FLUIDS IN SEPSIS

MISSES THAT MATTER

FLUIDS ARE GREAT!

FLUIDS ARE EVIL!

FLUIDS ARE COMPLICATED

Surviving Sepsis Campaign

30 CC / KG


Context


Insert this side into recorder
Do not touch the tape inside
VHS
REWIND

Surviving Sepsis Campaign

Society of Critical Care Medicine

ESICM European Society of Intensive Care Medicine

Surviving Sepsis Campaign Guidelines ~~2021~~ 2016

"We recommend that, in the resuscitation from sepsis-induced hypoperfusion, at least 30 mL/kg of IV crystalloid fluid be given within the first 3 hours"

Quality of evidence: Low

Recommendation: Strong

Surviving Sepsis Campaign

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Surviving Sepsis Campaign Guidelines ~~2021~~ 2016

"Although little literature includes controlled data to support this volume of fluid, recent interventional studies have described this as usual practice in the early stages of resuscitation, and observational evidence supports the practice"

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"The fact that an opinion has been widely held is no evidence whatever that it is not utterly absurd"

~*Bertrand Russell*

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CITED OBSERVATIONAL EVIDENCE SUPPORTING 30ML/KG FLUID BOLUS

Levy et al. Intensive Care Med 2010:36(2):222-31

No association found between CVP>8 and mortality

Levy et al. Crit Care Med. 2015;43(1):3-12

Combined outcome of early fluids and pressors associated with improved mortality

Leisman et al. Crit Care Med. 2017;45(10):1596-1606

Early fluids associated with decreased mortality

...but 95% of the early fluids group got early antibiotics and 65% of the late fluids group got early antibiotics

The NEW ENGLAND JOURNAL of MEDICINE

Seymour et al. NEJM 2017;376(23):2235-2244

Time to Treatment and Mortality during Mandated Emergency Care for Sepsis

Multicenter retrospective observational trial of 49,331 patients after implementation of a New York state mandate requiring hospitals to follow protocols for early identification and treatment of sepsis

More rapid completion of a 3-hour sepsis bundle and rapid administration of antibiotics - but NOT fluid administration - were associated with lower risk-adjusted hospital mortality

JAMA

Andrews et al. JAMA 2017;318(13):1233-40

Effect of an Early Resuscitation Protocol on In-hospital Mortality Among Adults With Sepsis and Hypotension: A Randomized Clinical Trial

Prospective randomized controlled trial 212 patients with septic shock

Significantly increased in-hospital mortality (48% vs 33%) associated with protocolized fluid resuscitation versus management per treating clinician

Annals of Internal Medicine Pepper et al. Ann Intern Med 2018;168(8):558-568

Evidence Underpinning the Centers for Medicare & Medicaid Services' Severe Sepsis and Septic Shock Management Bundle (SEP-1): A Systematic Review

No high- or moderate-level evidence that a 30ml/kg fluid bolus improves sepsis mortality

"The Centers for Medicare & Medicaid Services should examine its performance measure approval process to determine how it adopted interventions lacking evidence meeting the agency's own criteria"

Annals of Internal Medicine Townsend, Tefera & Rivers. Ann Intern Med 2018;168(8):609-610

Evidence Underpinning the Centers for Medicare & Medicaid Services' Severe Sepsis and Septic Shock Management Bundle (SEP-1)

"We were alarmed by Pepper and colleagues' inaccuracies and misrepresentations about the role of SEP-1 in CMS quality reporting programs...

...As long as a hospital reports its data - even if none of its patients with sepsis were treated with SEP-1 interventions - that hospital would not be penalized"


Insert this side into recorder
Do not touch the tape inside
VHS
FAST
FORWARD

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Surviving Sepsis Campaign Guidelines 2021

"For sepsis induced hypoperfusion or septic shock we suggest that at least 30 mL/kg of IV crystalloid fluid should be given within the first 3 hours"

Quality of evidence: Low

Recommendation: Weak

Critical Care Medicine

Kuttab et al. Crit Care Med 2019; 47(11):1582-1590

Evaluation and Predictors of Fluid Resuscitation in Patients With Severe Sepsis and Septic Shock

Single center retrospective observational trial of 1032 patients with sepsis and septic shock

Failure to reach 30cc/kg by 3 hours associated with increased hospital mortality (OR 1.52, CI 1.03-2.24), even after controlling for time to antibiotics, disease severity, heart failure, ESRD

Critical Care Explorations
Society of Critical Care Medicine
The Intensive Care Professionals
Yohannes et al. Crit Care Explor 2023;5(7):e0932

Recommended 30 cc/kg Fluid Dose for Patients With Septic Shock and Hypoperfusion With Lactate Greater Than 4 mmol/L

Multicenter retrospective observational trial of 1491 patients with septic shock

Stratified by fluid volume given in first 3h: Lowest group <15cc/kg and highest group >50cc/kg

Higher mortality in >50cc/kg group, but no other differences in mortality, LOS, lactate clearance

The NEW ENGLAND JOURNAL of MEDICINE

Shapiro et al. NEJM 2023;388(6):499-510

Early Restrictive or Liberal Fluid Management for Sepsis-Induced Hypotension

Multicenter randomized controlled trial of 1563 patients with septic shock

Fluid liberal vs fluid restrictive strategy after initial volume resuscitation

No differences whatsoever between the groups in terms of outcomes

The NEW ENGLAND JOURNAL of MEDICINE

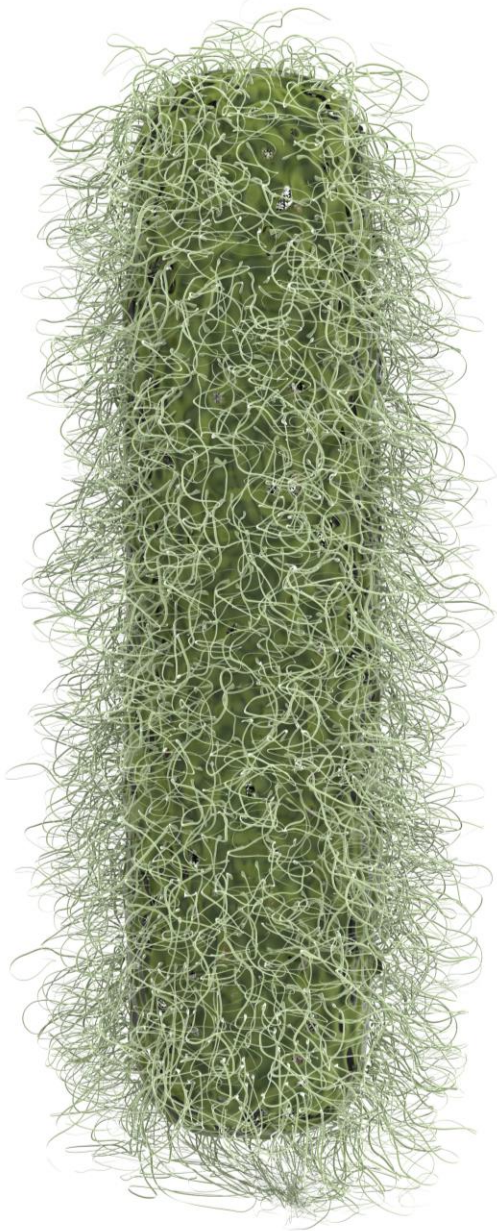
Shapiro et al. NEJM 2023;388(6):499-510

Early Restrictive or Liberal Fluid Management for Sepsis-Induced Hypotension

Caveat 1: Average patient age was <60 years old

Caveat 2: Non-statistically significant difference in ESRD patient subset with 27% mortality in fluid restrictive group vs 47% mortality in fluid liberal group (CI -41 to +1.5)

Caveat 3: Excluded patients if hypotension suspected to be due to non-sepsis cause



ASSUMPTION:

We can correctly diagnose the cause of the patient's shock to be sepsis within 1-hour of presentation

Is my patient developing shock?

Why is my patient developing shock?

JAMA

Singer et al. JAMA 2016;315(8): 801-810

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

"The current use of 2 or more SIRS criteria to identify sepsis was unanimously considered by the task force to be unhelpful"

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Surviving Sepsis Campaign Guidelines 2021

"We recommend against using qSOFA compared with SIRS, NEWS, or MEWS as a single screening tool for sepsis or septic shock"

Quality of evidence: Moderate

Recommendation: Strong


38
40
42
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41
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°C

American Heart Association

Jentzer et al. Circ Cardiovasc Qual Outcomes 2020;13(12): e006956

Inflammatory Response Syndrome Is Associated With Increased Mortality Across the Spectrum of Shock Severity in Cardiac Intensive Care Patients

Over 1/3 of cardiac ICU patients met SIRS criteria

Positive SIRS criteria associated with increased mortality

WestJEM

Santucci et al. West J Emerg Med 2008;9(2):81-85

Leukocytosis as a predictor of severe injury in blunt trauma

Mean WBC 16.9 in patients with significant traumatic injury

WBC had an AUC of 0.74 for predicting serious traumatic injury

...WBC has an AUC ~0.75 for predicting sepsis (Crouser et al. Crit Care Med 2019;47(8):1018-25)

Annals of Emergency Medicine

Knack et al. Ann Emerg Med 2024; 25:S0196-0644(24)00099-4

Early Physician Gestalt Versus Usual Screening Tools for the Prediction of Sepsis in Critically Ill Emergency Patients

Ability of different screening tools to predict sepsis as a hospital discharge diagnosis at 15 and 60 minutes after presentation (2484 patient encounters)

AUC for predicting sepsis as a hospital discharge diagnosis:

SIRS 0.67 qSOFA 0.67 MEWS 0.66

Annals of Emergency Medicine

Knack et al. Ann Emerg Med 2024; 25:S0196-0644(24)00099-4

Early Physician Gestalt Versus Usual Screening Tools for the Prediction of Sepsis in Critically Ill Emergency Patients

Ability of different screening tools to predict sepsis as a hospital discharge diagnosis at 15 and 60 minutes after presentation (2484 patient encounters)

AUC for predicting sepsis as a hospital discharge diagnosis:

SIRS 0.67 qSOFA 0.67 MEWS 0.66 Physician gestalt 0.90

There is no single test, metric or score that definitively identifies sepsis (sorry...)

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Surviving Sepsis Campaign Guidelines 2021

"For adults suspected of having sepsis, we suggest measuring blood lactate"

Quality of evidence: Low

Recommendation: Weak

LACTATE CANNOT BE USED TO RULE-IN NOR RULE-OUT SEPTIC SHOCK

1. Lactate ≠ Sepsis
2. Lactate ≠ Sepsis
3. Lactate ≠ Sepsis

nature SCIENTIFIC REPORTS

Sauer et al. Sci Rep 2021;11(1):20076

Understanding critically ill sepsis patients with normal serum lactate levels: results from U.S. and European ICU cohorts

ICU database study: Highest lactate in first 24h of admission in critically ill patients with sepsis in the highest quartile of SoIS

27% Lactate ≥4

50% Lactate >2 to ≤4

23% Lactate <2

LACTATE IS USEFUL, JUST NOT MAGIC...

LACTATE CAN BE DANGEROUS

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Surviving Sepsis Campaign Guidelines 2021

"We suggest guiding resuscitation to decrease serum lactate in patients with elevated lactate level, over not using serum lactate"

Quality of evidence: Low

Recommendation: Weak

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Surviving Sepsis Campaign Guidelines 2021

???

"We suggest guiding resuscitation to decrease serum lactate in patients with elevated lactate level, over not using serum lactate"

Quality of evidence: Low

Recommendation: Weak

Hernandez, Bellomo & Bakker. J Intensive Care Med 2019;45(1):82-85

The ten pitfalls of lactate clearance in sepsis

"The complexity of lactate... makes it impossible to define what goal it should be a marker or target of... Seeking to lower lactate levels (by whatever means given the multiple events that regulate its blood levels) has no credibility and no logic in terms of hemodynamics, bioenergetics, or tissue protection."

Legrand et al. J Intensive Care Med 2024;50:728–730

Serial lactate measurements to guide resuscitation: more evidence not to?

"Altogether, the current literature on sepsis does not support that guiding treatment based on serial [lactate] measurements would improve outcomes... Potential harm may result from serial measurements with excessive fluids or excess of vasopressors."

LACTO-BOLUS REFLEX

Giving fluids will only decrease the lactate if the underlying shock physiology is improved by volume adminitration

LACTO-BOLUS REFLEX ALTERNATIVE

1. Fully addressing shock precipitants?
2. Correctly identifying shock etiology?
3. Additional shock etiology developing?

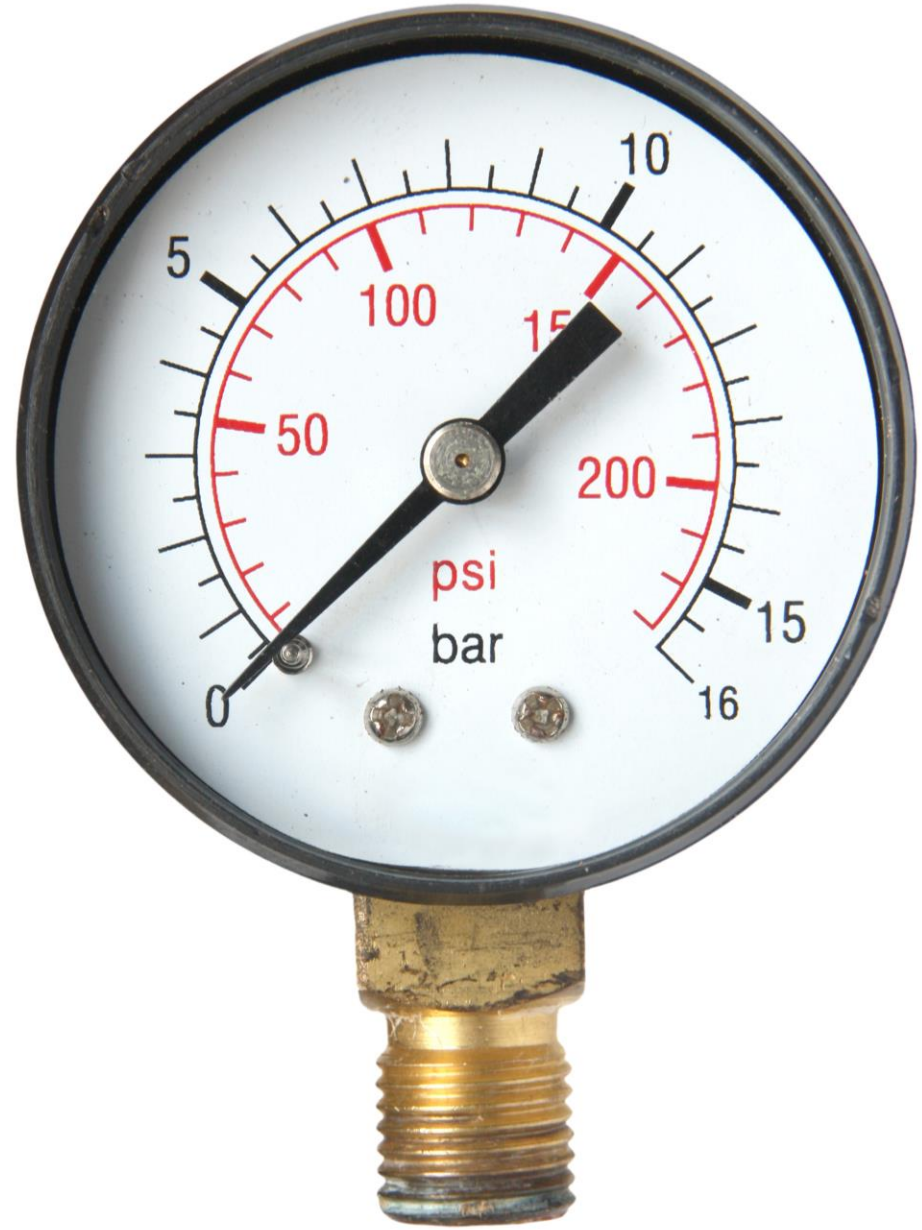
Fluids vs Pressors?

Incentive Structures Encourage Fluids Over Vasopressors

1. You don't have to put in central line
2. You don't have to call the ICU
3. You don't get angry emails

CIRCULATORY PHYSIOLOGY

Volume only counts if it's pressurized!



CRITICAL CARE

Ospina-Tascón et al. Am J Respir Crit Care Med 2019;199(9):1097-1105

Effects of very early start of norepinephrine in patients with septic shock: a propensity score-based analysis

Prospective observational propensity-matched study of 163 patients with septic shock

Very early vasopressor group: norepinephrine was initiated within an hour of initial fluid bolus

Very early vasopressors associated with decreased net fluid balance and decreased 28-day mortality (HR 0.31, CI 0.17-0.57) with no increased incidence of acute renal failure

ATS Journals

Permpikul et al. Am J Respir Crit Care Med 2019;199(9):1097-1105

Early Use of Norepinephrine in Septic Shock Resuscitation (CENSER Trial)

Single center randomized controlled trial of 310 patients with septic shock

Patients randomized to early low-dose norepinephrine at fixed rate vs placebo

No significant difference in 28-day mortality (early norepi 16% vs placebo 22%), but early norepi associated with more rapid control of shock and decreased incidence of pulmonary edema

FLUIDS ARE COMPLICATED


ONE-SIZE FITS ALL
STORE
SALE

Right Approach to Fluid Resuscitation

Reasonable

~~Right~~ Approach to Fluid Resuscitation

Reasonable

~~Right~~ Approach to Fluid Resuscitation

Optimizing volume status is one component of an individualized, iterative approach to restoring tissue perfusion

APPROACH TO FLUID RESUSCITATION IN SEPSIS

1. Diagnostic certainty?
2. Additional hypovolemia?
3. Therapeutic window?
4. Fluid tolerance?
5. Fluid responsiveness?

YOUR TIME IS A ZERO-SUM GAME

BUYING TIME WITH PRESSORS?

FLUIDS IN SEPSIS

Is my patient developing shock?

Why is my patient developing shock?

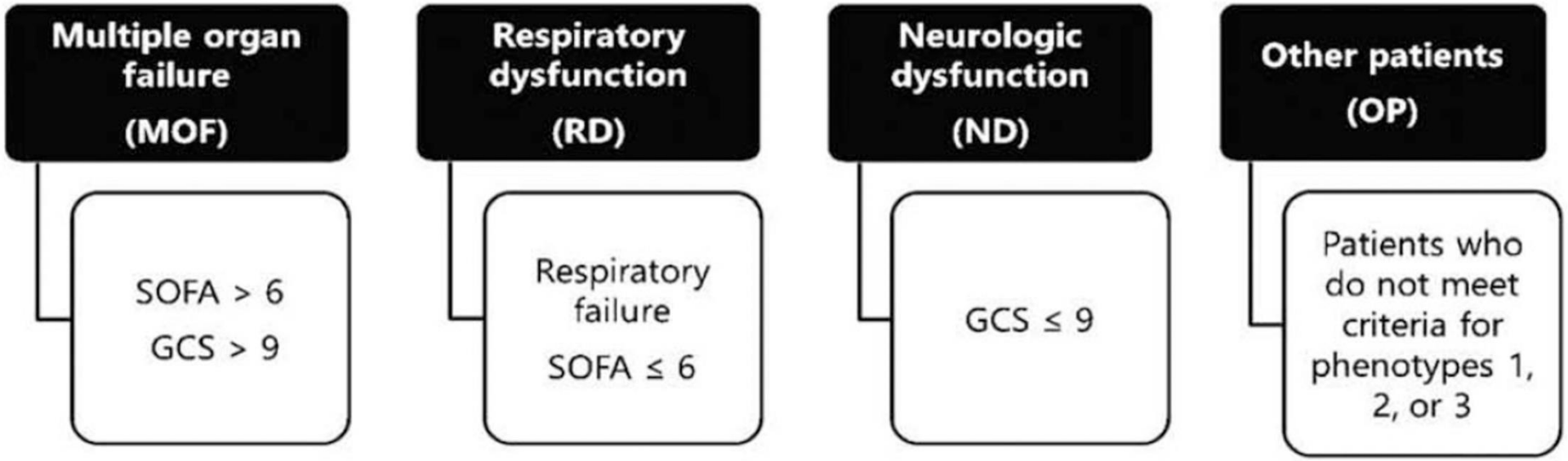
Surviving Sepsis Campaign

OUR COLLECTIVE ABILITY TO CHANGE AND IMPROVE

SHOCK
Injury, Inflammation, and Sepsis: Laboratory and Clinical Approaches

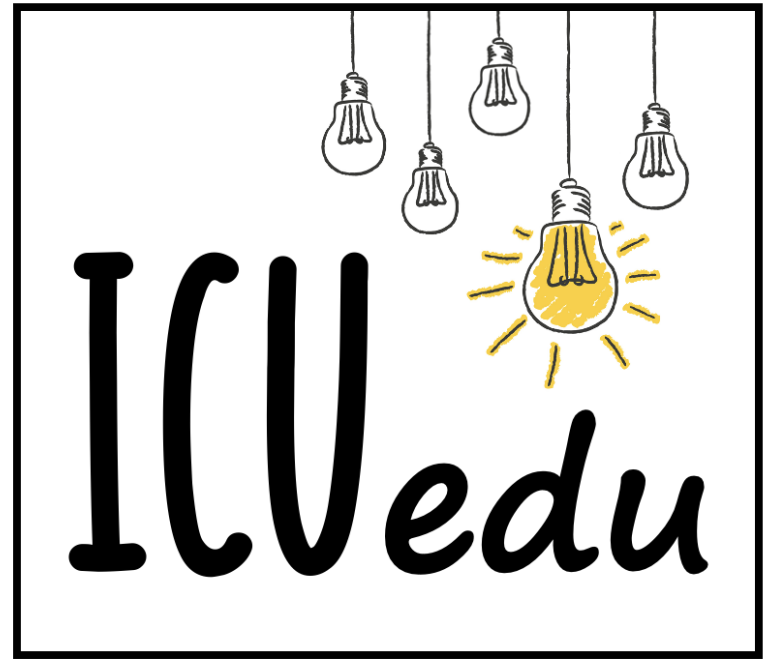
Shald et al. Shock 2022;57(1): 57-62

Impact of Clinical Sepsis Phenotypes on Mortality and Fluid Status in Critically Ill Patients




The End

THANKS FOR LISTENING!



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