

ENA Topic Brief

Key Information

- Sepsis is one of the leading causes of death in children worldwide.²
- The etiology of pediatric sepsis is varied, with the bloodstream and the respiratory and genitourinary systems being the most common sites of origin.^{2,4}
- Each year, between 20,000 and 40,000 children in the United States are diagnosed with sepsis.⁵
- Guidelines for early diagnosis and treatment of pediatric sepsis have been developed and updated twice since 2002.⁷
- Early recognition and rapid intervention have been shown to decrease morbidity and mortality in the pediatric patient with sepsis.^{2,4}

Early Recognition of Sepsis in the Pediatric Patient

Purpose

Advancements in detection and treatment of sepsis in the adult population have resulted in sepsis treatment protocols in emergency departments (EDs) across the country.¹ Early recognition of sepsis in the pediatric patient is impeded by wide variations in age-specific vital sign ranges and the need for care providers to have knowledge of normal growth and development stages. Some emergency departments have yet to develop pediatric sepsis care protocols or resources despite literature showing that such interventions improve outcomes.^{2,3,4} The purpose of this topic brief is to provide information and resources for the timely identification of sepsis in the pediatric patient (beyond the neonatal period) and the appropriate emergency nursing care.

Overview

Pediatric sepsis continues to be a major cause of mortality and morbidity despite improvements in treatment and the development of evidence-based guidelines.¹ Because early intervention produces the best outcomes, it is imperative that adherence to these guidelines begins in the emergency department.^{1,2} Education leading to an increased awareness of the incidence of pediatric sepsis will result in timely recognition of the early signs, early intervention, and decreased morbidity and mortality in this patient population.^{1,3}

Sepsis affects 20,000 to 40,000 children annually in the United States.⁵ Most pediatric patients with sepsis have one or more comorbidities, most commonly cancer or congenital cardiac disease.^{4,5}

Considerations for Care

Triage

Children's hospitals account for only 10% of pediatric emergency care, with the majority of children receiving care in all-ages, or blended, emergency departments (EDs).⁶ Resources and support to achieve early identification and treatment for multigenerational EDs is crucial to adequately meet the needs of the pediatric population. Waiting for admission to the intensive care unit or transfer to a pediatric center to

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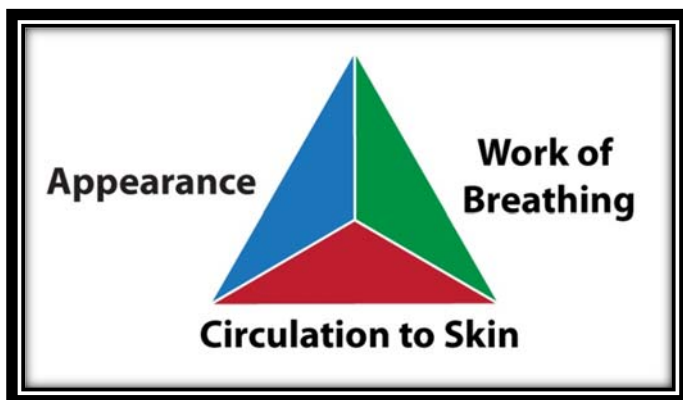
initiate a sepsis protocol may be or is detrimental.¹ Recognition of the signs of sepsis at triage, and early intervention while still in the emergency department, can prevent the development of sepsis and septic shock.

Larsen et al.² reviewed inpatient protocols and guidelines for the identification and treatment of pediatric shock, including those of the American College of Critical Care Medicine and the American Heart Association Pediatric Advanced Life Support, and adapted them for the unique environment of the emergency department, beginning in triage.

Components of this ED-specific protocol for pediatric patients presenting with risk factors for sepsis include a complete set of values for vital signs and parameters for clinical assessment. In sepsis, abnormal vital signs, such as fever (or hypothermia in the young infant) and tachycardia, are often indicators of an inflammatory response and early compensation for shock.

Other clinical findings associated with sepsis are those consistent with early and progressive shock. These include delayed capillary refill, altered mental status, diminished or bounding pulses, and skin that is either cool and mottled or flushed and ruddy. As septic shock progresses, oxygenation and perfusion are impaired, lactic acidosis develops, heart and respiratory rates begin to fall, and hypotension ensues.^{1,2,3,4,8,9,10} The use of the Pediatric Assessment Triangle (PAT) can help identify some of these findings (Figure 1). The PAT is intended to be a rapid, across-the-room, visual assessment. The three components of the PAT are general appearance or mental status, work of breathing, and circulation to the skin. Noting these sometimes subtle signs in triage can enable the nurse and healthcare team to initiate a set of interventions based on accepted guidelines.^{11,12}

Figure 1: Pediatric Assessment Triangle



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Electronic Medical Record (EMR)

Use of the electronic medical record (EMR) incorporating evidence-based practice guidelines has led to improvement in patient care and outcomes.^{13, 14, 15, 16, 17} When vital signs and assessment findings are entered into the patient record, many EMRs can be programmed to recognize criteria for early sepsis and trigger the practice guideline to initiate interventions. However, the EMR will not trigger alerts for those with subtle signs, and some systems may not have the capacity to incorporate bundles for complex diagnoses like sepsis. Therefore, relying on technology alone to identify patients at risk is not advised. Awareness and education about key assessment criteria for the emergency nurse will complement the use of the EMR and can facilitate early recognition of sepsis and timely intervention.

Care Guidelines

The Surviving Sepsis Campaign: Pediatric Considerations is a useful resource for the development of clinical practice guidelines for pediatric sepsis.¹ Evidence-based clinical practice guidelines provide clear direction and a common goal for the interdisciplinary team. Guidelines are implemented at triage, have clear, identified disposition criteria, and include items such as:¹

- A consistent weight estimation tool¹⁸
 - An accurate weight, whether obtained with a scale locked to read only in kilograms or a length-based resuscitation tape, is the foundation of efficient and accurate dosing for fluid resuscitation and medication administration for the pediatric patient with shock symptoms.
- Monitoring
 - Dynamic cardiopulmonary monitoring facilitates trending of vital signs.
- Oxygen administration
 - The recommendation is to begin with a high-flow face mask and, if further intervention to improve oxygenation is needed, switch to a high-flow nasal cannula or continuous positive airway pressure (CPAP).
- Vascular access
 - Fluid resuscitation is indicated for the patient in septic shock. Peripheral intravenous or intraosseous access is preferred to facilitate early infusion to replace fluids lost from the intravascular space. The process of obtaining central venous access may delay fluid resuscitation.
- Fluid administration
 - Fluid boluses (given over 5 to 10 minutes) of 20 mL/kg of isotonic crystalloid or 10 mL/kg of albumin are recommended to reach the end points of resuscitation.¹⁹
 - Recommended endpoints of fluid resuscitation:¹
 - Capillary refill of less than or equal to 2 seconds
 - Blood pressure within normal parameters for age

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- Normal pulses, neither bounding nor diminished, that are equal when comparing central and peripheral
- Warm extremities
- Urine output of greater than 1 mL/kg/hour
- Normal mental status without sedation
- Stop fluid administration in the presence of hepatomegaly or rales and begin inotropic support
- Antibiotics and source control¹
 - Early antibiotic therapy within an hour of identification of sepsis is recommended for best outcomes.
 - Initial broad spectrum therapy is advised, narrowing to a targeted approach as the source organism is identified.
 - Obtaining blood and other cultures before beginning antibiotic therapy is recommended, but if this step causes a delay in antibiotic administration, it should be deferred.
- Lactate levels⁸
 - Early elevation of lactate levels is associated with greater incidence of sepsis and organ dysfunction in the pediatric patient with signs of systemic inflammatory response.
- Early consult and transfer criteria

Application of clinical practice guidelines created collaboratively by emergency care, critical care, and inpatient providers for pediatric patients meeting the criteria for suspected sepsis, can ensure early recognition and intervention, thereby improving patient outcomes. Nurse-initiated protocols, bundles, and policies that are developed with collaboration with the emergency physician and based upon established guidelines, with specific inclusion and exclusion criteria, can prevent delays in implementation of care.

Definitions and terminology

Various definitions and terminology associated with sepsis have been used over the years. The Society of Critical Care Medicine and the European Society of Intensive Care medicine convened a panel to create the Third International Consensus Definitions for Sepsis and Septic Shock.²² The forum included experts in the fields of emergency and critical care medicine, trauma and epidemiology. This task force used expert debate and opinion, Delphi process, analysis of patient databases, peer review and finally endorsement to put forth a consensus on definitions and clinical criteria. Their recommendations included the elimination of the use of the terms systemic inflammatory response syndrome (SIRS) and severe sepsis. This group advocated for the use of the Sequential Organ Failure Assessment (SOFA) tool to define the severity of sepsis-induced organ dysfunction. Because the SOFA tool defines sepsis-induced organ dysfunction in the adult population and not for pediatric patients, no consensus on definition of

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pediatric sepsis-induced organ dysfunction exists at this time. Recommendations were made to define and develop additional resources for the pediatric patient.²²

Conclusion

Sepsis continues to be an urgent and life-threatening healthcare condition for pediatric patients. Research in this area has led to the identification of strategies and techniques that enhance patient care and improve patient outcomes. Although recent literature indicates more research, resources, definitions are needed for the pediatric patient; pediatric-specific guidelines have been developed and are available for implementation.

Definition of Terms

Term:	Definition:
Altered mental status:	A deviation from baseline neurologic and/or developmental function. Behaviors in the pediatric patient that may indicate altered mental status include: restlessness, agitation, irritability, inappropriate cry, inconsolability, combativeness, drowsiness, confusion, delirium, lethargy, stupor, and obtundation. ²⁰
Fluid bolus:	Large volume of fluid given intravenously over a short period of time. ²¹
Sepsis:	Systemic response to an infectious process that produces life-threatening organ dysfunction. ²²
Septic shock:	Sepsis with cardiac output dysfunction. Hypotension is not considered one of the criteria for definition as it includes both early and late shock and hypotension occurs late in the shock state. ¹
Sepsis-induced hypotension:	Systolic blood pressure (SBP) less than 90 mmHg, mean arterial pressure (MAP) less than 70 mmHg, or an SBP decrease greater than 40 mmHg or a decrease greater than two standard deviations below normal for age in the absence of other causes of hypotension. ¹



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References

1. Dellinger, R. P., Levy, M. M., Rhodes, A., Annane, D., Gerlach, H., Opal, S. M., ... The Surviving Sepsis Campaign Guidelines Committee. (2013). Surviving Sepsis Campaign: International guidelines for management of severe sepsis and septic shock, 2012. *Intensive Care Medicine*, 39(2), 165–228. doi:10.1007/s00134-012-2769-8
2. Larsen, G. Y., Mecham, N., & Greenberg, R. (2011). An emergency department septic shock protocol and care guideline for children initiated at triage. *Pediatrics*, 127(6), e1585–e1592. doi:10.1542/peds.2010-3513

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3. Randolph, A. G. & McCulloh, R. J. (2014). Pediatric sepsis: Important considerations for diagnosing and managing severe infections in infants, children, and adolescents. *Virulence*, 5(1), 179–189. doi:10.4161/viru.27045
4. Ruth, A., McCracken, C. E., Fortenberry, J. D., Hall, M., Simon, H. K., & Hebbbar, K. B. (2014). Pediatric severe sepsis: Current trends and outcomes from the Pediatric Health Information Systems database. *Pediatric Critical Care Medicine Journal*, 15(9), 828–838. doi:10.1097/PCC.0000000000000254
5. Riley, C., & Wheeler, D. S. (2012). Prevention of sepsis in children: A new paradigm for public policy. *Critical Care Research and Practice*, 2012. Article ID 437139. doi:10.1155/2012/437139
6. Kessler, D.O., Walsh, B., Whitfill, T., Gangadharan, S., Gawel, M., Brown, L., & Auerbach, M. (2015). Disparities in adherence to pediatric sepsis guidelines across a spectrum of emergency departments: A multicenter, cross-sectional observational in situ simulation study. *The Journal of Emergency Medicine*, doi: 10.1016/j.jemermed.2015.08.004
7. Rozenfeld, R. A. (2014). Sepsis guidelines: The work of the Society of Critical Care Medicine. *Clinical Pediatric Emergency Medicine*, 15(2), 120–122. doi:<http://dx.doi.org/10.1016/j.cpem.2014.05.001>
8. Scott, H. F., Donoghue, A. J., Gaieski, D. F., Marchese, R. F., & Mistry, R. D. (2012). The utility of early lactate testing in undifferentiated pediatric systemic inflammatory response syndrome. *Academic Emergency Medicine*, 19(11), 1276–1280. doi:10.1111/acem.12014
9. Society of Critical Care Medicine (2015). *Surviving Sepsis Campaign: Updated bundles in response to new evidence*. Retrieved from http://www.survivingsepsis.org/sitecollectiondocuments/ssc_bundle.pdf
10. Society of Critical Care Medicine (2012). *Surviving Sepsis Campaign: Recommendations: Special consideration in pediatrics*. Retrieved from <http://www.survivingsepsis.org/Guidelines/Documents/Pediatric%20table.pdf>
11. Booth, J. S. (2014). *Pediatric resuscitation technique*. Retrieved from the Medscape website: <http://emedicine.medscape.com/article/1948389-technique>
12. Horeczko, T., Enriquez, B., McGrath, N. E., Gausche-Hill, M., & Lewis, R. J. (2013). The Pediatric Assessment Triangle: Accuracy of its application by nurses in the triage of children. *Journal of Emergency Nursing*, 39(2), 182–189. doi:10.1016/j.jen.2011.12.020
13. Fiks, A. G., Zhang, P., Localio, A. R., Khan, S., Grundmeier, R. W., Karavite, D. J., ... Forrest, C. B. (2015). Adoption of electronic medical record-based decision support for otitis media in children. *Health Services Research*, 50(2), 489–513. doi:10.1111/1475-6773.12240
14. Escobedo, M., Kirtane, J., & Berman, A. (2013). Health information technology: A path to improved care transition and proactive patient care. *Generations - Journal of the American Society on Aging*, 38(4), 56–62.
15. Schulz, L., Osterby, K., & Fox, B. (2013). The use of best practice alerts with the development of an antimicrobial stewardship navigator to promote antibiotic de-escalation in the electronic medical record. *Infection Control and Hospital Epidemiology*, 34(12), 1259–1265. doi:10.1086/673977
16. Saviñon, C., Taylor, J. S., Canty-Mitchell, J., & Blood-Siegfried, J. (2012). Childhood obesity: Can electronic medical records customized with clinical practice guidelines improve screening and diagnosis? *Journal of the American Academy of Nurse Practitioners*, 24(8), 463–471. doi:10.1111/j.1745-7599.2012.00735.x

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17. Topaz, M., Radhakrishnan, K., Masterson-Creber, R., & Bowles, K. H. (2012). Putting evidence to work: Using standardized terminologies to incorporate clinical practice guidelines within homecare electronic health records. *Online Journal of Nursing Informatics, 16*(2). Retrieved from <http://ojni.org/issues/?p=1694>
18. Emergency Nurses Association (2012). *Position statement: Weighing pediatric patients in kilograms*. Retrieved from <https://www.ena.org/SiteCollectionDocuments/Position%20Statements/WeighingPTsinKG.pdf>
19. American Heart Association (2015). Web-based integrated 2010 & 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care: Part 12: Pediatric advanced life support. Retrieved from <https://eccguidelines.heart.org/wp-content/themes/eccstaging/dompdf-master/pdffiles/part-12-pediatric-advanced-life-support.pdf>
20. Hockenberry, M. J., & Wilson, D. (Eds.). (2015). *Wong's nursing care of infants and children* (10th ed.). St. Louis, MO: Mosby Elsevier.
21. Intravenous bolus. In *Free Medical Dictionary*. Retrieved from <http://medical-dictionary.thefreedictionary.com/intravenous+bolus>
22. Singer, M., Deutschman, C.S., Seymour, C.W., Shankar-Hari, M., Annane, D., Bauer, M.,...Angus, D.C. (2016). The Third International Consensus Definitions for Sepsis and Septic Shock. *JAMA Cardiology 315*(8), 762-774. doi:10.1001/jama.2016.0288

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