Critically Analyze the Evidence

The GRADE criteria were used to evaluate the quality of evidence presented in research articles reviewed during the development of this guideline. The table below defines how the quality of evidence is rated and how a strong versus a weak recommendation is established.

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PICO Question 1: In infants, do maximum dwell times for central lines compared to unlimited dwell times decrease the rate of central line associated bloodstream infections (CLABSIs)?

Recommendation(s): In neonates with long-term venous access needs, replace umbilical venous catheters after a dwell time of 7 days with a PICC line – Strong recommendation, low quality evidence. In neonates with short-term venous access needs of 7 to 14 days, consider removing the UVC after a dwell time of 7 days and placing a PIV, if able to obtain. - Weak recommendation, low quality evidence. Complete daily reassessments of the necessity of central lines and remove as needed. - Strong recommendation, low quality evidence

A review of the literature revealed ten observational studies focusing on the relationship between catheter dwell time and the risk of CLABSI in infants and children. (1-10) A 2012 retrospective cohort study researching the effects of a PICC care bundle on the risk of CLABSI found that infants with a UVC dwell time ≤ 7 days had 1.0 CLABSI/1000 catheter days while infants with a UVC dwell time > 7 days had 4.0 CLABSI/1000 catheter days (p < 0.001). (3) Yumani 2013 reported umbilical catheter dwell-time less than 7 days compared to ≥ 7 days decreased the rate of catheter-associated bloodstream infections in neonates (RR 0.1, 95% CI 0.01 – 0.6, p=0.012). (9) There is inconsistent evidence on the PICC and/or CVC dwell time that increases the risk of CLABSIs with studies reporting an increase in infection as early as day seven. National guidelines recommend daily assessment of the need for central catheters and prompt removal when the line is no longer essential for patient care. (11)

PICO Question 2: In infants and children, does chlorhexidine use for cleansing hubs/ports compared to 70% alcohol decrease the rate of central line associated blood stream infections?

Recommendation(s): Weak Recommendation with low quality of evidence. Consider the use of chlorhexidine for cleansing hubs/ports of venous access catheters and administration sets without a contraindication for chlorhexidine use

Four observational studies that compared cleansing of the hub/port with chlorhexidine to 70% alcohol found an associated reduction in the rate of infections. (13-16) In a retrospective cohort study to determine if 2% chlorhexidine in 70% isopropanol reduced the rate of sepsicaemia in infants receiving parenteral nutrition due to congenital or acquired gastrointestinal anomalies, the incidence ratio of sepsis for the chlorhexidine group was 0.72 (95% CI: 0.61 – 0.84) compared with controls (p < 0.005). (13) Pichler (2014) reported 3.1 CRBSI/1000 catheter days when alcohol was used as the catheter connector antisepsis in children with intestinal failure receiving parenteral nutrition for >28 days. After changing the catheter hub/port disinfectant to 2% chlorhexidine in 70% isopropanol, the study reported a decrease in the rate of infection to 0.4 CRBSI/1000 catheter days. The method of disinfection used was to scrub the catheter for 30 seconds and allow the catheter hub to dry completely prior to use. (15) Miller (2011) compared the use of a chlorhexidine
(30-second scrub with a 30-second dry time) for catheter hubs/ports antisepsis, chlorhexidine impregnated sponges for dressing changes, and a combination of the two interventions with a control group to determine the effect of the rate of CLABSI in pediatric ICU patients. During this time period, the units implemented maintenance bundles. The study found that the rate of CLABSI decreased in all four groups without a statistically significant difference in results. (17)

In an experimental study, Hong (2013) compared catheter hub disinfection with 3.15% chlorhexidine gluconate – 70% isopropyl alcohol with 70% isopropyl alcohol alone. The study compared a swipe, 5, 15 and 30 second scrubs for each solution with at least a 30 second dry time. The study found that with a scrub time of at least 5 seconds and a dry time of at least 30 seconds there is not a significant difference between chlorhexidine-alcohol and alcohol alone. However, chlorhexidine showed residual disinfectant activity up to 24 hours and alcohol alone showed no continuing antimicrobial effectiveness. The procedure to test solutions for residual disinfectant activity was a 15 second scrub with a dry time of either 5 minutes or 24 hours at room temperature. (18)

**PICO Question 3:** In infants and children, what is the optimal timing for replacement of intravascular administration sets to decrease the rate of central line associated blood stream infections?

**Recommendation(s):** Strong recommendation, low quality evidence. Intravascular administration sets (tubing) for continuous infusions of fluids other than blood, blood products, or lipids should be changed no more frequently than every 96 hours. Intravascular administration sets (tubing) for continuous infusions of lipid containing parenteral nutrition should be changed every 24 hours.

A 2013 meta-analysis reviewed 16 studies (N=5001 patients) to identify the relationship between the frequency of administration set changes and the rate of CLABSI. The studies compared different combinations of intervals for administration set replacement including 24, 48, 72 and 96 hours. The meta-analysis reported the frequency of administration set replacement did not show an effect on catheter-related bloodstream infections (RR 1.06; 95% CI: 0.67 – 1.69). (19)

**PICO Question 4:** In infants and children, does the use of a PICC team compared to standard of care decrease the rate of central line associated blood stream infections?

**Recommendation:** Weak recommendation, low quality evidence. Hospitals should consider the use of a dedicated team of staff for the maintenance and insertion of central catheters.

Evidence demonstrates that the use of a PICC team is associated with a decrease in the rate of central line associated blood stream infections; however there is great variability in delegated tasks outlined in the literature. (20-23) In a 2012 observational study to determine the association between the establishment of a line maintenance team and the incidence of CLABSI, the overall rate of CLABSI before the line team was 12.9/1000 and 4.0/1000 catheter days after the implementation of the line team. The line team was responsible for all tubing changes, accessing central lines for blood draws, all dressing changes, and mid-study assumed responsibility for central line medication administration. (22) Taylor (2011) completed a before and after intervention to evaluate whether the implementation of a PICC team would reduce the rate of CLABSI in the NICU. This PICC team was responsible for weekly dressing changes and line assessments, identifying patients eligible for central lines, and PICC insertions. The study found that there was no difference in the rate of CRBSI between groups that had catheter dwell times of 0 to 29 days. Patients with catheter dwell times ≥ 30 days had less risk of CLABSI than controls (p = 0.047). (23) A retrospective review studying a cohort of patients that received central line dressing changes by bedside nurses compared to patients receiving dressing changes by infusion therapy team nurses found no difference in the rate of CLABSI during a one year period. (24)

**PICO Question 5:** In infants and children, does the use of silver-alginate-coated dressings compared to the standard of care decrease the rate of central line associated blood stream infections?

**Recommendation(s):** Weak recommendation, low quality evidence. Silver-alginate-coated dressings should not be used at this time to decrease the rate of CLABSI in neonates. Further research should be completed to determine the effects of this intervention on the risk of CLABSI in infants and children.

There is insufficient evidence to recommend the use of silver-alginate-coated dressings to reduce the rate of CLABSI in neonates. Hill (2010) did not detect a statistically significant difference in infection rates between the group of neonates with silver-alginate-coated dressings (12.4%; 11/89) and the control group (17.2%; 5/29). The study found no adverse skin changes or any other adverse events associated with the patch. (25) A 2010 randomized control trial was undertaken to measure the systemic absorption of silver in very low birth weight infants using silver-impregnated alginate catheter dressings. The study reported the treatment group had a 45.8% reduction in infections per 1000 catheter days, however the sample size (N=50) was insufficient to complete a meaningful statistical analysis. (26)
• In neonates with long-term venous access needs, replace umbilical venous catheters after a dwell time of 7 days with a PICC line – Strong recommendation, low quality evidence
• In neonates with short-term venous access needs of 7 to 14 days, consider removing the UVC after a dwell time of 7 days and placing a PIV, if able to obtain. - Weak recommendation, low quality evidence
• Complete daily reassessments of the necessity of central lines and remove as needed. (1-11) – Strong recommendation, low quality evidence
• Consider the use of chlorhexidine for cleansing hubs/ports of venous access catheters and administration sets without a contraindication for chlorhexidine use. (13-18) – Weak recommendation, low quality evidence
• Intravascular administration sets (tubing) for continuous infusions of fluids other than blood, blood products, or lipids should be changed no more frequently than every 96 hours. - Strong recommendation, low quality evidence
• Intravascular administration sets (tubing) for continuous infusions of lipid containing parenteral nutrition should be changed every 24 hours. (19) – Strong recommendation, low quality evidence
• Hospitals should consider the use of a dedicated team of staff for the maintenance and insertion of central catheters. (20-24) – Weak recommendation, low quality evidence

Evidence Against
• Silver-alginate-coated dressings should not be used at this time to decrease the rate of CLABSI in neonates. Further research should be completed to determine the effects of this intervention on the risk of CLABSI in infants and children. (25-29) – Weak recommendation, low quality evidence.

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.
References


Clinical Standards Preparation
This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children’s Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

Central Line-Associated Bloodstream Infection Prevention
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Additional EBOC Support
Tom Burke, Research Assistant
Sherin Titus, Research Assistant

Development Process
This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts

2. Review of Existing External Guidelines
   - Guidelines for the Prevention of Intravascular Catheter-Related Infections CDC, 2011
   - Infusion Nursing Standards of Practice 2011

3. Literature Review of Relevant Evidence
   - Searched: Pubmed, Cochrane Library, CINAHL

4. Critically Analyze the Evidence
   - 6 observational studies, 10 retrospective cohort studies, 1 epidemiologic study, 3 prospective cohort studies, 1 quality improvement studies, 2 experimental studies, 1 non-randomized studies, 1 meta-analysis, 1 randomized study, 1 intervention study, 2 randomized control trials

5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a Central Line-Associated Bloodstream Infection evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence
Published clinical guidelines were evaluated for this review using the AGREE II criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

The following categories describe how research findings provide support for treatment interventions. “Evidence Supports” provides evidence to support an intervention. “Evidence Against” provides evidence against an intervention. “Evidence Lacking/Inconclusive” indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn from the evidence.

The GRADE criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

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Recommendations
Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis/management of Central Line-Associated Bloodstream Infection Prevention in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process
Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children’s Hospital. Content Expert Teams are involved with every review and update.

Disclaimer
Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient’s family, to make the ultimate judgment regarding care.

Version History

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