

Scvo2 en Réanimation

Quoi de neuf en 2020 ?

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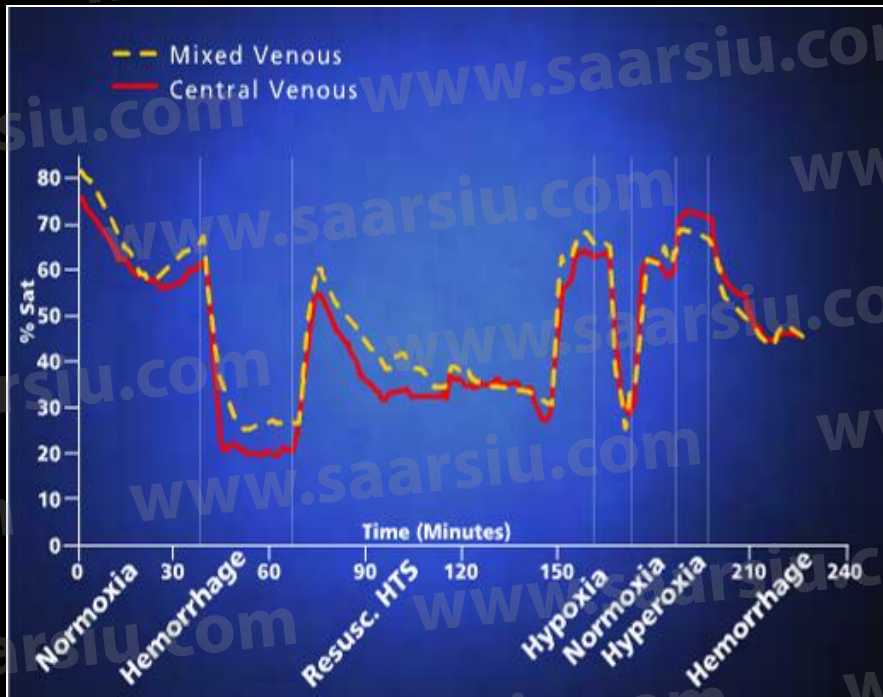
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INTRODUCTION

- Stratégie de prise en charge de l'état de choc
- Surviving Sepsis Campaign
- Marqueur pronostic

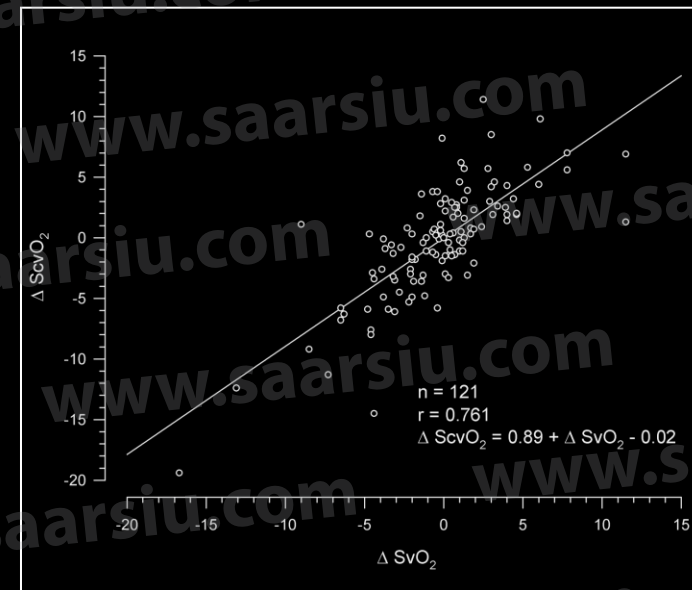
Comparison of central-venous to mixed-venous oxygen saturation during changes in oxygen supply/demand

Reinhart et al. Chest 1989; 95: 1216-1221



Pas d'équivalence numérique stricte
mais :

- Évolution parallèle
- Surestimation de la SvO_2 par la $ScvO_2$
- Même pathogénicité



Reinhart et al. Intensive Care Med 2004

O2 DEMAND

Cardiac output

Hb

SaO2

O2 DELIVERY

SvO2

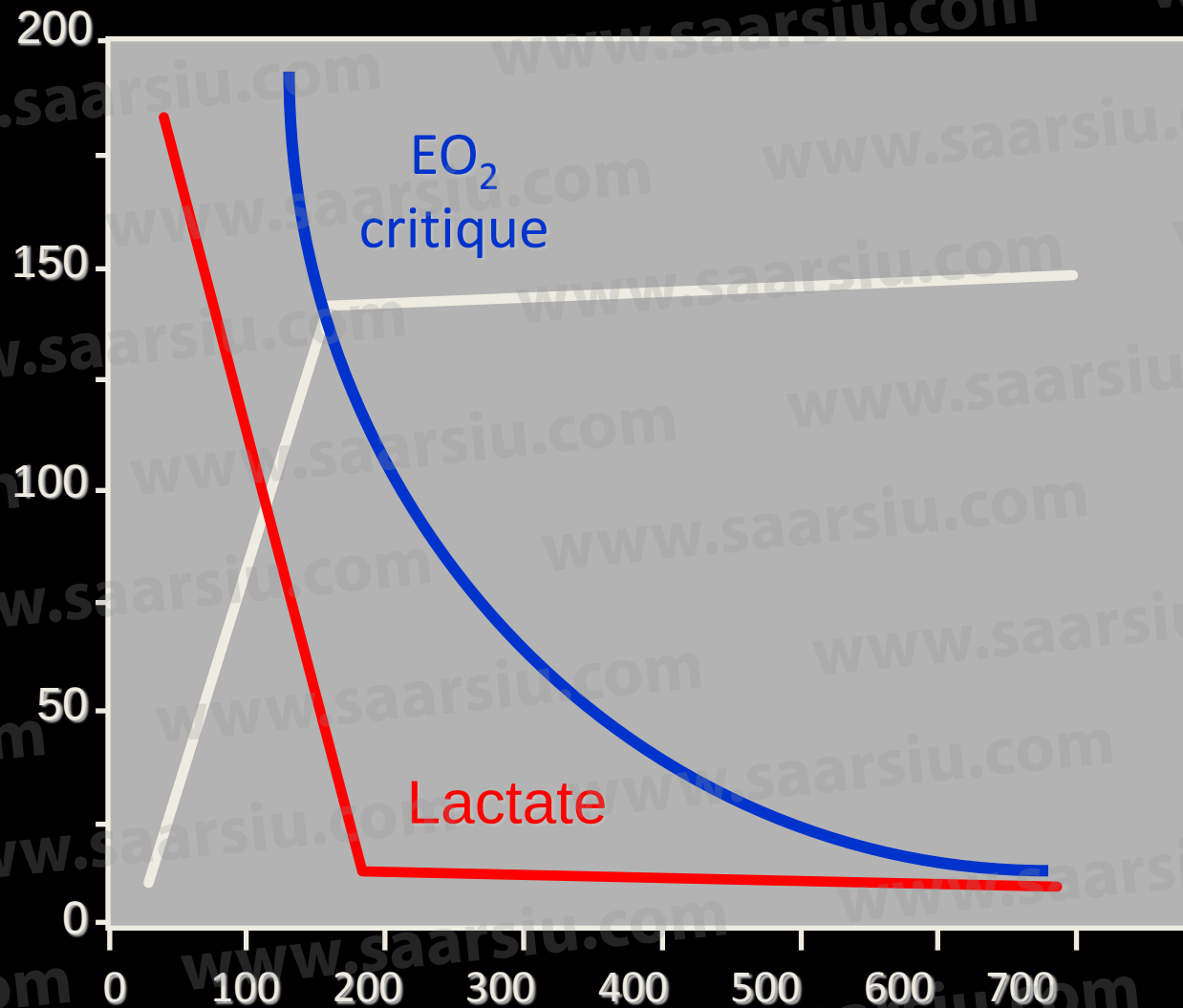
$$DO_2 = CO \times CaO_2$$

$$VO_2 = CO \times 1,34 \text{ Hb} \times (SaO_2 - Svo_2)$$

$$Svo_2 = SaO_2 - (VO_2 / CO \times 1,34 \text{ Hb})$$

$$Svo_2 = 1 - EO_2$$

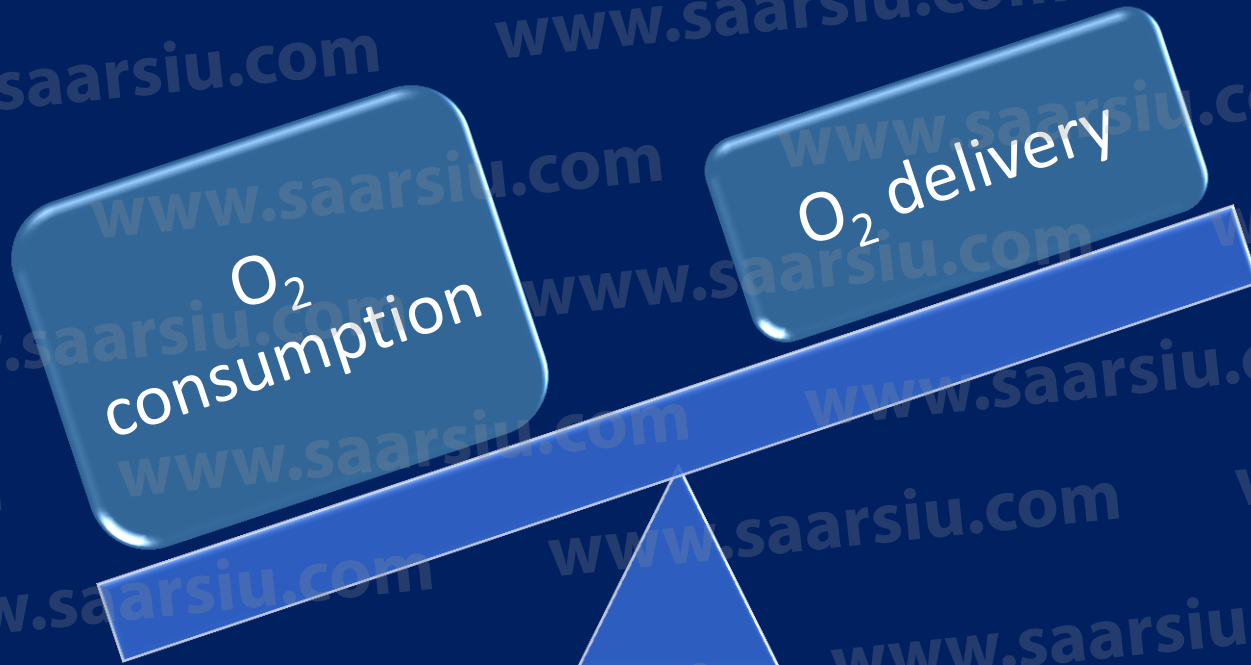
Consommation d'oxygène (mL/min/m²)



Transport en oxygène (mL/min/m²)

↑ Demand ↓ Supply

Shock



↓ Demand ↑ Supply

O_2
consumption

O_2 delivery



Exploration hémodynamique: la SvO₂

SvO₂
(%)

90

83

80

70

57

40

1

2

3

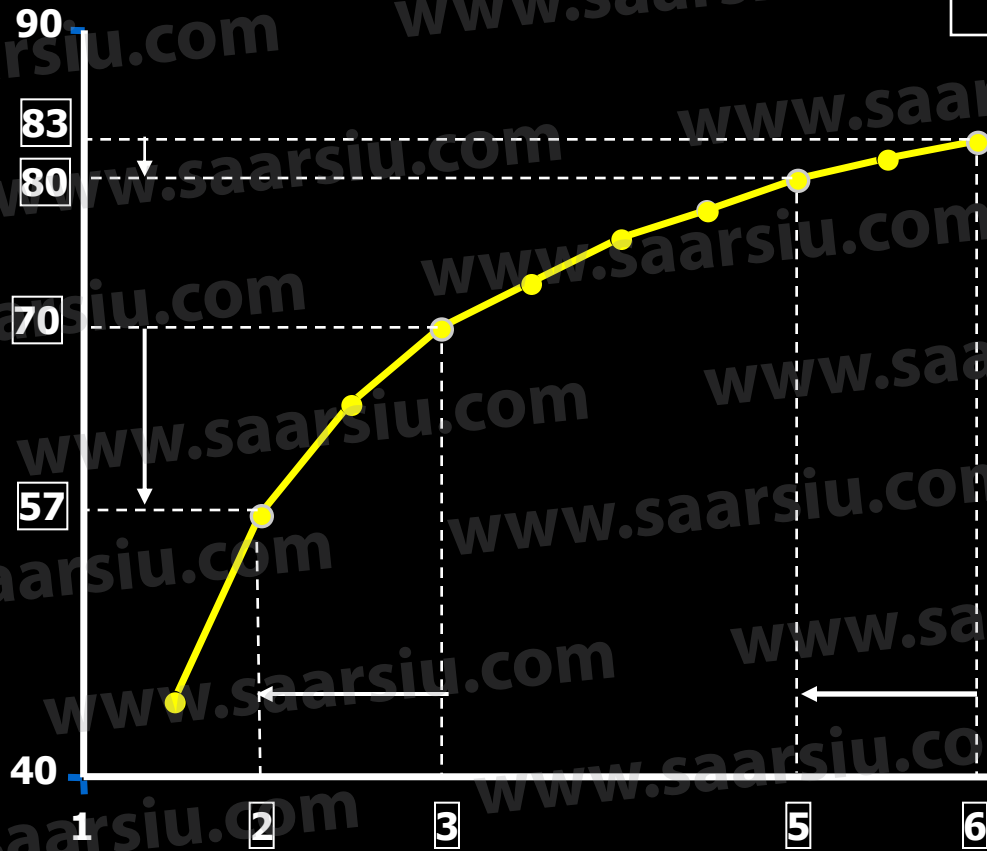
5

6

7

- VO₂ : 110 mL/min/m²
- SaO₂ : 95 %
- Hb : 11 g/dl

**Index
Cardiaque**
(L/min/m²)



IN CRITICALLY ILL TARGETING TO

SCVO₂ $\geq$ 70%

IS EQUIVALENT TO CI $\geq$ 2,5L/min/m²

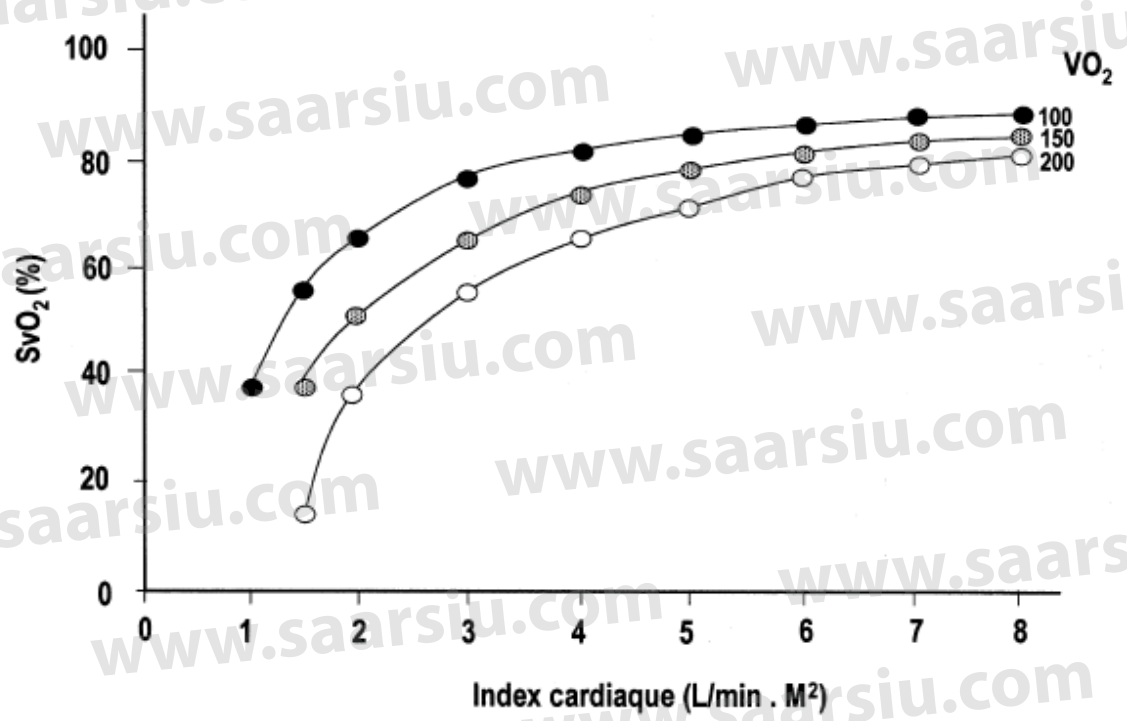


Fig. 1. Relation SvO₂/débit cardiaque.

Selon l'équation modifiée de Fick, la relation SvO₂/DC est curvilinéaire. Par conséquent pour une VO₂ constante, les variations du DC entraînent de grandes variations de la SvO₂ lorsque la valeur initiale du DC est basse. À l'opposé lorsque les valeurs de départ du DC sont déjà élevées, ses variations influencent très peu la SvO₂. Ces relations sont encore plus complexes lorsque les variations du DC s'accompagnent simultanément d'une variation de la VO₂.

Index Cardiaque

3.0 L/min/m²

SaO₂ = 97%



T° 35°C

Post-chirurgie cardiaque

Ventilation mécanique

Fin de sédation

SvO₂ = 80%

T° 39°C

Pneumonie

RR 30 C/min

Anxiété, agitation

SvO₂ = 45%

Scvo2 et Vo2

Quels sont les déterminants de la SvO₂ ?

Teboul et al. Critical Care 2011, 15:1065
<http://ccforum.com/content/15/6/1065>



COMMENTARY

SvO₂ to monitor resuscitation of septic patients:
let's just understand the basic physiology

Jean-Louis Teboul^{1*}, Ota Hamzoui² and Xavier Monnet^{1*}

SvO₂ $\searrow$ si

$\nearrow$ VO₂

Agitation

Tremblements

Fièvre

Détresse respiratoire

...

$\searrow$ SaO₂

$\searrow$ Hb

$\searrow$ CO

$\searrow$ précharge

$\searrow$ contractilité

SvO₂ $\nearrow$ si

$\searrow$ VO₂

Sédation

Analgésie

Hypothermie

Détresse respiratoire

...

Oxygénothérapie

Transfusion

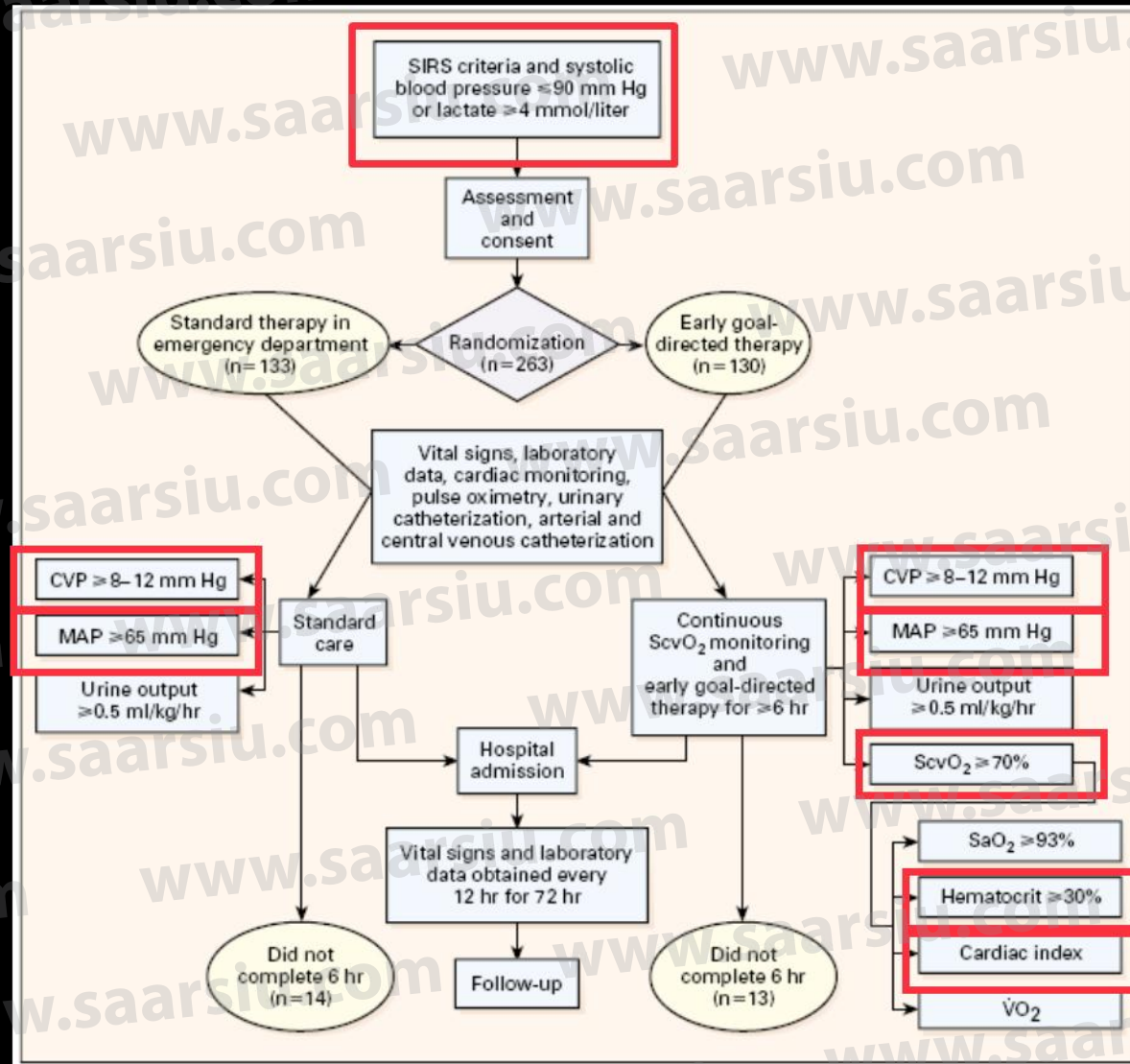
$\nearrow$ CO

Expansion volémique

Inotrope

EGDT

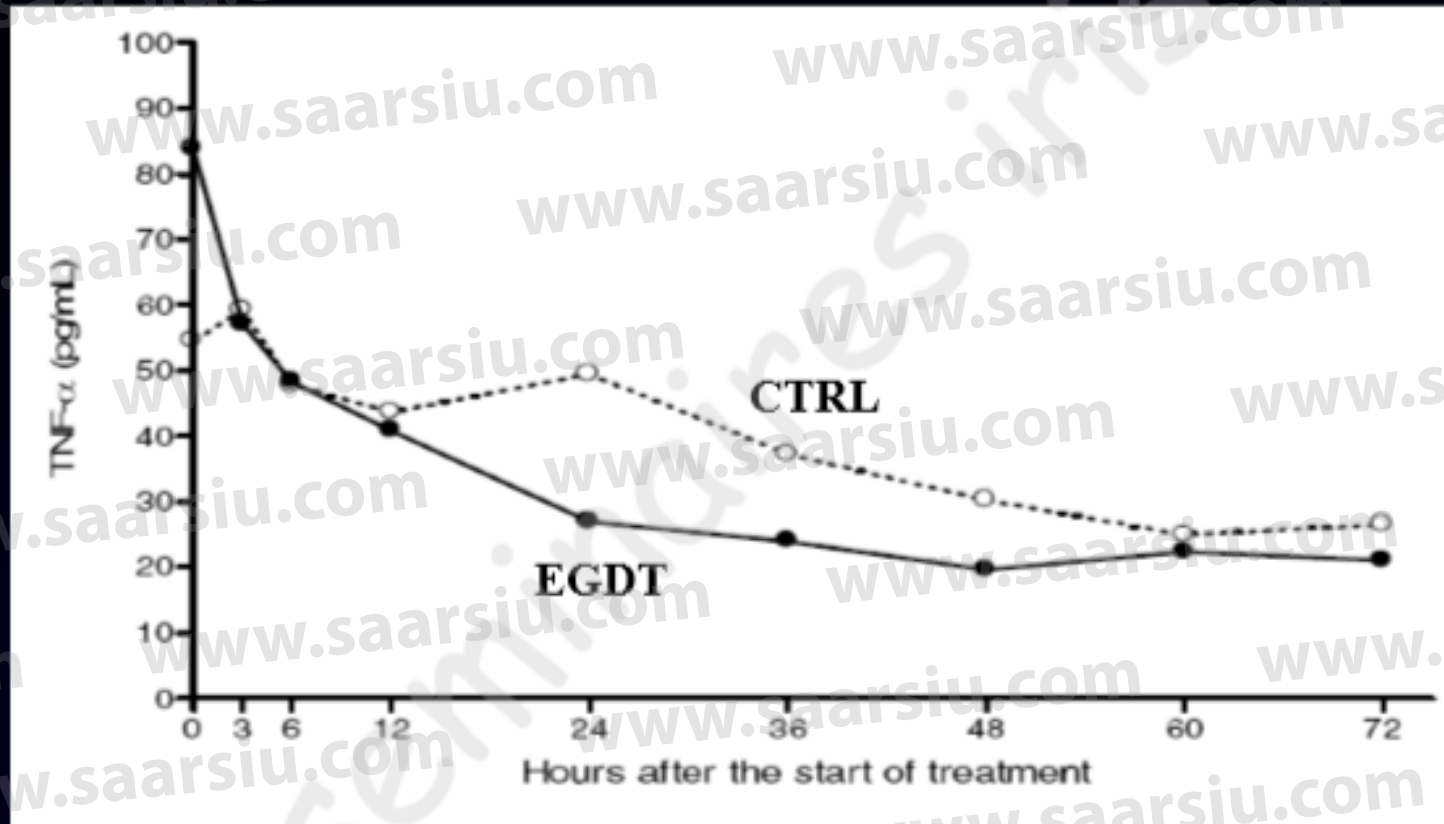
NEJM 2001; 345:1368



Correction of hypoxia limits the development of inflammation

Rivers et al

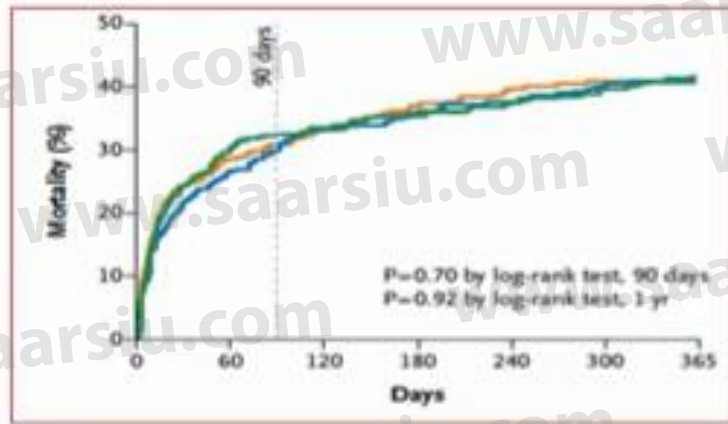
CCM 35:2016;2007



243 patients assigned to EGDT or CTRL group

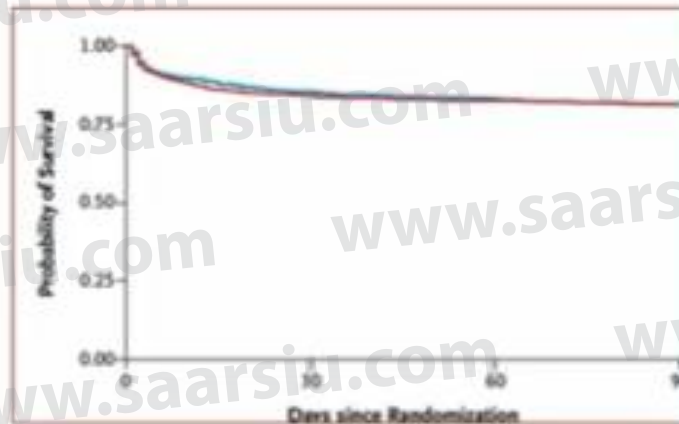
prévalence de ScvO₂ <70% faible
Biais de sélection probable
Faible mortalité

ProCESS



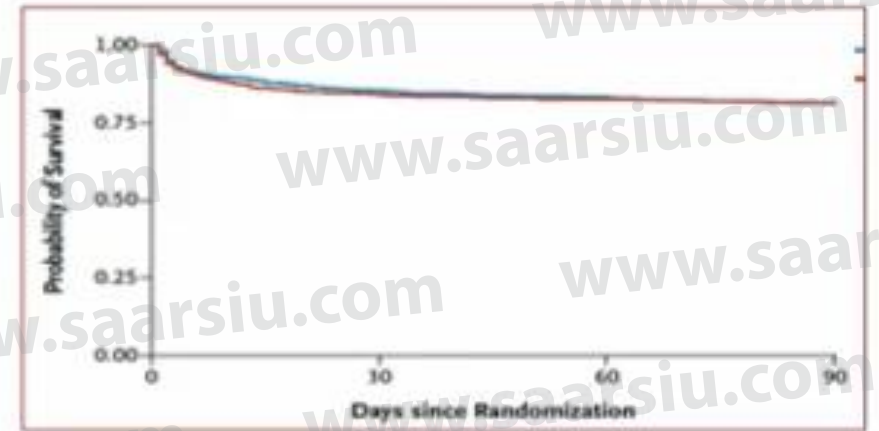
2014
1341 patients

ARISE



2014
1600 patients

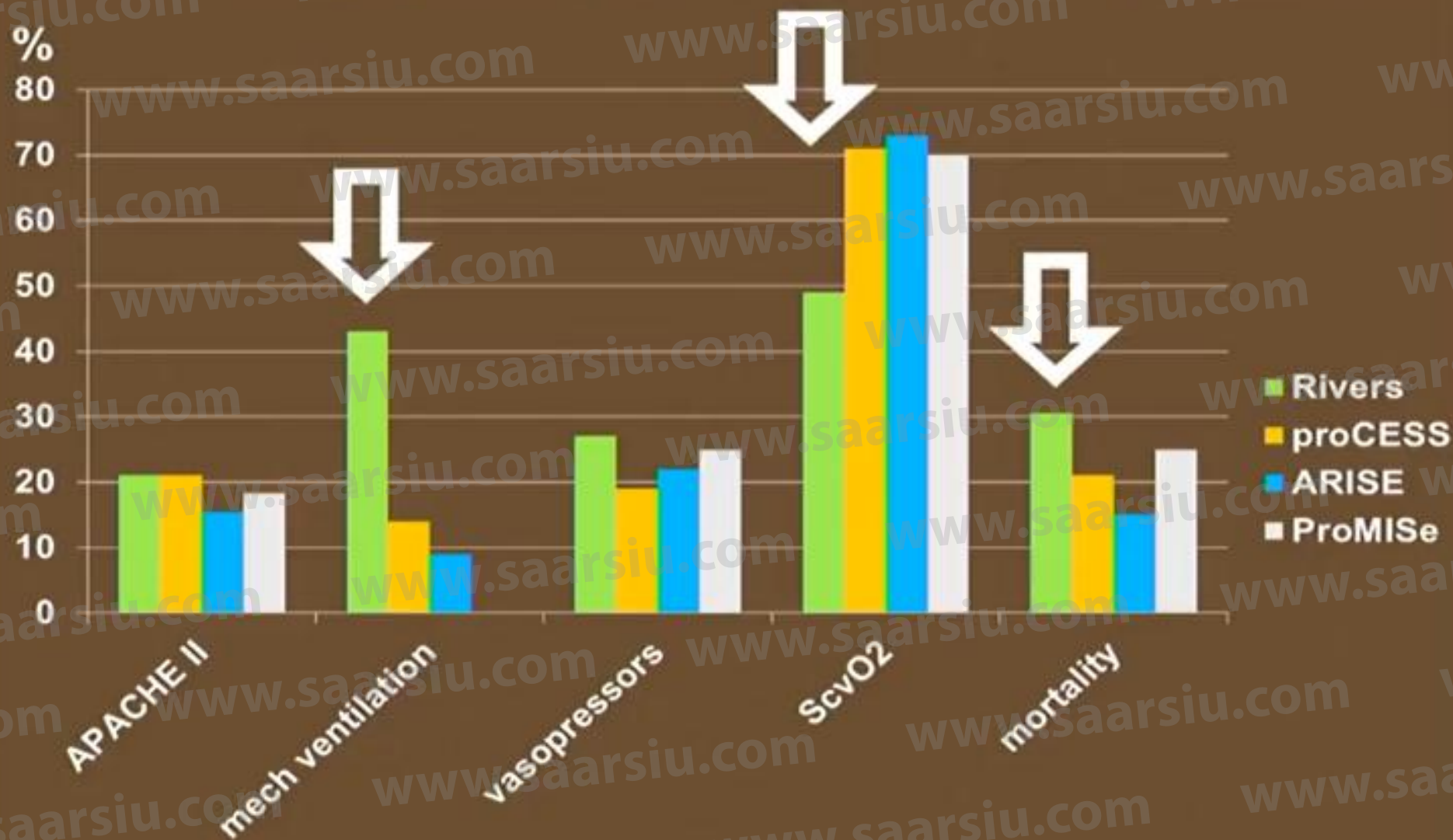
PROMISE



2015
1260 patients

The NEW ENGLAND JOURNAL of MEDICINE

EARLY GOAL DIRECTED THERAPY IN SEPTIC SHOCK



Major differences in mortality in control arm

	Rivers et al	PROCESS	ARISE	PROMISE
Mortality % (ctrl)	50	19	19	29
ScvO ₂ %	49	71	73	70

Rivers et al
NEJM 2001

Angus D et al
NEJM 2014

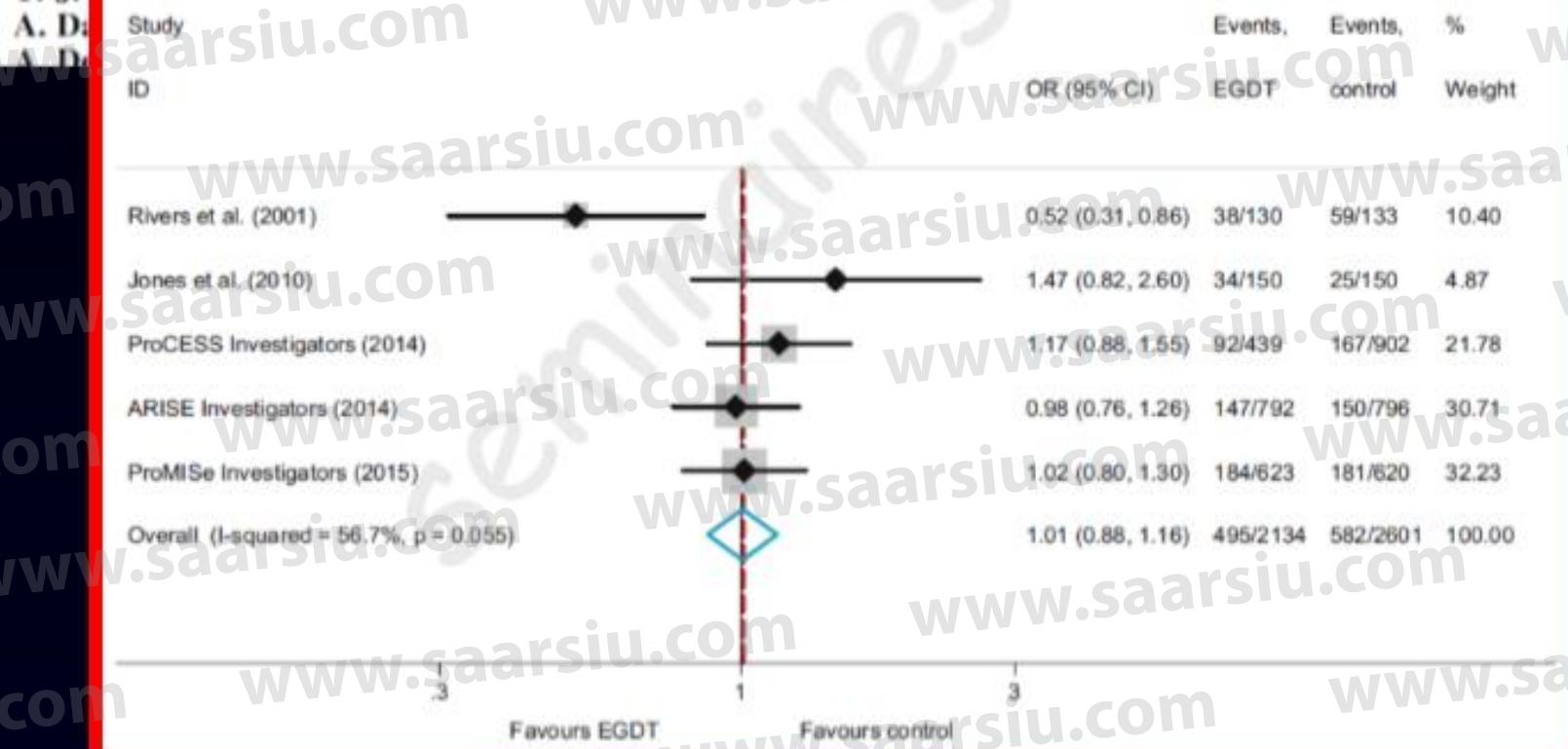
Peake S et al
NEJM 2014

Mouncey P et al
NEJM 2015

Inclusion: refractory hypotension and/or lactate ≥ 4 (despite fluids)

D. C. Angus
A. E. Barnato
D. Bell
R. Bellomo
C.-R. Chong
T. J.

A systematic review and meta-analysis of early goal-directed therapy for septic shock: the ARISE, ProCESS and ProMISe Investigators



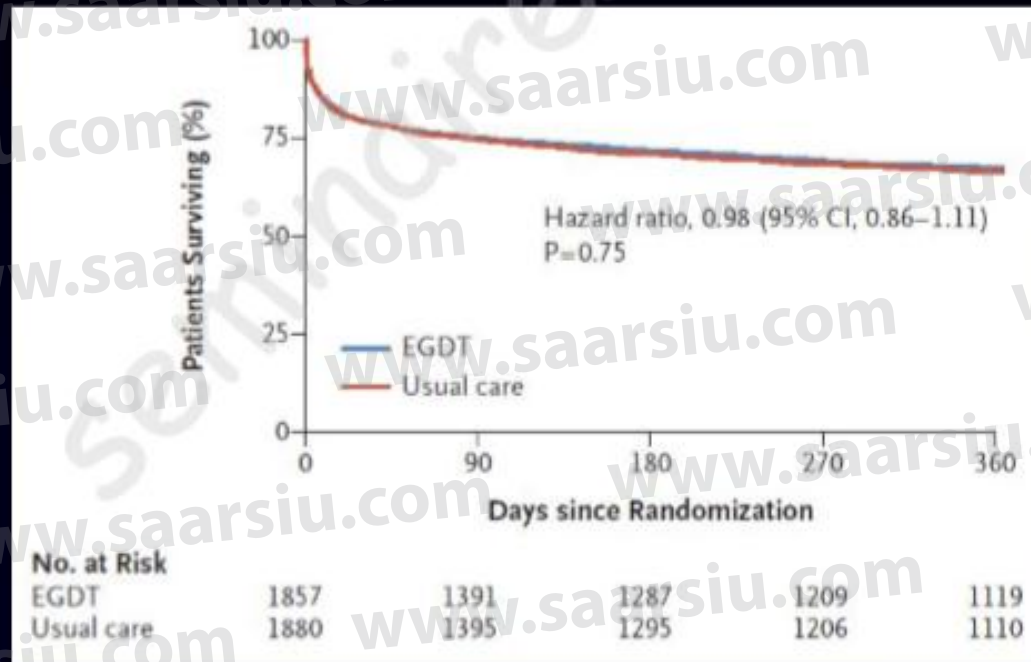
THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

NEJM 2017

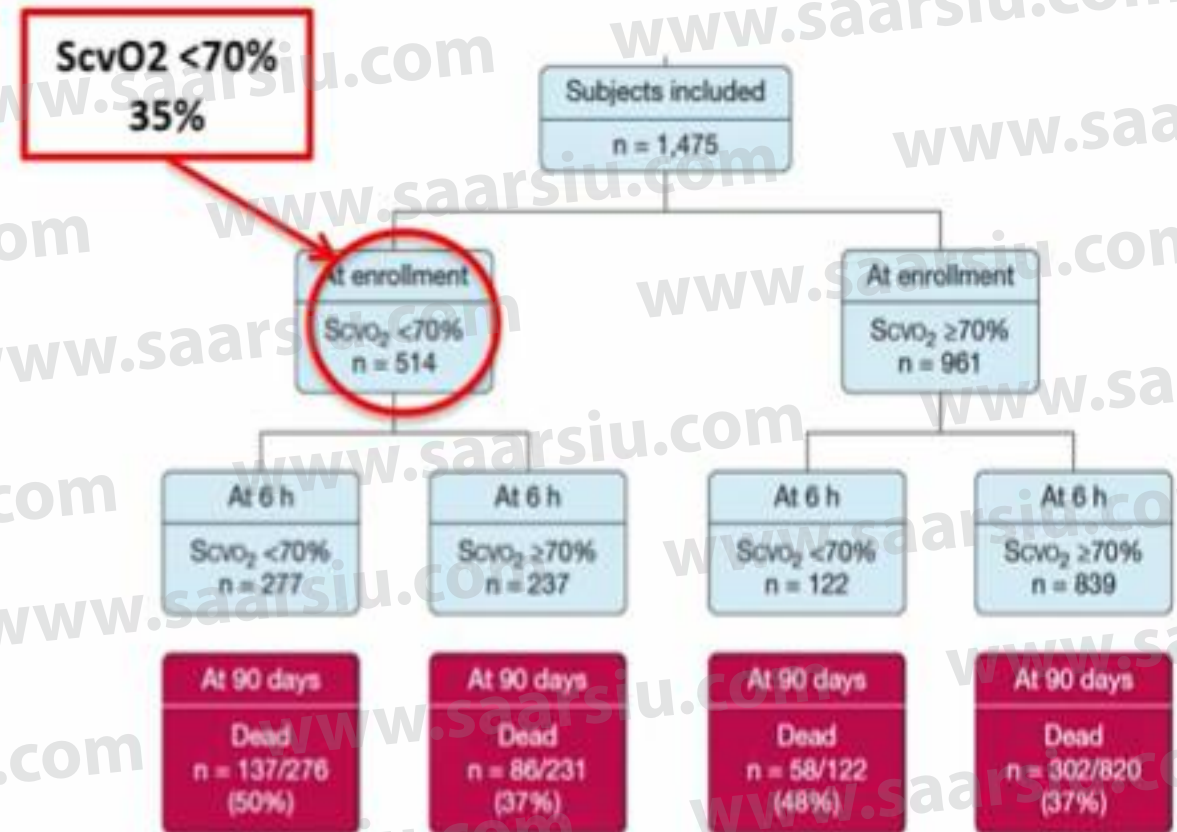
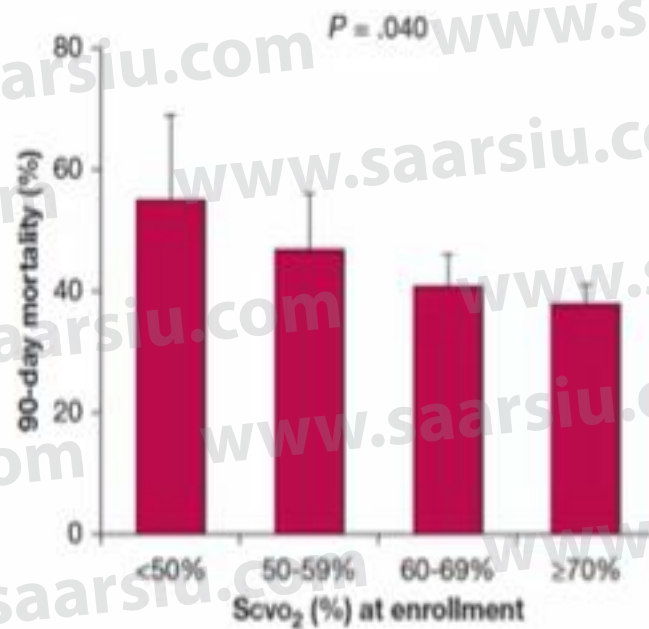
Early, Goal-Directed Therapy for Septic Shock
— A Patient-Level Meta-Analysis

The PRISM Investigators*



Persistence of Central Venous Oxygen Desaturation During Early Sepsis Is Associated With Higher Mortality

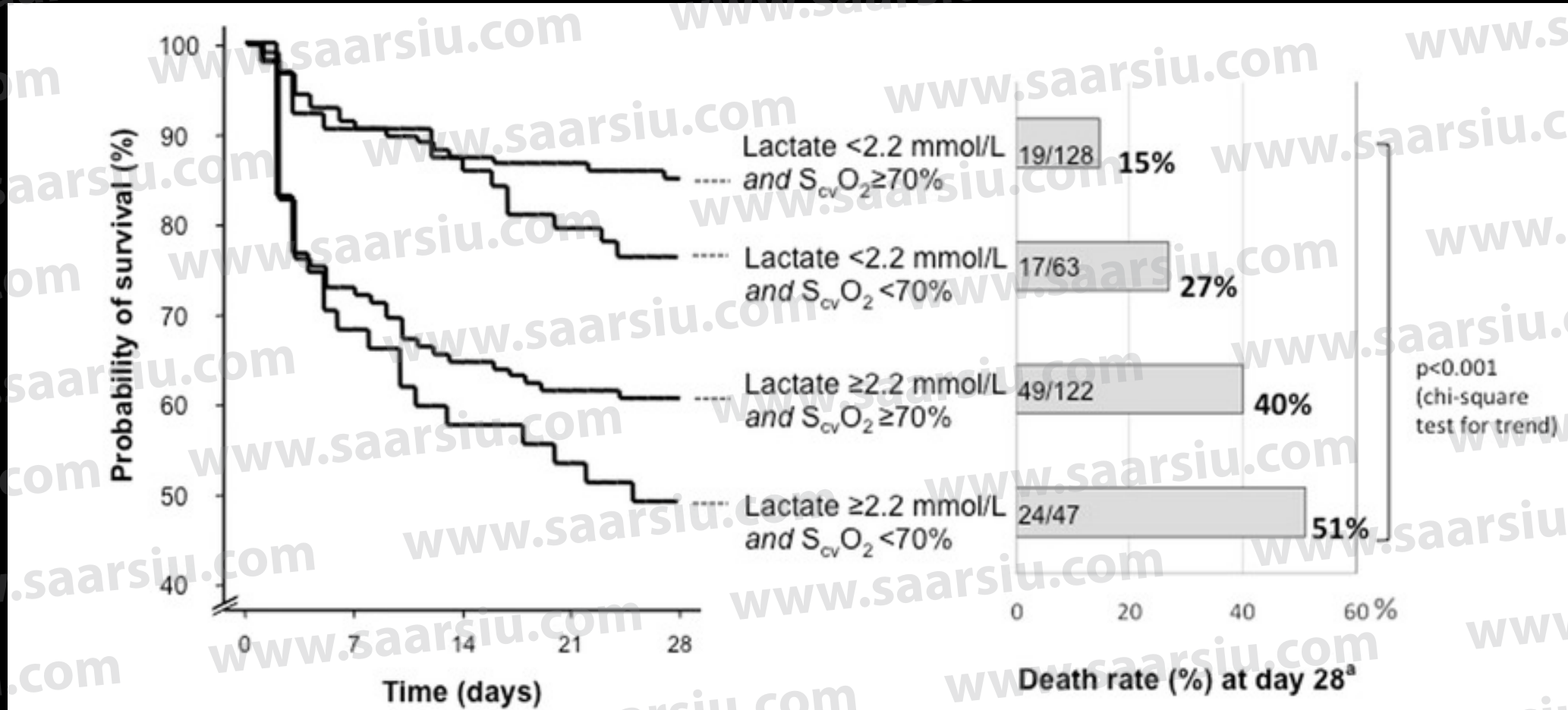
A Retrospective Analysis of the ALBIOS Trial



Protti Aet al, Chest 2018

SCVO2 ET PRONOSTIC

Boulain T et al
Crit care 2014



363 patients septiques

Low ScvO₂ at the bedside

❖ High risk surgery (n= 123)

scvo₂ < 64,4% predicts postoperatives complications

Pearse R et al crit care 2005 9: 694 -9

❖ SVO₂ in peep titration and weaning

Low and decreasing scvo₂ predicts weaning failure

Suter P N Engl J Med 1975

Jubran A Am J Resp Crit Care Med 1998

❖ Admission Scvo₂ < 65% in trauma

Higher mortality and prolong hospital stay

Scalea TM J Trauma 1990

RESEARCH

Open Access

High ScvO₂ are associated with worse outcomes

max ScvO₂

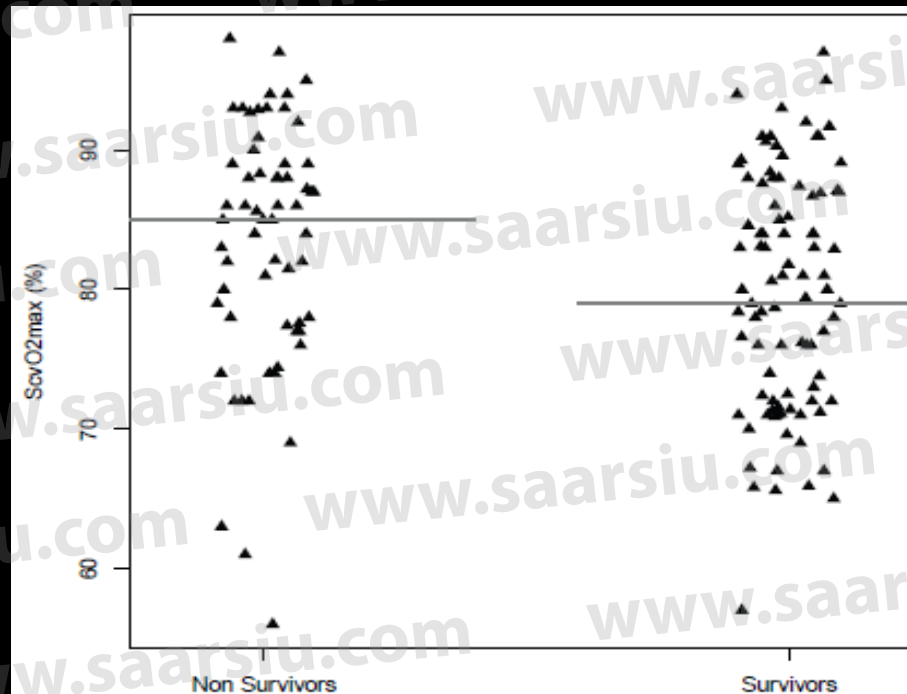


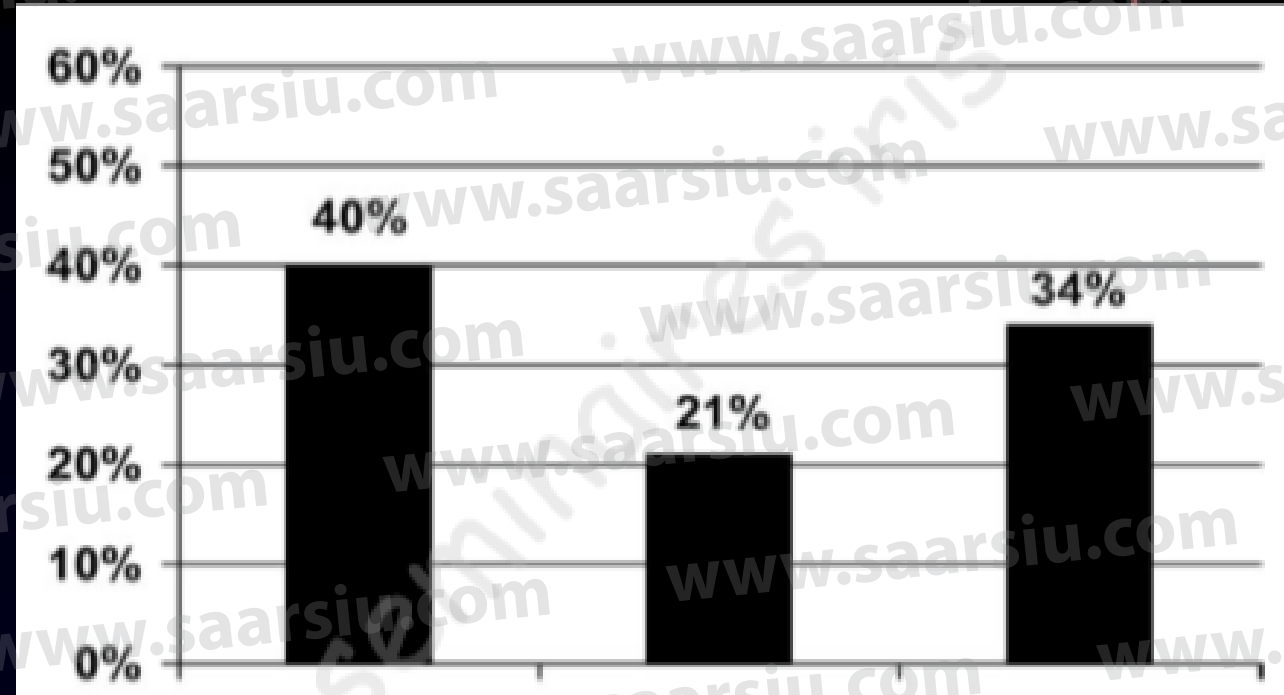
Figure 2 Maximal central venous oxygen saturation (ScvO_{2max}) is higher in the non-survivors than in the survivors.

Non-survivors

Survivors

Pope J et al
Ann Emerg Med
15:40;2010

Mortality, %



ScvO2 <70%

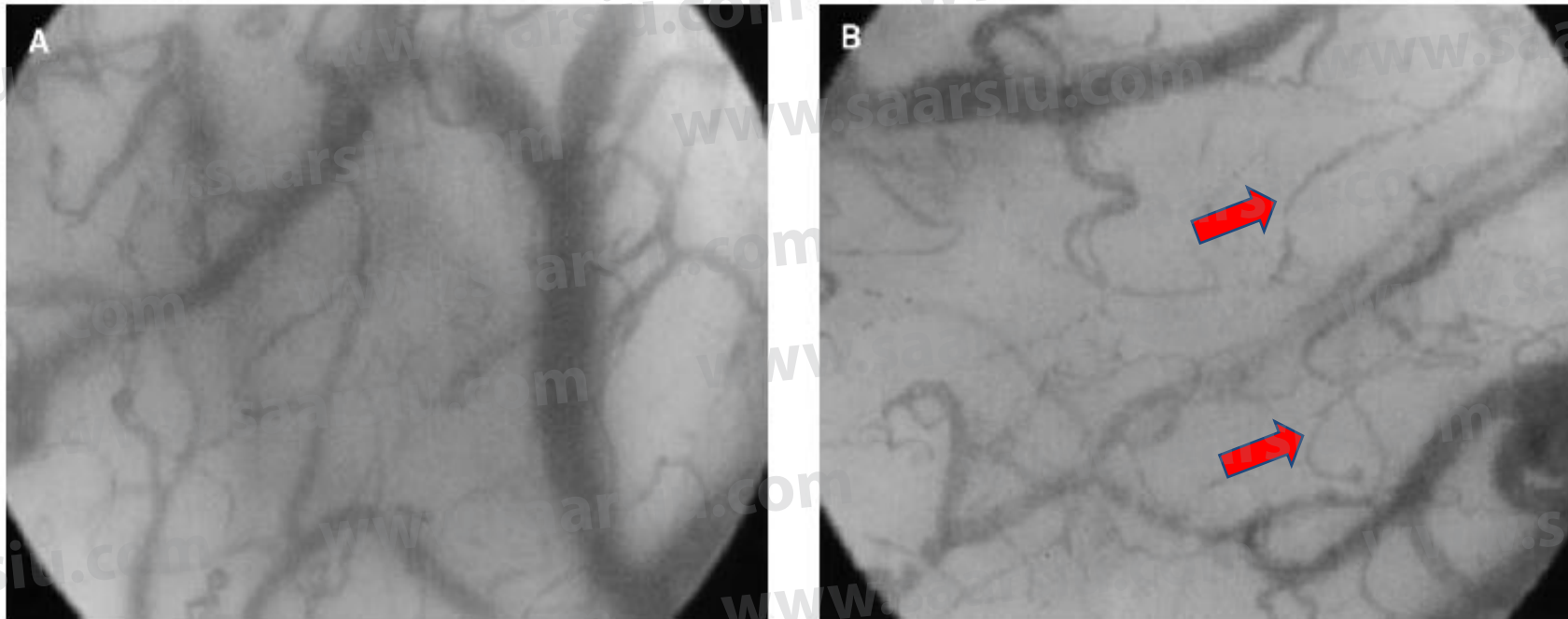
70-90%

>90%

619 pts severe sepsis (ED)

Microvascular Blood Flow Is Altered in Patients with Sepsis

Daniel De Backer, Jacques Creteur, Jean-Charles Preiser, Marc-Jacques Dubois, and Jean-Louis Vincent



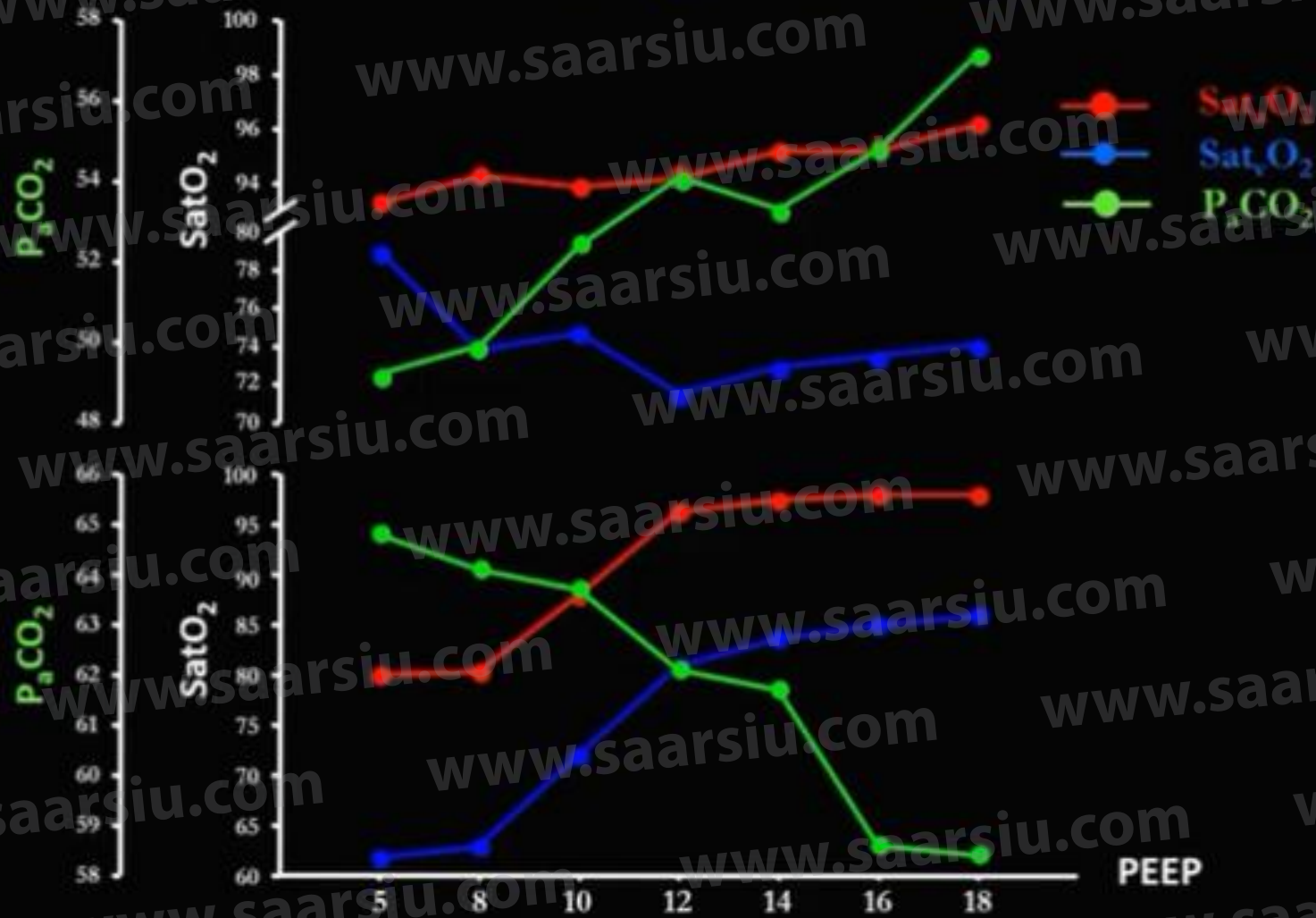
Am J Respir Crit Care Med Vol 166. pp 98–104, 2002

SCVO2 ET SEPSIS

2. ScVo2 basse ($<65\%$, $<70\%$) : **Tao2 insuffisant par rapport aux besoins globaux en o2**

1. ScVO2 élevée : **peut masquer l'existence de secteurs circulatoires ou le transport en oxygène est insuffisant**

PEEP trial and gas exchange

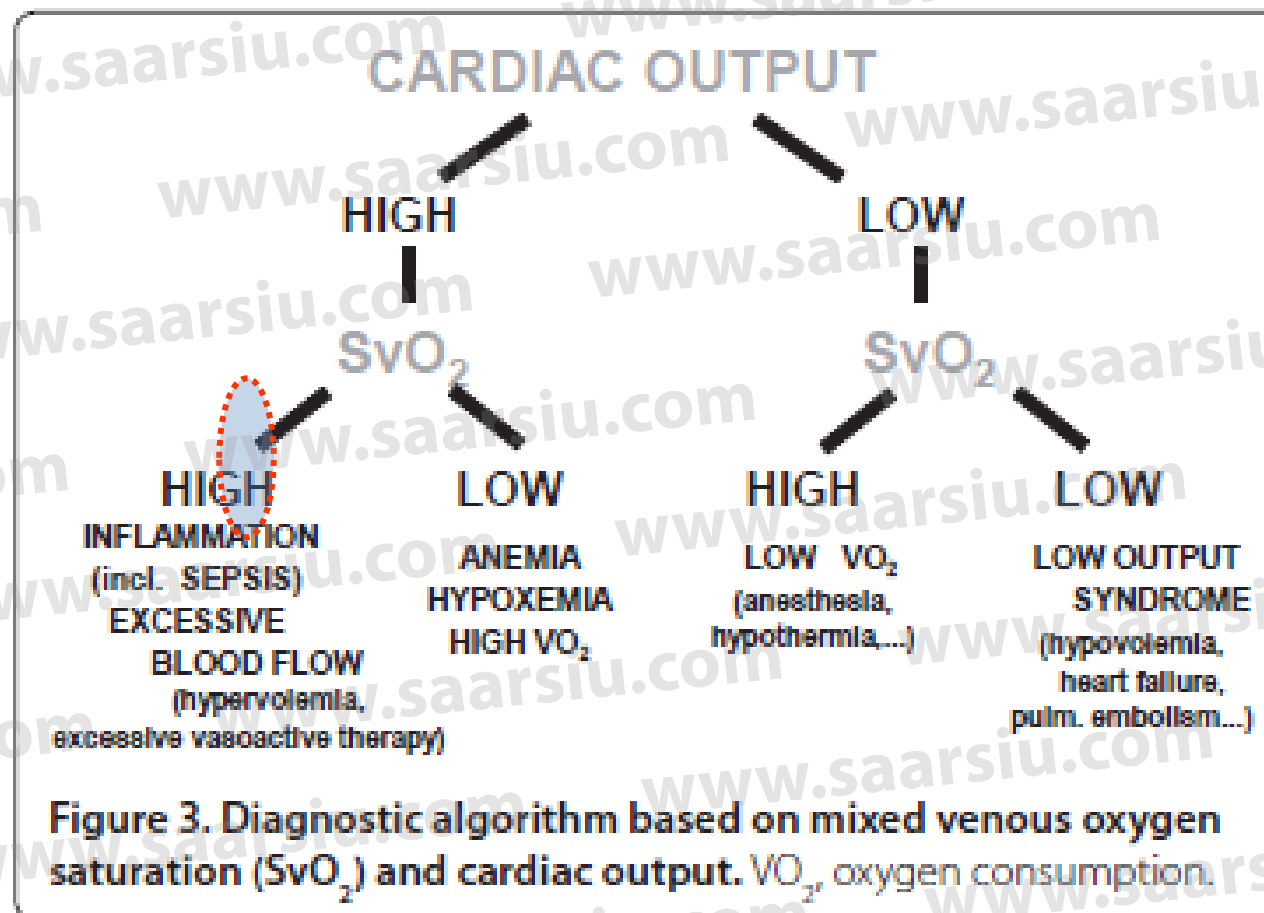


Gattinoni, 2003

REVIEW

Clinical review: Update on hemodynamic monitoring - a consensus of 16

Jean-Louis Vincent^{1*}, Andrew Rhodes², Azriel Perel³, Greg S Martin⁴, Giorgio Della Rocca⁵, Benoit Vallet⁶, Michael R Pinsky⁷, Christoph K Hofer⁸, Jean-Louis Teboul⁹, Willem-Pieter de Boode¹⁰, Sabino Scolletta¹¹, Antoine Vieillard-Baron¹², Daniel De Backer¹, Keith R Walley¹³, Marco Maggiorini¹⁴ and Mervyn Singer¹⁵



From Early Goal-Directed Therapy to Late(r) Scvo2 Checks

Jean-Louis Vincent, MD, PhD, FCCP, Daniel De Backer, MD, PhD

CHEST

Volume 154, Issue 6, Pages 1267-1269 (December 2018)

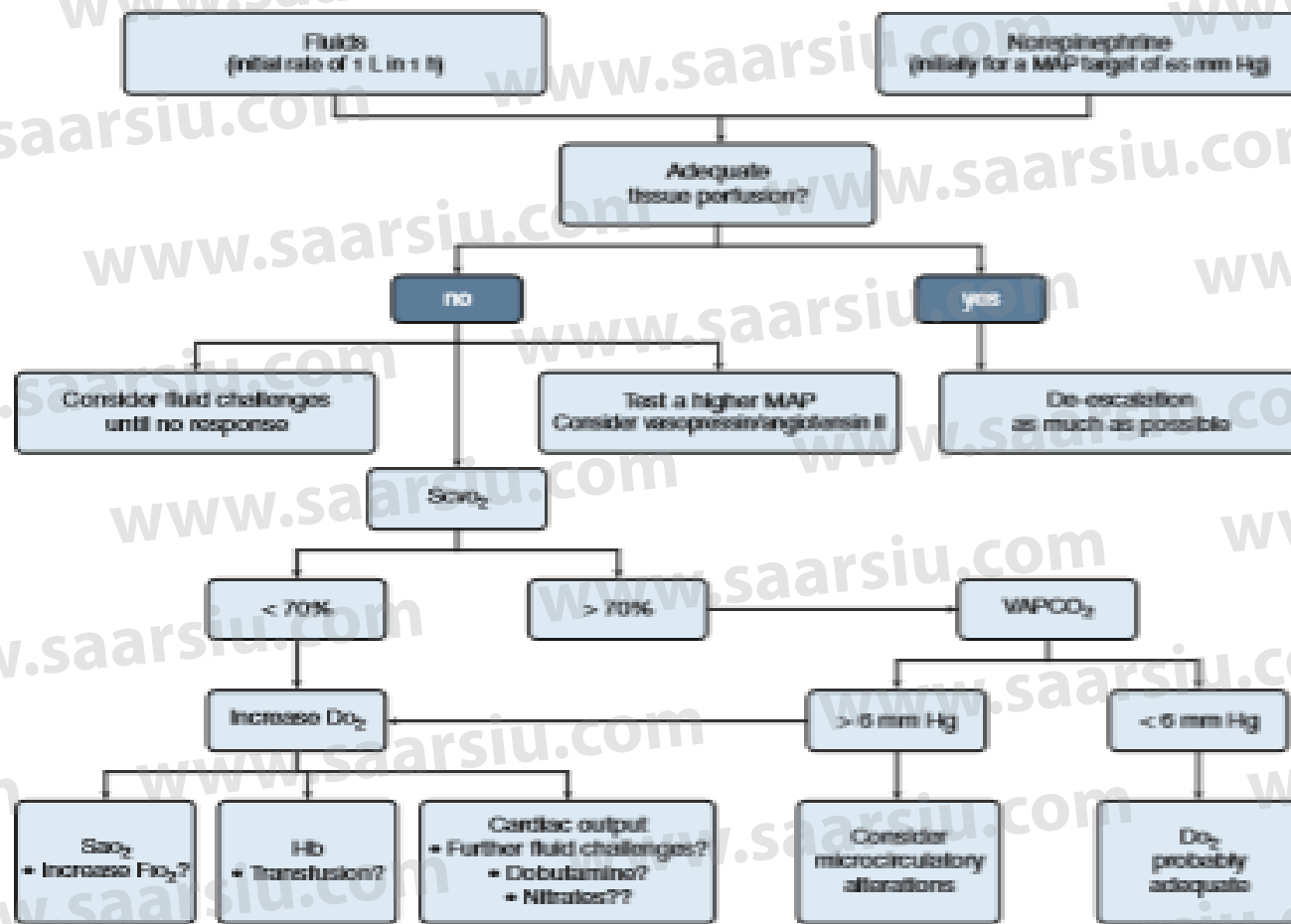


Figure 1 – Suggested algorithm for hemodynamic management of septic shock using Scvo₂. DO₂ = oxygen delivery; Hb = hemoglobin; MAP = mean arterial pressure; Sao₂ = oxygen saturation; Scvo₂ = central venous oxygen saturation; VAPCO₂ = venoarterial partial pressure of carbon dioxide.

CONCLUSION

- Monitoring de l'adéquation DO_2/VO_2
- Cible thérapeutique
- Marqueur pronostic