Surviving Sepsis: Early Management of Childhood Systemic Infection

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Objectives

- Define sepsis and septic shock
- Recognize the signs in a child
- Manage the early hours of therapy
- Know when to transfer to tertiary care center







Definitions

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

Septic shock: severe infection leading to cardiovascular dysfunction

- Hypotension
- Need for vasoactive medication
- Impaired perfusion

Sepsis-associated organ dysfunction: severe infection leading to cardiovascular dysfunction and/or non-cardiovascular dysfunction





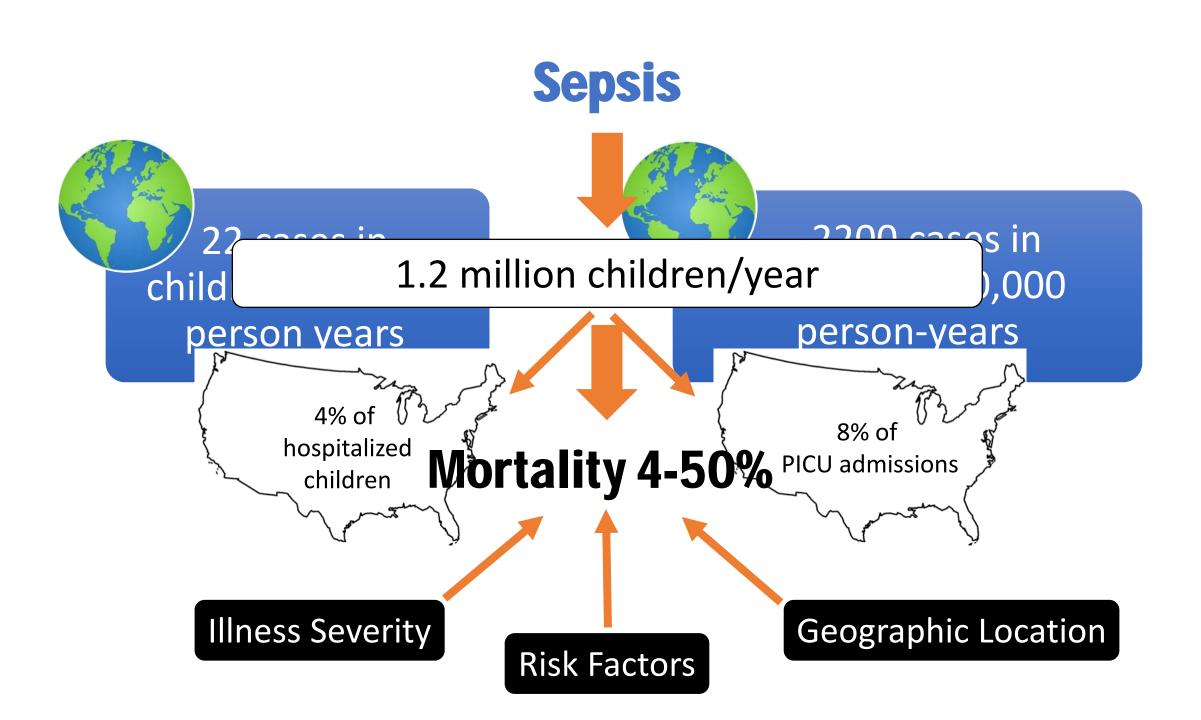
Surviving Sepsis ··· Campaign ··

- Pediatric patients from full-term birth to 18 years
- Guidelines for best practices and other recommendations
- *Pediatric Critical Care Medicine*, February, 2020;21(2):e52-e106

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







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Most deaths occur within the initial 48-72 hours after presentation.







- Children who present as acutely unwell should have a timely & systematic screening for septic shock and related organ dysfunction
- All healthcare entities should have a sepsis quality improvement program
- Facilities with EHRs may institute electronic triggers to alert clinicians









Altered mental status, temperature instability



Tachypnea, abnormal lung sounds, hypoxia

Recognition



Tachycardia, peripheral pulse changes, perfusion abnormalities, hypotension



Abdominal pain, vomiting, decreased appetite

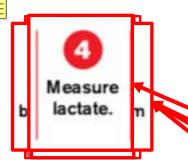


Poor urine output



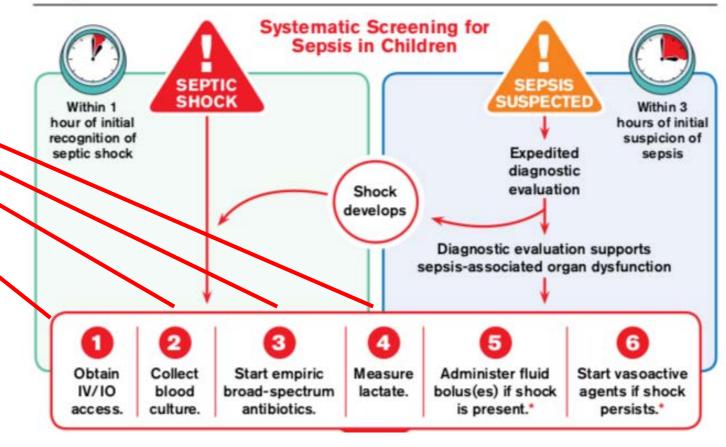
Mottling, flushing, rash

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Initial Resuscitation Algorithm for Children





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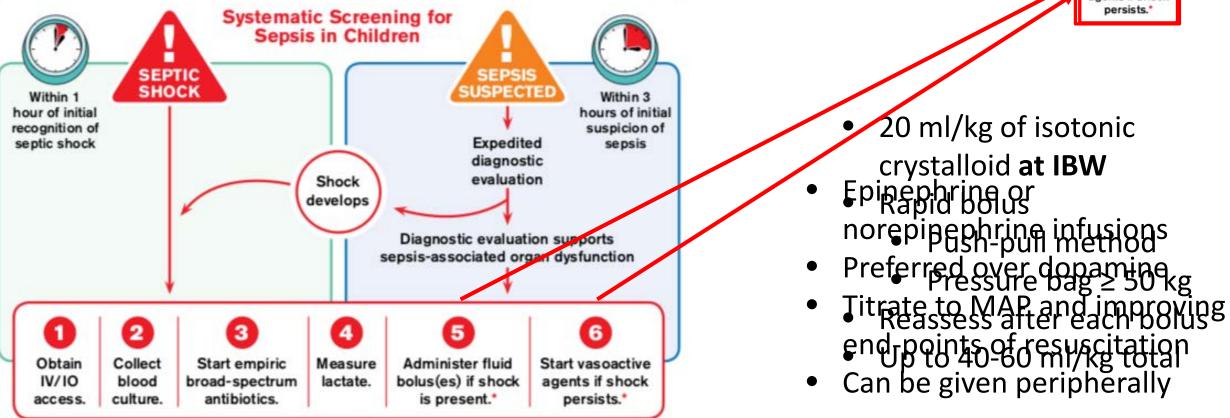




Initial Resuscitation Algorithm for Children

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6 Start vasoactive agents if shock persists.*



Surviving Sepsis ...

Campaign.





When is fluid resuscitation a good thing?

- Clinical markers of improving shock
 - Heart rate
 - Blood pressure
 - Capillary refill time
 - Level of consciousness
 - Urine output
 - Resolving lactic acidosis

| MAP in Children in a Hospital Setting | | |
|---------------------------------------|-----------------------------------|------------------------------------|
| Age | 5 th percentile (mmHg) | 50 th percentile (mmHg) |
| Neonate | 39 | 56 |
| 1-6 mo | 41-44 | 59-62 |
| 6-12 mo | 48 | 67 |
| 1-6 yr | 52-53 | 69-72 |
| 6-13 yr | 54-56 | 71-73 |
| 13-18 yr | 56-57 | 74-76 |

Roberts, et al. PCCM. 2020;21(9):e759-768





When is fluid resuscitation a bad thing?

- Signs of fluid overload from heart failure
 - Pulmonary edema: crackles, worsening respiratory status, x-ray findings
 - Hepatomegaly: liver palpable below costal margin
 - Ultrasound: full IVC with little respiratory variation
- Downstream effects
 - Increased mortality
 - Prolonged mechanical ventilation
 - Acute kidney injury





Respiratory support

- Supplemental O2 for all children with septic shock
- No recommendation on the timing of intubation in children without respiratory failure
- Noninvasive ventilation (CPAP, BiPAP) is an option for patients with respiratory distress and who are responding to resuscitation





Antibiotics

- Empiric broad-spectrum antibiotics are indicated to cover most likely pathogens
- Sepsis in children is most commonly due to Gram (-) and Gram (+) bacteria
- Special populations
 - Immunosuppressed
 - Indwelling devices
 - Recent hospital admissions

- Seasonal pathogens
- Neonates
- Recent immigration





Other management

- Hydrocortisone: consider for fluid- and pressor-refractory shock
- Fever control: unclear if fever is helpful or harmful
 - Comfort
 - Hyperpyrexia > 40°C
 - Refractory shock
- Blood glucose management: prevent low and high
- Transfusions
 - Hgb \geq 7 gm/dL
 - Platelets and plasma for clinical bleeding or specific populations





COVID pandemic effect

- Moderate-severe MIS-C presents similarly to septic shock
 - Fever
 - Cardiovascular compromise
 - Rash
- Acute COVID tests ±

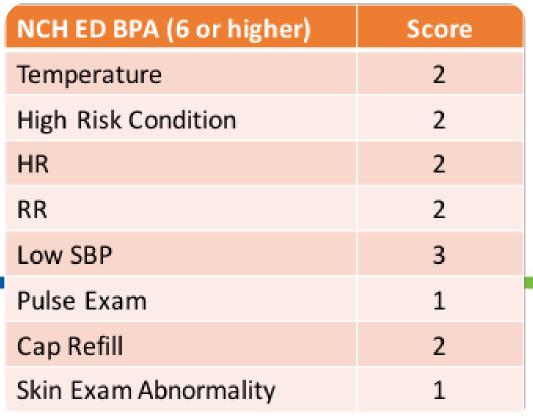
- GI symptoms
 - Mucocutaneous signs
- Elevated inflammatory markers
- Heart failure more prominent that hypovolemia
- Treatment: vasoactive drips, steroids, IVIG, biologics, antithrombic





EHR tools

- Pediatric sepsis screening tool
- Best practice advisory alerts
 - Scoring systems based on vital signs ± labs
 - Pop-up window when opening chart
- Pediatric sepsis order set
- Data accumulation for QI activities
- Unit-based or hospital-wide





Tertiary care transfer

- Septic shock and sepsis-associated organ dysfunction
- Intubation/chronic respiratory failure
- Complex medical issues
- Possible need for extracorporeal support
 - ARDS and refractory hypoxia
 - Renal replacement therapy
 - Plasma exchange





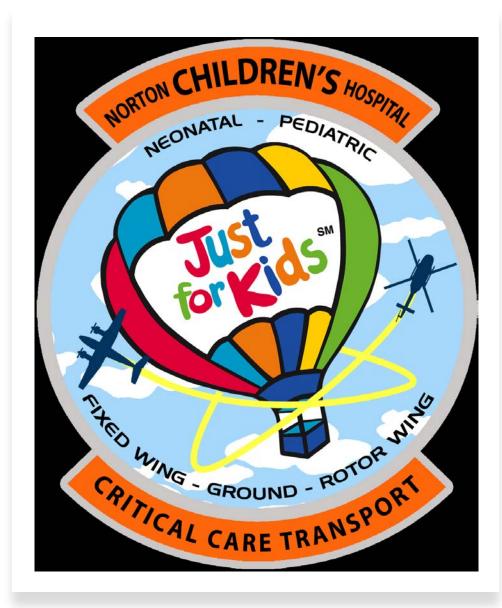


Just for Kids Transport

- Mobile ICU for ages 0-21 years
- Respiratory devices
 - Heated high-flow nasal cannula
 - BiPAP/CPAP
 - Mechanical ventilation
- Cardiovascular support/IV access

1-(888) 729-9111

• On-line medical direction



Recommendations

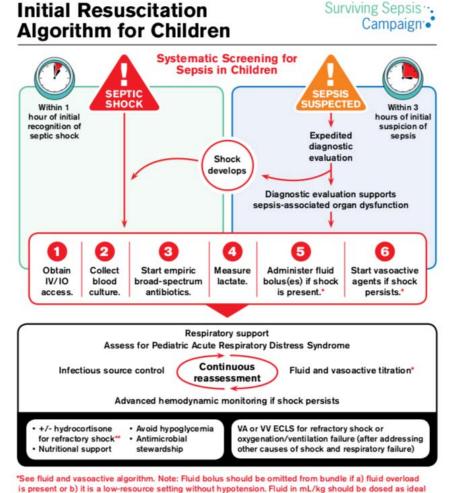
- Pediatric sepsis screening tool and management protocol
- Focus on good IV skills
- Frequent reassessment of patient status
- Prevent treatment delays
- Early, appropriate use of pediatric transport services

Review Surviving Sepsis Guidelines in the context of your practice





Surviving Sepsis Campaign Algorithm



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.

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

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Surviving Sepsis Campaign Algorithm

Fluid and Vasoactive-Inotrope Campaign• Management Algorithm For Children **Healthcare Systems** Healthcare Systems WITH Intensive Care н **WITHOUT Intensive Care** SEPTIC SHOCK Abnormal Perfusion with Abnormal perfusion Abnormal perfusion or without Hypotension WITHOUT WITH hypotension* hypotension If signs of fluid overload If signs of fluid overload are absent, administer Do NOT give fluid are absent, administer fluid bolus, 10-20 mL/kg. bolus unless fluid bolus, 10-20 mL/kg. there are signs of Assess hemodynamic Repeat assessment of dehydration with hemodynamic response response to fluid and ongoing fluid losses to fluid and consider fluid repeat fluid boluses, 10-20 (eg, diarrhea). boluses, 10-20 mL/kg, until mL/kg, until hypotension shock resolves or signs of resolves or signs of Start maintenance fluid overload develop. fluids. fluid overload develop. Monitor Assess cardiac function. Assess cardiac function (if available) hemodynamics Consider epinephrine closely. if there is myocardial Consider epinephrine/ norepinephrine if dysfunction or epinephrine/ Consider vasoactivehypotension persists norepinephrine if shock inotropic support persists after 40-60 mL/ (if available). after 40 mL/kg or kg (or sooner if signs of sooner if signs of fluid fluid overload develop). overload develop. Fluid in mL/kg should be dosed as ideal body weight. Shock resolved, perfusion improved Do not give more Consider Monitor for signs/symptoms fluid boluses. maintenance fluids. of recurrent shock. SBP *Hypotension SBP SBP Presence of all 3 World in healthcare < 50 mm Hg < 60 mm Hg < 70 mm Hg Health Organization criteria: systems WITHOUT in children in children in children OR cold extremities, prolonged intensive care is aged < 12 aged 1 to 5 aged > 5 capillary refill > 3 seconds, defined as either: months weak/fast pulse years years www.sccm.org/SurvivingSepsisCampaign/Guidelines/Pediatric-Patients © 2020 the Society of Critical Care Medicine and the European Society of Intensive Care Medicine. All Rights Reserved. \triangle Society or Critical Care Medicine

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