

Duration of peripheral intravenous catheter use and development of phlebitis

Rita Andriyani, Hindra Irawan Satari, Pustika Amalia

Abstract

Background Phlebitis is a common complication in patients with peripheral intravenous catheters, in addition to extravasation and bacterial colonization. Phlebitis may increase morbidity and length of hospitalization. One factor contributing to the rate of phlebitis is the duration of peripheral intravenous catheter use. Several adult studies have shown that the risk of developing phlebitis increased when the peripheral intravenous catheter was used for more than 72 hours. However, in pediatric patients this risk has not been consistently observed. As such, there is no recommendation for routine catheter removal every 72 hours in children.

Objective To assess for a possible relationship between duration of peripheral intravenous catheter use and the development of phlebitis.

Methods This analytic observational study had a case control design. Subjects consisted of 73 case subjects and 73 control subjects. We collected subjects' data through history-taking and clinical examinations. The duration of peripheral intravenous catheter use was reported in hours.

Results From October 2011 to February 2012, 146 children from the Department of Child Health at Dr. Cipto Mangunkusumo Hospital and Tangerang Hospital who used peripheral intravenous catheters were enrolled in this study. There was no significant difference between <72-hour and \geq 72-hour duration of peripheral catheter use (OR 1.31; 95%CI 0.687 to 2.526; $P=0.407$) on the development of phlebitis.

Conclusion We observe no relationship between duration of peripheral intravenous catheter use and the development of phlebitis in our subjects. [Paediatr Indones. 2013;53:117-20].

Keywords: phlebitis, peripheral intravenous catheter, children

Peripheral intravenous catheters are generally inserted into a peripheral vein and used for continuous or intermittent treatments.^{1,2} Major complications associated with these catheters are phlebitis, extravasation, and bacterial colonization, as well as development of catheter-related bloodstream infections (CRBSI).³ Boedjang reported the prevalence of phlebitis was 16.5%, followed by infiltration rate of 14.6% and bacteremia rate of 7.9% among neonates hospitalized in the Neonatal Intensive Care Unit (NICU) at Cipto Mangunkusumo Hospital.⁴

One factor related to the development of phlebitis is duration of peripheral intravenous catheter use. Adult studies have reported a relationship between the duration of peripheral intravenous catheter use and the development of phlebitis. It has been suggested that catheters should be removed every 72-96 hours to reduce the risk of phlebitis, but there has been no such recommendation for children.⁵ Other adult studies reported contradictory results, suggesting that female gender or diagnosis of infection were factors related to phlebitis, while other studies showed no such relationship to phlebitis.⁶ There has been no

From the Department of Child Health, University of Indonesia Medical School, Cipto Mangunkusumo Hospital, Jakarta.

Reprint requests to: Rita Andriyani, Jl. Kartini, Kompleks Pengairan Blok H no. 6 Bekasi 17113. Tel. +62-211-2688835, +62-180-8606522. E-mail: andriyani3001@yahoo.com

characteristics of pediatric patients shown to correlate to phlebitis.

The purpose of this study was to evaluate a possible association between duration of peripheral intravenous catheter use and the development of phlebitis in pediatric patients. In addition, we assessed if pediatric patient characteristics such as age, gender, diagnosis group or nutritional status were related to phlebitis in patients with peripheral intravenous catheters.

Methods

This was a case control study on all subjects used peripheral intravenous catheters, aged >28 days-18 years and were hospitalized in the Department of Child Health wards at Cipto Mangunkusumo Hospital and Tangerang Hospital. Subjects with phlebitis based on the diagnosis criteria of phlebitis were matched with a control subject in the same age group who had similar nutritional status. The early stage showed at least two of the following signs: pain at intravenous site, erythema, or swelling. The medium stage showed pain along path of cannula, erythema, and induration, while the late stage of phlebitis showed all the signs above with the palpable venous cord. Thrombophlebitis occurred when all the signs showed with fever. We recorded the duration of peripheral intravenous catheter use and other characteristics by history-taking, as well as from the medical records of subjects in both groups. There were 73 subjects in

the case group and 73 subjects in the control group, meeting the required sample size for our study. The relationship between dependent and independent variables were analyzed by Chi square test, with a P value of < 0.05 in a 95% confidence interval was considered to be statistically significant.

Results

During the study period, between October 2011 to February 2012, we collected 146 subjects of whom 73 subjects had phlebitis (case group) and 73 subjects served as a matched control group. Median age in the case group was 1 year and 6 months (range 2 months-16 years). Characteristics of subjects are shown in **Table 1**.

We found that the median duration of catheter use for development of phlebitis was 66 hours (2 days and 18 hours), ranging from 10 hours to 255 hours (10 days 15 hours) in our subjects. We defined catheter use duration as < 72 hours or ≥ 72 hours. Chi square test revealed that there was no significant difference between the phlebitis and non-phlebitis groups in terms of duration of catheter use ≥ 72 hours (OR 1.31; 95%CI 0.687 to 2.526; P=0.407). The location of catheter insertion in most subjects was in the upper extremities, rather than in the lower extremities, and was not significantly different (OR 0.862; 95%CI 0.295 to 2.514; P=0.785) between the case and control groups. No subjects had catheters in scalp veins. Chi square test revealed that subjects' genders were

Table 1. Characteristics of subjects

Characteristics	Case group (n=73)	Control group (n=73),
Age		
Median	1 year 6 months	1 year 9 months
Range	2 months-16 years	1 month-16 years
Gender, n (%)		
Male	43 (58.9)	31 (42.5)
Female	30 (41.1)	42 (57.5)
Diagnosis group, n (%)		
Infection	40 (54.8)	44 (60.3)
Non-infection	33 (45.2)	29 (39.7)
Nutritional status, n (%)		
Severely malnourished	6 (8.2)	6 (8.2)
Malnourished	15 (20.5)	15 (20.5)
Well nourished	52 (71.2)	52 (71.2)

significantly different (OR 1.942; 95%CI 1.006 to 3.749; P=0.047) between the two groups, with more males in the case group than in the control group (Table 2).

We recorded the intravenous medications and fluid that subjects had received when phlebitis developed and categorized them into chemotherapy drugs, non-chemotherapy drugs, fluid or blood products. In both groups, non-chemotherapy drugs were the most common medication given (Table 3).

We found that most subjects in the case group were in an early stage of phlebitis. No thrombophlebitis was found in our subjects. (Figure 1).

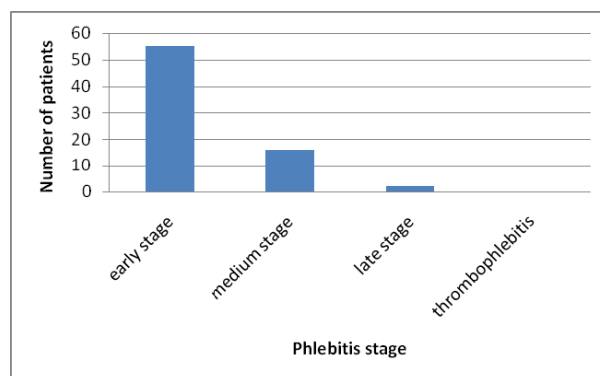


Figure 1. Distribution of stages of phlebitis

Table 2. Factors assessed for an association to the development of phlebitis

Variables	Case group (n=73)	Control group (n=73)	P value	OR (95% CI)
Duration of catheter use, n (%)				
<72 hours	41 (56.1)	36 (49.3)	0.407*	1.31 (0.687-2.526)
≥72 hours	32 (43.8)	37 (50.6)		
Inserted location, n (%)				
Upper extremity	65 (89)	66 (90.4)	0.785*	0.862 (0.295-2.514)
Lower extremity	8 (11)	7 (9.6)		
Gender, n (%)				
Male	43 (58.9)	31 (42.5)	0.047*	1.942 (1.006-3.749)
Female	30 (41.1)	42 (57.5)		

*Chi square test

Table 3. Distribution of intravenous medications and fluid

Intravenous products	Case group (n)	Control group (n)
Medications		
Chemotherapy	22	30
Non-chemotherapy	90	81
Fluid		
Isotonic solution	59	69
Hypertonic solution (non-blood product)	9	9
Blood products	26	11

Discussion

During the study period, we enrolled 146 subjects of which 73 subjects had phlebitis (case group) and remaining 73 subjects served as the control group. The median age of the case group was 1 year and 6 months (range 2 months-16 years), and was not significantly different from that of the control group with median age 1 year and 9 months (range 1 month-16 years). In both groups, most subjects were 1 month - 5 years

of age. In infants, it is often more difficult to insert peripheral intravenous catheters due to their tiny and fragile veins. It may be difficult to properly localize their veins when inserting a catheter, making it easier for them to develop phlebitis.⁷

The case group had significantly more male subjects than that of the control group. In contrast, a study of 300 adults in Iran showed that the development of phlebitis was associated with female gender, and related to hormonal status.⁶ In our study, most subjects

were aged 1 month-5 years, so they were likely not yet influenced by their pubertal hormonal status.

Most subjects had been diagnosed with infectious diseases. antibiotic treatment of these patients may have led to the development of chemical phlebitis. Most subjects from both groups were well nourished. Nutritional status was matched between the case and control subjects, since it is thought that malnourished patients would be more susceptible to infectious disease.

We found no difference in the percentage of patients who had catheter duration of ≥ 72 hours in the phlebitis group compared to the control group. This result was similar to that of another study that showed that a > 72 hour duration of peripheral intravenous catheter use was not associated with the development of phlebitis.⁸ Based on these results, we suggest that it is not necessary to remove catheters every 72 hours in children, as long as observation is done vigilantly to examine for signs of phlebitis. If signs of phlebitis are found, the catheter should be removed. At the Department of Child Health, Cipto Mangunkusumo Hospital, this is currently our standard operating procedure. Prior to the year of 2008, we routinely removed peripheral intravenous catheters every 72 hours.

In the case group, non-chemotherapy drugs were the most common drugs given. A limitation of our study was that we were unable to determine which drugs or fluid influenced the development of phlebitis, since all drugs/fluid were often given through the same route and at the same time.

We found that most of the case subjects were at an early stage of phlebitis. This condition was to be expected if medical workers were adequately observing the patients and looking for signs of phlebitis. No thrombophlebitis was found in our subjects during this study.

Another limitation of our study was that the subjects were obtained from 2 different hospitals which may have differed in terms of staff hand hygiene, sanitation, and other factors related to the development of phlebitis. Also, researchers examining and diagnosing

phlebitis may have differed in clinical judgment.

We found no relationship between the duration of peripheral intravenous catheter use and the development of phlebitis in our pediatric subjects. Therefore, we conclude that peripheral intravenous catheter may continue to be used as long as there is no sign of phlebitis. Careful and vigilant observation of the catheter must be undertaken and the catheter should be removed at the first sign of phlebitis.

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