Selected Best Practices and Suggestions for Improvement

PDI 10: Postoperative Sepsis

Why focus on postoperative sepsis in children?

- Postoperative sepsis remains a major surgical complication in children, occurring in around 10 per 1,000 surgical pediatric discharges.[1]
- In the United States, the overall incidence of sepsis has increased significantly in recent decades.[2]
- One study found this complication resulted in an average excess length of stay of 26 days and $117,815 in additional charges[1]; another study found an excess length of stay of 23.52 days and even higher excess charges of $261,173.[3]

Recommended Practice	Details of Recommended Practice
Implement strategies to prevent sepsis.	Infection prevention strategies include general infection control practices, hand washing, and strategies to prevent nosocomial infections.[4]
Screen patients for sepsis.	Develop a 1-page sepsis screening tool; integrate tool into electronic medical record.[5,6]
Use a sepsis resuscitation bundle.	Develop a specific resuscitation bundle with end goals specific to the pediatric population.[5]
Develop policies and procedures.	Use Surviving Sepsis Campaign's evidence-based guidelines; include the 3-hour and 6-hour bundles.[5]
Adopt sepsis measures.	Evaluate compliance by using process measures such as door-to-antibiotic time; share reports regularly to communicate progress.[5]

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, respiratory therapists, dietitians, and pharmacists from infection control, intensive care, and inpatient pediatric units, including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care.[5]

Recommended Practice: Implement strategies to prevent sepsis

- General infection control practices include[4]:

  o Use standard precautions for all patients.
  o Apply contact precautions for appropriate patients with pathogens that can be transmitted by direct or indirect contact.
  o Apply droplet precautions to patients with pathogens that can be transmitted by infectious droplets.

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- o Apply airborne precautions to patients with epidemiologically important pathogens that can be transmitted by the airborne route.

- Require hand washing before and after any patient contact and handling of any contaminated items, and between tasks and procedures.
- Reduce nosocomial infections by implementing the following:

  - o Oral care and proper positioning to prevent nosocomial pneumonia
  - o Appropriate insertion, maintenance, and removal protocols for all invasive catheters
  - o Appropriate skin and wound care

Recommended Practice: Screen patients for sepsis

- Develop a 1-page sepsis screening tool using a standardized set of physiologic triggers or early warning signs that alert providers to respond quickly with appropriate interventions; integrate tool into electronic medical record, if applicable.
- Ensure that nurses assess patients with a history suggestive of a new infection for sepsis at least daily.
- Ensure that screening begins upon patient arrival at the emergency department or soon after hospital admission, if not admitted through the ED.
- Use a rapid response team to respond to a positive screen.
- Pilot the screening tool with 1 or 2 nursing units. Allow the staff piloting the tool to provide feedback. Incorporate staff feedback when the tool is revised.

Recommended Practice: Use a sepsis resuscitation bundle

- Develop a pediatric sepsis resuscitation bundle with the following elements[5]:

  - o Start with addressing hypoxemia or respiratory distress, if present.

    - Consider using any of the following to improve oxygenation: face mask, high-flow nasal cannula, or nasopharyngeal continuous positive airway pressure (CPAP). If mechanical ventilation is used, use lung-protective strategies whenever possible.

  - o Aim for end goals of pediatric sepsis resuscitation at central venous oxygen saturation ($ScvO_2$) greater than or equal to 70% and a cardiac index between 3.3 and 6.0 $L/min/m^2$. Specific targets include:

    - A capillary refill of ≤ 2 s.
    - Normal blood pressure for age.
    - Normal pulses with no differential between peripheral and central pulses.
    - Warm extremities.
    - Urine output greater than 1 mL/kg/hr.
    - Normal mental status.
    - An initial hemoglobin of 10g/dL, then maintain greater than 7.0 g/dL.
    - Blood glucose target of ≤ 180 mg/dL.

  - o Use the American College of Critical Care Medicine-Pediatric Advanced Life Support (PALS) guidelines for the management of septic shock (refer to the Surviving Sepsis

Campaign Guidelines, Figure 2, for the PALS management algorithm; see Additional Resources, "Systems/Processes").

- o Evaluate and treat for pneumothorax, pericardial tamponade, or endocrine emergencies (e.g., hypoadrenalism and hypothyroidism) in patients with refractory shock.
- o Administer antibiotics within 1 hour of sepsis recognition. Blood cultures should ideally be obtained before the administration of antibiotics but should not delay the start of antibiotics.
- o Provide early and aggressive infection source control (e.g., debridement or drainage, peritoneal washout).
- o Perform fluid resuscitation with crystalloids or albumin.

    - Bolus 20 mg/kg over 5-10 minutes until hemodynamically stable.
    - Consider inotropic support if fluid resuscitation not successful. If low cardiac output and elevated systemic vascular resistance with normal blood pressure present, add vasodilator therapies.

- o Add extracorporeal membrane oxygenation (ECMO) in children with refractory septic shock or with refractory respiratory failure (if available).
- o Initiate timely hydrocortisone therapy in children with fluid-refractory, catecholamine-resistant shock and suspected or proven absolute (classic) adrenal insufficiency.
- o Use enteral nutrition in children who can tolerate it; parenteral nutrition in those who cannot.

Recommended Practice: Develop policies and procedures

- An organizationwide pediatric sepsis management protocol, policy, and/or procedures are necessary to integrate evidence-based guidelines into clinical practice.
- Convene a multidisciplinary team that includes different professions and service lines.[5]
- Incorporate the "Surviving Sepsis Campaign" evidence-based pediatric guidelines into the sepsis management protocol and/or procedures.[5]
- Develop a systemwide protocol. Institute the goal that all pediatric services use the same protocol, including the emergency and pediatric and neonatal intensive care departments.
- Develop order sets, preferably electronic, for nonsevere sepsis and for severe sepsis/septic shock.
- Develop a systemwide antibiotic policy and/or procedure that includes type, dosing, initiation, timing, and compatibility.
- Use a process for screening pediatric patients for sepsis, such as a paper or electronic screening tool that is 1 page and will take 2-3 minutes to complete. Also consider use of the rapid-response team for screening.
- Incorporate a mechanism for handoff communication between the emergency department and pediatric/neonatal intensive care unit.
- Implement a systemwide sepsis education program. Include didactic presentations and electronic offerings.

Recommended Practice: Adopt sepsis measures

- Organizational performance goals need to be determined. Use a retrospective chart review tool to identify baseline sepsis management compliance.

- o Evaluate compliance by using process measures such as door-to-antibiotic time; share reports regularly with stakeholders to communicate progress.

- Use a systemwide mechanism to share data with administrators, providers, and staff, such as a sepsis management dashboard and/or reports.

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in sepsis prevention and care (emergency department, intensive care unit, etc.). Education should occur upon hire, annually, and when this protocol is added to job responsibilities.[5]

Effectiveness of Action Items

- Track compliance with elements of established protocol steps.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.
- Mandate that all personnel follow the sepsis protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.[5]
- Monitor and evaluate performance regularly to sustain improvements achieved.[5]

Additional Resources

Systems/Processes

- The Pediatric Guidelines from the Surviving Sepsis Campaign: Considerations for Care
  http://sccmmedia.sccm.org/video/OnDemand/SurvivingSepsis/SSC-Pediatric-Guidelines.mp4
- AHRQ Innovations Exchange: Emergency Department Protocol Leads to Faster Identification and Treatment of Pediatric Patients With Sepsis
  https://innovations.ahrq.gov/profiles/emergency-department-protocol-leads-faster-identification-and-treatment-pediatric-patients

Policies/Protocols

- Stony Brook Medicine Severe Sepsis/Septic Shock Recognition and Treatment Protocols
  http://www.survivingsepsis.org/SiteCollectionDocuments/Protocols-Sepsis-Treatment-Stony-Brook.pdf

Tools

- Sepsis Pediatric Order Set - Stony Brook
  http://www.survivingsepsis.org/SiteCollectionDocuments/Protocols-Sepsis-Orders-Stony-Brook.pdf
- Pediatric ICU Severe Sepsis Screening Tool - Stony Brook
  http://www.survivingsepsis.org/SiteCollectionDocuments/Protocols-Pediatric-ICU-Screening-Tool.pdf

Staff Required

- Emergency Department staff
- Pediatric/Neonatal Intensive Care Unit staff
- Postoperative pediatric unit staff
- Ancillary staff (lab, respiratory, dietary, etc.)

Equipment

- Equipment for blood draws
- Appropriate medications, including antibiotics and vasopressors

Communication

- Communication of critical lactate and blood culture results to team in a timely manner

Authority/Accountability

- Senior leadership mandating protocol for all providers

References

1. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. Pediatrics 2004;113(6):1741-6.
2. Vogel TR, Dombrovskiy VY, Lowry SF. Trends in postoperative sepsis: are we improving outcomes? Surg Infect (Larchmt) 2009 Feb;10(1):71-8. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2846560/. Accessed May 17, 2016.
3. Kronman MP, Hall M, Slonim AD, et al. Charges and lengths of stay attributable to adverse patient-care events using pediatric-specific quality indicators: a multicenter study of freestanding children's hospitals. Pediatrics 2008;121(6):e1653-59.
4. Kleinpell RM, Munro CL, Giuliano KK. Targeting health care-associated infections: evidence-based strategies.In: Hughes RG, ed. Patient safety and quality: an evidence-based handbook for nurses. Rockville, MD: Agency for Healthcare Research and Quality; 2008. Chapter 42. http://www.ncbi.nlm.nih.gov/books/NBK2632/. Accessed May 17, 2016.
5. Dellinger RP, Levy MM, Rhodes A, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis shock: 2012. Crit Care Med 2013;41(2):580-637.
6. Cardoso T, Carneiro AH, Ribeiro O, et al. Reducing mortality in severe sepsis with the implementation of a core 6-hour bundle: results from the Portuguese community-acquired sepsis study (SACiUCI study). Crit Care 2010;4(3):R83.