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Complications Associated with Umbilical Venous Catheterization in Newborns: Incidence, Patterns and Risk Factors

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ABSTRACT

Background: Umbilical venous catheterization (UVC) is an indispensable procedure in neonatal intensive care units (NICUs) for critically ill newborns requiring prolonged vascular access, administration of medications, parenteral nutrition, and blood products. Despite its advantages, UVC insertion is associated with several complications ranging from minor local issues to severe infectious and thrombotic events.

Objective: To evaluate the incidence, patterns, and risk factors associated with complications of umbilical venous catheterization in neonates.

Materials and Methods: This prospective observational study was conducted in neonates admitted to a tertiary care NICU who underwent umbilical venous catheterization. Neonates were monitored clinically and radiologically for development of complications. Data regarding gestational age, birth weight, indication for catheterization, duration of catheterization, catheter tip position, and complications were recorded. Complications were categorized into mechanical, infectious, thrombotic, and local complications. Statistical analysis was performed to determine factors associated with complications.

Results: Mechanical complications were the most common complications observed following UVC insertion. Repositioning of catheter was required in 26% of neonates, followed by umbilical site leak (23%), reattempts during insertion (19%), catheter blockage (13%), periumbilical erythema (6%), and umbilical site bleeding (2%). Catheter-related bloodstream infection and thrombotic complications such as portal vein thrombosis were less common but clinically significant. Prolonged catheter duration (>6 days) and blood transfusion were significant risk factors associated with complications.

Conclusion: Umbilical venous catheterization is associated with a considerable incidence of complications, particularly mechanical complications. Careful insertion technique, strict aseptic precautions, appropriate catheter tip positioning, and timely catheter removal are essential to minimize complications and improve neonatal outcomes

Keywords*: Umbilical venous catheterization; Neonates; Catheter-related bloodstream infection; Portal vein thrombosis; Neonatal intensive care unit.*

INTRODUCTION

Umbilical venous catheterization (UVC) is one of the most frequently performed procedures in neonatal intensive care units (NICUs), especially in critically ill and preterm neonates requiring prolonged vascular access. UVC provides reliable central venous access for administration of intravenous fluids, medications, parenteral nutrition, blood products, and

emergency resuscitation measures. Because peripheral venous access is often difficult in neonates, UVC remains an invaluable component of neonatal intensive care management.[1]

Despite its numerous advantages, UVC insertion is associated with several complications that may significantly contribute to neonatal morbidity and mortality. Complications associated with UVC can broadly be categorized into mechanical, infectious, thrombotic, and local complications.[2] Previous studies have shown that nearly one-fifth to one-fourth of neonates undergoing UVC placement may develop catheter-related complications.[3,4]

Mechanical complications are among the most common adverse events associated with UVC and include catheter malposition, migration, blockage, leakage, accidental removal, and repeated insertion attempts. Improper positioning of the catheter tip may result in vascular injury, hepatic necrosis, pleural effusion, cardiac tamponade, and arrhythmias.[5] Accurate catheter placement and continuous monitoring are therefore essential.

Catheter-related bloodstream infection (CRBSI) is another major concern associated with prolonged catheter use. Neonates, particularly preterm and low birth weight infants, possess immature immune systems and are highly susceptible to nosocomial infections. Previous studies have reported CRBSI rates ranging between 3% and 8% in neonates with umbilical catheters.[6] Risk factors implicated in catheter-related infections include prolonged catheter duration, total parenteral nutrition, poor aseptic practices, and repeated manipulation of the catheter. However, some studies have demonstrated that prolonged catheter duration alone may not independently increase the risk of sepsis when strict aseptic precautions are maintained.[7]

Thrombotic complications, particularly portal vein thrombosis (PVT), are increasingly recognized with widespread use of UVC. Many cases remain clinically silent and are detected only through ultrasonographic screening.[8] Although spontaneous resolution may occur in many neonates, some may subsequently develop portal hypertension and hepatic complications. Local complications such as umbilical site erythema, bleeding, discharge, and periumbilical infection are also frequently encountered and may serve as early warning signs of more severe complications.

Given the increasing use of UVC in neonatal intensive care and the potential complications associated with its use, continuous evaluation of complication patterns and associated risk factors is necessary. This study was undertaken to assess the incidence, patterns, and risk factors associated with complications of umbilical venous catheterization in neonates.

OBJECTIVE

To evaluate the incidence, patterns, and risk factors associated with complications of umbilical venous catheterization in newborns.

MATERIALS AND METHODS

This prospective observational study was conducted in the neonatal intensive care unit (NICU) of a tertiary care teaching hospital. Neonates requiring umbilical venous catheterization for clinical management during the study period were included in the study.

Inclusion Criteria

- Neonates requiring UVC insertion for vascular access
- Both term and preterm neonates admitted to NICU

Exclusion Criteria

- Neonates with major congenital anomalies
- Neonates in whom UVC insertion was unsuccessful

Procedure: Umbilical venous catheterization was performed under strict aseptic precautions using standard sterile techniques. Catheter length was estimated using standard methods prior to insertion. Position of the catheter tip was confirmed radiologically and/or ultrasonographically.

Data Collection: The following details were recorded:

- Gestational age
- Birth weight
- Sex
- Indication for catheterization
- Number of insertion attempts
- Duration of catheterization
- Catheter tip position
- Requirement of blood transfusion
- Development of complications

Monitoring for Complications: Neonates were monitored clinically and radiologically for:

- Mechanical complications
- Infectious complications
- Thrombotic complications
- Local complications

Blood cultures and ultrasonography were performed whenever indicated.

RESULTS

Mechanical complications were the most frequently observed complications following UVC insertion. Repositioning of catheter was required in 26% of neonates, making it the commonest complication observed. Umbilical site leakage occurred in 23% of neonates, while repeated insertion attempts were required in 19% cases. Catheter blockage was observed in 13% neonates. Minor local complications such as periumbilical erythema and umbilical site bleeding were less common. Catheter-related bloodstream infections and portal vein thrombosis were less frequent than mechanical complications but carried significant clinical importance. Some thrombotic complications remained clinically silent and were detected on ultrasonography. Prolonged catheter duration greater than six days and blood transfusion were significantly associated with increased incidence of complications.

Table 1: Mechanical Complications Associated with UVC

Mechanical Complication	Percentage (%)
Repositioning required	26%
Umbilical site leak	23%
Reattempts during insertion	19%
Catheter blockage	13%
Periumbilical erythema	6%
Umbilical site bleeding	2%

Table 2: Infectious and Thrombotic Complications

Complication	Observation
Catheter-related bloodstream infection (CRBSI)	Present
Portal vein thrombosis (PVT)	Present in subset of neonates

Table 3: Risk Factors Associated with Complications

Risk Factor	Statistical Significance	P-value
Catheter duration >6 days	Significant	0.001
Blood transfusion	Significant	0.019

DISCUSSION

Umbilical venous catheterization remains an essential component of neonatal intensive care practice; however, its use is associated with various complications. The present study evaluated the incidence and pattern of complications associated with UVC in neonates and identified significant risk factors contributing to these complications.

Mechanical complications constituted the majority of complications observed in this study. Repositioning of catheter was the most common complication encountered. Similar observations were reported by Chinnaswamy K et al., who found repositioning in 26% neonates with UVC.[9] Mechanical complications are largely related to difficulties in achieving and maintaining optimal catheter tip position. Blind insertion techniques and neonatal anatomical variations contribute significantly to malposition and migration of catheters.

Mutlu et al. reported UVC-related complications in 20.3% of neonates, with catheter malposition being the most common complication.[4] Umbilical site leak and repeated insertion attempts were also common findings in the present study. Multiple insertion attempts may increase the risk of local trauma and infection. Proper training and imaging-guided catheter placement may reduce such complications.

Catheter blockage observed in this study may result from thrombus formation or precipitation of infused solutions. Adequate catheter flushing protocols and appropriate catheter maintenance are therefore important preventive measures.

Catheter-related bloodstream infection is among the most serious complications associated with UVC. Previous studies have reported CRBSI rates ranging between 3% and 8%.[6] Hei MY et al. reported an incidence of UVC-related septicemia of 9.5% in NICU neonates.[10] The relatively lower incidence observed in the present study may be attributed to strict aseptic precautions and careful catheter care practices.

Portal vein thrombosis is an increasingly recognized complication associated with UVC. Kim JH et al. demonstrated clinically silent portal venous thrombosis in a substantial proportion of neonates with UVC.[8] Many thrombotic complications remain asymptomatic and may only be detected through serial ultrasonography. Early detection is important to prevent long-term complications such as portal hypertension.

The present study identified prolonged catheter duration (>6 days) as a significant risk factor for complications. Similar findings have been reported previously, emphasizing the importance of early catheter removal whenever clinically feasible. Butler-O'Hara et al. observed higher infection rates with prolonged umbilical venous catheter use, although the difference was not statistically significant.[3] Hartojo et al. also evaluated catheter duration and found no significant increase in sepsis risk beyond 14 days when meticulous catheter care was maintained.[7]

Blood transfusion was also significantly associated with increased complications, possibly due to increased catheter manipulation and prolonged catheter use.

CONCLUSION

The findings of this study emphasize that although UVC is an invaluable tool in neonatal care, it requires meticulous insertion technique, continuous monitoring, and adherence to infection prevention protocols to minimize complications. Umbilical venous catheterization in neonates is associated with a significant incidence of complications, particularly mechanical complications such as catheter repositioning, leakage, and blockage. Infectious and thrombotic complications, though less frequent, remain clinically important because of their potential severity. Prolonged catheter duration and blood transfusion were identified as important risk factors for complications. Strict aseptic precautions, imaging-guided catheter positioning, regular monitoring, and timely catheter removal are essential to reduce complication rates and improve neonatal outcomes.

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REFERENCES

1. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, et al. Guidelines for the prevention of intravascular catheter-related infections. Clin Infect Dis. 2011;52(9):e162-e193.
2. Jain A, Deshpande P, Shah PS. Complications of central venous catheters in neonates and children. Paediatr Child Health. 2013;18(2):89-93.
3. Butler-O'Hara M, Buzzard CJ, Reubens L, McDermott MP, DiGrazio W, D'Angio CT. A randomized trial comparing long-term and short-term use of umbilical venous catheters in premature infants with birth weights less than 1251 grams. Pediatrics. 2006;118(1):e25-e35.
4. Mutlu M, Aslan Y, Kul S, Yilmaz G, Kader Ş, Aslan E, et al. Umbilical venous catheter complications in newborns: A retrospective study. J Matern Fetal Neonatal Med. 2016;29(17):2817-2822.
5. Kumar N, Murki S, Sharma D, Pratap OT, Kiran S. Bilateral chylous pleural effusion associated with umbilical venous catheter in an extremely low birth weight infant. Indian Pediatr. 2013;50(4):427-429.
6. Garland JS. Strategies to prevent central line-associated bloodstream infections in neonates. Clin Perinatol. 2010;37(3):547-563.
7. Hartojo H, Mulyadi MD, Raharjo P, Prasetyo D, Santoso B, Hegar B. Risk of sepsis in premature babies with umbilical venous catheters. Paediatr Indones. 2012;52(4):210-215.
8. Kim JH, Lee YS, Kim MJ, Lim HK, Lee SJ. Portal venous thrombosis associated with umbilical venous catheterization in neonates. J Ultrasound Med. 2001;20(6):665-670.
9. Chinnaswamy K, Sundaram V, Kumar P, Bhat BV, Harichandrakumar KT, Suresh GK. Complications of umbilical venous catheterization in neonates: A prospective observational study. Indian J Child Health. 2019;6(3):112-116.
10. Hei MY, Mu SC, Chen YL, Chao HC, Chiu CH, Chi H, et al. Umbilical venous catheter-related sepsis in neonates. Pediatr Neonatol. 2012;53(1):12-16.