

Prevalence of Portal Vein Thrombosis Following Umbilical Catheterization in Neonatal Period

Fatemeh Farahmand^{1,*}, Mohammad Ali Kiani¹, Homan Alizadeh³, Mehrzad Mahdizadeh³, Mahin Behjati³, Seyedeh Fatemeh Khatami⁴, Malihe Kadivar⁵, Majid Ghayour Mobarhan⁶, Shabnam Mohammadi⁷, Seyed Ali Jafari², Raheleh Jahanbani⁶, Ali Khakshur⁸, Ebrahim Kiani⁹

¹Department of Gastroenterology, Faculty of Medicine, Tehran University of Medical Sciences (TUMS), Tehran, Iran.

²Department of Gastroenterology, Faculty of Medicine, Mashhad University of Medical Sciences (MUMS), Mashhad, Iran.

³Department of Radiology, Faculty of Medicine, Tehran University of Medical Sciences (TUMS), Tehran, Iran.

⁴Neonatologist, Associate Professor, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

⁵Department of Neonatology, Faculty of Medicine, Tehran University of Medical Sciences (TUMS), Tehran, Iran.

⁶Nutritional Research Center, Faculty of Medicine, Mashhad University of Medical Science (MUMS), Mashhad, Iran.

⁷Department of Anatomy, Faculty of Medicine, Mashhad University of Medical Science (MUMS), Mashhad, Iran.

⁸Department of pediatric Faculty of Medicine, North Khorasan University of Medical Science, Bojnord, Iran.

⁹Department of pediatric, Faculty of Medicine, Islamic Azad University – Mashhad Branch, Mashhad, Iran.

Abstract

Introduction:

Portal venous thrombosis (PVT) is one of the most common causes of extrahepatic portal hypertension in children that may be occurring following umbilical venous cauterization or omphalitis during neonatal period. We investigated the effects of umbilical cauterization during neonatal period on portal vein thrombosis.

Materials and Methods:

This study investigated the frequency of thrombosis of portal vein in term or preterm infants following umbilical catheterization by color doppler ultrasound. Fifty neonates who had age range (3.6+ 8days) and birth weights 1250- 4230 gram were recruited for this study and umbilical venous catheters were placed on neonates. All parents of these neonates signed a consent form. Color doppler ultrasound sonography of the portal vein was performed by two expert radiologists within 3 days following umbilical cauterization and serially for at least a period of 6 months intervals up to 3 years (6 times for each case). Ten children were excluded from the study because of lack of follow up. Forty children completed the study.

Results:

From total of 40 subjects, portal vein thromboses were detected in two children (1 girl, 1 boy) with age 2.5 and 1.5 years respectively. In these two children, other clinical signs of portal vein thrombosis manifested such as esophageal and stomach varices and splenomegaly confirmed by endoscopy. In all the other children, the physical examinations and ultrasounds were normal during 6 stages.

Conclusion:

It is recommended that care be exercised during cauterization placement in order to prevent thrombosis of the portal vein from occurring.

Keywords:

Neonate, Portal venous thrombosis, Umbilical vein catheterization

Introduction

The umbilical vein is one of the most commonly used vascular routes in neonates

(1,2). Umbilical vein catheterization has become a common bedside procedure in the neonatal at the intensive care units following significant increase in the number of

*Corresponding Author: Department of Gastroenterology, Mashhad University of Medical Sciences, Mashhad, Iran. E-mail: kianiMD@yahoo.com
Received: 24 July 2012; Accepted: 14 Aug 2012

premature babies (2). In the UK approximately 250000 intravascular catheters are used per year (3). Sepsis is one of the complications of the catheterization that is accompanied by with high mortality and morbidity. Infection can be localized at the site of insertion where the catheter enters the patient's skin or can be systemic with bacteraemia leading to septicemia (4,5).

Vein cauterization is associated with complications such as catheter malposition, thrombosis, phlebitis, venous perforation, dysrhythmias, pleural and pericardial fusions (6-9). The skill of physician is a significant consideration in umbilical catheterization. Several drugs can be given through an endotracheal tube with some require intravenous administration. The umbilical vein is a suitable route of administration (10). The purpose of this study was to investigate the thrombotic complications of catheterization in the preterm and term neonates.

Materials and Methods

Subjects: This study was performed from December 2008 to April 2011 following ethical approval by Tehran University Ethical Committee. Upon receipt of an informed written consent from parents, 40 neonates with umbilical venous catheter who had been admitted to neonatal intensive care unit or neonatal ward were included. Fifty neonates (28 girls, 22 boys, with aged 8 days to 36 months) who required exchanging transfusions were recruited. Mean age of infants was 8 ± 3.6 days and birth weights between 1250 to 4230 grams. The newborns with cardiac heart disease or with omphalocele were excluded. The duration of follow-up ranged from 6 to 36 months. Ten infants were lost to follow-up and therefore excluded.

Study Design: Single lumen umbilical venous catheters (3.5 or 5.0 French) were inserted on NICU or neonatal department during admission. Abdominal sonography and color doppler of the portal vein were performed by a 7.5 MHz transducer within

3 days following catheter placement and serially for at least 6 months intervals up to 3 years (6 times for each child). In each sonography we evaluated the port vein's condition (open or closed), the existence of thrombosis, port vein size and diameter, spleen and liver echogenicity and existence of ascites by two expert radiologists.

Statistics Analysis: Data analyzed using SPSS version 15 and descriptive statistics.

Results

Among 40 children were studied, portal vein thrombosis were detected by radiologist color doppler ultrasound. Signs and symptoms of portal hypertension were observed in two children (1 girl, 1 boy) with age 2.5 and 1.5 years respectively (fig 1).

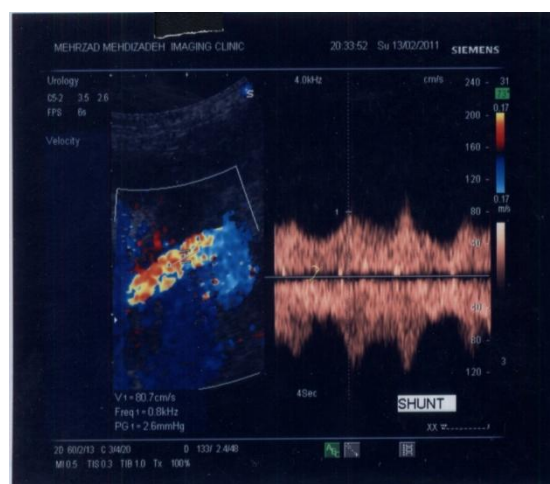


Fig 1: Color doppler of a portal venous thrombus in a case with 2.5 years old.

These two patients were found in the fourth and fifth stages. Coagulation disorder was not found in these two children (protein C, S-negative). Wall and lumen of portal and umbilical vein was normal by color doppler sonography in other children. In endoscopic evaluations, esophageal and stomach varices grade I, II were observed in a 2 year old girl. Splenomegaly was found in an 18 month old boy. Presence of portal vein thrombosis confirmed by color doppler sonography. All stages of sonography were done by two experienced radiologists. Spleen and liver

echogenicity were normal in other children and also there was no indication of ascites existence (fig 2).

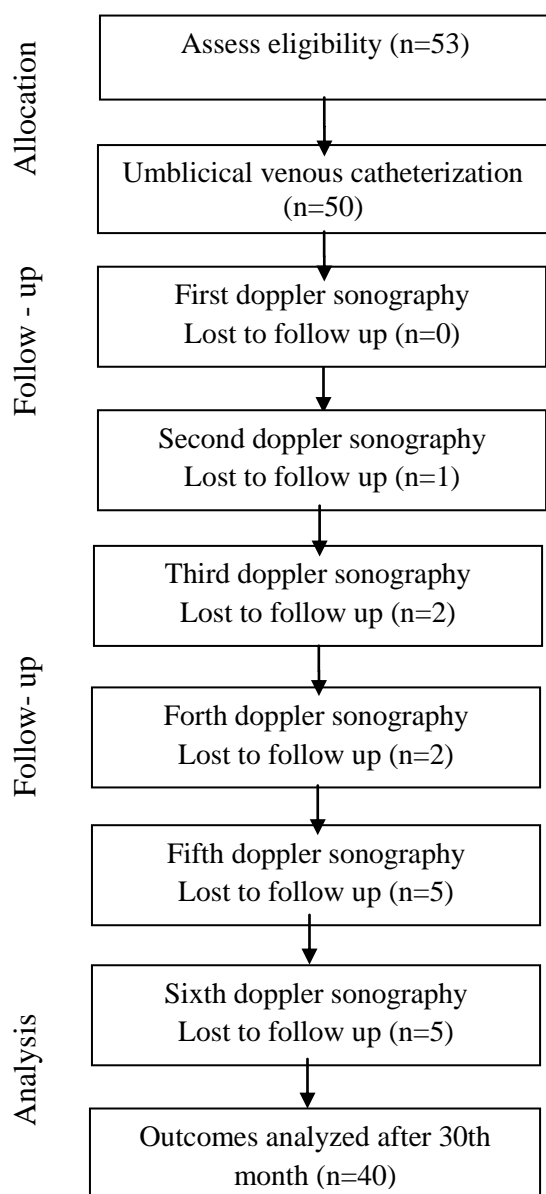


Fig2: Trial flow-chart

Occlusion of a portal vessel causes congestion of the organs it drains, with increased venous pressures and the development of collateral circulation and hepatosplenomegaly. It can also reduce hepatic perfusion by as much as 2/3 (11). The frequency of thrombosis resulting from catheterization is almost 4 percent. Moreover, we observed that possibility of thrombosis

increased with the growth of the infants. This study is still on progress since we continue to follow up cases.

Discussion

The result of the present study showed that the prevalence of portal vein thrombosis following catheterization of the umbilical vein during the neonatal period is 4% of children. An investigation by Schmit and colleagues reported the incidence of portal vein thrombosis in 2.4 per 1000 of neonates admitted to NICU (12). Another publication by Nowak-Gottl reported the incidence of thrombotic events in 5.1 per 100,000 deliveries (13). Autopsy findings indicated umbilical vein thrombosis from 3% to 30% while clinical studies found catheter-related thrombosis in 13% to 30% of newborns (14, 15). Morag *et al.* in 2011 reported that 73% of children with portal vein thrombosis had a history of umbilical catheter in situ (16). However, the studies did not observe a thrombus in their study population. For example, a study by Guimarães investigated whether umbilical venous cauterization causes the development of thrombosis in neonates. Forty neonates (16 girls and 24 boys) with exchanging transfusions due to severe hyper bilirubinemia were included. All cases were identified as normal using sonographic, laboratory and clinical investigations except for 3 children. It might be due to short-term placement catheterization that was only 120 minutes (17). Guimarães concluded that umbilical cauterization seldom causes portal vein thrombosis, risk factors such as umbilical infections and trauma following cauterization should be investigated (17).

Schwartz *et al* reported the prevalence of portal vein thrombosis 1.3% following umbilical venous cauterization (1). Differences in the prevalence of portal vein thrombosis may be due to physician's skill during umbilical cauterization. Although congenital thrombophilia events were reported not to be related with venous

thrombosis (18), but some studies have shown an increased rate of congenital thrombophilia in newborns with catheter-related thrombosis (19). Another study in Toronto investigated complication rates of the umbilical catheter in 133 infants (20). Their findings demonstrated an association between the incidence of portal vein thrombus, time of placed umbilical catheter and severity of thrombus. There were no remarkable effects on study outcome after anticoagulation treatment (20). In studies, sonography was known as a useful method for detection of thrombosis events in short and long term. This approach is consistent with the findings by Guimaraes and Morag doppler ultrasound used for recognizing progression of thrombosis in neonates (17,20).

Even a small venous thrombosis may lead to complications, therefore prevention of thrombosis events should be considered as a valuable strategy. The likelihood of venous thrombosis could be decreased by elevated umbilical positioning and single lumen construction. In addition, a reduction in period of catheterization and usage of heparin coated catheters are useful for prevention of thrombosis.

Overall, long term follow up is required for early diagnosis of thrombosis. It is recommended that physician's perform the cauterization placement carefully so as to prevent thrombosis of the portal vein from occurring.

Acknowledgments

The authors are grateful from the kind cooperation of all subjects performing this study.

References

1. Schwartz DS, Gettner PA, Konstantino MM. Umbilical venous catheterization and the risk of portal vein thrombosis. *The Journal of pediatrics* 1997. 131(5): p. 760-62.
2. Yigiter M, Arda S, Hi sönmez A. Hepatic laceration because of malpositioning of the umbilical vein catheter: case report and literature review. *Journal of pediatric surgery* 2008 43(5): p. e39-e41.
3. Elliott T. An update on antimicrobial central venous catheters. *Journal of Hospital Infection* 2007. 65: p. 34-8.
4. Zhang L, Gowardman J, Rickard CM. Impact of microbial attachment on intravascular catheter-related infections. *International Journal of Antimicrobial Agents* 2011.
5. Sobhonslidsuk A, Reddy KP. Portal vein thrombosis: a concise review. *The American journal of gastroenterology* 2002. 97(3): p. 535-41.
6. Gorski LA. Infusion nursing standards of practice. *Journal of Infusion Nursing*, 2007 30(3): p. 151.
7. Mitsufuji N. Extravascular collection of fluid around the vertebra resulting from malpositioning of a peripherally inserted central venous catheter in extremely low birth weight infants. *Journal of perinatal medicine*, 2002 30(4): p. 341-44.
8. Pettit J. Assessment of infants with peripherally inserted central catheters: Part 1. Detecting the most frequently occurring complications. *Advances in Neonatal Care* 2002. 2(6): p. 304.
9. Brisse H. Portal vein thrombosis during antineoplastic chemotherapy in children: report of five cases and review of the literature. *European Journal of Cancer* 2004. 40(18): p. 2659-66.
10. Paes BA, Blatz S, Kraftcheck D. Neonatal Cardio-pulmonary Arrest: Emergency Catheterization of Umbilical Vein. *Canadian Family Physician* 1990. 36: p. 1135.
11. Yang, JYK, Chan AKC. Neonatal Systemic Venous Thrombosis. *Thrombosis research* 2010. 126(6): p. 471-6.
12. Schmidt B, Andrew M. Neonatal thrombosis: report of a prospective Canadian and international registry. *Pediatrics* 1995; 96: 939-43.
13. Nowak-Gottl U, von Kries R, Gobel U. Neonatal symptomatic thromboembolism in Germany: two year survey. *Arch Dis Child Fetal Neonatal Ed* 1997; 76:F163-F167.
14. Khilnani P, Goldstein B, Todres ID. Double lumen umbilical venous catheters in critically ill neonates: a randomized prospective study. *Crit Care Med* 1991;19: 1348-51.

15. Tanke RB, van Megen R, Daniels O. Thrombus detection on central venous catheters in the neonatal intensive care unit. *Angiology* 1994; 45:477–80.
16. Morag I, Shah PS, Epelman M, Daneman A, Strauss T, Moore AM. Childhood outcomes of neonates diagnosed with portal vein thrombosis. *Journal of Paediatrics and Child Health* 2011; Article in press.
17. Guimarães H, Castelo L, Guimarães J, Cardoso A, d'Orey C. Does umbilical vein catheterization to exchange transfusion lead to portal vein thrombosis? *European Journal of Pediatrics*. 157(6): 461-463.
18. Turebylu R, Salis R, Erbe R. Genetic prothrombotic mutations are common in neonates but are not associated with umbilical catheter-associated thrombosis. *J Perinatol* 2007; 27:490–5.
19. Heller C, Schobess R, Kurnik K. Abdominal venous thrombosis in neonates and infants: role of prothrombotic risk factors – a multicentre case-control study. For the Childhood Thrombophilia Study Group. *Br J Haematol* 2000; 111:534–9.
20. Morag I, Epelman M, Daneman A. Portal vein thrombosis in the neonate: risk factors, course, and outcome. *J Pediatr* 2006; 148:735–9.
21. Barrington KJ. Umbilical artery catheters in the newborn: effects of catheter design (end vs side hole). *Cochrane Database Syst Rev* 2000; 2:CD000508.