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A survey of central venous catheter practices in Australian and New Zealand tertiary neonatal units

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ABSTRACT

Background: Infection is the most common problem with central venous catheters (CVCs) in neonates. There are two published guidelines, including the Centers for Disease Control and Prevention (CDC), for the prevention of intravascular catheter-related infection that describes evidence-based practice to reduce nosocomial infection.
Objective: Our aims were to survey current medical and nursing management of central venous catheters in tertiary neonatal intensive care units in Australia and New Zealand and to compare with the CDC evidence-based practice guideline.
Methods: A cross sectional survey was performed across 27 Australian and New Zealand neonatal units in September 2012. Two web-based questionnaires were distributed, one to medical directors related to the insertion of CVCs while CVC "maintenance" surveys were sent to nurse unit managers.
Results: Seventy percent (19/27) medical management and 59% (16/27) on nursing management surveys were completed. In all neonatal intensive care units (NICUs) there were guidelines for CVC maintenance and for 18 out of 19 there were guidelines for insertion. In the seven units using femoral lines, three had a guideline on insertion and four for maintenance. CVC insertion was restricted to credentialed staff in 57.9% of neonatal units. Only 26.5% used full maximal sterile barriers for insertion. Skin disinfection practices widely varied. Dressing use and dressing change regimens were standardised; all using a semi-permeable dressing. Duration of cleaning time of the access point varied significantly; however, the majority used a chlorhexidine with alcohol solution (68.8%). Line and fluid changes varied from daily to 96 h. The majority used sterile gloves and a sterile dressing pack to access the CVC (68.8%). In the majority of NICUs stopcocks were used (62.5%) with a needle-less access point attached (87.5%). In less than 50% of NICUs education was provided on insertion and maintenance.
Conclusion: There is diversity of current practices and some aspects vary from the CDC guideline. There is a need to review NICU current practices to align with evidence based guidelines. The introduction of a common guideline may reduce variations in practice.

Introduction

The neonatal population is at increased risk of infection due to an underdeveloped immune system[1] and the immaturity of the skin barrier.[2] The characteristics of the Neonatal Intensive Care Unit (NICU) environment such as incubator humidity and warmth, overcrowding, multiple procedures, indwelling devices, ventilation, and use of parenteral nutrition also greatly increase the risk of infection.[3–9] Central venous catheters (CVCs) are commonly used in the NICU for intravenous nutrition, administration of medications and monitoring, which further increases the neonates susceptibility to blood stream infection.[10]

The reported incidence of central line associated blood stream infection (CLABSI) varies with case definition and with the demographic characteristics of the population studied. CLABSI reported to the National Healthcare Safety Network (NHSN) demonstrated extremely low birth weight infants have more central line related

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infections. The NHSN CLABSI rates range from 3.1 per 1000 catheter days for infants weighing 750 g or less to 1.4 per 1000 per catheter days for infants >1501 g.[11] Other studies reported wide variation in the infection rates ranging from 0 to 29% of catheters placed and from 2 to 49 per 1000 catheter days.[9,12–17] Neonates, particularly very low birth weight (VLBW) infants with CLABSI, have an increased risk of mortality with attributable mortality ranging from 4 to 20%[18] and a range of important morbidities including the need for intensive care, mechanical ventilation, bronchopulmonary dysplasia, necrotising enterocolitis, retinopathy of prematurity and prolonged hospitalisation.[18–21] Treatment costs are doubled when an infant has a blood stream infection and length of stay increases between 6.8% and 16.1%.[22]

The Centers for Disease Control and Prevention (CDC) in the United States and the National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England (epic 2) both have published guidelines for the prevention of infection in intravascular devices.[23,24] Neither of these guidelines is specific to neonates, however, both have subsections dedicated to the neonatal population and also include evidence from neonatal trials. The CDC guidelines are the most recent, developed by a multidisciplinary group to provide evidence based recommendations to prevent catheter related infection across all healthcare disciplines. Other surveys in adult intensive care have shown a lack of knowledge in CVC practices[25] and diversity in practice that lacks consistency with the CDC guidelines.[26,27] Although the CDC guidelines have existed since 1981, how these are integrated in neonatal care is unknown. This study was carried out to determine current practices in Australian and New Zealand tertiary neonatal units and to compare these practices to the CDC evidence-based guidelines and reveal any variation in practice.

Materials and methods

A cross sectional descriptive study utilising a survey methodology was performed using an on-line tool 'Survey Monkey'. To ensure the accuracy of the data, the survey was separated into two components. Catheter insertion is generally a medical procedure whereas maintenance of the catheter is a nursing responsibility. It was therefore deemed appropriate to direct insertion and general medical care to the medical director or representative and maintenance and ongoing nursing care to the Nurse Unit Manager (NUM) or representative. Between September and November, 2012, 54 surveys were distributed to the medical directors or their representatives ($n = 27$) and nursing managers or representatives ($n = 27$) across all tertiary neonatal units in Australia and New Zealand, using the 2012 contact list from the Australian and New Zealand Neonatal Network (ANZNN). The questionnaire was developed by the researcher based on the CDC guideline for the prevention intravascular catheter related infections.[23] Fixed response and multiple choice questions were used throughout both surveys, when an exhaustive list of answers could not be guaranteed an 'other' category was used with space for the respondent to add information. The tool was reviewed by individuals with qualifications similar to the intended recipients, three senior medical staff and four senior nurses. The recipients were asked to comment on length of time measured for completion, any difficulties with the questions, any practice areas that were not covered and the survey construction. Minor amendments were made following feedback. The final questionnaires consisted of 35 medical management and 29 nursing management questions.

Ethics approval was obtained from the Faculty of Health Sciences Human Ethics Committee, La Trobe University, Victoria, ref number FHEC12/118. All participants completed a consent form at commencement of the survey. Confidentiality of individual and institutional responses has been maintained.

Analysis of data was performed utilising the analysis software in Survey Monkey. Data was analysed using absolute numbers and percentages.

Results

CVC insertion (medical management)

Out of the 27 surveys sent to the medical directors, 19 surveys were fully completed (70%) and included representation from all but two regions across Australia and New Zealand. Seventeen of the respondents were consultants (89%) and two were senior nurses (9%).

All the units used umbilical venous catheters (UVCs) and peripherally inserted central venous catheters (PICCs). Only seven (36.8%) used femoral venous catheters and 10 (52.6%) used tunnelled catheters. All the units had a written policy/procedure for the insertion of umbilical catheters, and three (42.9%) for the insertion of a femoral line. All except one unit had a written policy/procedure for PICC insertion and the respondent reported that this was currently being written.

Education and training

Education on insertion was provided annually in only six units (31.6%) whereas knowledge was assessed annually in eight units. A high number of units, 15 in total, reported feeding back infection rates to the medical team (78.9%). Catheter insertion was performed by a dedicated team in two hospitals (11.1%), and was restricted to credentialed staff in 11 units (57.9%); the remaining eight do not restrict CVC insertion.

Aseptic technique

During insertion all the units used sterile gloves and surgical gown (see Table 1), however, only five (26.3%) used maximal sterile barriers (MSB) (cap, mask, sterile gown, sterile gloves and full body drapes). A designated trolley for CVC insertion was used in 10 units (52.6%). During insertion of the catheter 11 units (57.9%) would stop the insertion if there was a breach in infection control, six units (31.6%) did not use a designated observer to watch or stop the procedure and two units (10.5%) would not stop the procedure if there was a breach in infection control.

Skin disinfection

There was a wide variety in practice for skin disinfection prior to catheter insertion (see Table 1). Skin care practice varied based on weight, age or gestational age; however, these were not consistent amongst the units. Aqueous chlorhexidine was used in two units (10.5%) for very low birth weight infants (VLBW), in one unit (5.3%) for infants below 30 weeks gestation, in another unit (5.3%) for infants below 28 weeks gestation and for all infants in two units (10.5%). The strength of aqueous chlorhexidine also varied between 0.015% and 2%. A single unit used both povidone–iodine, allowed it to dry and then used 2% chlorhexidine. All units (100%) allow the skin disinfection to dry prior to inserting the catheter.

Dressings

The dressing material used for PICCs was standard. All 19 units used a semi-permeable dressing to cover the site (see Table 2). The units that used non-sterile tape also used steri-strips and semi-permeable dressing; therefore it could be assumed that the non-sterile tape was not placed directly on the insertion site. None of the units use a chlorhexidine impregnated sponge to cover the catheter site.