grandezza variabile, eseguita mediante appositi strumenti (monitor).

- Intermittente/continuo
- Non invasivo/invasivo
- Macro-parametri/micro-parametri
- Statici/dinamici

A LETTO DEL PAZIENTE…



PARAMETRI VITALI

- PAM [PAD + 0.412 X (PAS – PAD)]
- FC
- FR (ispezione e palpazione)
- COSCIENZA (GCS, ACVPU)
- PERFUSIONE CUTANEA (grado di marezzatura, RCT, gradiente di temperatura)
- DIURESI (CV)

PRESSIONE ARTERIOSA MEDIA

- **PAM [PAD + 0.412 X (PAS-PAD)]**

PAS/PAD	→	PAM
120/70	→	90,6
101/40	→	65,1
90/35	→	57,6

Maurizio Cecconi
Daniel De Backer
Massimo Antonelli
Richard Beale
Jan Bakker
Christoph Hofer
Roman Jaeschke
Alexandre Mebazaa
Michael R. Pinsky
Jean Louis Teboul
Jean Louis Vincent
Andrew Rhodes

Consensus on circulatory shock and hemodynamic monitoring. Task force of the European Society of Intensive Care Medicine

Shock is typically associated with evidence of inadequate tissue perfusion on physical examination. The three organs readily accessible to clinical assessment of tissue perfusion are the:

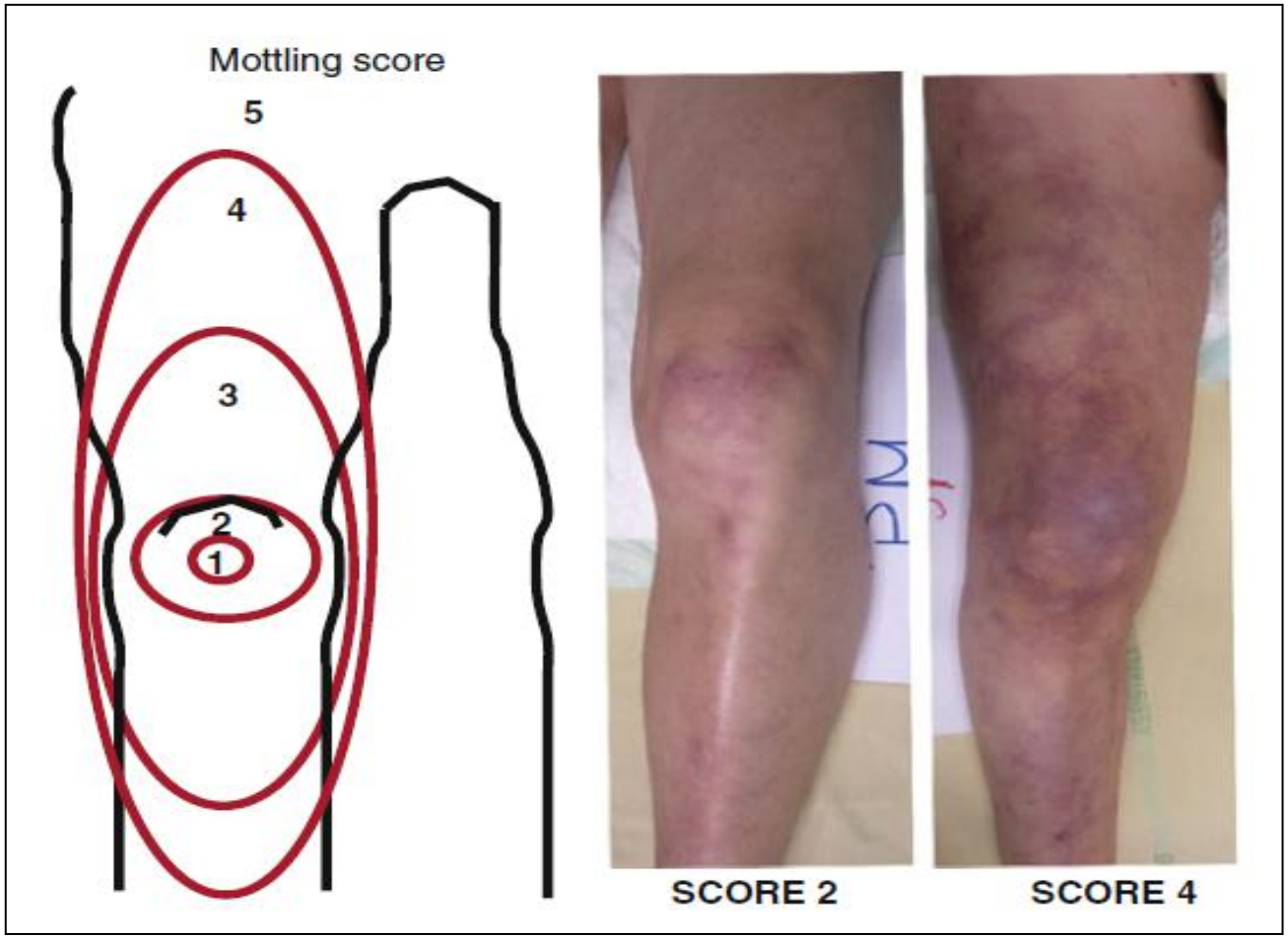
-skin (degree of cutaneous perfusion);
kidneys (urine output); and
brain (mental status)

VALUTAZIONE DELLA PERFUSIONE CUTANEA

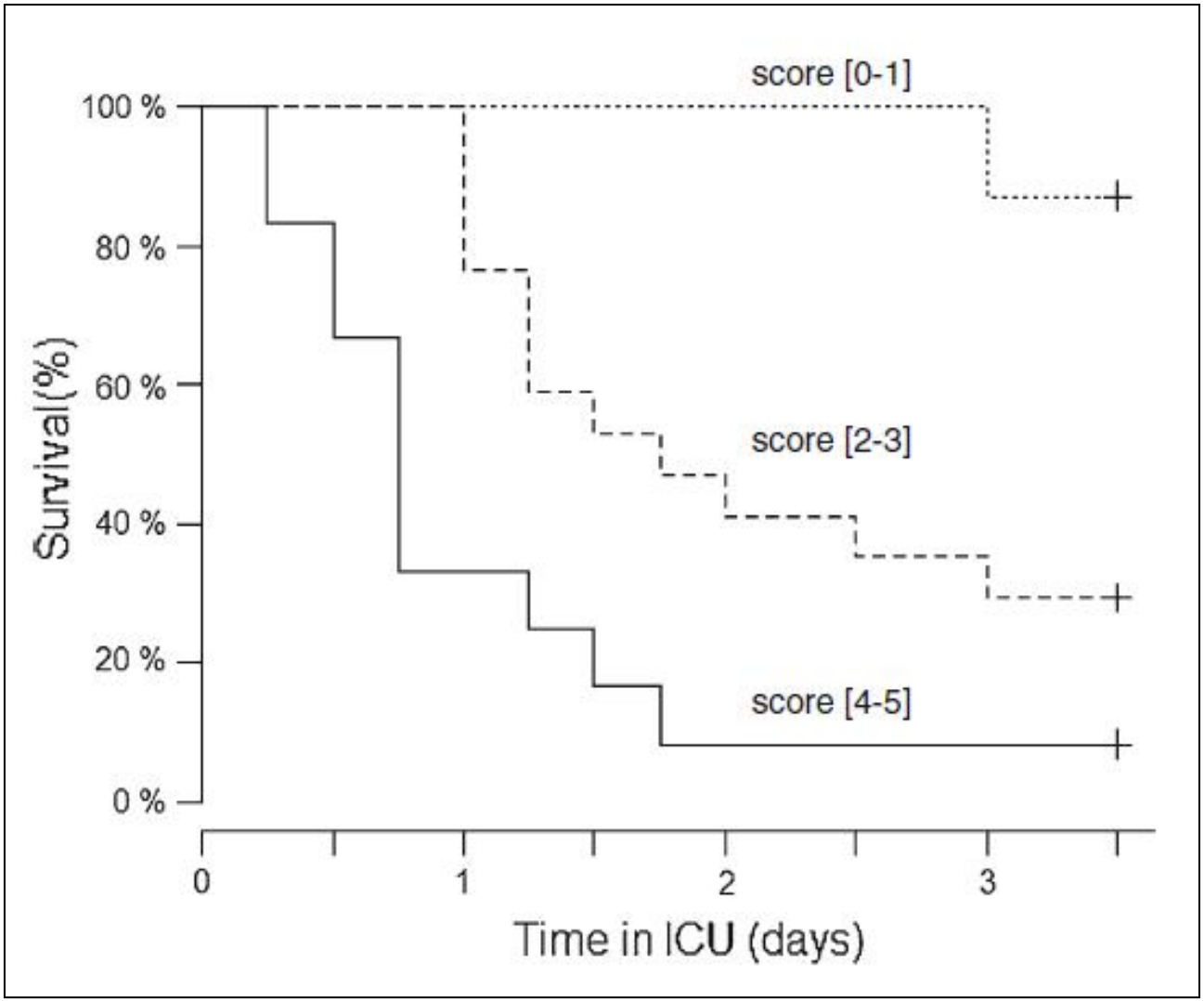
Metodo	Variabile	Vantaggio	Limiti	Significato
Marezzatura cutanea	Presente/ assente	Facile da esaminare	Poco specifico	-
	Punteggio	Facile e riproducibile	Non utile se cute scura	Pz grave se score 4-5
Refill capillare	Refill indice	Facile e riproducibile	Risultati variabili	Shock > 2.5 sec
	Refill ginocchio	Riproducibile	Non utile se cute scura	Shock > 5 sec
Gradiente di temperatura	Avambraccio-dito	Metodo validato	Tecnologia complessa	Significativo se > 4°C
	Centrale-alluce	Metodo validato	Tecnologia complessa	Significativo se > 7°C

Hafid Ait- Oufella, and Jan Bakker.
Understanding clinical signs of poor tissue perfusion during septic shock.
Intensive Care Med 2016.

GRADO DI MAREZZATURA CUTANEA



H. Ait-Oufella et al.
Mottling score predicts survival in septic shock.
Intensive Care Med (2011) 37:801–807.



Poco marezzato
Prognosi migliore

Molto marezzato
Prognosi peggiore

H. Ait-Oufella et al.
Mottling score predicts survival in septic shock.
Intensive Care Med (2011) 37:801–807.

Intensive Care Med (2014) 40:958–964
DOI 10.1007/s00134-014-3326-4

ORIGINAL

H. Ait-Oufella
N. Bige
P. Y. Boelle
C. Pichereau

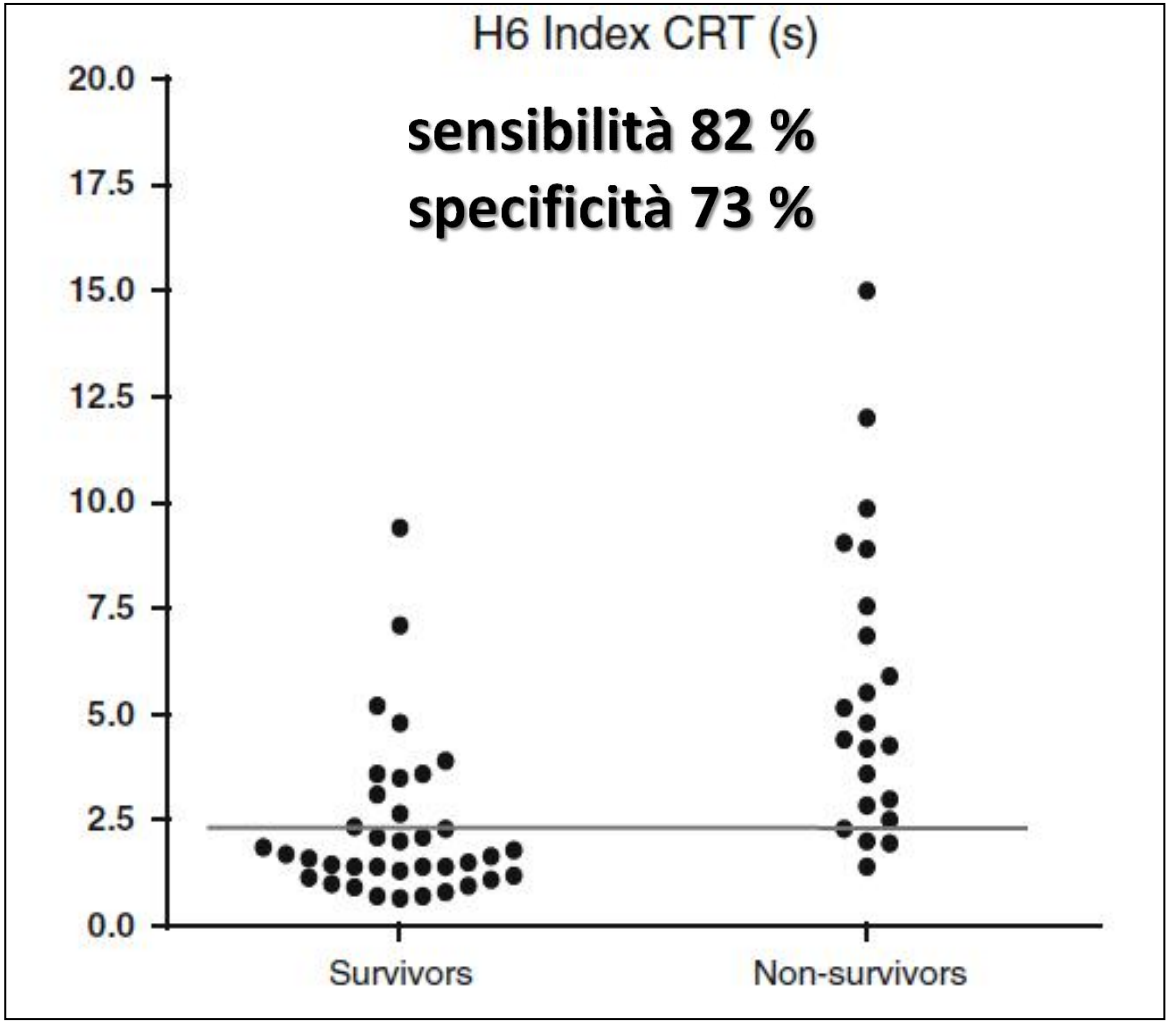
Capillary refill time exploration during septic shock

Capillary refill time:

firm pressure to the distal phalanx of the index finger for 15 s.

Time for return of the normal color.

IL REFILL CAPILLARE



H. Ait-Oufella.

Intensive Care Med (2014) 40:958–964

FLUID RESPONSIVENESS

"… fluid responsiveness is a measure of preload dependence or preload reserve of the two ventricles…"

" Physiological controversies and methods used to determine fluid responsiveness: a qualitative systematic review". B. M. Ansari,V. Zochios,F. Falter and A. A. Klein. *Anaesthesia 2016, 71, 94–105.*

"Whose SV increases by 10-15% after a fluid challenge (250-500 ml) is considered to be a fluid responder."

Marik PE, Monnet X, Teboul JL. **" Hemodynamic parameters to guide fluid therapy".** *Ann Crit Care 2011; 1: 1*

PREDIZIONE
FLUID RESPONSIVENESS

"To predict fluid responsiveness, two methods must be combined to generate the changes in preload on one hand and to measure the subsequent changes in stroke volume on the other hand."

"Basic concepts of fluid responsiveness" **T. G. V. Cherpanath & B. F. Geerts & W. K. Lagrand & M. J. Schultz & A. B. J. Groeneveld.** *Neth Heart J (2013) 21:530–536*

FLUID RESPONSIVENESS, PREMESSE

" It is likely that less than 40% of hypotensive patients with severe sepsis or septic shock are fluid responders…

… in patients with sepsis, less than 5% of a crystalloid bolus remains intravascular an hour after the end of the infusion…"

"A rational approach to fluid therapy in sepsis". P. Marik, and R. Bellomo *British Journal of anaesthesia, 116 (3): 339-49.*

" The concept of fluid responsiveness is based on pathophysiologic consideration and has not been rigorously evaluated in randomized controlled trials …"

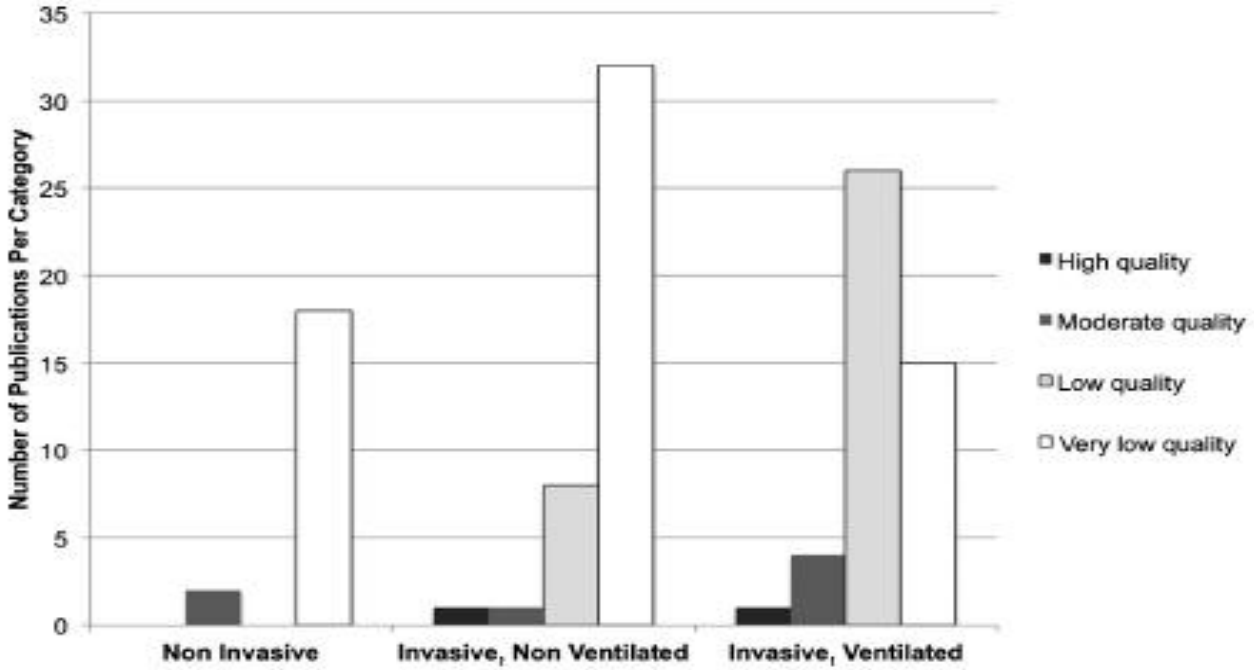
A.S. Saleh,**"Is the concept of fluidresponsiveness evidence-based?".** *Intensive Care Medicine, Vol 42, no 7, pp 1187-1188 2016.*

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.jccjournal.org

Conclusions: This review has highlighted the plethora of goals and methods for monitoring fluid therapy. Strikingly, there is scant high quality evidence, in particular for non-invasive G/M combinations in non-operative and non-intensive care settings. There is an urgent need to address this research gap, which will be helped by methodologies to compare utility of G/M combinations.



Clinical Review & Education

JAMA | The Rational Clinical Examination

Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids?

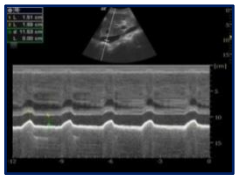
Peter Bentzer, MD, PhD; Donald E. Griesdale, MD, MPH; John Boyd, MD; Kelly MacLean, MD; Demetrios Sirounis, MD; Najib T. Ayas, MD, MPH

"…diagnostic accuracy of dry mucous membranes, dry axilla, decreased tissue turgor, CRT > 2 seconds, tachycardia and low jugular venous pressure… LR and respective 95% CIs for all of these findings crossed 1.0…

… diagnostic accuracy of a systematic clinical assessment of skin turgor, CRT, jugular vein distension, appearance of mucous membranes, pulmonary ascultation and presence of leg edema, ascites and pleural effusions… this approach was poor predictor of fluid responsiveness with 95% Cis of the LRs crossing 1.0 (LR + 0.93, LR – 1.2)."

MONITORAGGIO "AVANZATO"

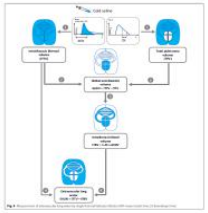
Eco VCI



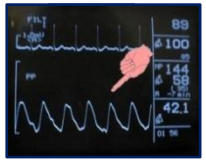
acute circulatory failure

- evident fluid loss?
- early phase of sepsis?

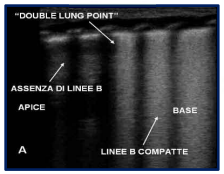
Termodiluizione



PVI



LUS



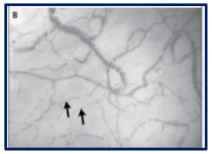
yes

fluid administration

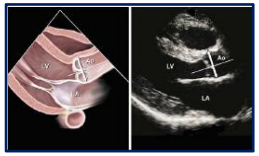
no

- spontaneous breathing?
- cardiac arrhythmias?
- low tidal volume/low lung compliance?

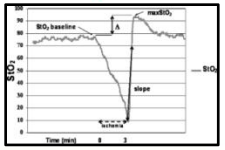
SDF



TTE



Sto2/VOT



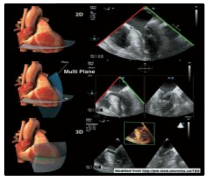
yes

- passive leg raising test
- end-expiratory occlusion test
- «mini» fluid challenge

no

- pulse pressure/stroke volume respiratory variation
- passive leg raising test
- end-expiratory occlusion test
- «mini» fluid challenge

TEE



"Assessment of volume responsiveness during mechanical ventilation: recent advances".
Xavier Monnet, Jean-Louis Teboul. Monnet and Teboul. *Critical Care 2013, 17:217.*

COSA MISURARE?

Maurizio Cecconi
Daniel De Backer
Massimo Antonelli
Richard Beale
Jan Bakker
Christoph Hofer
Roman Jaeschke
Alexandre Mebazaa
Michael R. Pinsky
Jean Louis Teboul
Jean Louis Vincent
Andrew Rhodes

Consensus on circulatory shock and hemodynamic monitoring. Task force of the European Society of Intensive Care Medicine

- We raccomend that fluid resuscitation should be guided by more than one single hemodynamic variable

- We raccomend using dynamic over static variables, when applicable, to predict fluid responsiveness, when applicable

- When raccomend for fluid administration is made we raccomend to perform a fluid challenge unless in cases of obvious hypovolemia

Septic Shock
Advances in Diagnosis and Treatment

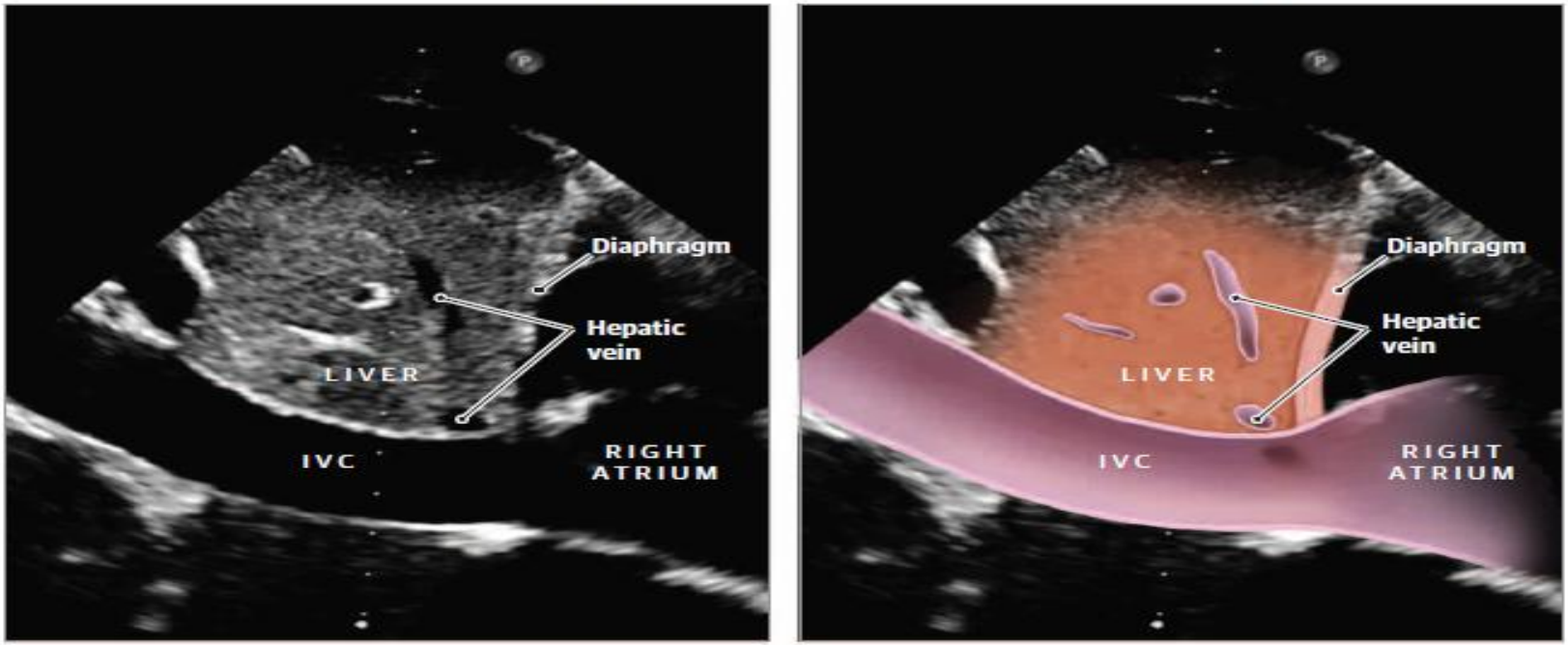
JAMA. 2015;314(7):708-717.

Christopher W. Seymour, MD, MSc; Matthew R. Rosengart, MD, MPH

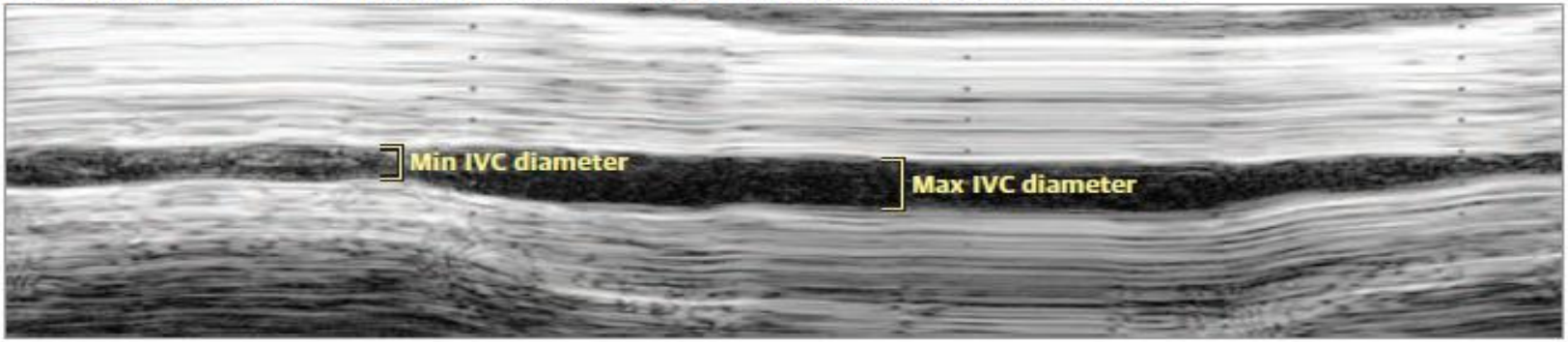
Focused ultrasonography is a diagnostic technique to consider as part of multimodal hemodynamic assessment during the care of select patients with septic shock

Classe C di evidenza: opinioni di esperti

A Longitudinal subcostal ultrasound of IVC (left) with illustration of anatomical structures in view (right)

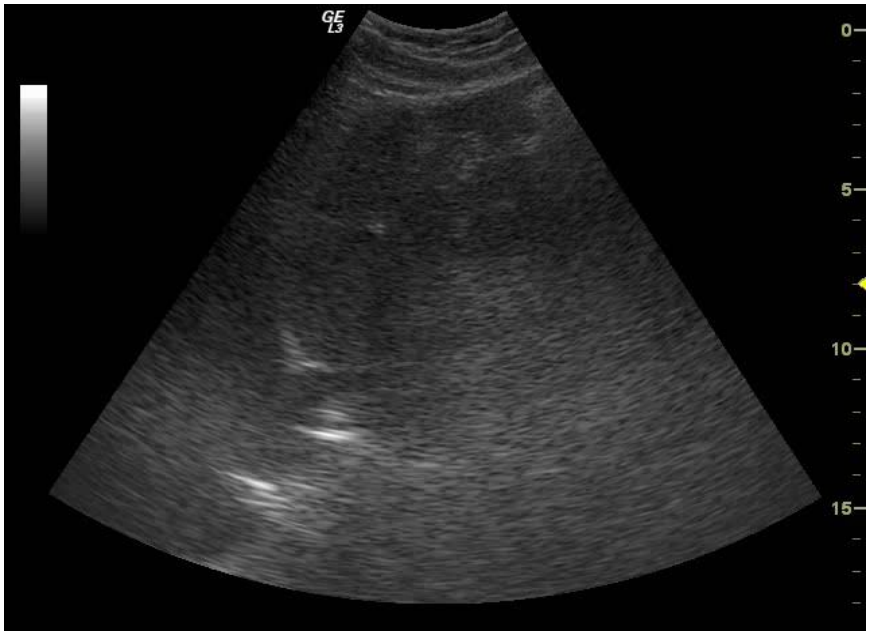


Collapsibility index of IVC = [(max IVC diameter - min IVC diameter)/max IVC diameter] x 100

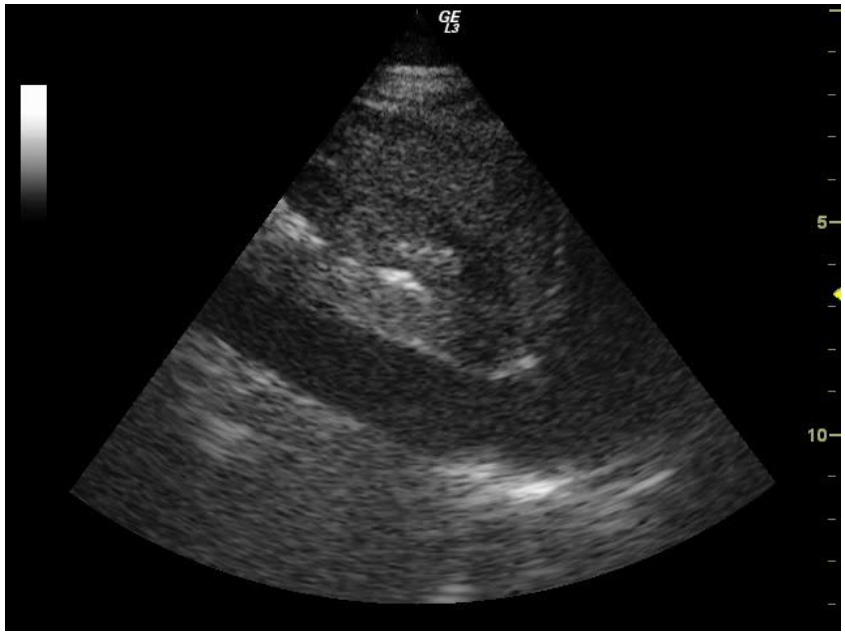


"Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids?" Peter Bentzer, MD, PhD; Donald E. Griesdale, MD, MPH; John Boyd, MD, *JAMA September 27, 2016 Volume 316, Number 12*.

ECO VCI



VUOTA



PIENA

DIPENDE…

ECO VCI

Le escursioni respiratorie della VCI possono risultare falsamente ridotte in varie condizioni cliniche e pertanto, se non interpretate, precludere un'adeguata terapia infusiva in pazienti ancora fluid-responder:

- **PNX**
- **Tamponamento cardiaco**
- **TEP, IMA vdx, insufficienza tricuspidalica severa,CPC**
- **Contusione cardiaca**
- **ARDS**
- **PEEP**
- **Sindrome compartimentale addominale**
- **Compressione ab estrinseco**

ECO VCI

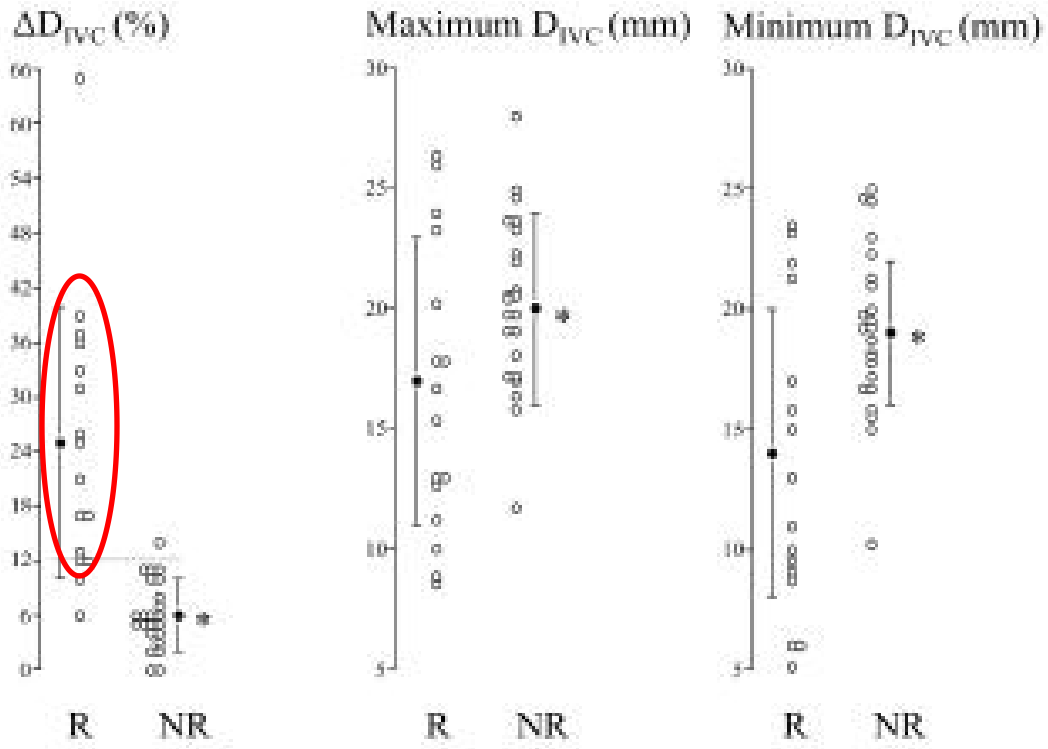
Intensive Care Med (2004) 30:1834–1837
DOI 10.1007/s00134-004-2233-5

BRIEF REPORT

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

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

Conclusion:
responders v



ntification of ively.

ECO VCI

Intensive Care Med (2004) 30:1740–1746
DOI 10.1007/s00134-004-2259-8

ORIGINAL

Christophe Barbier
Yann Loubières
Christophe Schmit
Jan Hayon
Jean-Louis Ricôme
François Jardin
Antoine Vieillard-Baron

Respiratory changes in inferior vena cava diameter are helpful in predicting fluid responsiveness in ventilated septic patients

Conclusion: Using a threshold dIVC of 18%, responders and non-responders were discriminated with 90% sensitivity and 90% specificity. A strong relation (r=0.9) was observed between dIVC at baseline and the CI increase following blood volume expansion.
Baseline central venous pressure did not accurately predict fluid responsiveness.

ECO VCI

Airapetian et al. Critical Care (2015) 19:400
DOI 10.1186/s13054-015-1100-9

CRITICAL CARE

RESEARCH Open Access

Does inferior vena cava respiratory variability predict fluid responsiveness in spontaneously breathing patients?

Table 5 Accuracy of cIVC at baseline, IVCmax and ΔCO after PLR for predicting fluid responsiveness

	Se	Sp	LR+	LR-	PPV	NPV
cIVC > 42 %	31 %	97 %	9	0.7	90 %	59 %
IVCmax at baseline < 2.1 cm	93 %	33 %	1.4	0.2	57 %	83 %
ΔCO > 10 %	52 %	87 %	4	0.6	79 %	65 %

ΔCO change in CO between baseline and after PLR, *cIVC* collapsibility index at baseline, *IVCmax* maximum diameter of the IVC, *PLR* passive leg raising, *Se* sensitivity, *Sp* specificity, *LR* likelihood ratio, *PPV* positive predictive value, *NPV* negative predictive value

ECO VCI

Muller et al. Critical Care 2012, 16:R188
http://ccforum.com/content/16/5/R188

CRITICAL CARE

RESEARCH Open Access

Respiratory variations of inferior vena cava diameter to predict fluid responsiveness in spontaneously breathing patients with acute circulatory failure: need for a cautious use

Conclusion: In spon

fluid responsiveness

sually associated with

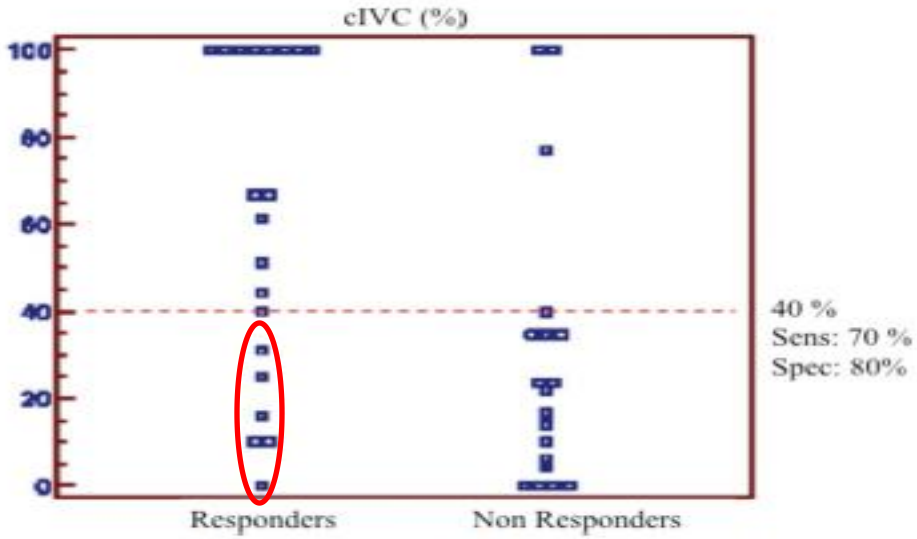


Figure 1 Individual values of inferior vena cava collapsibility (cIVC) (%) after infusion of 500 mL of HES. The best cutoff value is 40%.

Clinical Review & Education

JAMA | The Rational Clinical Examination

Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids?

Peter Bentzer, MD, PhD; Donald E. Griesdale, MD, MPH; John Boyd, MD; Kelly MacLean, MD; Demetrios Sirounis, MD; Najib T. Ayas, MD, MPH

"Despite the fact that the pooled LRs indicate relatively good accuracy (LR + 5.3, LR – 0.27 in ventilated patient, VCD index thershold of 15%, LR + 3.5, LR – 0.38 in spontaneously breathing patientes, VCC index of 41%), the test should be interpreted with some caution.
Respiratory varation in the VC is less useful and requires further confirmatory studies. "

Intensive Care Med (2016) 42:1461–1463
DOI 10.1007/s00134-015-4172-8

EDITORIAL

Jukka Takala

Volume responsive, but does the patient need volume?

Giving volume to fluid responders as long as they respond should not become the iatrogenic syndrome of the decade

REVIE

n Access

Extra
rece

Mathieu J

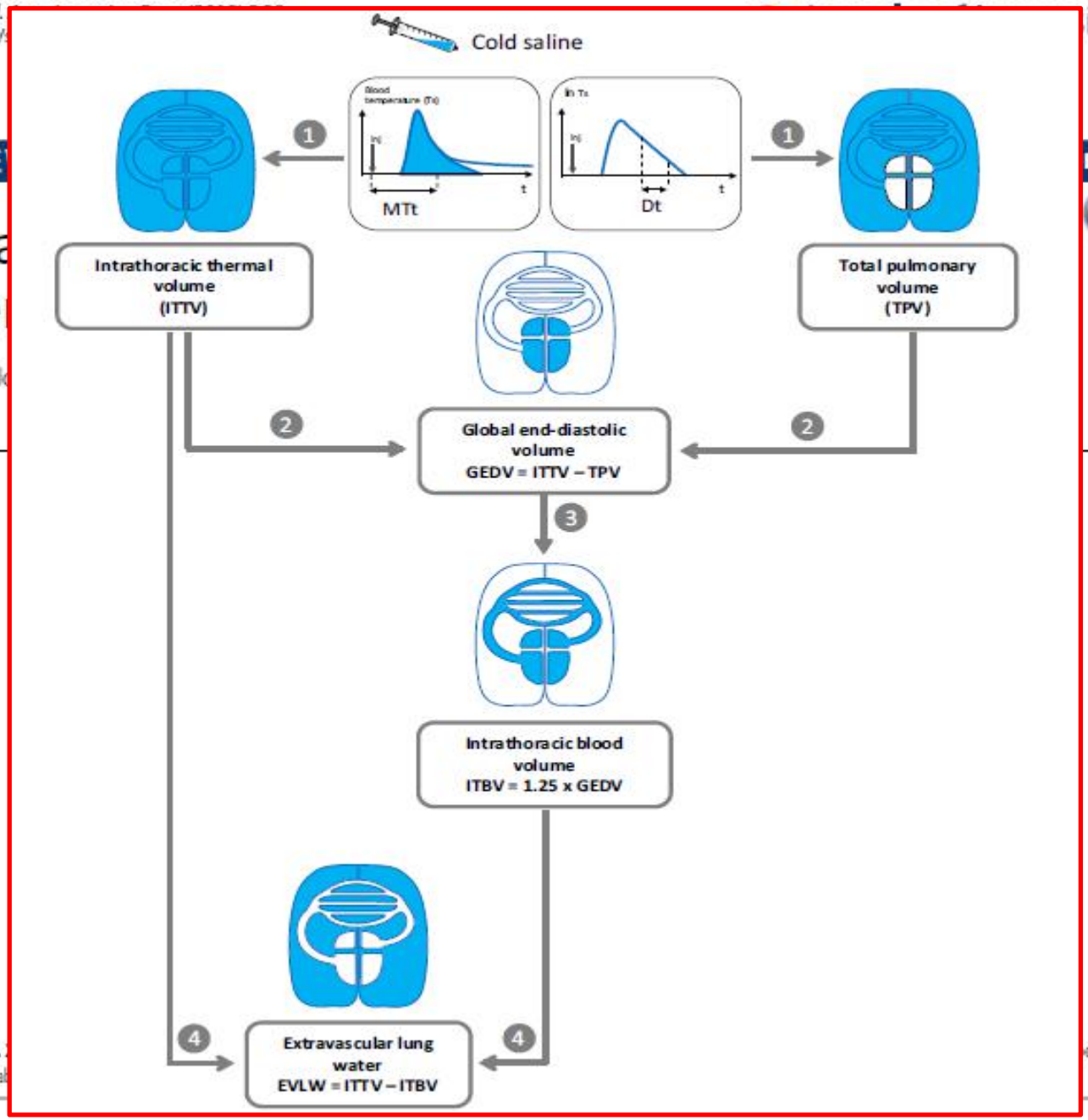
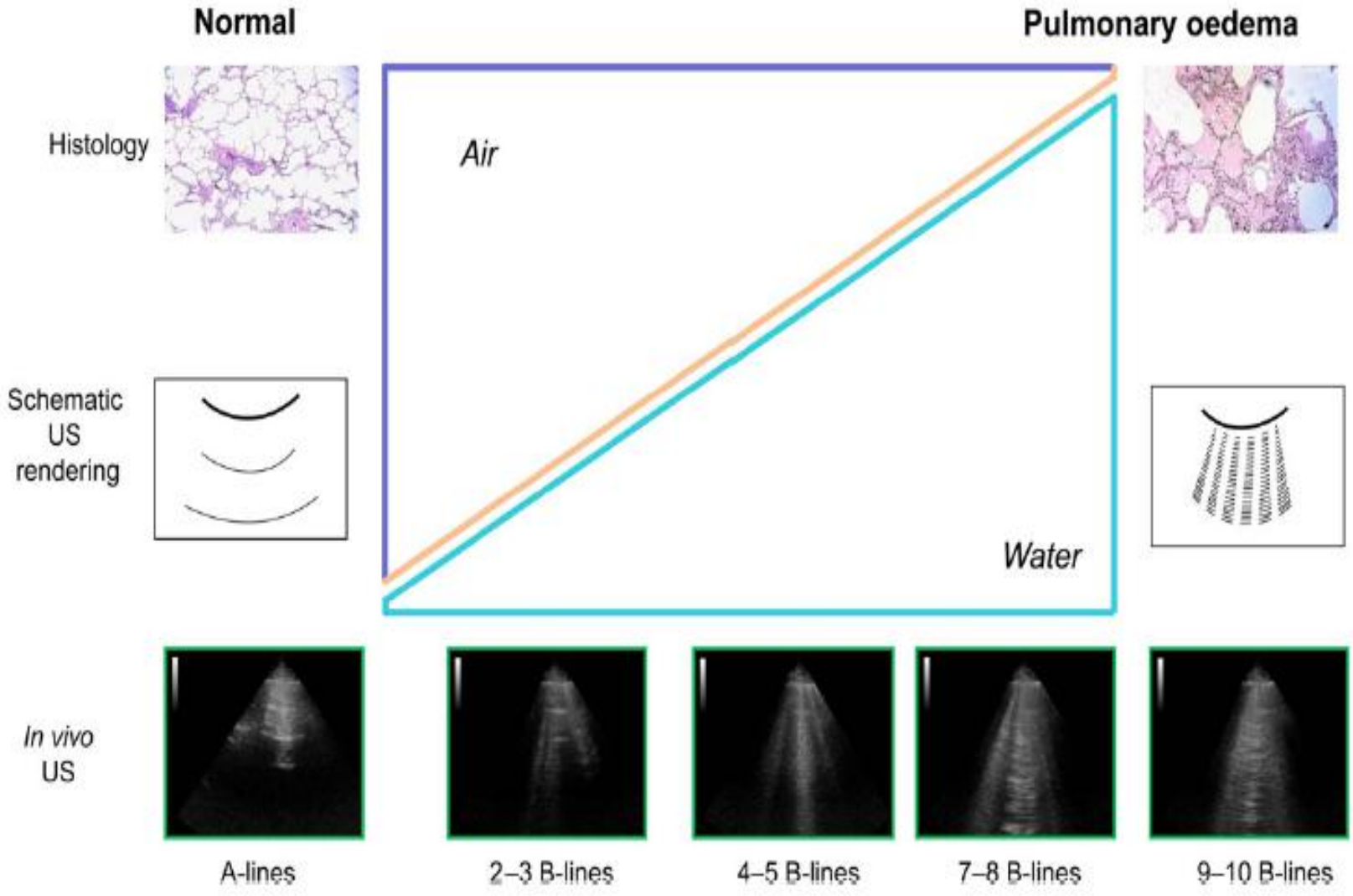


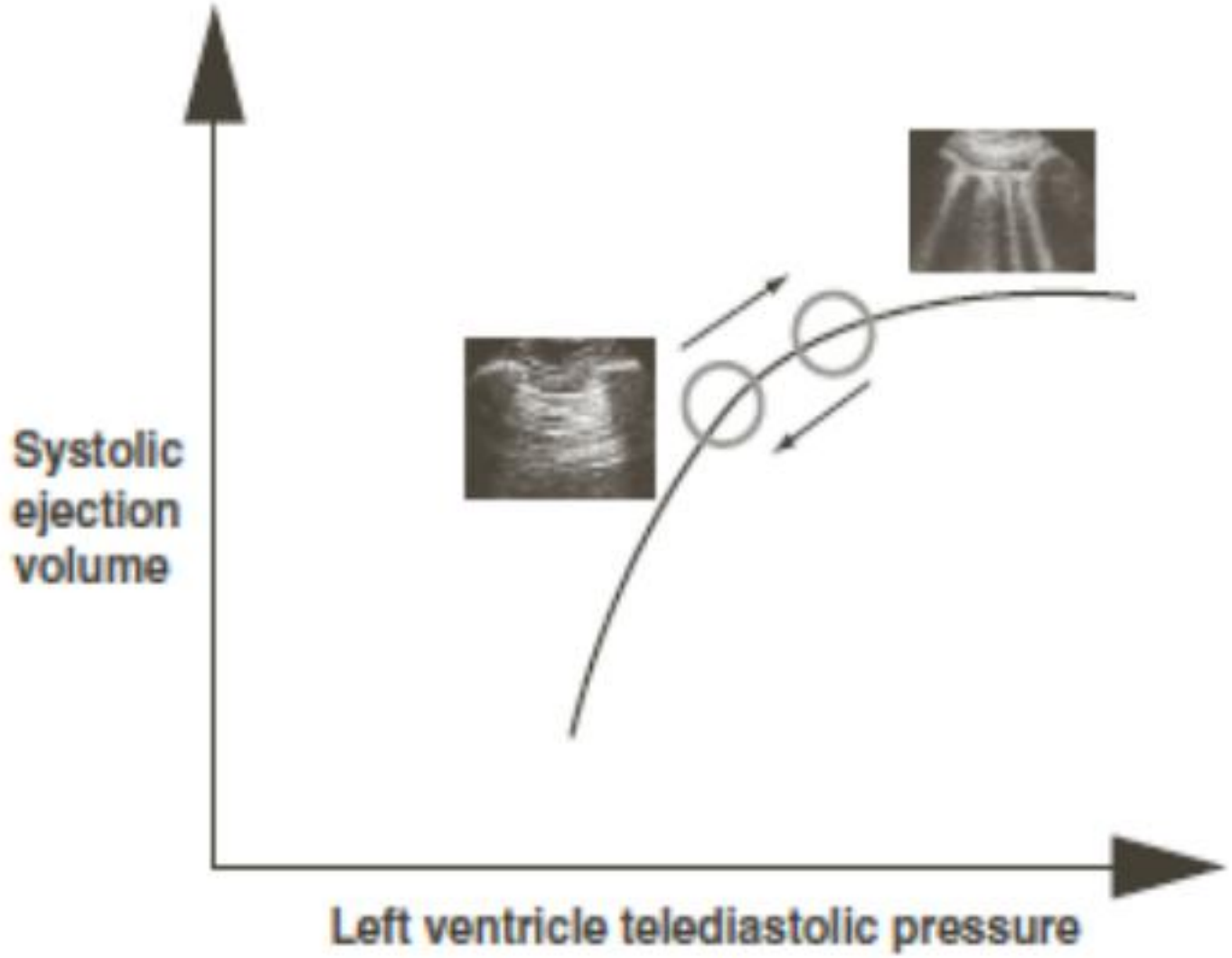
Fig.
mea

LUS



“Clinical update Ultrasound of extravascular lung water: a new standard for pulmonary congestion“
E Picano and Patricia A. Pellikka. *European Heart Journal Advance Access published May 12, 2016*

LUS, fluid responsiveness e EVLW

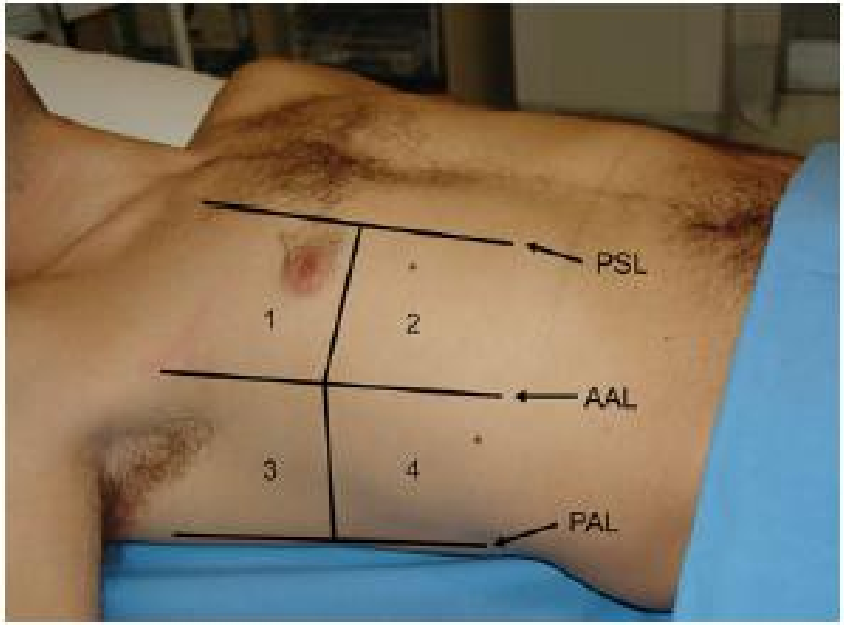


"Whole body Ultrasonography in the critical ill". Daniel A. Lichtenstein 2010

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

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 Breitkreutz
Armin Seibel
Luca Neri
Enrico Storti
Tomislav Petrovic
International Liaison Committee on Lung Ultrasound (ILC-LUS) for the International Consensus Conference on Lung Ultrasound (ICC-LUS)



European Heart Journal Advance Access published May 12, 2016

European Heart Journal
doi:10.1093/eurheartj/ehw164

REVIEW

Table 2 Scoring of B-lines

Score	Number of B-lines	EVLW
0	≤5	Absent
1	6–15	Mild degree
2	16–30	Moderate degree
3	>30	Severe degree

Figure 1 The recommended protocol for evaluating B-lines is performed by scanning 28-region protocol on the anterior chest with the patient in the supine position.[3,4,23]

Point of Care Ultrasound *Fluid Resuscitation Guide*

- using IVC and lung ultrasound -

Underfilled

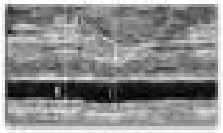
< 1.5 cm

Normal

1.5 - 2.5 cm

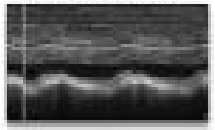
Intubated

Passive



$\frac{(D_{max}-D_{min})}{\left[\frac{(D_{max}+D_{min})}{2}\right]}$ > 12%

Triggering

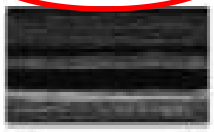


Not Intubated

A-line predominance

B-line predominance

Distended



> 2.5 cm, non-varying IVC

**Exceptions: Elevated RA pressure e.g. tamponade, pHTN, etc. or B-line etiologies other than pulmonary edema.

May still be fluid responsive.

Fluid Resuscitate

Give Crystalloid* [1,2]

*Septic patients, consider dynamic fluid responsiveness test

Fluid Test

Consider Crystalloid [3]

Crystalloid may help and unlikely to harm

Dynamic fluid responsiveness test indicated if available

Fluid Restrict**

Hold Crystalloid [3,4]

Vasoactive agents indicated to support shock

1. Fessel et al. Intensive Care Med 2004; 30(9):1834–1837.
2. Barbier et al. Intensive Care Med 2004; 30(9):1740–1746.
3. Lichtenstein et al. J Crit Care 2013; Oct;28(5):835.e11-8.
4. Lichtenstein et al. Am J Respir Crit Care Med 1997;156(5):1640-6.

Arntfield, Lee, Kory 2015

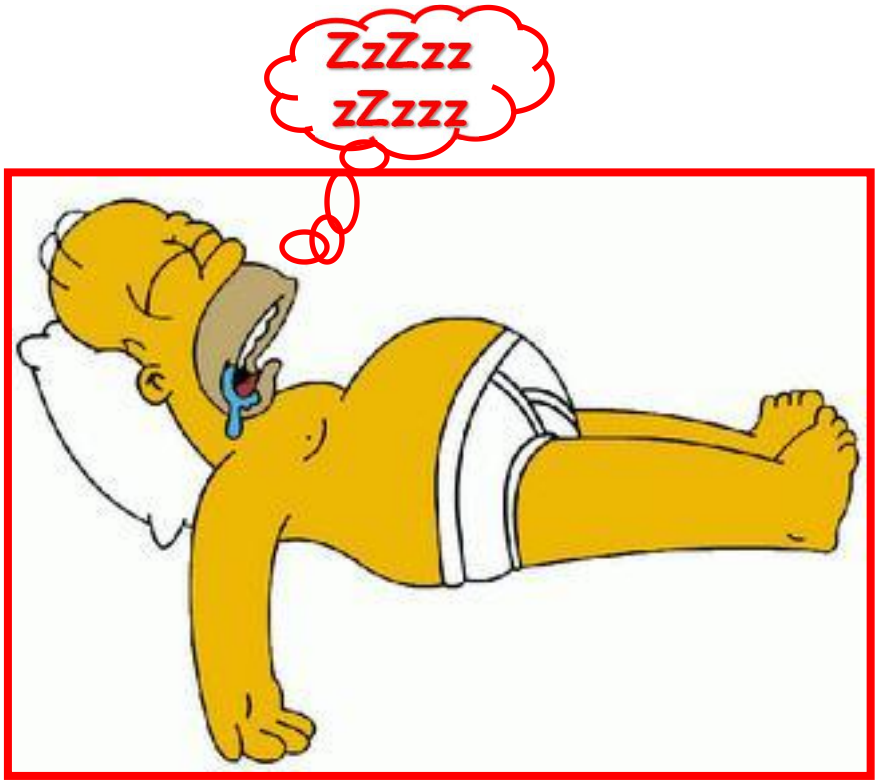
Clinical Review & Education

JAMA | The Rational Clinical Examination

Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids?

Peter Bentzer, MD, PhD; Donald E. Griesdale, MD, MPH; John Boyd, MD; Kelly MacLean, MD; Demetrios Sirounis, MD; Najib T. Ayas, MD, MPH

"Relying on a single measurement to make clinical decisions could lead to poor outcome… the decision to administer fluid at bedside not be based solely on a test result but also on risks and benefits of fluid administration in the clinical context."



GRAZIE PER L'ATTENZzzIONE!

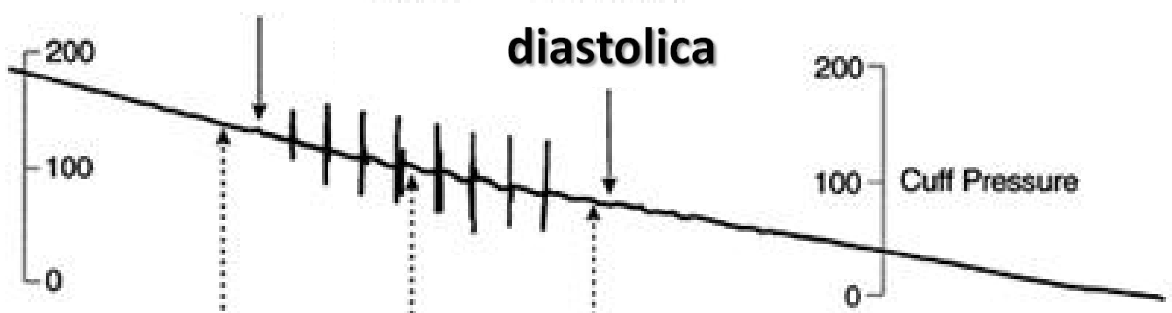
2 calcolo

1 misuro **1 misuro**

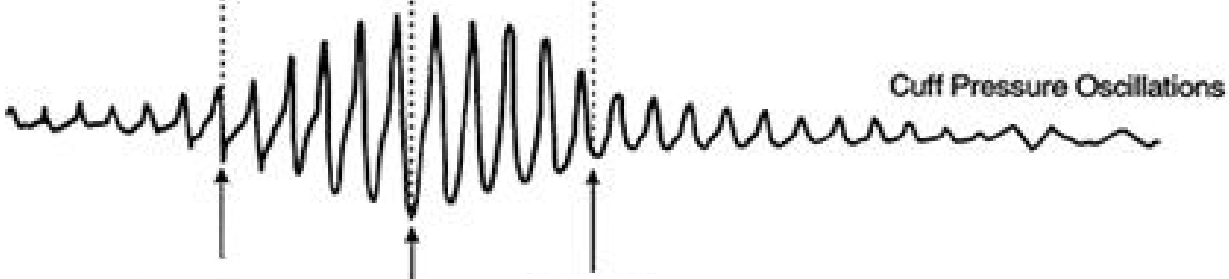
sistolica

diastolica

PA manuale, sfigmomanometro



PA automatica, monitor



sistolica **diastolica**

media

1 misura

2 calcola **2 calcola**

Kiers HD1, Hofstra JM, Wetzels JF. **Oscillometric blood pressure measurements: differences between measured and calculated mean arterial pressure.** *NethJMed.2008 Dec;66(11):474-9.*

Enghard et al. Critical Care (2015) 19:36
DOI 10.1186/s13054-015-0756-5

CRITICAL CARE

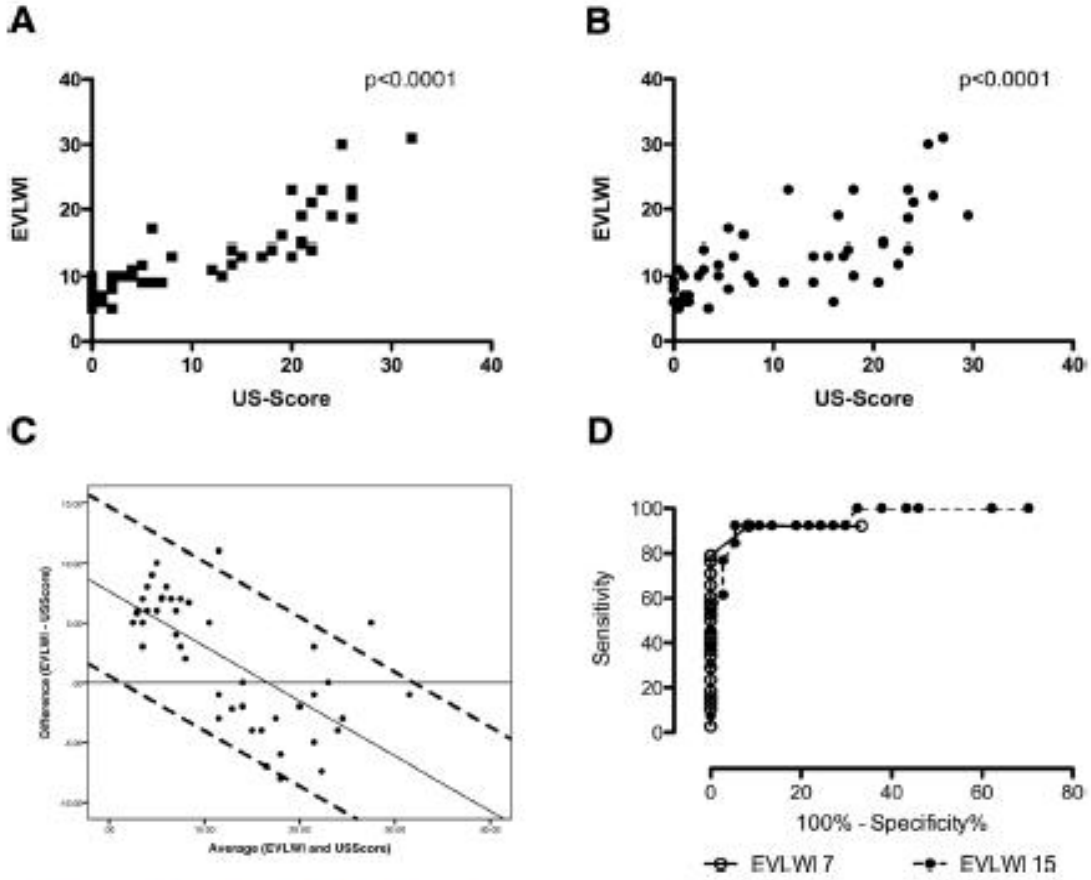


Figure 3 Correlation of the extravascular lung water index with the ultrasound score. **(A)** We found a close correlation of the ultrasound (US) score with the extravascular lung water index (EVLWI) (Spearman's $r = 0.91$, $P < 0.0001$). **(B)** Correlation of the blinded US score as a mean of two independent examiners is shown (Spearman's $r = 0.72$, $P < 0.0001$). **(C)** Bland-Altman plot comparing the difference (EVLWI – US score) with the average (of EVLWI and US score). Additionally, a linear regression (difference = 7.62 – 0.46 × average) and the 95% confident intervals (linear regression ± 1.96 × 3.6) are plotted. **(D)** Receiver operating characteristic curves of the US score obtained to identify patients with EVLWIs >7 and >15 show excellent diagnostic performance, as indicated by the areas under the curve of 0.9419 and 0.9636.

FALLS-protocol: lung ultrasound in hemodynamic assessment of shock

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