Monitorage des lactates dans le choc septique

Pr Ben Lakhal Salah

Service de Réanimation Médicale

CHU La Rabta de Tunis

VENDREDI 29 NOVEMBRE 2019

08:00-09:15: ACCUEIL ET INSCRIPTION

09:15-09:30: OUVERTURE

CONFÉRENCES — Salle Elyssa — 09:30-10:45

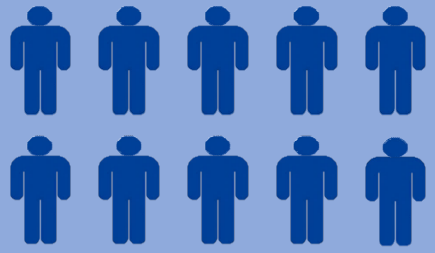
09:30-09:50 : Monitorage hémodynamique en Réanimation : Quand et Comment ? — Pr JL. Teboul

09:50-10:10 : Monitorage des lactates dans le choc septique — Pr S. Ben Lakhal

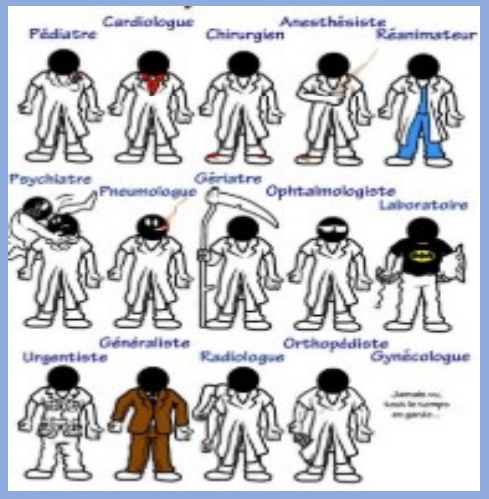
10:10-10:30 : Solutés balancés — Pr S. El Atrous

10:30-10:45 : Discussion

Epidémiologie



10% des admissions à l'hôpital



Toutes les disciplines médicales

20%

60%

Selon vos soins apportés dans les premières 24 heures

Clinical Review & Education

Special Communication | CARING FOR THE CRITICALLY ILL PATIENT JAMA February 23, 2016 Volume 315, Number 8

The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)

Mervyn Singer, MD, FRCP; Clifford S. Deutschman, MD, MS; Christopher Warren Seymour, MD, MSc; Manu Shankar-Hari, MSc, MD, FFICM; Djillali Annane, MD, PhD; Michael Bauer, MD; Rinaldo Bellomo, MD; Gordon R. Bernard, MD; Jean-Daniel Chiche, MD, PhD; Craig M. Coopersmith, MD; Richard S. Hotchkiss, MD; Mitchell M. Levy, MD; John C. Marshall, MD; Greg S. Martin, MD, MSc; Steven M. Opal, MD; Gordon D. Rubenfeld, MD, MS; Tom van der Poll, MD, PhD; Jean-Louis Vincent, MD, PhD; Derek C. Angus, MD, MPH

Sepsis → **Choc septique**

JAMA February 23, 2016 Volume 315, Number 8

Research

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Developing a New Definition and Assessing New Clinical Criteria for Septic Shock

For the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)

Manu Shankar-Hari, MD, MSc; Gary S. Phillips, MAS; Mitchell L. Levy, MD; Christopher W. Seymour, MD, MSc; Vincent X. Liu, MD, MSc; Clifford S. Deutschman, MD; Derek C. Angus, MD, MPh; Gordon D. Rubenfeld, MD, MSc; Mervyn Singer, MD, FRCP; for the Sepsis Definitions Task Force

≥ 65 mmHg

serum lactate level greater than 2 mmol/L

(18 mg/dL)

= the lowest serum lactate level independently associated with a greate risk of death

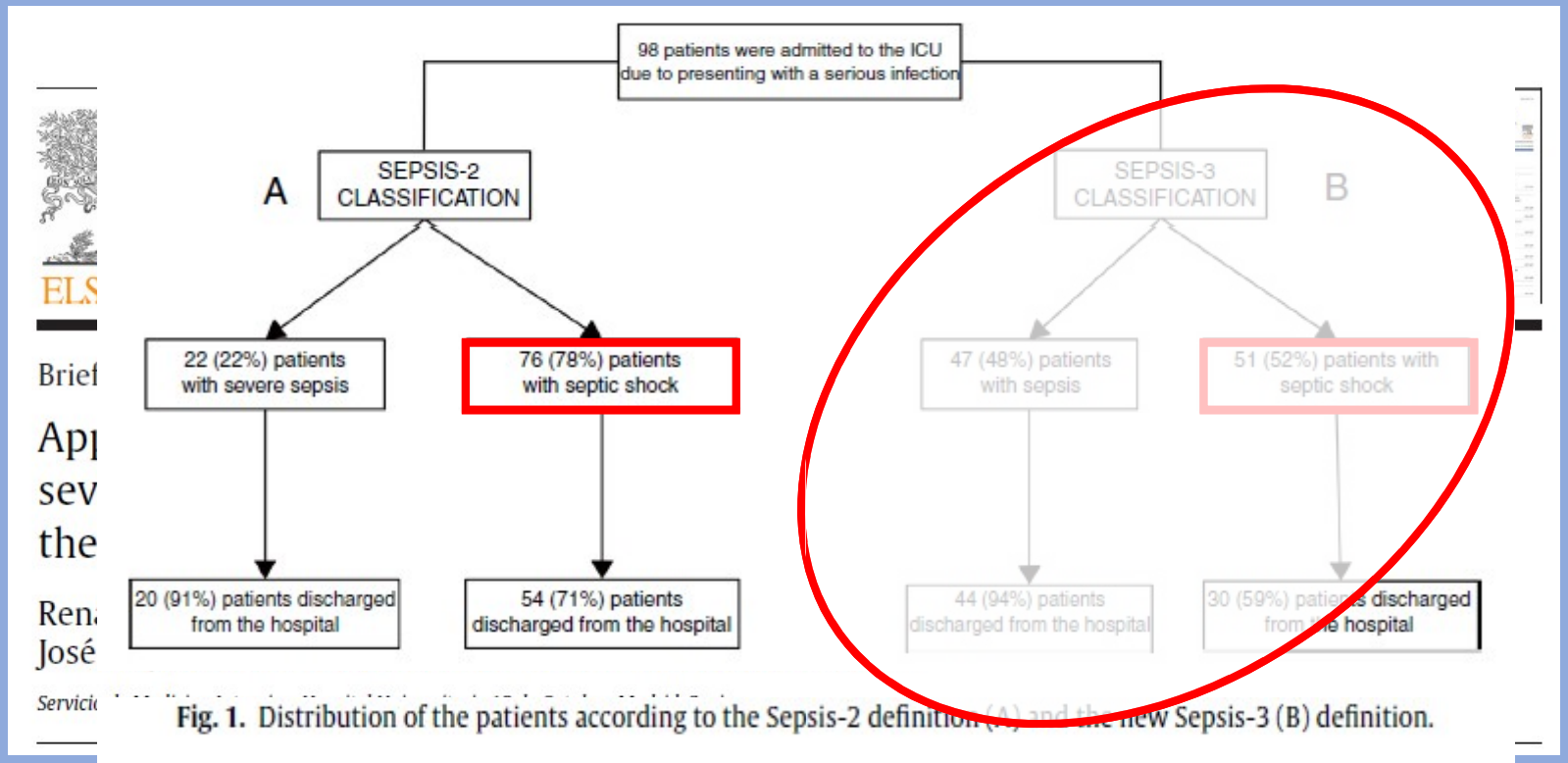


Fig. 1. Distribution of the patients according to the Sepsis-2 definition (A) and the new Sepsis-3 (B) definition.

ICU mort

Inpatient H
mortal

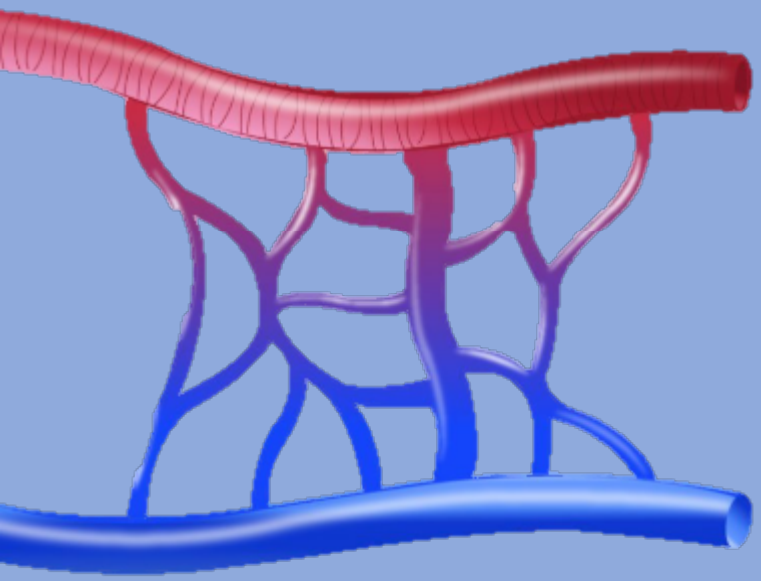
We can conclude that the new Sepsis-3 criteria can make a distinction between 2 very different levels of severity associated with very dissimilar prognoses. Based on our experience, the addition of the SOFA scale score and the lactate levels in the definition of septic shock seems to improve the *ability to assess the risk of inpatient hospital mortality when applied to patients with septic shock admitted to the HED.*

2% vs 35.3% $p < 0.001$

6,4% vs 41.2 $p < 0.001$

Monitorage de la macrocirculation est-il suffisant?

Pourquoi?



Altérations endothéliales

Alteration de la vasoréactivité artériolaire

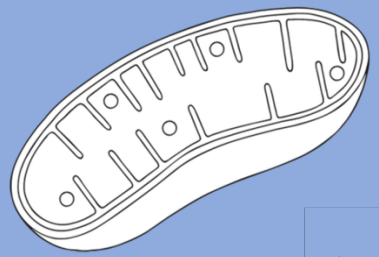
Alteration de la perfusion capillaire

Alteration du globules rouges

Etat de choc ?

Défaillance circulatoire aigue induisant une inadéquation entre les apports et les besoins en oxygène

Hypoxie cellulaire



Lactates

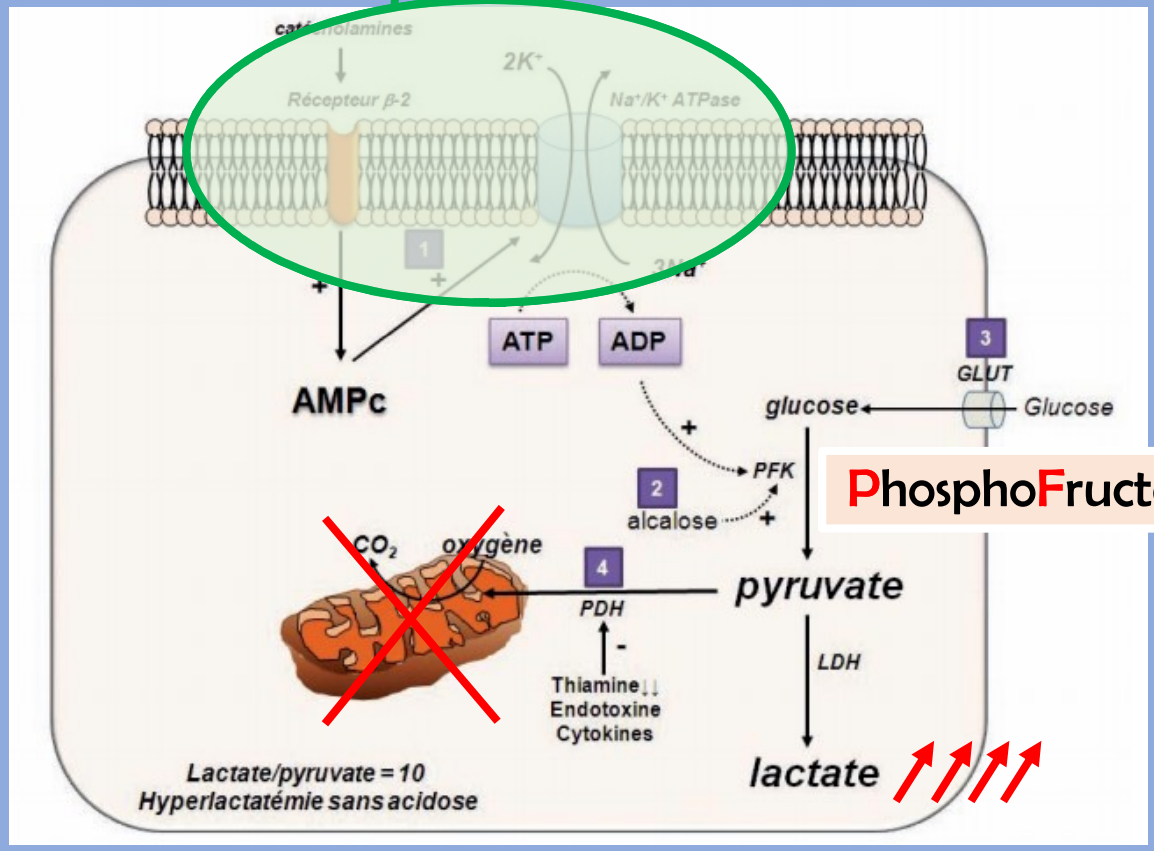
Réanimation (2011) 20:95-97
DOI 10.1007/s13546-011-0225-3

MISE AU POINT / *UPDATE*

Stress adrénergique

Mécanisme de formation du lactate dans les états de c
Apport de la microdialyse musculaire

Mechanisms of lactate formation in states of shock. Information from m



↗ Glycémie et/ou
transporteur au gluco
(GLUT)

PhosphoFructoKi

TaO2 vs Lactates

Dysoxie

vate DésHydrogénase

Sepsis

Métabolisme anaérobie de la malperfusion tissulaire

Glycolyse aérobie accélérée due au stress adrénergique

Clairance réduite

Effets médicamenteux

Dysfonctionnement de la microcirculation

Hypoxie cytopathique et l'atteinte mitochondriale directe

Lactates


Prognosis

Ex
an

By

tudies on Lactate
of the Severity of
ure (Shock)

ELMONEN A. AFIFI, PH.D.

Circulation. 1970;41:989-1001

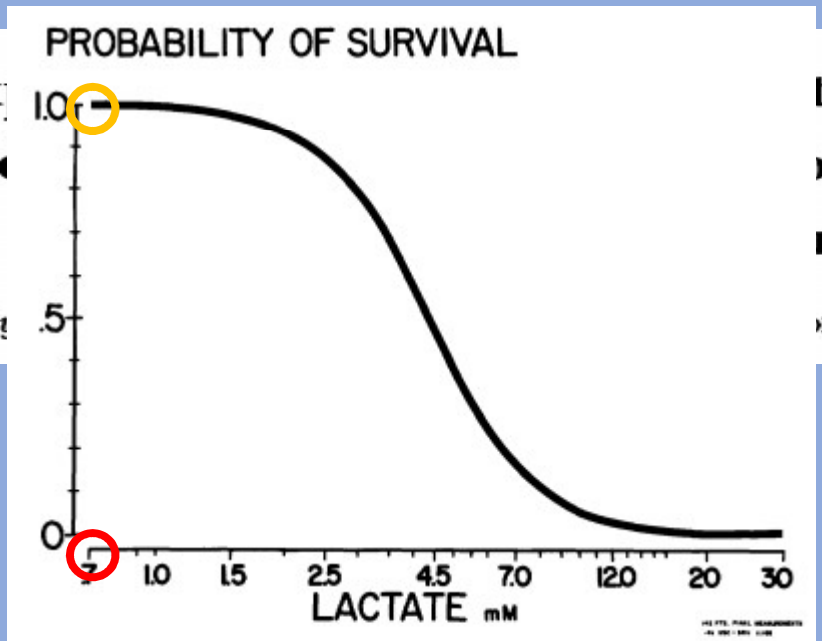


Figure 7

Probability curve indicating the likelihood of survival based on a given value of arterial blood lactate (L).

Diverses études ont confirmé ces données, y compris chez des patients en choc septique

[redacted]

Intensive Care
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C. Charpenti
G. Audibert
B. Dousset
M. Weber
J. Garric
P. Welfringe
M. C. Laxen

Research

Open Access

The prognostic value of blood lactate levels relative to that of vital signs in the pre-hospital setting: a pilot study

Tim C Jansen[1], Jasper van Bommel[1], Paul G Mulder[2], Johannes H Rommes[3], Selma JM Schieveld[3] and Jan Bakker[1]

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Critical Care 2008, **12**:R160 (doi:10.1186/cc7159)
This article is online at: http://ccforum.com/content/12/6/R160

Levels to
Trauma

correlated
scored fo
hepatic, a
score of 8

PANAGIOTIS MANIKIS, MD,
STANISLAW JANKOWSKI, FRCA, MRCP, HAIBO ZHANG, MD,
ROBERT J. KAHN, MD, JEAN-LOUIS VINCENT, MD, PHD

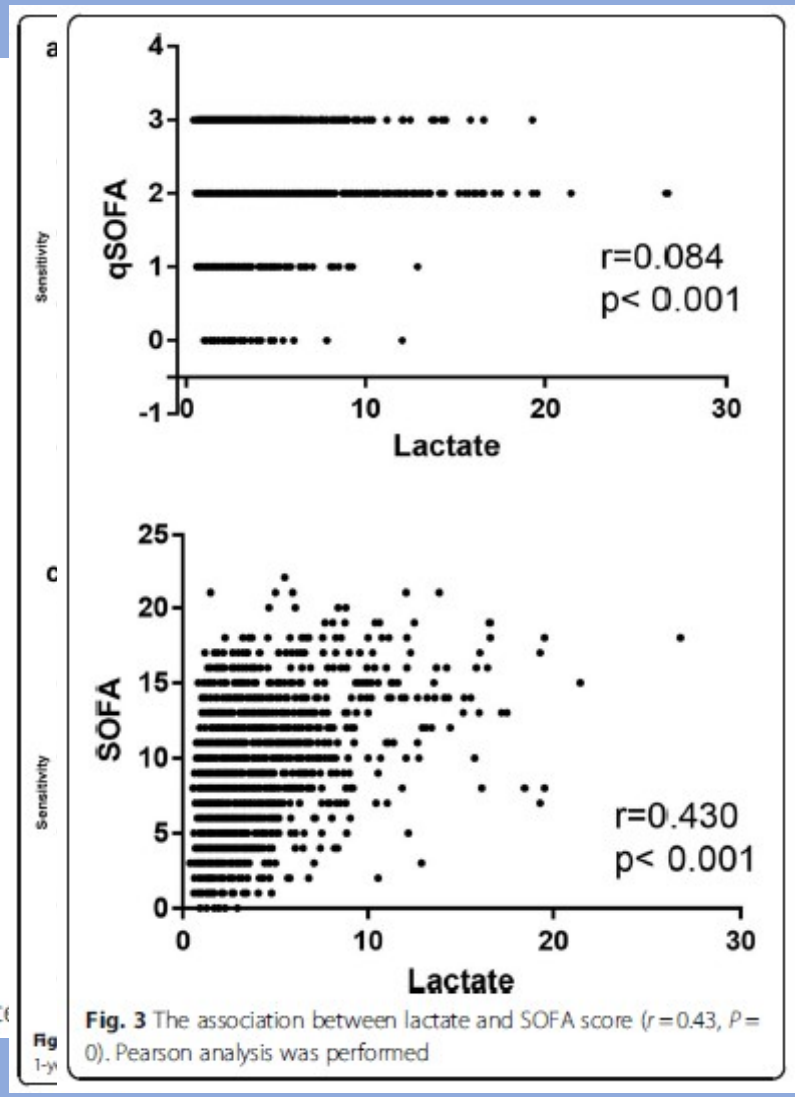
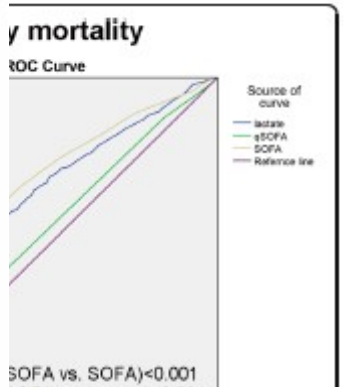
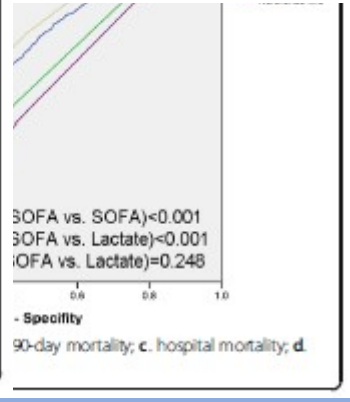


Fig. 3 The association between lactate and SOFA score ($r = 0.43$, $P = 0$). Pearson analysis was performed



ons

n to its simplicity and accuracy, lactate is a better
: factor than qSOFA and SOFA in adult patients
s. Further study is needed given that this work is
retrospective data and that the timing of lactate
tion in this study may affect results obtained.



90-day mortality; **c**. hospital mortality; **d**.

Fig. 1 The detailed proce

Original Article

JBPKIHS 2019; 2(1): 43-51

Serum Lactate Level as a Predictor of Outcome in Patients with Septic Shock

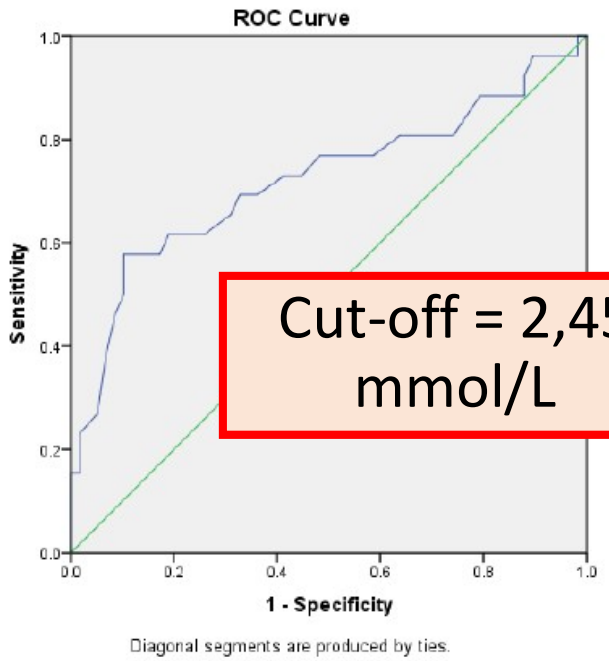
Rupak Bhandari, R Bhandari, M Paudel, GB Malla

Department of General Practice and Emergency Medicine, BPKIHS, Dharan

To **determine serum lactate levels** at the time … **outcome** and **correlate lactate levels** with the … SS

Prospec … who met the … 2.

Figure 1: Receiver-operating characteristics curve for the performance of serum lactate as a predictor of mortality in septic shock



Cut-off = 2,45 mmol/L

The significant variables were

Serum la…

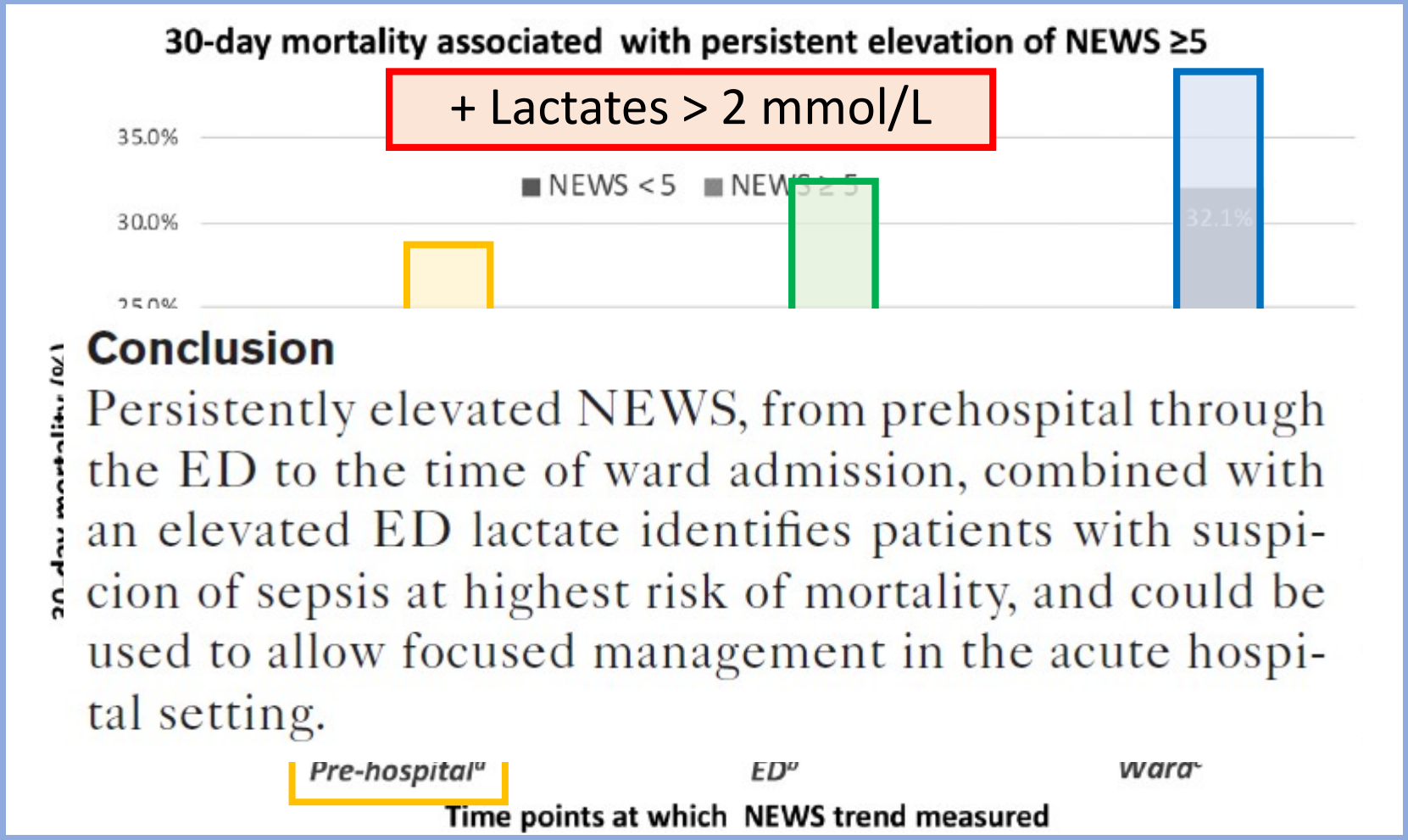
pH lev…

Seru…

Area	SE	P	95% CI	
			Lower Bound	Upper Bound
0.721	0.068	0.001	0.588	0.855

SE: Standard Error; CI: Confidence Interval

ORa= 2.75, CI= 0.890- 4.041



13,6% vs 29,3%	13,3% vs 32,2%	16,4% vs 42,1%
$p < 0,001$	$p < 0,001$	$p < 0,001$


400
STATIC
1400
DYNAMIC

Nichol *et al. Critical Care* 2011, **15**:R2
http://ccforum.com/content/15/5/R2

Le temps passé avec un lactate anormal

RESEARCH

Dynami
tic

CRITICAL CARE

Vitesse de décroissance de l'hyperlactatémie

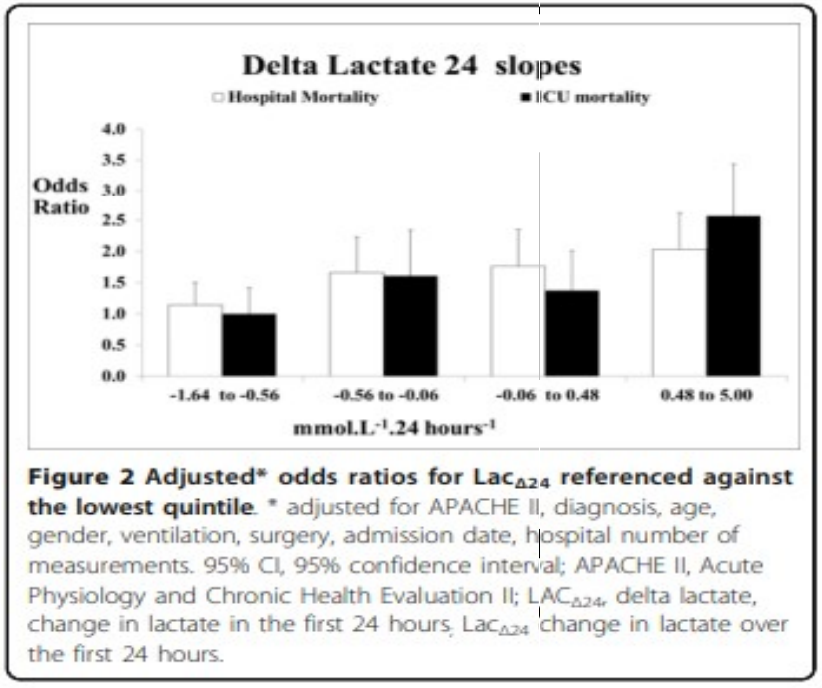


Figure 2 Adjusted* odds ratios for $Lac_{\Delta 24}$ referenced against the lowest quintile. * adjusted for APACHE II, diagnosis, age, gender, ventilation, surgery, admission date, hospital number of measurements. 95% CI, 95% confidence interval; APACHE II, Acute Physiology and Chronic Health Evaluation II; $LAC_{\Delta 24}$, delta lactate, change in lactate in the first 24 hours, $Lac_{\Delta 24}$ change in lactate over the first 24 hours.

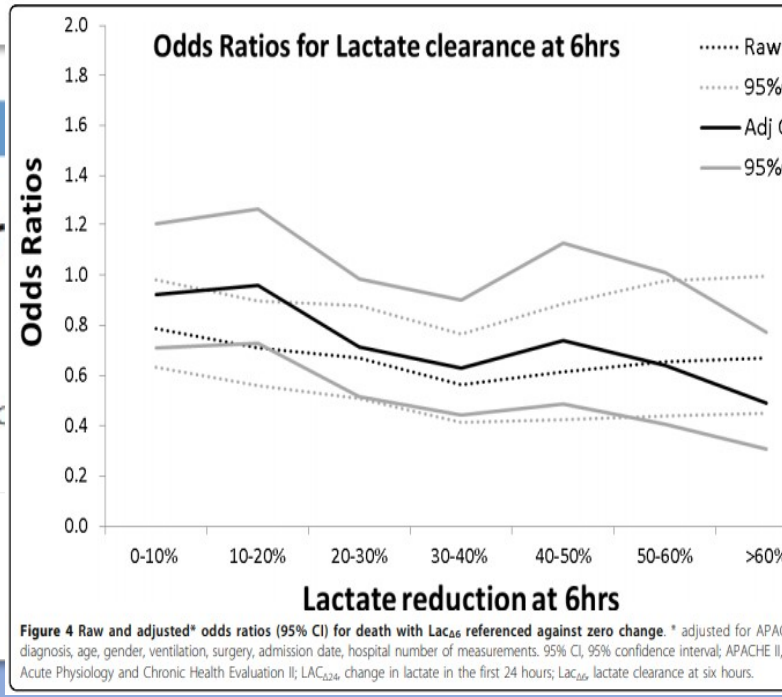


Figure 4 Raw and adjusted* odds ratios (95% CI) for death with $Lac_{\Delta 6}$ referenced against zero change. * adjusted for APAC diagnosis, age, gender, ventilation, surgery, admission date, hospital number of measurements. 95% CI, 95% confidence interval; APACHE II, Acute Physiology and Chronic Health Evaluation II; $LAC_{\Delta 24}$, change in lactate in the first 24 hours; $Lac_{\Delta 6}$, lactate clearance at six hours.

Plus grande est la clairance, meilleures sont les chances de survie

Clairance ≥ 60 % dans la limite de h d'admission = meilleur devenir

Total number of ICU admissions

n = 1405

Received: 4 January 2019 | Revised: 26 Feb

DOI: 10.1111/aas.13366

5 | CONCLUSIONS

For ICU patients with septic shock, we found an optimal rate of lactate decrease to be ≥2.5% per hour during the first 24 hours of ICU. A delay in this rate was associated with an increased risk of 30-day mortality, in particular, in combination with baseline lactate >4 mmol/L. This study shows that the data obtained from point-of-care arterial blood gas analyser, which are frequently and easily checked at the bedside, allow for the determination of short time lactate reduction rates, which can be preferable when monitoring acute responses to treatment changes. To further improve the validity of these results, an external validation in other centres including an expansion of sample size is suggested.

FIGURE 2 Receiver operating ch
lactate and ΔLact/h for 30-d morta
ΔLact/h: mean hourly reduction rat

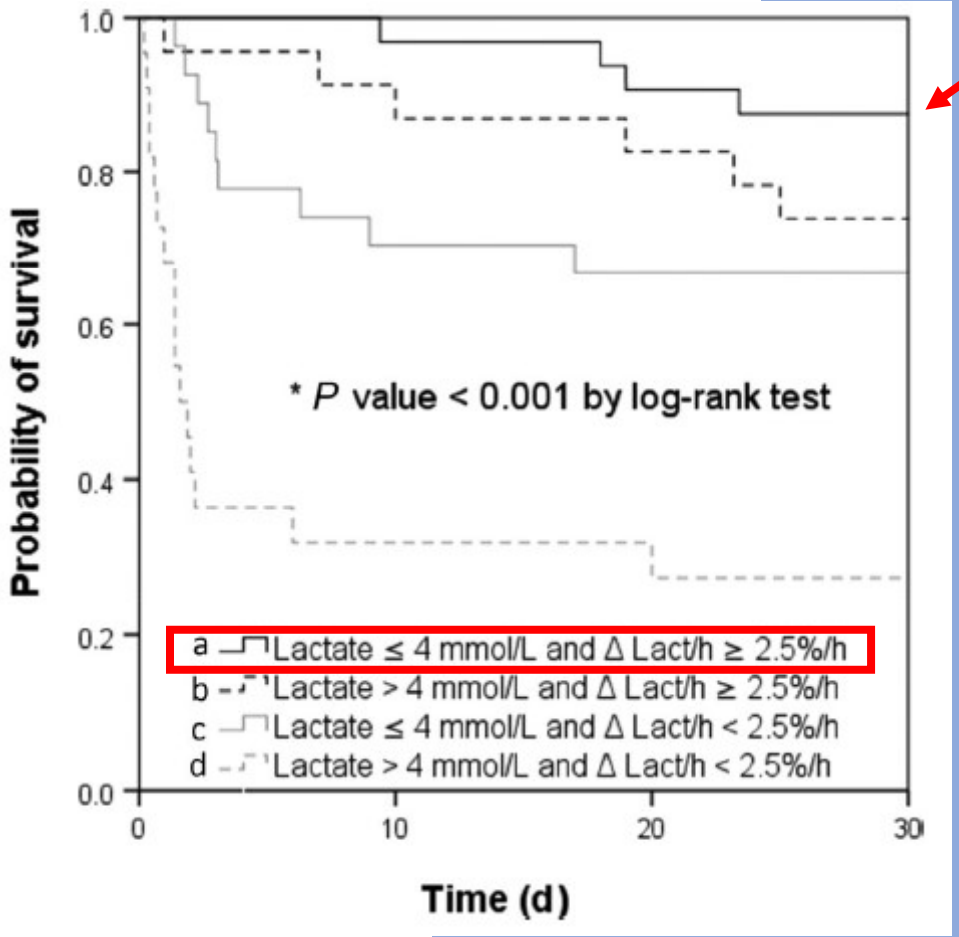


Table 2. Univariate and multivariate analysis of 6 and 24 hour lactate normalization.

Logistic Regression analysis	Univariate analysis OR [95% CI]	Multivariate analysis OR [95% CI]	p-value
Early lactate normalization			
6 hour lactate normalization	OR 0.42 [95% CI 0.33–0.53]	OR 0.58 [95% CI 0.45–0.75]	<0.001
Age	OR 1.02 [95% CI 1.01–1.03]	OR 1.03 [95% CI 1.02–1.04]	<0.001
Sex (Male)	OR 0.76 [95% CI 0.61–0.94]		
Diabetes	OR 1.25 [95% CI 1.00–1.56]		
Malignancy	OR 1.43 [95% CI 1.13–1.81]	OR 1.53 [95% CI 1.17–2.00]	0.002
Pulse rate, beats/min	OR 1.02 [95% CI 1.01–1.02]	OR 1.01 [95% CI 1.01–1.02]	<0.001
Hemogl			
Creatin			
Asparta			
C-reacti			
SOFA s			
Late lactat			
24 hour			
Age	OR 1.02 [95% CI 1.01–1.03]	OR 1.03 [95% CI 1.02–1.04]	<0.001
Sex (Male)	OR 0.76 [95% CI 0.61–0.94]		
Diabetes	OR 1.25 [95% CI 1.00–1.56]		
Malignancy	OR 1.43 [95% CI 1.13–1.81]	OR 1.49 [95% CI 1.13–1.95]	0.004
Pulse rate, beats/min	OR 1.02 [95% CI 1.01–1.02]	OR 1.01 [95% CI 1.01–1.02]	<0.001
Hemoglobin, g/dL	OR 0.92 [95% CI 0.88–0.96]	OR 0.91 [95% CI 0.87–0.96]	0.001
Creatinine, mg/dL	OR 1.13 [95% CI 1.06–1.20]		
Aspartate transaminase, IU/L	OR 1.00 [95% CI 1.00–1.01]		
C-reactive protein, mg/dL	OR 1.01 [95% CI 1.00–1.02]		
SOFA score	OR 1.23 [95% CI 1.20–1.27]	OR 1.19 [95% CI 1.15–1.23]	<0.001

Mortality 21,4%

Conclusions

Early lactate normalization within 6 h as well as delayed lactate normalization within 24 h from shock recognition was also independently associated with mortality. Lactate normalization may have a role in early risk stratification as well as a therapeutic target.

Intensive Care Med (201
htt

Conclusion

ΔLac was robustly associated with short- and long-term mortality in our study cohort of critically ill patients, constituting a quick and easy risk stratification parameter. For future prospective studies with treatment algorithms specifically including ΔLac as target, we provide real-world data and suggest a handy Δ24Lac cut-off of approximately one fifth.

100

Δ24Lac >19%

physiology score

higher long-term mortality (log-rank $p < 0.001$)

Table 2 Δ24Lac at a cut-off of ≤ 19% is associated with mortality after correction for APACHE II and need for catechola-

	95%CI	*p* value
	1.27–1.85	< 0.001
	1.04–1.07	< 0.001
	1.21–1.76	< 0.001
	1.02–1.03	< 0.001
	1.28–1.87	< 0.001
	1.03–1.05	< 0.001
	0.74–1.16	0.54
	1.26–1.99	< 0.001

tion, *SAPS* simplified acute

Intensive Care Med (2019) 45:113–114
https://doi.org/10.1007/s00134-018-05507-8

EDITORIAL

La
pr
w

Guill

In conclusion, despite its limitations, the study by Masyuk et al. identifies a cutoff value of 19% lactate changes to discriminate patients at high risk of death that could be integrated in future studies that will evaluate the clinical effectiveness of lactate-guided resuscitation protocols.

A summary of all statements determined by the

septic shock requiring vasopressors (strong rec-

2012 RECOMMENDATIONS	2016 RECOMMENDATIONS
L RESUSCITATION	**A. INITIAL RESUSCITATION**
. Protocolized, quantitative resuscitation of patients with sepsisinduced tissue hypoperfusion (defined in this document ashypotension persisting after initial fluid challenge or blood lactate concentration ≥ 4 mmol/L). Goals during the first 6 hours of resuscitation: a. Central venous pressure 8–12 mm Hg b. Mean arterial pressure ≥ 65 mm Hg c. Urine output ≥ 0.5 mL/kg/hr d. Central venous (superior vena cava) or mixed venous oxygen saturation 70% or 65%, respectively (grade 1C). . In patients with elevated lactate levels,targeting resuscitation to normalize lactate (grade 2C).	1. Sepsis and septic shock are medicalemergencies, and we recommend that treatment and resuscitation begin immediately (BPS). 2. We recommend that, in the resuscitation from sepsis-induced hypoperfusion, a least 30 mL/kg of IV crystalloid fluid be given within the first 3 hours (strong recommendation, low quality of evidence). 3. We recommend that, following initial fluid resuscitation, additional fluids be guided by frequent reassessment of hemodynamic status (BPS). Remarks: Reassessment should include a thorough clinical examination and evaluation of available physiologic variables (heart rate, blood pressure, arterial oxygen saturation, respiratory rate, temperature, urine output, and others as available) as well as other noninvasive or invasive monitoring, as available. 4. We recommend further hemodynamic assessment (such as assessing cardiac function) to determine the type of shock if the clinical examination does not lea to a clear diagnosis (BPS). 5. We suggest that dynamic over static variables be used to predict fluid responsiveness, where available (weak recommendation, low quality of evidence). 6. We recommend an initial target mean arterial pressure of 65 mmHg in patients with septic shock requiring vasopressors (strong recommendation, moderate quality of evidence). 7. We suggest guiding resuscitation to normalize lactate in patients with elevated lactate levels as a marker of tissue hypoperfusion (weak recommendation, low quality of evidence).

pressure (MAP) of 65 mm Hg in patients with

and treatment. As part of this, we recommend that initial

Intensive Care Med (2019) 45:420–433
https://doi.org/10.1007/s00134-019-05544-x

REVIEW

Chall… shock… a narrative review

Until such time, microcirculation-guided therapy in septic shock will continue to be relegated to the research arena.

Daniel De Backer[1*], Maurizio Cecconi[2], …[3], Flavia Machado[4], Sheila Nainan Myatra[5], Marlies Ostermann[6], Anders P…, Jean-Louis Vincent[9] and Keith R. Walley[10]

Until such time, microcirculation-guided therapy in septic shock will continue to be relegated to the research arena.

of both ventricles, potentially leading to impaired cardiac output. The decrease in vascular tone also contributes to impaired regional blood flow distribution. In addition, microcirculatory alterations occur, leading to alterations

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Full author information is available at the end of the article

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the side effects of any interventions used to obtain these targets.

The perfusion pressure is reflected by the mean arterial pressure (MAP) for most vital organs (e.g. brain, kidney), and diastolic arterial pressure for the left ventricle. The organ perfusion pressure also depends on the downstream pressure, i.e. central venous pressure (CVP) and interstitial pressure. To select the optimal MAP, CVP should be considered together with comorbidities

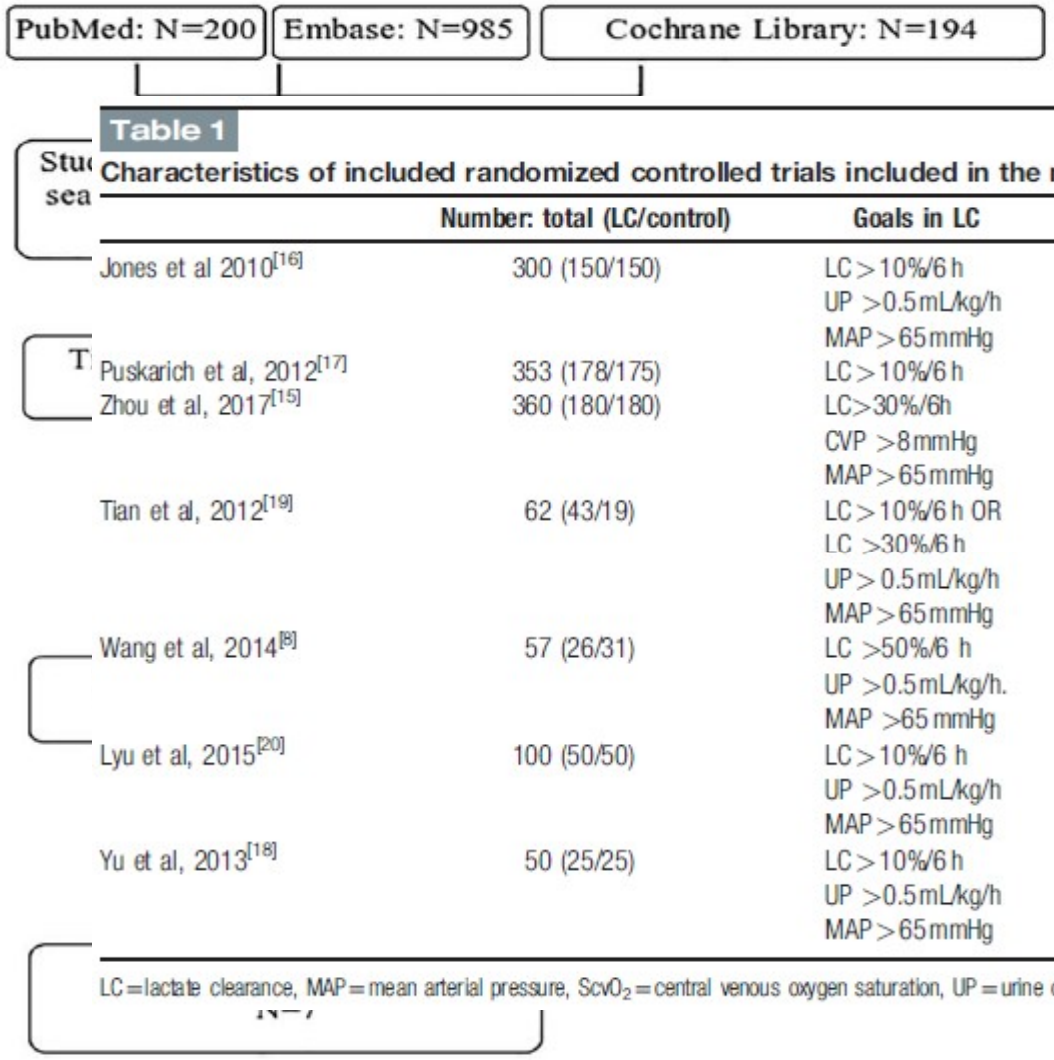


Table 1

Characteristics of included randomized controlled trials included in the meta-analysis.

	Number: total (LC/control)	Goals in LC	Goals in control group	Follow-up	Risk o
Jones et al 2010[16]	300 (150/150)	LC > 10%/6 h UP > 0.5 mL/kg/h MAP > 65 mmHg	$ScvO_2$ > 70% UP > 0.5 mL/kg/h MAP > 65 mmHg	In-hospital mortality	Low
Puskarich et al, 2012[17]	353 (178/175)	LC > 10%/6 h	$ScvO_2$ > 70%,	In-hospital mortality	Low
Zhou et al, 2017[15]	360 (180/180)	LC>30%/6h CVP > 8 mmHg MAP > 65 mmHg	$ScvO_2$ > 70% CVP > 8 mmHg MAP > 65 mmHg	60-Day mortality	Low
Tian et al, 2012[19]	62 (43/19)	LC > 10%/6 h OR LC > 30%/6 h UP > 0.5 mL/kg/h MAP > 65 mmHg	$ScvO_2$ > 70%, UP > 0.5 mL/kg/h. MAP > 65 mmHg	28-Day mortality	Low
Wang et al, 2014[8]	57 (26/31)	LC > 50%/6 h UP > 0.5 mL/kg/h. MAP > 65 mmHg	$ScvO_2$ > 70% UP > 0.5 mL/kg/h MAP > 65 mmHg	28-Day mortality	Low
Lyu et al, 2015[20]	100 (50/50)	LC > 10%/6 h UP > 0.5 mL/kg/h MAP > 65 mmHg	$ScvO_2$ > 70% UP > 0.5 mL/kg/h MAP > 65 mmHg	28-Day mortality	Low
Yu et al, 2013[18]	50 (25/25)	LC > 10%/6 h UP > 0.5 mL/kg/h MAP > 65 mmHg	$ScvO_2$ > 70% UP > 0.5 mL/kg/h MAP > 65 mmHg	28-Day mortality	Low

LC = lactate clearance, MAP = mean arterial pressure, $ScvO_2$ = central venous oxygen saturation, UP = urine output.

Figure 1. Flow diagram of study inclusion. RCT = randomized controlled trial.

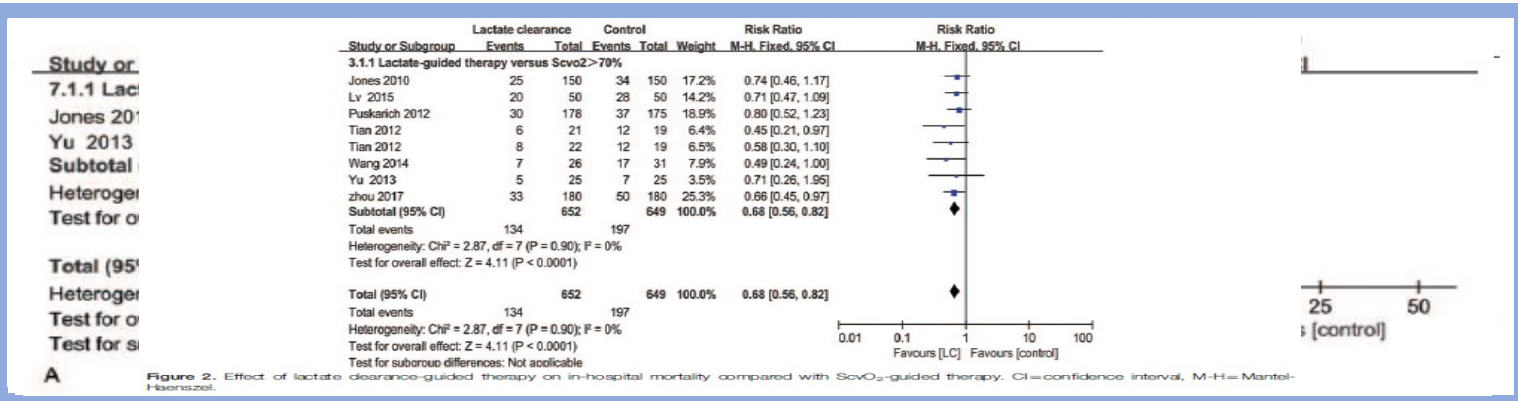
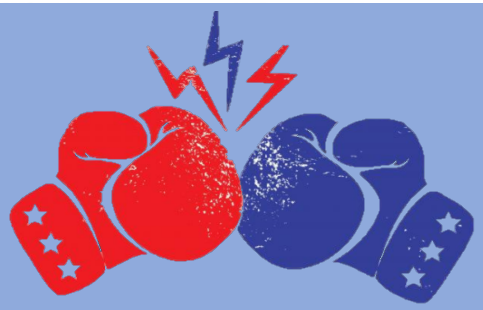


Figure 2. Effect of lactate clearance-guided therapy on in-hospital mortality compared with $ScvO_2$-guided therapy. CI=confidence interval, M-H=Mantel-Haenszel.

Lactate clearance-guided therapy



ScvO2-guided therapy

Hospital Mortality

Hospital length of stay

ICU length of stay

Mechanical ventilation

SOFA score

APACHE II

	Peripheral perfusion group	Lactate group	p
	212	212	
Mean difference 48-72h	- 0.36 mMol/L	- 0.34 mMol/L	< 0.01
28 d Mortality	34.9%	43.4%	0.06
Organ dysfunction 72 h	mean difference SOFA score, - 1.00		0.045

Internal and Emergency Medicine
https://doi.org/10.1007/s11739-0

THE CUTTING EDGE: RESEARCH UPDATE

Conclusions

التونسية لطب الانعاش
ASSOCIATION TUNISIENNE DE REA

Lactate as a goal of what?

Intensive Care Med (2019) 45:82–85
https://doi.org/10.1007/s00134-018-5213-x

Lactate = molécule, …ur, source d'énergie, composant de certai… …ulateur majeur de la bioénergétiq… …hysiologique)

Une telle complexité rend impossible la définition de l'objectif pour l… …e cible

Vouloir réduire les niveaux de lactate

Aucune logique en termes d'hémodynamique, de bioénergétique ou de protection des tissus

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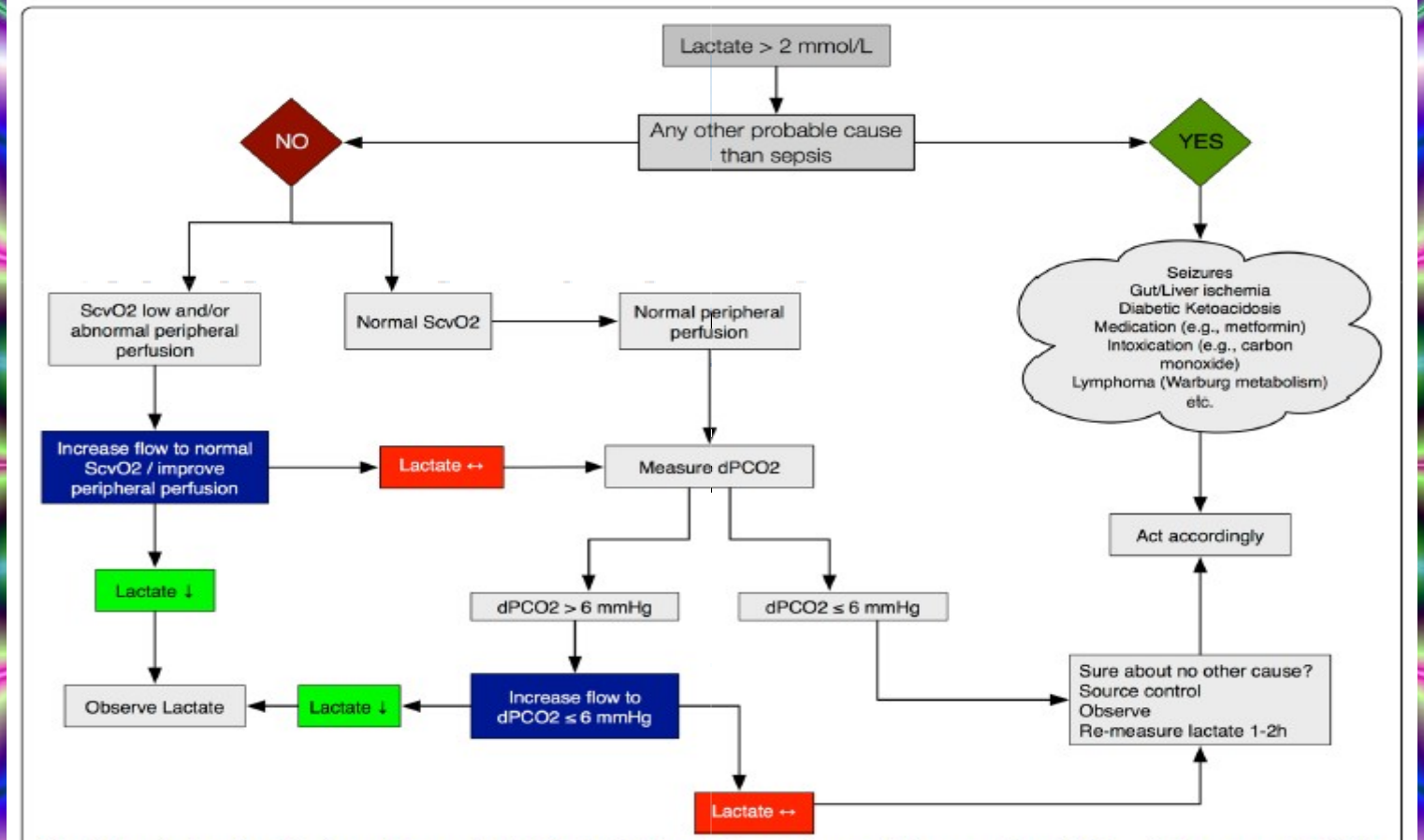

Fig. 1 Flowchart on the clinical use of increased lactate levels. *ScvO2* central venous hemoglobin oxygenation, *dPCO2* central venous–arterial PCO_2 difference


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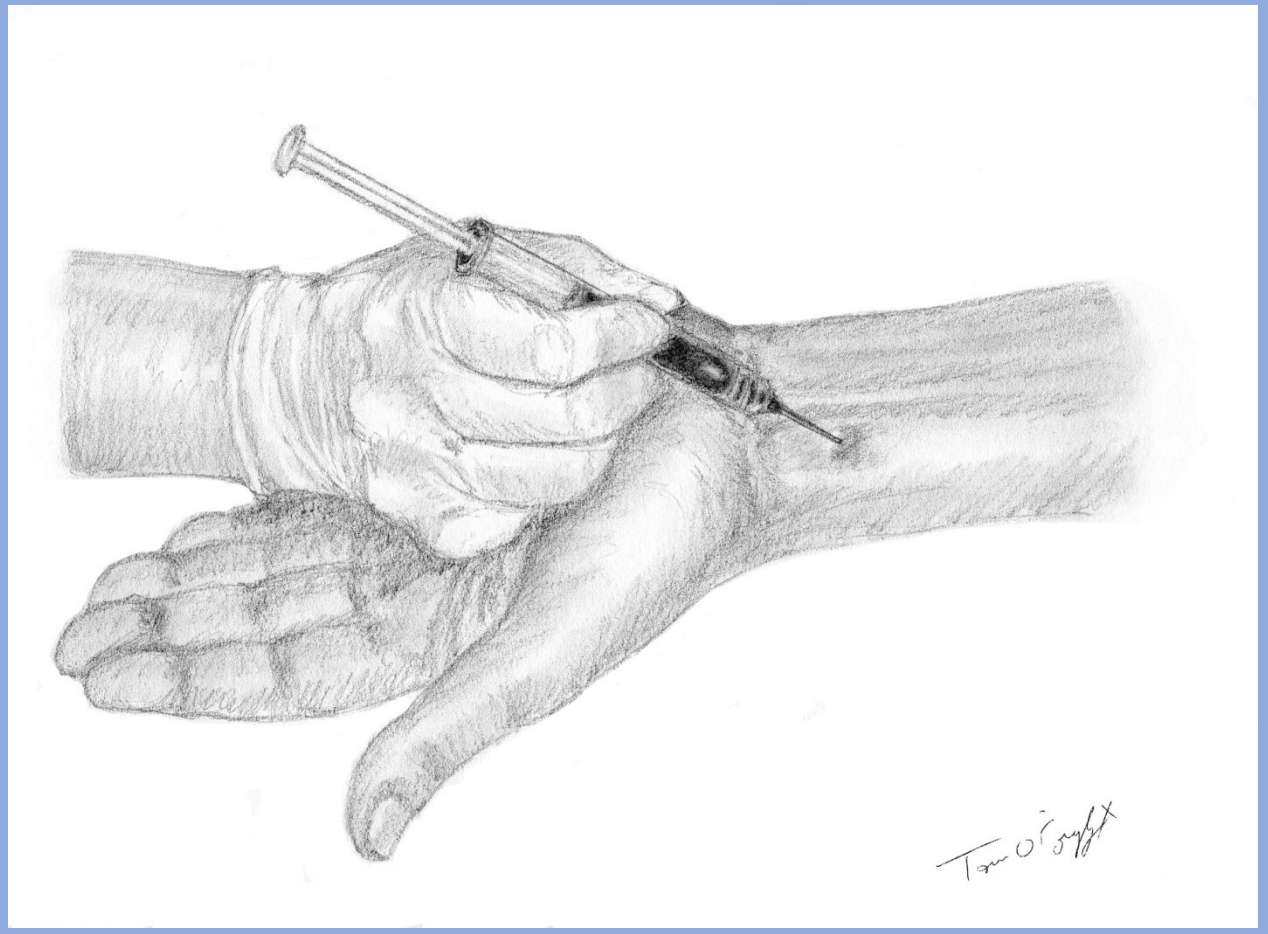

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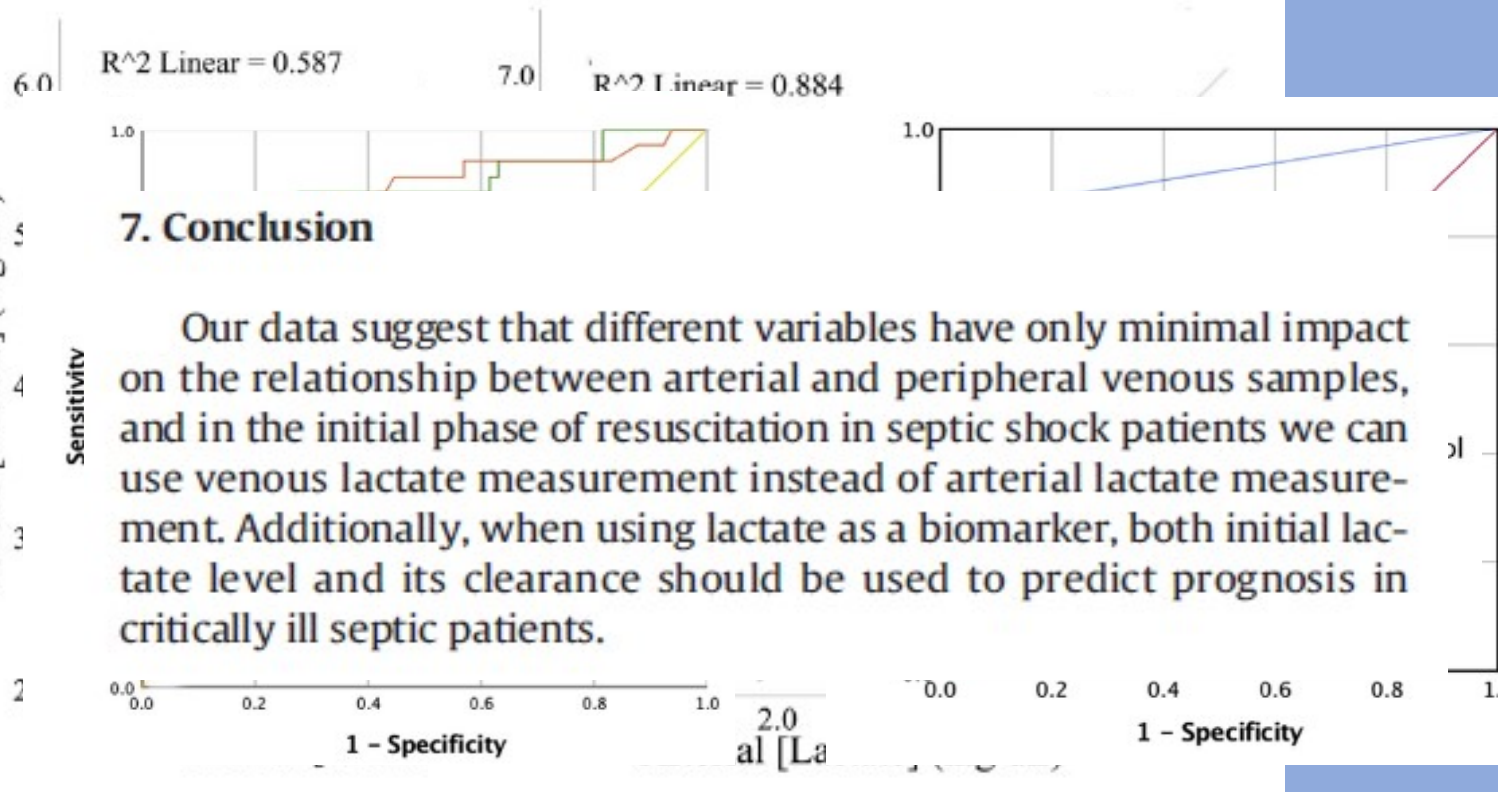
Table 1
Demographic and baseline characteristics of patients.

Characteristic	
Age (years)	63 ± 11
Gender	
Sequential or	
Acute Physio	
Lactate level	
Venous	
Arterial	
Lactate level	
Venous	
Arterial	
$ScvO_2$ at time	
$ScvO_2$ at afte	



7. Conclusion

Our data suggest that different variables have only minimal impact on the relationship between arterial and peripheral venous samples, and in the initial phase of resuscitation in septic shock patients we can use venous lactate measurement instead of arterial lactate measurement. Additionally, when using lactate as a biomarker, both initial lactate level and its clearance should be used to predict prognosis in critically ill septic patients.