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Effect of a vascular access team on central line-associated bloodstream infections in infants admitted to a neonatal intensive care unit: A systematic review

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ABSTRACT

Objective: To review the effect of a vascular access team on the incidence of central line-associated bloodstream infections in infants admitted to a neonatal intensive care unit.

Data sources MEDLINE, CINAHL, Embase, Web-of-Science and the Cochrane Library were searched until December 2013.

Study Selection Studies that evaluated the implementation of a vascular access team, and focused on the incidence of central line-associated bloodstream infections in infants admitted to a neonatal intensive care unit, were selected.

Data Extraction Incidence rates of central line-associated bloodstream infections were extracted, as well as information on vascular access team tasks and team composition. The quality of studies was critically appraised using the McMaster tool for quantitative studies.

Data Synthesis Seven studies involving 136 to 414 participants were included. In general, the implementation of a vascular access team coincided with the implementation of concurrent interventions. All vascular access teams included nurses, and occasionally included physicians. Main tasks included insertion and maintenance of central lines. In all studies, a relative decrease of 45–79% in central line-associated bloodstream infections was reported.

Conclusions: A vascular access team is a promising intervention to decrease central line-associated bloodstream infections in infants admitted to a neonatal intensive care unit. However, level of evidence for effectiveness is low. Future research is required to improve the strength of evidence for vascular access teams.

What is already known about the topic?

- Central line-associated bloodstream infections occur frequently within a neonatal intensive care unit.
- Premature infants are particularly vulnerable to bloodstream infections.

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What this paper adds?

- This is the first review on the effectiveness of a neonatal vascular access team on central line-associated bloodstream infections.
- A vascular access team is a promising intervention to decrease central line-associated bloodstream infections in infants admitted to a neonatal intensive care unit.
- The composition and tasks of a vascular access team are delineated.

1. Introduction

Central line-associated bloodstream infections occur frequently in neonatal intensive care units, with reported incidences of 11.6 to 35.2 per 1000 catheter days among all admitted infants (Aly et al., 2005; Holzmann-Pazgal et al., 2012; Wright et al., 2002). Incidence rates among very low birth weight infants (<1500 g) differ from 11% to 53% (Aziz et al., 2005; Ng et al., 2004; Stoll et al., 2002). Premature infants are particularly vulnerable to bloodstream infections, due to their compromised immune system, exposure to multiple healthcare workers, and invasive interventions (Cooley and Grady, 2009).

Multiple definitions for central line-associated bloodstream infection are found in the literature. The Centers for Disease Control definition is used in this study. Central line-associated bloodstream infections can be defined as "a laboratory-confirmed bloodstream infection where a central line or umbilical catheter was in place for >2 calendar days, with all elements of the bloodstream infection criteria first present together, with day of device placement being day 1, and a central line or umbilical catheter was in place on the date of event or the day before" (CDCP, 2012).

Especially in very low birth weight infants, central line-associated bloodstream infections are associated with an increase in morbidity, mortality, length of hospital stay and costs (Aly et al., 2005; Holzmann-Pazgal et al., 2012). In addition, bloodstream infections also increase the incidence of chronic lung disease, brain injury, poor neuro-developmental outcomes and gastrointestinal disease (Helder et al., 2013; Singhal and La Gamma, 1996).

Many strategies have been developed to decrease episodes of central line-associated bloodstream infections, such as maximum sterile barrier precautions for line insertion, optimal hand hygiene practices, daily assessment of the need for a central venous catheter and the use of chlorhexidine gluconate for skin antisepsis (Cooley and Grady, 2009; Curry et al., 2009; Taylor et al., 2011; Helder et al., 2013). These strategies are key components of an insertion bundle, defined as a group of evidence-based interventions that, when implemented together, have better outcomes than when each is implemented separately (Cooley and Grady, 2009). A recent review reported evidence for vascular access bundles (Helder et al., 2013). These bundles included maximum sterile barrier precautions for line insertion, optimal hand hygiene practices, daily assessment of the need for a central venous catheter, and the use of chlorhexidine gluconate for skin antisepsis. High compliance with a maintenance care bundle is associated with reduced central line-associated bloodstream infections (Miller et al., 2010). However, insertion bundle compliance is not associated with reduced central line-associated bloodstream infections (Miller et al., 2010). An additional strategy, focusing on proper placement and on maintenance of central venous lines by a specialized team, revealed promising results in neonatal intensive care units (Taylor et al., 2011). This so called vascular access team is responsible for: early identification of patients who need line placement; surveillance of line site; maintaining dressing integrity; and monitoring of complications (Taylor et al., 2011). Members of a vascular access team are trained and certified to perform line insertion, promote best practice and minimize variability in technique (Taylor et al., 2011). By consistently and repeatedly performing line insertions, vascular access team members are likely to become more skilled as compared to nurses who perform these interventions less often (Holzmann-Pazgal et al., 2012).

Though efforts to implement a vascular access team seem promising, the effect of a vascular access team on central line-associated bloodstream infections in neonates has not been systematically reviewed. Therefore, we performed a review in which we evaluated the effectiveness of a neonatal vascular access teams on central line-associated bloodstream infections.

2. Method

2.1. Study design

The Center for Reviews and Dissemination Guidance for Undertaking Reviews and Healthcare (CRD, 2009) was used to conduct this review. The protocol was adapted a priori to the study purposes by the reviewers (ML and AH). No post hoc changes were made.

2.2. Search strategy

A literature search was performed in December 2013 in MEDLINE, CINAHL, Embase, Web-of-Science and the Cochrane Library. The following keywords were used: infant, newborn [MeSH]; neonates [tiab]; catheter team [tiab], IV-team [tiab], PICC-team [tiab], infection [MeSH]; bloodstream infection [tiab]; catheter related* [tiab]; catheter associated* [tiab]. For example, we used the following syntax for the MEDLINE search: (Neonat* OR infant [MeSH] OR newborn [MeSH] OR "very-low-birth-weight") AND (IV team OR "IV team*" OR "Peripherally inserted central catheter team" OR PICC-team OR "Infusion therapy team" OR "Percutaneous* inserted central catheter team") AND ("Catheter-related bloodstream infections" [MeSH] OR "Catheter-related infections" OR "Catheter-related complications" OR "Catheter-associated infections" [MeSH] OR "Catheter-associated adverse effects" OR Sepsis [MeSH] OR Infection [MeSH] OR "Bloodstream infection" [MeSH]).

2.3. Study selection

Publications concerning the effect of special teams on central line-associated bloodstream infections in