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Vein Thrombosis Associated with Umbilical Vascular Catheters with Color Doppler

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Abstract: The aim of this study was to evaluate the incidence and risk factors of umbilical catheter associated thrombosis in newborn infants using color Doppler. In this analytic-descriptive study, 256 newborn infants with umbilical catheters were evaluated during a 15 month. Color Doppler ultrasonography was employed for detection of vascular thrombosis associated with the umbilical catheter placement in the first 24-48 h after admission, weekly until discharge and 72 h after discharge. Among 256 newborns, 12 cases (4.7%) had vascular thrombosis. The rate of thrombosis was 6.9 and 5.7% in the umbilical artery and vein catheters, respectively. Umbilical catheters is accompanied with the risk of thrombosis. Color Doppler ultrasonography is a good way for diagnosis of this thrombosis.

Key words: Umbilical vascular catheter, thrombosis, color doppler ultrasonography

INTRODUCTION

Umbilical artery catheterization is a common procedure in the neonatal intensive care unit and has become the standard of care for arterial access in neonates (Azimi *et al.*, 2013; Goldust and Rezaee, 2013; Lotti *et al.*, 2013; Verheij *et al.*, 2010). Catheter can be used as umbilical arterial (UAC) or umbilical vascular (UVC) (Nejad *et al.*, 2013; Gharehbaghi *et al.*, 2011; Goldust *et al.*, 2013a; Mohebbipour *et al.*, 2012). The placement of umbilical catheters is an essential technique for the treatment of many newborns in unstable condition (Goforoushan *et al.*, 2013; Razi *et al.*, 2013; Salehi *et al.*, 2013a; Yousefi *et al.*, 2013). Thrombosis formation on tip of the umbilical arterial catheter is always problematic (Goldust *et al.*, 2013b, c; Qadim *et al.*, 2013; Sakha *et al.*, 2007). According to several reports, real incidence rate of thrombosis varies from 4.7 to 95% (Goldust *et al.*, 2013d; Nemati *et al.*, 2013; Roy *et al.*, 2002; Vafae *et al.*, 2012). Clinically, those thrombosis associated with umbilical catheters are detected difficultly since more than one third of the cases are asymptomatic (Daghigh *et al.*, 2013; Goldust *et al.*, 2012; Kim *et al.*, 2001; Sadighi *et al.*, 2011). Therefore, evaluation using color Doppler may be useful in detecting these cases. Following thrombosis detection, risk factors developing thrombosis such as combination of infusion fluid through catheter, size and

material of catheter, location of catheter tip, duration of catheter leftover and etc., can be commented. However, the available data is heterogeneous (Golfurushan *et al.*, 2011; Milan *et al.*, 2011; Salehi *et al.*, 2013d; Vali *et al.*, 2010). Developing NICU and increase of umbilical arterial and vascular catheter to monitor very ill infants revealed that evaluating incidence rate of the resulted thromboses as well as determining the risk factors related to thrombosis incidence seems applied and necessary (Goldust *et al.*, 2011; Sadeghpour *et al.*, 2011; Soleimanpour *et al.*, 2013). The present study aimed at evaluating these possible risk factors.

MATERIALS AND METHODS

In this cumulative retrospective study, 256 infants with umbilical vascular catheters were evaluated considering thrombosis and using color Doppler sonography in NICU of Tabriz Pediatrics hospital for 15 months. Accordingly, the patients were divided into two with and without thrombosis and possible risk factors related to thrombosis were studied. Doppler study was conducted in all understudy patients and during first hours and days (i.e., at least 6 h and utmost to 7 days after catheterization). If catheterization was lasted, re-lasting and continued after catheterization, Doppler study was repeated one, two, three and four weeks later. The

patients were evaluated during initial 48-72 h after catheter placement with sonography, every week until removing the catheter and 72 h after its removing. All patients were evaluated using Ultrasonix-XP sonography set with multi-frequency canox probe of 3-7 MHZ. Suffering from major definite anomaly, congenital cardiac disease and any other systemic disease (e.g., renal dysplasia, etc.) during every period of hospitalization, dehydration, sepsis, polycythemia, congenital heart disease. were regarded as the exclusion criteria. Considering study method, there was not any special administrative or moral problem. The studied cases included thrombosis location, detection time of thrombosis, gender, at-birth weight, delivery age, type, size and location of catheter, duration of umbilical catheterization, background diseases, calcium and vancomycin prescription using catheter.

Statistical analysis: The obtained data has been stated as Mean±standard deviation, frequency and percentage and SPSS TM-15 was used as the statistical software. Mann-Whitney U-test (Student T-test (Independent Samples) were used to compare the quantitative variables. Contingency tables, Chi-square test and Fisher's exact test were used to compare the qualitative variables considering the governing conditions. In all understudy cases, the results were regarded statistically meaningful if $p = 0.05$.

RESULTS

In this study, 256 infants with umbilical vascular catheter were evaluated. Vascular thrombosis was

confirmed in 12 cases using color Doppler sonography. Out of 144 arterial, 35 vascular and 77 arterial-vascular catheters, there was thrombosis in 10 and 2 cases, respectively. Thrombosis was located in port vein of 8 patients (66.7%), umbilical vein in 3 cases (25%) and port-umbilical vein in one patient (8.3%). The thrombosis was diagnosed during first week in 1 patient (8.3%), second week in 2 cases (16.7%) and 72 h after removing the catheter in 9 patients (75%). The understudy variables in both with and without thrombosis groups have been summarized and compared in Table 1. Accordingly, only mean of catheterization duration in the group suffering from thrombosis was meaningfully more than the group without thrombosis. There was not any statistically meaningful difference in other cases.

DISCUSSION

The present study evaluated incidence rate of vascular thrombosis resulting from umbilical vascular catheters using color Doppler. Accordingly, 4.7% of infants with umbilical vascular catheter suffered from thrombosis. It was respectively 6.9 and 5.7% in cases with umbilical arterial and umbilical vascular catheter. In their study, Boo *et al.* (1999) studied 137 infants with umbilical vascular catheter using Doppler sonography 48 h after removing the catheter. Finally, thrombosis was registered in 32.3 and 4.1% of cases with umbilical arterial and umbilical vascular catheter, respectively. Incidence rate of thrombosis was totally 28.2% in these infants (Boo *et al.*, 1999). Comparing with results of other studies, outcomes of the current study are at low level although located in

Table 1: Variables studied in both groups of with and without thrombosis

Variable	With thrombosis (n = 12)	Without thrombosis (n = 244)	p-value	Odds ratio
Gender				
Male	6 (50)	144 (59)	0.37	0.69
Female	6 (50)	100 (41)		
At-birth weight				
Normal	4 (33)	88 (36)	0.56	0.89
Less than normal	8 (67)	156 (54)		
Delivery age				
Term	4 (33)	107 (44)	0.47	0.64
Pre-term	8 (67)	137 (56)		
Type of catheter				
Arterial	10 (83)	134 (55)	0.064	--
Vascular	2 (17)	33 (14)		
Arterial-vascular	0 (0)	77 (31)		
Size of catheter				
≤F3.5	6 (50)	179 (73)	0.08	0.36
>F3.5	6 (50)	50 (21)		
Location of catheter				
High	10 (83)	207 (85)	0.57	0.89
Low	2 (17)	37 (15)		
Catheterization duration (day)	5.3±2.7 (5)	3.3±1.1 (3)	0.01*	--
Background disease				
HMD	12 (100)	194 (79.5)	0.07	1.26
MAS	0 (0)	50 (20.5)		
Prescription of calcium using catheter	3 (25%)	27 (11.1%)	0.15	0.37
Prescription of vancomycin using catheter	2 (16.7%)	24 (9.8%)	0.35	0.55

* Non-parametric test, HMD: Hyaline membrane disease, MAS: Meconium aspiration syndrome

this range. In our study, 75% of thromboses were detected 72 h after removing umbilical vascular catheter. Thrombosis was occurred in port vein (66.7%), umbilical vein (25%) and simultaneously port and umbilical vein (8.3%) in our study. The study conducted by Oppenheimer and Carroll (1982) indicated that out of 10 cases of thrombosis associated with umbilical arterial catheter, 5 cases occur in aorta, 3 cases in aorta and common iliac artery and 2 cases in common iliac artery (Oppenheimer and Carroll, 1982). As referred, the above-mentioned study only evaluated those infants with umbilical arterial catheters. One of the effective factors in this regard is objective of umbilical vascular catheterization determining placement of catheter tip (Turebylu *et al.*, 2007). The major differences among the many investigations include the prospective or retrospective nature of the study; the diagnostic method used to study the thrombus; the time schedule of examinations and catheter variables such as size, location and duration (Fardiazar *et al.*, 2013; Ganjpour Sales *et al.*, 2013; Salehi *et al.*, 2013b, c). In general, prospective US examinations, starting shortly after catheterization, revealed a 17-44% incidence of thrombosis associated with use of umbilical venous catheters, umbilical arterial catheters, or femoral venous catheters (Farhoudi *et al.*, 2012; Kujur *et al.*, 2012; Nourizadeh *et al.*, 2013; Yilmaz *et al.*, 2010). Different risk factors can be introduced as one of the factors related to variability of incidence rate of thrombosis associated with umbilical vascular catheters in different studies (Karzar *et al.*, 2012; Seyyednejad *et al.*, 2012; Shakeri *et al.*, 2013; Vahedi *et al.*, 2012). Our study demonstrated that there was not any meaningful relationship between thrombosis incidence and factors such as infant's gender, at-birth weight, delivery age, type of umbilical catheter (arterial/vascular), size of catheter, catheter placement, background disease and kind of medicine prescribed using catheter. Duration of umbilical catheterization was the only variable related to this condition. Hermansen and Hermansen (2005) stated that 55% hematocrit during first week of life, infant premature and history of mother's pre-eclampsia were as risk factors related to thrombosis incidence (Hermansen and Hermansen, 2005). As mentioned previously, results of different studies are really varied in this regard (Ganjpour Sales *et al.*, 2012; Sadeghpour *et al.*, 2012; Smith and Dills, 2003). The reason can be attributed to complexity of development process of thrombosis and its relationship with umbilical vascular catheters. Evidently, placement of umbilical vascular catheters significantly increases risk of thrombosis incidence. It has been estimated about 3.5 times (Grupo de Hospitales Castrillo, 2000; Fardiazar *et al.*, 2012; Nikanfar *et al.*, 2012).

CONCLUSION

In this study, 4.7% of infants with umbilical vascular catheter suffered from thrombosis, 6.9% of the infants with umbilical arterial and 5.7% of infants with umbilical vascular catheter suffered from thrombosis. Catheterization duration was the only risk factor related to incidence of secondary thrombosis in umbilical vascular catheters (averagely 5.3 days in patients with thrombosis vs. 3.3 days in cases without thrombosis).

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