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Pediatric Sepsis

About the Guideline

- The guideline was developed by a panel consisting of 49 international experts from 12 international organizations.
- The guideline includes 77 statements on the resuscitation and management of children with septic shock and sepsis-related organ dysfunction, including 6 strong recommendations, 52 weak recommendations, and 9 best-practice statements.
- Septic shock is defined as a severe infection leading to cardiovascular dysfunction (including hypotension, the need for treatment with vasoactive medications, and impaired perfusion). Sepsis-associated organ dysfunction is defined as a severe infection leading to cardiovascular or noncardiovascular organ dysfunction, or both.
- The guideline is intended for children (ranging in age from at least 37 weeks' gestation or greater at birth to 18 years) with septic shock or sepsis-associated organ dysfunction.

Key Clinical Considerations

Become familiar with the recommendations and best-practice statements provided in this guideline, especially if you work in an acute care setting.

Diagnosis

- Children with sepsis and septic shock require emergent assessment and treatment, with frequent reevaluation of their response to treatment.
- Institute systematic screening for sepsis, because early recognition leads to prompt treatment and improves outcomes. The guideline does not recommend an optimal screening tool, and instead suggests adapting screening tools to the type of patients, resources, and processes particular to each facility.
- Obtain blood cultures before initiating antibiotic therapy, provided this will not substantially delay antibiotic administration.
- Obtain additional cultures from urine, cerebrospinal fluid, and tracheal aspirate, as well as from fluids from other drainage devices, as appropriate, to identify other potential pathogens.
- No recommendation exists for use of lactate levels in children; however, in practice, panel members report measuring lactate levels to evaluate for septic shock and sepsis-associated organ dysfunction if levels can be rapidly obtained.

Antimicrobial Therapy

- Initiate broad-spectrum antibiotics within one hour of recognition for septic shock; within three hours for sepsis-associated organ dysfunction.
- Once sensitivities and pathogen are identified, narrow the antibiotic coverage. The duration of antibiotic therapy is based on the site of infection, the identified organism, the response to treatment, and the ability to obtain source control. The duration of therapy commonly ranges from seven to 14 days.

- If, in collaboration with experts in infectious diseases and microbiology, no pathogen is identified, then narrow the antibiotic coverage or stop antibiotic therapy depending on the child's clinical presentation, infection site, risk factors, and degree of clinical improvement.
- Reserve multidrug antibiotic therapy for children who are immune compromised and those who are at high risk for multidrug-resistant pathogens, or both.
- Assess antibiotic therapy daily, and de-escalate, when possible; base assessment on clinical findings and laboratory test results.

Source Control

- Identify the source of infection and remove intravenous access devices that are determined to be the source of sepsis or septic shock ***after*** establishing other vascular access, and depending on pathogen and risk versus benefit of a procedure.

Fluid Therapy

- In facilities with intensive care services, administer up to a 40 to 60 mL/kg bolus of isotonic crystalloid fluid in increments of 10 to 20 mL/kg per bolus, if the child is hypotensive. Titrate to clinical cardiac output markers, such as heart rate, blood pressure, capillary refill time, level of consciousness, and urine output. Discontinue if signs of fluid overload develop.
- In facilities where an intensive care unit is not available and if the child becomes hypotensive, limit initial fluid resuscitation to no more than 40 mL/kg.
- If the child does not become hypotensive, do not administer a fluid bolus; instead, administer maintenance IV fluids.

Hemodynamic Monitoring

- The target mean arterial pressure (MAP) should be between the 5th and 50th percentile, or greater than the 50th percentile for age.
- Use advanced hemodynamic monitoring (cardiac output, cardiac index, systemic vascular resistance, or central venous oxygen saturation) and clinical findings to guide fluid resuscitation.

Vasoactive Medications

- Begin EPINEPHrine or norepinephrine, if needed, after 40 to 60 mL/kg of fluid resuscitation if there are continued signs of abnormal perfusion, or sooner if fluid overload develops or other concerns related to fluid administration exist.
- Consider adding vasopressin or further titrating the vasopressors EPINEPHrine or norepinephrine in those children with septic shock requiring high-dose vasoactive infusions.

Corticosteroids

- The routine use of IV hydrocortisone is not recommended, but consider IV hydrocortisone if adequate fluid resuscitation and vasopressor therapy do not restore hemodynamic stability.

Blood Products

- Avoid red blood cell transfusion for hemoglobin 7 g/dL or higher, if the child is hemodynamically stable.

- Avoid plasma administration and platelet transfusion based solely on laboratory values if there is no active bleeding.
- Avoid routine use of IV immune globulin.

Mechanical Ventilation

- Consider a trial of noninvasive mechanical ventilation in those children who respond to initial resuscitation and who are without a clear indication for intubation. Closely monitor the child's condition.
- Avoid etomidate during intubation; consider ketamine and fentaNYL instead.
- If intubation is needed, consider the use of neuromuscular blocking agents for the first 24 to 48 hours in children with severe pediatric acute respiratory distress syndrome (PARDS).
- Consider high positive end-expiratory pressure (levels higher than 10 cm H_2O pressure may be needed with progressive hypoxemia) in children with PARDS; titrate to individual need and hemodynamic status.
- Initiate prone positioning for at least 12 hours per day, as tolerated, in children with severe PARDS.
- Avoid routine use of inhaled nitric oxide. Use it only as a rescue therapy with sepsis-induced PARDS and refractory hypoxemia after optimizing other oxygenation strategies.

Endocrine and Metabolic Interventions

- Routine insulin therapy to maintain a blood glucose level 140 mg/dL or below is *not* recommended; hypoglycemia should be avoided.
- Target blood glucose levels below 180 mg/dL are suggested; avoid hypoglycemia during insulin therapy, if used.
- Consider a permissive approach to fever or antipyretic therapy to optimize comfort, reduce metabolic demand, and to reduce extreme hyperthermia.

Nutrition

- Begin enteral nutrition through a gastric tube (rather than a postpyloric feeding tube) within 48 hours of admission, unless contraindicated.
- Do not withhold enteral feeding solely because of vasoactive medication use; enteral feeding is not contraindicated after adequate hemodynamic resuscitation, if escalating doses of vasopressors are no longer needed, or if weaning from vasoactive medications has begun.
- Consider withholding parenteral nutrition in the first 7 days following admission, with preference given to feeding enterally when able, unless the child is malnourished.
- Do not routinely measure gastric residual volumes.
- Avoid the routine use of prokinetic agents for feeding intolerance.
- Avoiding the use of supplements, such as specialized lipids, selenium, glutamine, arginine, zinc, ascorbic acid (Vitamin C), thiamine, and Vitamin D.

Advanced Life Saving Measures

- Plasma exchange in children with septic shock or other sepsis-associated organ dysfunction without thrombocytopenia-associated multiple organ failure is not recommended.

- Use renal replacement therapy to prevent or treat fluid overload in those children who are unresponsive to fluid restriction and diuretic therapy. Use standard hemofiltration over high-volume hemofiltration.
- Consider veno-veno extracorporeal membrane oxygenation (ECMO) in children with sepsis-induced PARDS and refractory hypoxemia. Reserve venoarterial ECMO for rescue therapy in septic shock, when all other treatments have been exhausted.

Prophylaxis

- Reserve stress ulcer prophylaxis for those children at high risk.
- Reserve deep vein thrombosis prophylaxis (mechanical or pharmacologic) for those at high risk (obesity, cancer, or children with multiple medical conditions, in particular kidney and cardiac disease).

Reference:

Weiss, S. L., Peters, M. J., Alhazzani, W., Agus, M., Flori, H. R., Inwald, D. P., Nadel, S., Schlapbach, L. J., Tasker, R. C., Argent, A. C., Brierley, J., Carcillo, J., Carrol, E. D., Carroll, C. L., Cheifetz, I. M., Choong, K., Cies, J. J., Cruz, A. T., De Luca, D., Deep, A., … Tissieres, P. (2020). Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children. *Pediatric critical care medicine: a journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies*, *21*(2), e52–e106. https://doi.org/10.1097/PCC.0000000000002198

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