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The Prevalence of Portal Vein Thrombosis in Children under 3 Years Old with History of Neonatal Umbilical Vein Catheterization in the Neonatal Intensive Care Unit

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Abstract

Background

Portal vein thrombosis (PVT) is one of the most common causes of extrahepatic portal hypertension in children, which may follow neonatal umbilical vein catheterization. The incidence rates of catheter-related PVT, in infants and children vary in different studies. This study aimed to determine PVT incidence in the children under 3 years old with a history of neonatal umbilical vein catheterization in the NICU of Ghaem Hospital, Mashhad- Iran.

Materials and Methods

This cross-sectional study included 38 children with a history of hospitalization in the NICU of Ghaem Hospital, Mashhad-Iran, during 2012 to 2013 for whom umbilical vein catheterization had been performed. The Children's histories were taken and they were examined. Color Doppler ultrasound was performed on them. Data analysis was carried out using SPSS-13 and descriptive statistics, t-test, Fisher's exact test.

Results

Fourteen (36.8%) and 24 (63.2%) of the infants were males and females, respectively. Mean age of the infants was 33.1±3.55 months. PVT evidence in a child raises a 2.6% PVT incidence. No statistically significant relationship was observed among gender, age, catheter type, and catheterization duration and PVT. A statistically significant relationship was observed between spleen size and portal vein size in ultrasound and PVT ($P<0.05$). The liver and spleen examination was only abnormal, in the patient with thrombosis.

Conclusion

The study findings suggest a 2.6% incidence for PVT. In addition, neonatal umbilical catheterization causes PVT during childhood.

Key Words: Neonate, NICU, Portal vein thrombosis (PVT), Umbilical catheterization.

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1- INTRODUCTION

PVT is rarely seen in children; however, knowledge about it is gradually increasing. As PVT rarely causes clinical problems during neonatal period, most of the cases are diagnosed in childhood. This has led to the hypothesis that PVT is highly rare in infants. It is the major cause of extrahepatic portal hypertension and gastrointestinal bleeding in children (1).

The incidence rate of PVT caused by umbilical vein catheter in infants and children varies between 0 and 43% in different studies. The difference of PVT incidence in the children whose records of umbilical vein catheterization were reported may be due to the following items: whether the study was prospective or retrospective, the diagnosis method used for thrombosis, time-based planning of tests and catheter-related variables (2-4). Thrombosis is probable while placing umbilical vein catheterization in 20-40 percent of the infants who died with catheters in their umbilical veins (1).

PVT etiology is different in children and adults. PVT in adults is largely due to liver cirrhosis; whereas, secondary PVT in children is due to placement of umbilical vein catheter with/without infection or due to liver transplant, intra-abdominal infection, splenectomy, sickle cell anemia, and a antiphospholipid antibodies. Nevertheless, about 50% of children with PVT have unknown underlying etiology (5-10).

One of the risk factors for developing PVT in children with a history of umbilical catheterization is catheter size and the location and application duration of the catheter. In addition, patient-related factors including low birth weight, low blood flow, hypercoagulopathy, hypoxia, infection, sepsis, birth defects, and gestational diabetes are also, involved in problems that are caused by umbilical vein catheterization. These problems necessitate the use of catheters in supportive treatment for critically ill infants. Despite the potential risk of thrombosis, umbilical vein catheterization is employed as an applied and extensively used method for monitoring and treating critically ill infants (1, 3). From the practical perspective, PVT is diagnosed through Doppler ultrasound. Color abdominal Doppler ultrasound is less invasive and traumatic for patients, and cheaper than CT and MRI (1).

The study of Farahmand et al. in 2012 aimed at evaluating the effect and determining the rate of catheterization prevalence in neonatal PVT. Studying 40 premature infants using color Doppler ultrasound with a three-year follow-up revealed two 1.5 and 2.5 year-old children were with PVT. Other clinical symptoms of thrombosis including splenomegaly and esophageal and gastric varices, were observed in the children using endoscopy. Physical and ultrasound examinations in other children were normal in all stages (11). The study of Nemati et al. in 2013 aimed at determining the incidence rate and risk factors for thrombosis caused by umbilical vein catheterization. Examining 256 children with the history of umbilical vein catheterization showed eight (3.1%) patients were with PVT. The researchers concluded that umbilical vein catheter caused thrombosis and Doppler ultrasound method was an appropriate method for diagnosis of thrombosis (12).

Access to the central vein in infants hospitalized in the NICU is very important, PVT (as one of the complications of umbilical vein catheterization), is accompanied by undesirable consequences (and by death of children), and few studies had been conducted on PVT. Therefore, this study aimed at studying prevalence of PVT in the children under 3 years old with a history of neonatal umbilical vein catheterization in the NICU of Ghaem Hospital, Mashhad- Iran.

2- MATERIALS AND METHODS

In this cross-sectional study, which included 38 children with hospitalization histories in the NICU of Ghaem Hospital, Mashhad city, North East of Iran during 2012 to 2013 with records of umbilical vein catheterization, convenience sampling was used. The infants' records were examined and a researcher-made questionnaire consisting of the infants' demographic data (age, gender, thrombosis, and prematurity) and catheterization specifications (causes of placing umbilical vein catheter, type of catheter (arterial-venous), and catheterization duration) was completed.

Consents were obtained from the children's parents before they were included in the study for PVT diagnosis. The children's records were collected and clinical examinations were performed on them. They were evaluated further in case there was evidence of a liver disease. Color Doppler ultrasound was then performed to detect thrombus. Data analysis was performed using SPSS-13 and descriptive statistics, t-test, Fisher's exact test.

3- RESULTS

Fourteen (36.8%) and 23 children (63.2%) were males and females, respectively. Mean age of the children was 33.1 ± 3.55 months with the range of 25-38 months. Hospitalization causes included blood exchange transfusion in thirteen (35.1%), RDS in nine (24.3%), prematurity in nine (21.6%), sepsis in five (13.5%), and asphyxia in two (5.4%) of the children. Types of catheter were venous in thirty-seven (97.4%) and arterial in one (2.6%) of the children. The mean of catheterization duration was 5.7 ± 8.03 days with the range of 2-50 days. Clinical examinations showed the spleens of 35 children (92.1%) were not palpable. The spleens of two children (5.3%) were palpable at a distance shorter than 2 cm below the ribs' edge. The spleen of one infant (2.6%) was palpable at a distance longer than 2 cm below the ribs' edge. The livers of 36 children (94.7%) were not palpable either. The liver of one child (2.6%) was palpable at a distance of 2 cm below the ribs' edge. The liver of only one child (2.6%) was palpable at a distance longer than 2 cm below the ribs' edge.

Ultrasound results showed that the mean of spleen size in the children under study was 74.8 ± 10.91 mm with the range of 60-130 mm. The size of portal vein was 7.2 ± 1.40 mm with the range of 6-14 mm. The results of color Doppler ultrasound in 37 patients (97.4%) were normal and that of one child (2.6%) was abnormal with evidence of PVT.

The patient with PVT was a 30-month-old female who had been hospitalized due to exchange blood transfusion. The patient had a venous catheter, which remained in the umbilical vein for 4 days. The edges of the spleen and liver were palpable at a distance of 4 cm from the edge of the ribs. Ultrasound showed the sizes of spleen and portal vein were 30 and 14 mm, respectively. The study showed no statistically significant relationship between PVT and gender (P=0.990), age (P=0.376), catheter type (P=0.990), and catheterization duration (P=0.825); but it had a statistically significant relationship with the spleen size and the portal vein size (P= 0.04).

4- DISCUSSION

Most studies have discussed the prevalence rate of neonatal catheter and few of them have examined the long-term effects of umbilical artery catheterization on PVT. The incidence of PVT in the children with a history of catheterization was 2.6%. In 2006, Sakha et al. examined the infants with umbilical vein catheterization, and ultrasound showed evidence of PVT in seventeen (34%) of the 50 infants. A 5-month follow-up revealed

that the developed thrombus had disappeared in 13 out of 17 patients (13).

In the study of Farahmand et al. (2012), evidence of PVT with a 3-year follow-up was found in two (5%) of the 40 infants with a history of catheterization (11). One hundred infants underwent umbilical vein catheterization in the study of Kim et al. (2001), and were examined at intervals of 2-7 days before and after catheterization until they were discharged. The PVT incidence rate in this study was 43%. It also, proved that 56% of the thrombi had disappeared spontaneously before discharge (2). Gharehbaghi et al. (2011) also, observed PVT in five (3.04%) of the 164 infants who had undergone umbilical vein catheterization (14).

Nemati et al. (2013) calculated PVT incidence as eight cases (3.1%) out of the 256 infants, who had undergone umbilical vein catheterization up to 3 days after discharge (12). The difference in PVT incidence rates might be due to the differences between the methods used to detect thrombosis, the time the tests were performed to detect thrombosis, and due to differences in the size of the catheter and in the location and duration of catheterization. In this study, catheterization duration had no effect on PVT incidence. Duration of umbilical vein catheterization in the study by Gharehbaghi et al. (2011) was 1.9 ±3.4 days, which had no effect on PVT incidence (14).

However, Kim et al. (2001) stated catheterization of longer than 6 days was a risk factor for PVT (2). Duration of umbilical vein catheterization (5.8 days) was associated with PVT incidence in the study by Nemati et al. (2013) (12). In this study, the infant with PVT was hospitalized due to blood transfusion. In the study by Gharehbaghi et al. (2011), thrombi in three patients had completely disappeared within 3-6 weeks. The two patients with thrombi after 6 weeks received catheter due to blood transfusion (14). Kim et al. (2001) considered blood transfusion through catheter as one of the risk factors for PVT (2). In this study, venous catheter was effective in PVT incidence. In the study by Nemati et al. (2013), venous or arterial catheters had no effect on PVT incidence (12).

4-1. Limitations of the study

Considering the small sample size and the fact that there was only one case of PVT in this study, it was not possible to examine accurately the effects of venous and arterial catheters and those of the reasons for hospitalization and catheterization on PVT incidence in infants. Neither was it possible to examine differences in catheterization duration in the two groups of children with/without evidence of thrombosis in their portal veins. Moreover, ultrasound is not capable of detecting microthrombi developed in arteries, and it is possible to study PVT prevalence rate more accurately using better methods and with modalities that are more sensitive. Other limitations in this research included lack of cooperation on the part of the patients and their parents. **5.**

5- CONCLUSION

In general, the findings of this research showed a 2.6% PVT incidence in children with umbilical vein catheterization. In addition, in the patient with thrombosis, the sizes of the spleen and of the portal vein in ultrasound, and the spleen and liver examinations, were different from those of the other children. The study also, proved that catheterization duration had no considerable effect on PVT incidence.

6- CONFLICT OF INTEREST: None.

7- ABBREVIATION

- CT*:* Computerized Tomography,
- MRI: Magnetic Resonance Imaging,

- NICU: Neonatal Intensive Care Unit,
- PVT: Portal Vein Thrombosis,
- RDS: Radio Data System.

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