# Septic shock treatment in emergency department

Dr. Shorafa

Pediatric Intensivist

# objective

- Screening
- Antibiotic
- Fluid resuscitation
- Vasoactive agent
- Blood products

# Case scenario

- 3 years old boy.
- Taken to pediatrician with fever and cough.
- Started on paracetamol and oral antibiotic.
- One week later still low grade fever and tachypnea.
- Referred to hospital.
- **Presentation:**
- Pale, irritable, respiratory distress,
- CVS: HR 150 , BP: 75/54, capillary refill 4”
- Respiratory: RR: 50 , rapid and shallow respiration
- Chest x-ray: bilateral patchy infiltration
- What do you do?

## SEPSIS is…

life-threatening organ dysfunction caused by a dysregulated host response to infection

**Suspect SEPSIS**

Save Lives

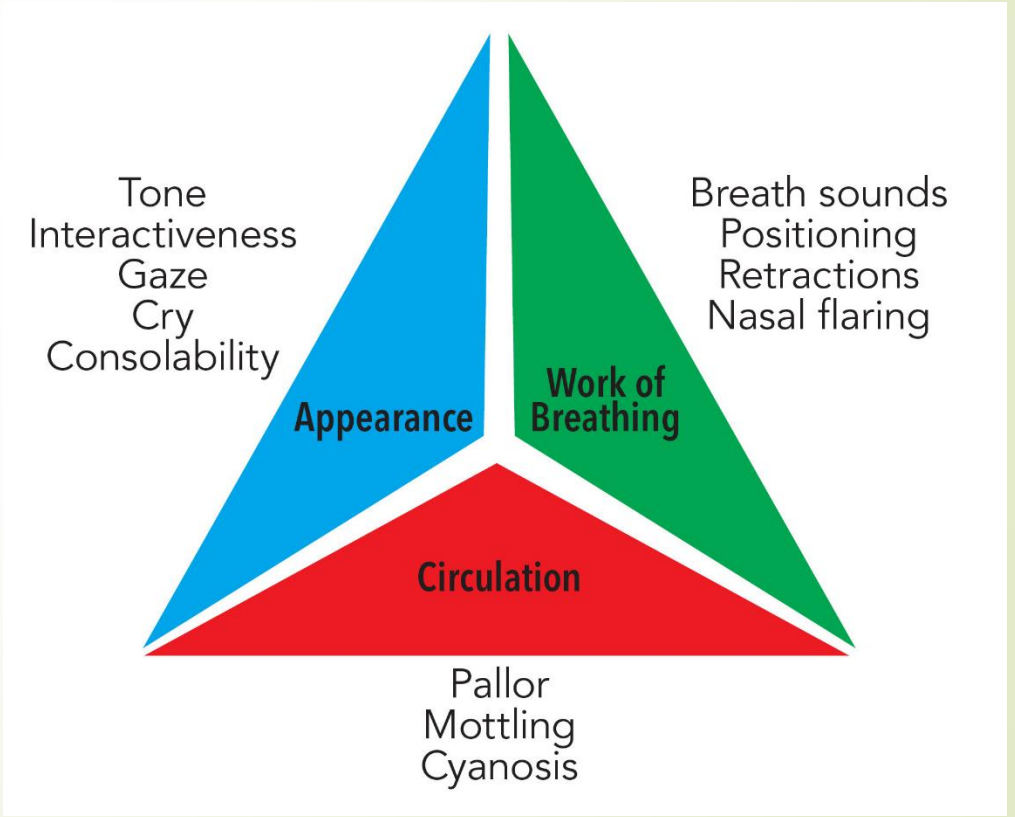
If you are concerned, please ask for the **Pediatric Rapid Response Team**

# Ask… "*Could this be Sepsis?*"

# Management-General



- **A**irway
  - If not protected or unable to be maintained, intubate.
- **B**reathing
  - Always give 100% oxygen to start
  - Sat monitor
- **C**irculation
  - Establish IV access rapidly
  - CR monitor and frequent BP



*Intensive Care Med (2018) 44:2242–2244*
https://doi.org/10.1007/s00134-018-5401-8

EDITORIAL

# How I treat septic shock

Jean-Louis Vincent*

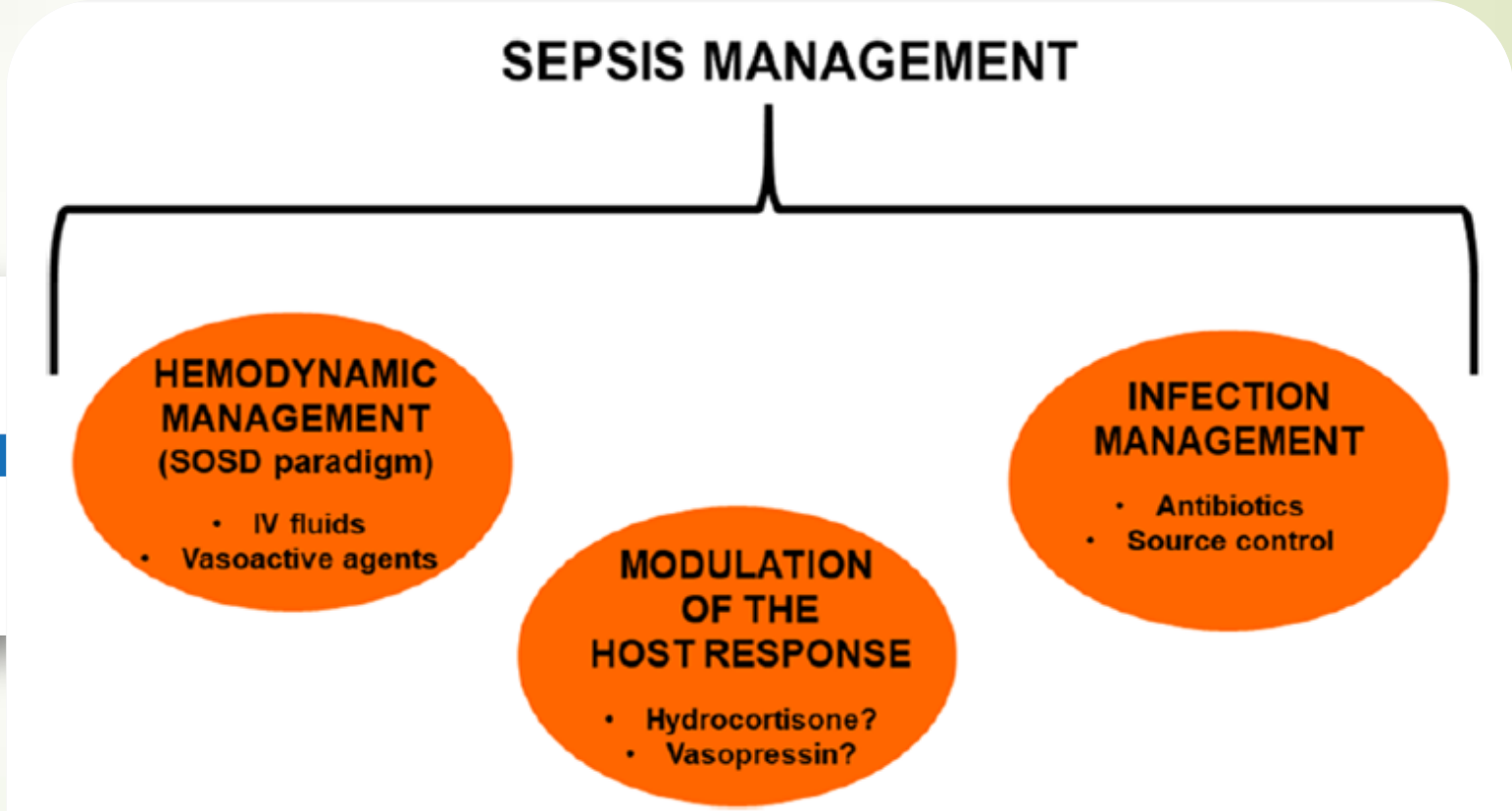



**Fig. 1** The three components of septic shock management. *SOSD* salvage, optimization, stabilization, and de-escalation

## Recognition bundle

- Screen patient for septic shock using an institution trigger tool.
- Clinician assessment within 15 minutes for any patient who screens positive in the trigger tool.
- Initiate resuscitation bundle within 15 minutes for patient identified by the trigger tool whom the assessing clinician confirms suspicion of septic shock.

## Stabilization bundle

- Use multimodal monitoring to optimize fluid, hormonal, and cardiovascular therapies to attain hemodynamic goals.
- Confirm administration of appropriate antimicrobial therapy and source control.

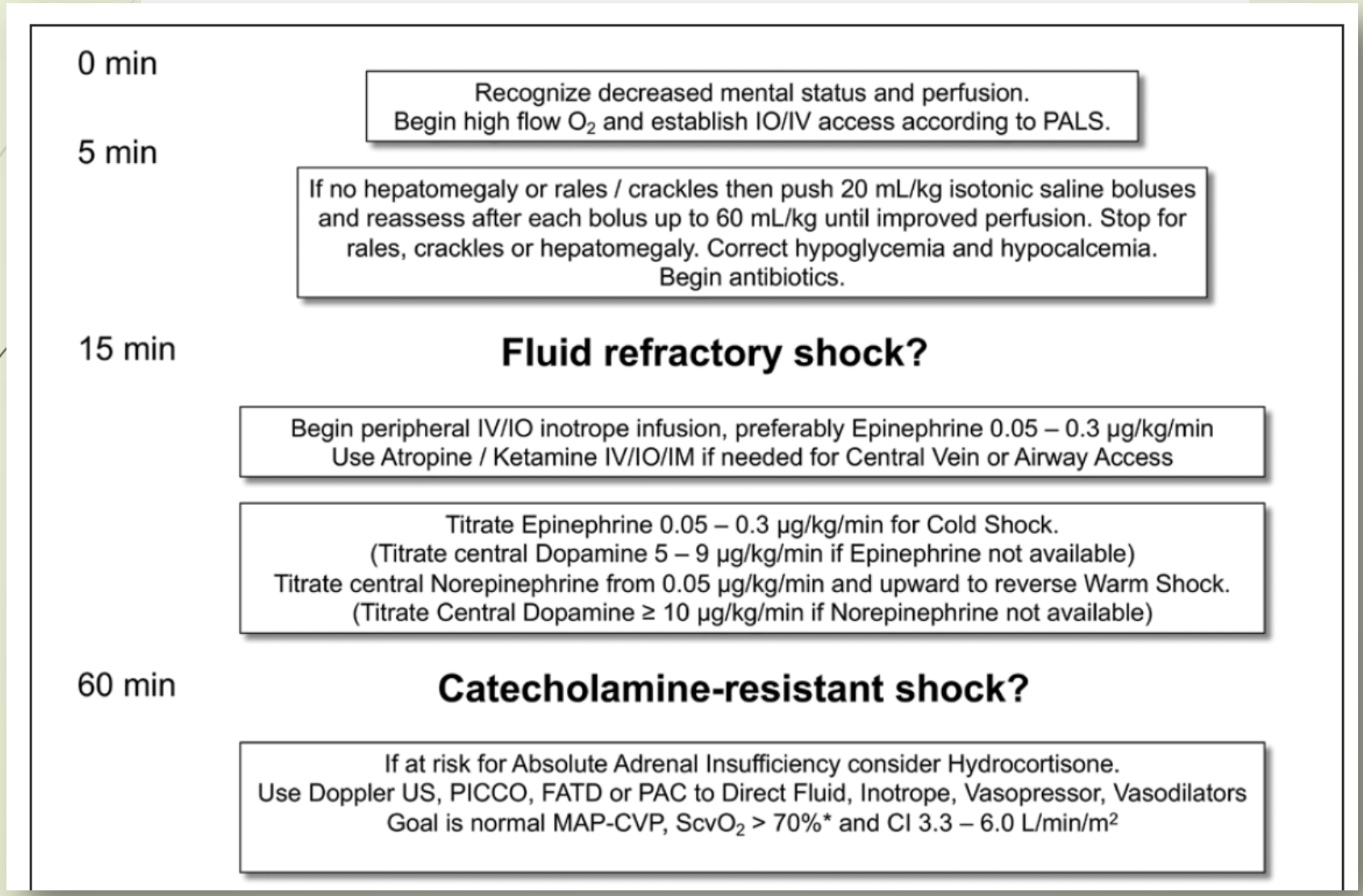
## Resuscitation bundle

- Attain IV/IO access within 5 minutes.
- Appropriate fluid resuscitation begun within 30 minutes.
- Initiation of broad-spectrum empiric antibiotics within 60 minutes.
- Begin peripheral or central inotrope infusion therapy for fluid-refractory shock within 60 minutes.

## Performance bundle

- Measure adherence to trigger, resuscitation, and stabilization bundies.
- Perform root cause analysis to identify barriers to adherence.
- Provide an action plan to address identified barriers.

# American College of Critical Care Medicine Clinical Practice Parameters for Hemodynamic Support of Pediatric and Neonatal Septic Shock



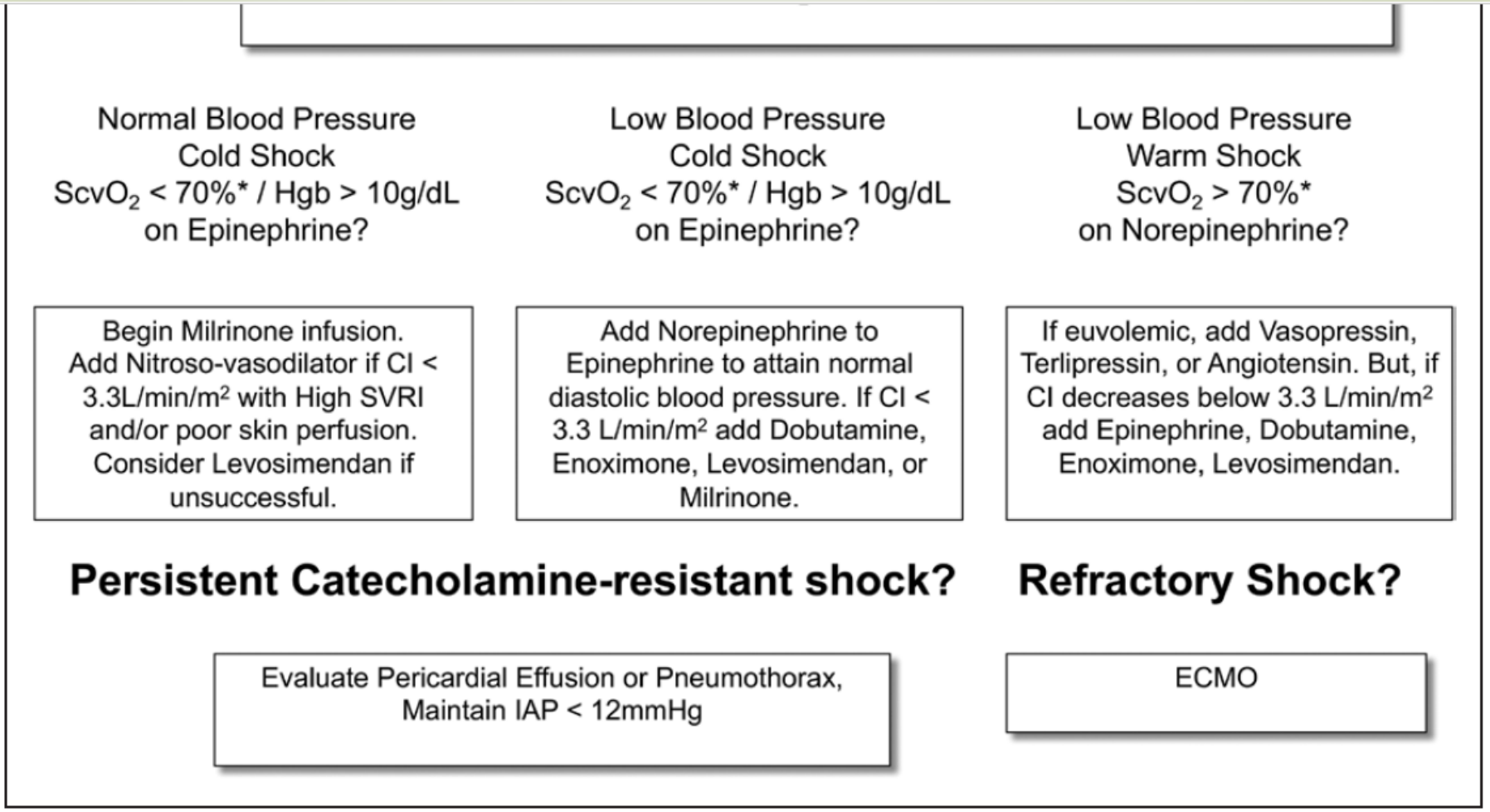
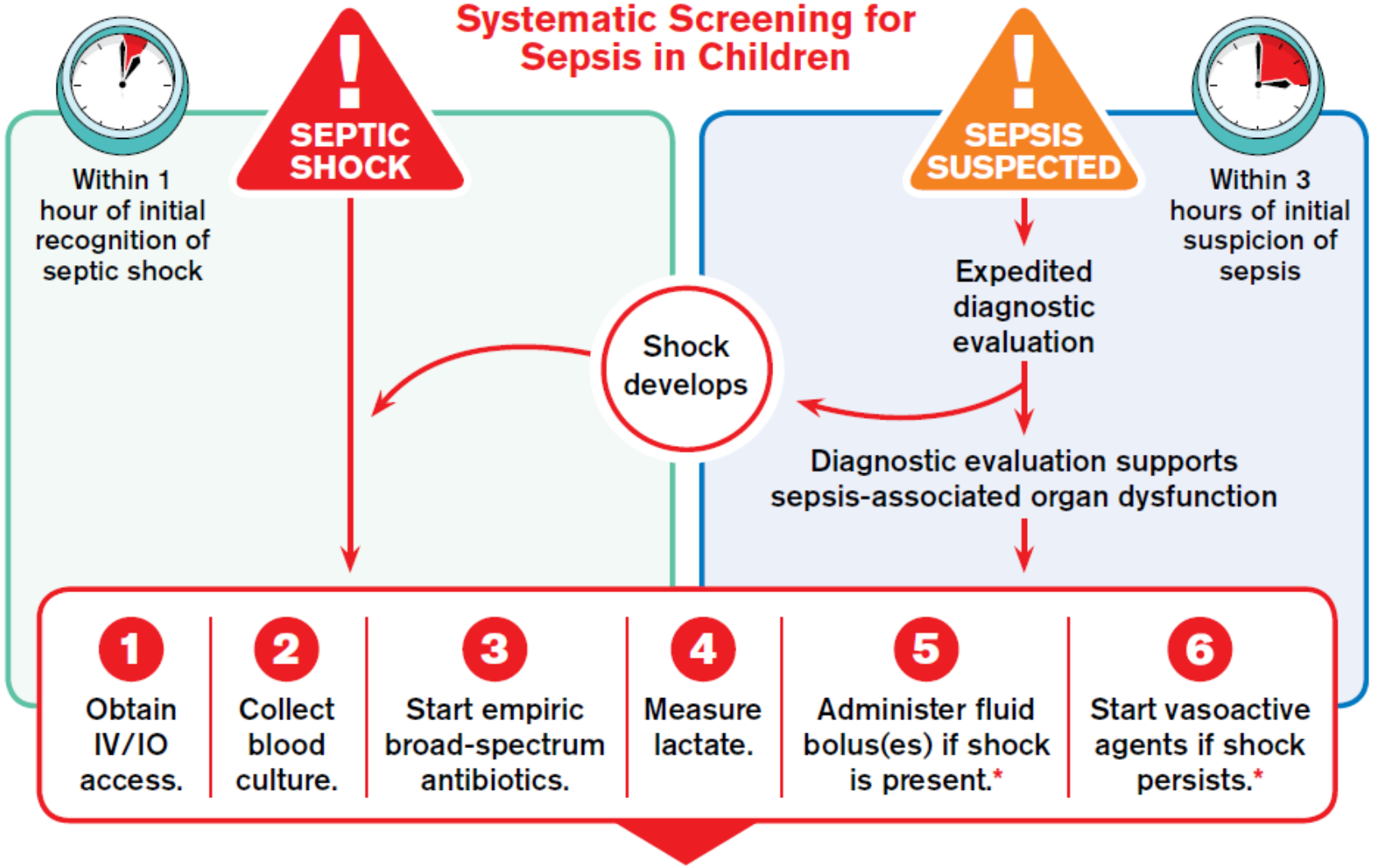
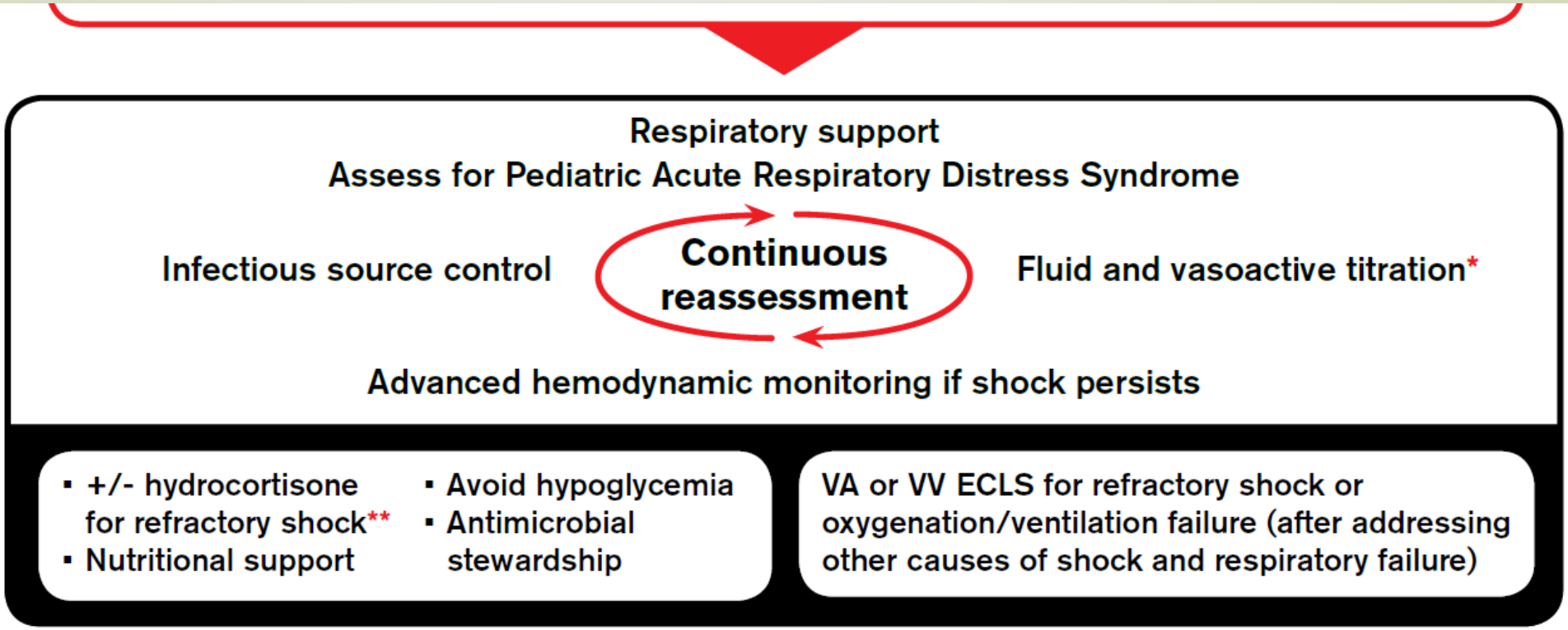



**Figure 2.** American College of Critical Care Medicine algorithm for time-sensitive, goal-directed stepwise management of hemodynamic support in infants and children. Proceed to next step if shock persists. 1) First-hour goals—restore and maintain heart rate thresholds, capillary refill ≤ 2 s, and normal blood pressure in the first hour/emergency department. 2) Subsequent ICU goals—if shock not reversed proceed to restore and maintain normal perfusion pressure (MAP – CVP) for age, $Scvo_2$ > 70% (* except congenital heart patients with mixing lesions), and cardiac index > 3.3 < 6.0 L/min/m² in PICU.

# Initial Resuscitation Algorithm for Children

Surviving Sepsis Campaign®






*See fluid and vasoactive algorithm. Note: Fluid bolus should be omitted from bundle if a) fluid overload is present or b) it is a low-resource setting without hypotension. Fluid in mL/kg should be dosed as ideal body weight.

**Hydrocortisone may produce benefit or harm.

# Fluid and Vasoactive-Inotrope Management Algorithm For Children

Surviving Sepsis Campaign

**Healthcare Systems WITH Intensive Care**

**SEPTIC SHOCK**

**Healthcare Systems WITHOUT Intensive Care**

## Abnormal Perfusion with or without Hypotension

- If signs of fluid overload are absent, administer fluid bolus, 10-20 mL/kg.
- Repeat assessment of hemodynamic response to fluid and consider fluid boluses, 10-20 mL/kg, until shock resolves or signs of fluid overload develop.
- Assess cardiac function.
- Consider epinephrine if there is myocardial dysfunction or epinephrine/ norepinephrine if shock persists after 40-60 mL/ kg (or sooner if signs of fluid overload develop).

## Abnormal perfusion WITHOUT hypotension

- Do NOT give fluid bolus unless there are signs of dehydration with ongoing fluid losses (eg, diarrhea).
- Start maintenance fluids.
- Monitor hemodynamics closely.
- Consider vasoactive-inotropic support (if available).

## Abnormal perfusion WITH hypotension*

- If signs of fluid overload are absent, administer fluid bolus, 10-20 mL/kg.
- Assess hemodynamic response to fluid and repeat fluid boluses, 10-20 mL/kg, until hypotension resolves or signs of fluid overload develop.
- Assess cardiac function (if available)
- Consider epinephrine/ norepinephrine if hypotension persists after 40 mL/kg or sooner if signs of fluid overload develop.

Fluid in mL/kg should be dosed as ideal body weight.

**Shock resolved, perfusion improved**

- Do not give more fluid boluses.
- Consider maintenance fluids.
- Monitor for signs/symptoms of recurrent shock.

*Hypotension in healthcare systems WITHOUT intensive care is defined as either:

- SBP < 50 mm Hg in children aged < 12 months
- SBP < 60 mm Hg in children aged 1 to 5 years
- SBP < 70 mm Hg in children aged > 5 years

OR

Presence of all 3 World Health Organization criteria: cold extremities, prolonged capillary refill > 3 seconds, weak/fast pulse

www.sccm.org/SurvivingSepsisCampaign/Guidelines/Pediatric-Patients

# Effects of saline or albumin fluid bolus in resuscitation: evidence from re-analysis of the FEAST trial

*Michael Levin*, Aubrey J Cunnington*, Clare Wilson, Simon Nadel, Hans Joerg Lang, Nelly Ninis, Mignon McCulloch, Andrew Argent, Heloise Buys, Christopher A Moxon, Abigail Best, Ruud G Nijman, Clive J Hoggart*

*Lancet Respir Med* 2019; 7: 581–93

## Summary

**Background** Fluid resuscitation is the recommended management of shock, but increased mortality in febrile African children in the FEAST trial. We hypothesised that fluid bolus-induced deaths in FEAST would be associated with

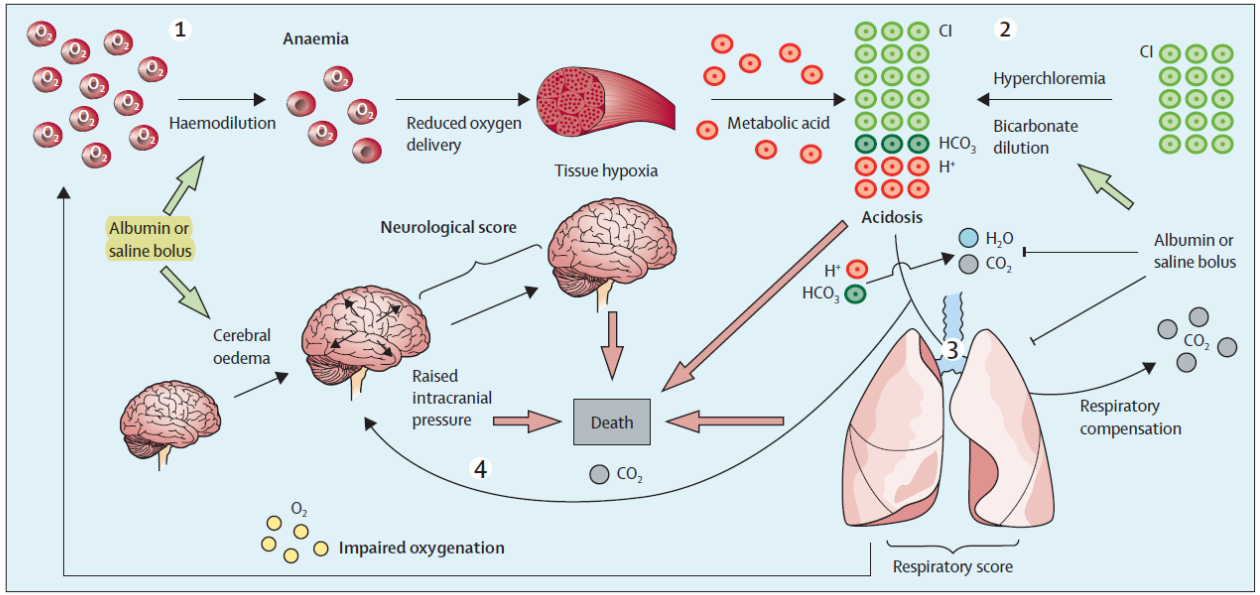



*Figure 5:* **Proposed physiological model of the adverse effects of fluid bolus**

Bolus fluid reduces haemoglobin concentration, resulting in decreased tissue oxygenation, increasing anaerobic metabolism, and metabolic acidosis. According to the Stewart model, maintenance of normal plasma pH is controlled by (1) the strong ion difference (charge difference between strong cations ($Na^+$, $K^+$, $Ca^{2+}$, and Mg2+), and strong anions (Cl– and lactate–); (2) $pCO_2$ and (3) charge from weak acids (phosphate, albumin).[28,29] Bolus of normal saline or 5% albumin (which have similar electrolyte content) caused hyperchloraemia and dilution of bicarbonate, resulting in a reduction in the strong ion difference. Hyperchloraemic acidosis increases the need for respiratory compensation through increased carbon dioxide excretion to maintain pH. Worsening of respiratory function due to bolus results in hypoxia (as evidenced by low oxygen saturation and increased respiratory score). This outcome, together with an inability to increase respiratory rate, impairs excretion of carbon dioxide (not shown in our study). Increasing carbon dioxide causes cerebral vasodilation, resulting in increased intracranial pressure. Fluid bolus might also directly cause cerebral oedema. The combination of adverse effects on haemoglobin concentration, acidosis, and respiratory and neurological function induced by modest albumin or saline fluid boluses might overwhelm compensatory mechanisms in the most severely ill patients, resulting in increased mortality.

# BLOOD PRODUCTS RECOMMENDATIONS TABLE

| RECOMMENDATION #65 | STRENGTH & QUALITY OF EVIDENCE |
|---|---|
| We ***suggest against*** transfusion of RBCs if the blood hemoglobin concentration is greater than or equal to 7 g/dL in hemodynamically stabilized children with septic shock or other sepsis-associated organ dysfunction. **Remarks:** According to the 2018 Transfusion and Anemia Expertise Initiative (TAXI) guidelines, for the purposes of RBC transfusion, "hemodynamically stabilized" is defined as a MAP higher than 2 sds below normal for age and no increase in vasoactive medications for at least 2 hours. | • Weak<br>• Low-Quality of Evidence |

| RECOMMENDATION #66 | STRENGTH & QUALITY OF EVIDENCE |
|---|---|
| We ***cannot make a recommendation*** regarding hemoglobin transfusion thresholds for critically ill children with unstable septic shock. | Insufficient |

| RECOMMENDATION #67 | STRENGTH & QUALITY OF EVIDENCE |
|---|---|
| We ***suggest against*** prophylactic platelet transfusion based solely on platelet levels in nonbleeding children with septic shock or other sepsis-associated organ dysfunction and thrombocytopenia. | • Weak<br>• Very Low-Quality of Evidence |

Society of Critical Care Medicine
© 2020 Society of Critical Care Medicine and European Society of Intensive Care Medicine
ESICM

# Case Scenario Conclusion

- 3 years old boy.
- Taken to pediatrician with fever and cough.
- Started on paracetamol and oral antibiotic.
- One week later still low grade fever and tachypnea.
- Referred to hospital.
- **Presentation:**
- Pale, irritable, respiratory distress,
- CVS: HR 150 , BP: 75/54, capillary refill 4”
- Respiratory: RR: 50 , rapid and shallow respiration
- Chest x-ray: bilateral patchy infiltration
- What do you do?

Thanks for your attention