Clinical audit on infection control of catheter-related bloodstream infection in neonatal ICU

Samia A. Mohammed, Ahlam B. Ali, Doaa H. Mohammed

Department of Pediatrics, Faculty of Medicine, Assiut University, Assiut, Egypt

Correspondence to Doaa H. Mohammed, MSc, Department of Pediatrics, Faculty of Medicine, Assiut University, Assiut, Egypt
Postal Code: 83511;
Tel: +20 100 451 0506; Fax: 0963330801;
e-mail: drdoaamanay@gmail.com

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Introduction
Intravascular catheters are indispensable in modern-day medical practice, particularly in neonatal ICU (NICU). Although such catheters provide necessary vascular access, their use puts patients at risk for local and systemic infection complications.

Patients and methods
The study included 100 newborns, admitted to NICU at Assiut University Hospital, for whom umbilical venous catheter was inserted during the first week of life. Evaluation was done for all newborns for appropriateness of steps of infection control measures before, during, and after fixation of umbilical catheter. The included cases were followed during the period of admission till discharge.

Results
Infection control measures before umbilical catheter fixation were done 100%. During umbilical catheter fixation, the measures were defective in 100% in the form of defective use of a large drape to cover patient in sterile fashion as well as defective use of face mask. After fixation, only 20% did not maintain sterile technique while applying dressing.

Conclusion
Infection control measures must be appropriately done with special attention for defective steps during and after fixation. The decision to insert a central line should always be carefully considered for every newborn individually, and the benefits must be weighed against the risks.

Keywords:
central line, infection control, neonatal ICU

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Introduction

Intravascular catheters are indispensable in modern-day medical practice, particularly in neonatal ICU (NICUs). Although such catheters provide necessary vascular access, their use puts patients at risk for local and systemic infections, including local site infection, catheter-related bloodstream infection, septic thrombophlebitis, endocarditis, and other metastatic infections (e.g. lung abscess, brain abscess, and osteomyelitis) [1].

To improve patient outcome and reduce healthcare costs, strategies should be implemented to reduce the incidence of these infections. This effort should be multidisciplinary, involving healthcare professionals who insert intravascular catheters.

Aim

The aim of the study was to evaluate how infection control measures are applied during umbilical venous catheter (UVC) fixation in NICU at Assiut University Hospital.

Patients and methods

The study included 100 newborns, admitted in NICU at Assiut University Hospital, for whom UVCs were inserted during first week of life for different indications. The study was approved by Ethics committee of Assiut University, faculty of medicine.

Inclusion criteria

The following were the inclusion criteria:
(1) Age: 0–28 days
(2) UVC fixation
(3) Time of insertion: during the first week of life
(4) Site of delivery: Assiut Maternal Health Hospital.

Exclusion criteria

The following were the exclusion criteria:
(1) Congenital pneumonia
(2) Other central venous line than umbilical catheter
(3) Congenital malformation
(4) Presence of septic focus
(5) Maternal premature rupture of membrane.

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Methodology

The included cases were followed during period of admission till discharge. The process of fixation of catheter was observed before, during, and after insertion. Then data were analyzed to detect to what extent the American guidelines of infection control measures were applied in this unit [2] (Tables 1 and 2).

Before procedure, the following were observed and evaluated:
(1) Marking site position correctly for the catheter
(2) Preparation of supplies
(3) Cleaning hands
(4) Preparation procedures site with alcohol 70%
(5) Usage of large drape to cover patient in a sterile fashion.

During procedure, the following were observed and evaluated:
(1) Wearing sterile gloves
(2) Wearing hat, mask, and sterile gown
(3) Maintain sterile field
(4) Wearing mask by all staff in the room.

After procedure, the following were observed and evaluated:
(1) Maintain sterile technique when applying dressing
(2) Dating the dressing
(3) Ordering follow-up radiology images.

Table 1 Number and frequencies of steps of infection control during fixation of umbilical catheter

	Yes [*n* (%)]	No [*n* (%)]
Before procedure		
Clean hand	85 (85.0)	15 (15.0)
Preparation of procedure site with alcohol 70%	99 (99.0)	1 (1.0)
Use a large drape to cover patient in a sterile fashion	0 (0.0)	100 (100.0)
During procedure		
Wear sterile gloves during catheter insertion	90 (90.0)	10 (10.0)
Wear hat and mask	0 (0.0)	100 (100.0)
Wear sterile gown	75 (75.0)	25 (25.0)
Maintain sterile field	80 (80.0)	20 (20.0)
Assistant follows the same precaution	75 (75.0)	25 (25.0)

Table 2 Number and frequencies of steps of infection control after fixation of umbilical catheter

After procedure	Yes [*n* (%)]	No [*n* (%)]
Sterile technique maintained when applying dressing	80 (80.0)	20 (20.0)
Dating dressing	100 (100.0)	0 (0.0)
Use low-dose heparin	100 (100.0)	0 (0.0)
Use topical antibiotic	0 (0.0)	100 (100.0)
Order follow-up radiology images	100 (100.0)	0 (0.0)

Results

There were 52 male and 48 female patients in this study. Most cases were very preterm (60%) extending from 28 to 31 weeks, 28% were late preterm (32–36 weeks), 8% were extreme preterm (<28 weeks), and only 4% were full-term.

Discussion

Central lines (CLs) including umbilical arterial catheters, UVCs, and peripherally inserted central catheters are often used in the care of preterm newborn infants to provide arterial and venous access. However, the use of CLs is associated with several complications including infection.

We reported 100 cases of neonates with UVC fixed during the first week of life at Assiut University Children Hospital. There were 4% full-term extending from 37 to 41 weeks, 28% late preterm extending from 32 to 36 weeks, most (60%) of them were very preterm extending from 28 to 31 weeks, and 8% were extreme preterm less than 28 weeks.

According to our study, all American Academy guidelines for infection control measures are accurately applied in most cases in this NICU, concerning hand washing, wearing sterile gloves, insertion in a sterile fashion, use of alcohol 70%, wearing sterile gown, ordering follow-up radiology images, adding low-dose heparin, and avoidance of topical antibiotic.

However, wearing a mask and hat has not been done at all. Moreover, covering neonate with a large sterile surgical towel with central aperture has not been done. This disagrees with American Academy of Pediatrics guidelines. So such defective steps should receive special attention from infection control team of the unit.

Stoll *et al.* [3] suggested an increase in central line-associated bloodstream infection (CLABSI) as gestational age and birth weight decreased. Butler – O'Hara *et al.* [4] found an accelerating risk of UVC-related CLABSI after 7 days of use, and a stable rate of peripherally inserted central catheter-related CLABSI for up to 14 days of use.

The Center for Disease Control and Prevention guidelines recommend a duration of umbilical arterial catheter use of less than 5 days and a duration of UVC use of less than 14 days to reduce the incidence of catheter-related blood stream infections [5], which agrees with American Academy of Pediatrics guidelines, which was done perfectly in this studied NICU.

Overall, 90% of umbilical catheters were removed, as their duration of insertion was ended. However, 10% were removed owing to appearance of local or systemic infection. The decision to insert a CL should always be carefully considered for every patient individually, and the benefits must be weighed against the risks.

Conclusion

A CL should only be inserted when clearly necessary and should be removed when no longer essential. Infection control measures must be appropriately done, with special attention paid to defective steps performed in the unit.

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Conflicts of interest

There are no conflicts of interest.

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