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Predictor Factors of Phlebitis Incidence for Children in Hospital Private in Sidoarjo, Indonesia

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ABSTRACT
This study to analyze the effect of the location of infusion, intravenous catheter size, duration of infusion, and type of dressing, on the study of phlebitis in hospitalized children between the ages of 1 and 10 years. The cross-sectional study with 144 child-age respondents from 1 month to 10 years of age, selected by simple random sampling. The data was collected to assess installation location data, intravenous catheter size, duration of infusion and type of dressing. The data was used to determine the predictor factors that affected the incidence of phlebitis in hospitalized children by using multiple linear regression. The level of significance was set at P <0.05. The results of multiple linear regression demonstrate that the location and duration of infusion were more influential on the incidence of infusion in children aged from 1 month to 10 years. More specifically, Y = 1,737 + 0,600 X1 + 2.427X2 + 0,400X3 + 4,601 X4, whereby Y is the incidence of phlebitis, 1.737 is the coefficient value, X1 (0.600) is the location of installation, X2 (2,427) is the size of the catheter, X3 (0,400) is the length of installation and X4 (4,601) is the type of dressing. The incidence of phlebitis in children aged from 1 to month to 10 years who were admitted to a private hospital in East Java, Indonesia, was more influenced by the location factor of infusion and duration of infusion. Therefore, the standard of infusion installation and treatment prioritized as peptic principles.

Keywords: Phlebitis, Location of Intravenous line, Duration of intravenous access, Type of Dressing, Catheter Size.

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INTRODUCTION

Phlebitis is an infection that is often caused by infusion. This incident was found in over 60% of patients who were admitted to the hospital. Based on data from the Infection Control Program team (2012) in a hospital in Sidoarjo, Indonesia, the incidence of phlebitis in patients receiving intravenous therapy in inpatient rooms was above the national average of 3.22%. This data shows the percentage that exceeds the rational average, of which the reference is less than 1.5%, in accordance with the Decree of the Minister of Health 129 (2008). From these data, it is also known that the highest incidence of phlebitis is in the inpatient rooms of children [1,2].

Based on the data, medical personnel carried out improper disinfection in the insertion area, did not perform hand hygiene before carrying out the infusion procedure, did not use sterile personal protective equipment (PPE), used non-transparent dressings, and used large catheter sizes to accelerate the delivery of infusion, which was often needed, especially in pediatric patients with dehydration and shock, often causing phlebitis[3-5]. The consequences of complications from phlebitis in patients were increased length of stay at the hospital or length of stay (LOS), increased the length of therapy and nurse responsibility, and caused patients to be at risk of other health problems.

Many factors were considered to be involved in the pathogenesis of phlebitis, including chemical factors such as irritant drugs or fluids, and injecting drugs that could cause inflammation of the veins and infusion solutions with osmolarity > 900 mOsm/L given through a central vein. Mechanical factors were also considered, including material, catheter size, location and duration of cannulation and infectious agents. The large cannula, if used on veins with small lumens, can potentially irritate the intima part of the vein. Besides that, improper fixation could cause inflammation or phlebitis. Bacterial factors play a role for nurses in the development of phlebitis, including performing hand hygiene before carrying out infusion, using the right PPE, and correct disinfection before inserting catheter insertions [6-8]

To reduce the occurrence of phlebitis in intravenous therapy, the effort made by nurses includes observing the signs of redness, swelling, or the patient feeling pain around the location of infusion [9]. The role of nurses in overcoming the above included preventive strategies, namely, proper hand hygiene before wearing gloves, replacing all peripheral venous catheters every 72 hours, and promoting the location of the patient's body attached to the infusion. Curatives that were working with other medical teams to overcome the impact of giving rehabilitative intra-venous therapy minimized the occurrence of phlebitis in patients with intravenous therapy. Therefore, to minimize the risk of infection, nurses needed to be aware and recognize the factors that are predictors of phlebitis occurrence in hospitals [10-12]. For this reason, the purpose of this study is to analyze the predictive factors of phlebitis occurrence in children treated in a private hospital in Sidoarjo, Indonesia.

METHOD

This research used a cross sectional study to analyze the predictive factors of phlebitis occurrence in children treated in a private hospital in Sidoarjo, Indonesia. The participants consisted of 144 children aged from 1 to 10 years was carried out. The sampling technique was simple random sampling, which was used to respond to the participants involved.

Data were collected between 1 February and 12 May 2019. The data were collected from participants who met the following inclusion criteria for first-time infusion of children. The data was collected by observation about the location of the infusion, the size of the intravenous catheter, the duration

of the infusion, and the type of dressing. The location of observation consisted of the cephalic vein or metacarpal vein location. The measured catheter size consisted of size no. 22 or 24. The duration of infusion that was assessed consisted of <72 hours or > 72 hours. The type of dressing assessed consisted of transparent film dressing or hypafix. The measurement of the presence of phlebitis was performed by using Andrew Jackson's visual infusion phlebitis score measurement, with the criteria that phlebitis would not occur if the injection site looked healthy, and phlebitis if it had one of the following criteria: stabbing pain, erythematic area stabbing, swelling, indurations, nervous chord palpable, or fever.

This study was approved from the Ethical Review Board (ERB) Committee of the University of Muhammadiyah Surabaya (Surabaya, Indonesia; ERB No. 415/2019. The study participation consent form included statements that participants could withdraw their participation at any time, collected data would only be used for research purposes, and participants' anonymity would be protected. Participants provided consent voluntarily after a thorough explanation Data analysis was used to determine the predictor factors that affected the incidence of phlebitis in children admitted to the hospital using multiple linear regression. The level of significance was set at P <0.05.

RESULTS

Table 1 shows that most of participants were aged 1 to <2 years of age (27.78%). There were more females involved (55.6%). The most common medical diagnosis of the respondents is gastroenteritis (41.66%).

Table 1: Distribution of Respondents Based on age, sex, and medical diagnosis in a private hospital in Sidoarjo, Indonesia (N=144)

Characteristics of Respondents		Frequency	Percentage
Age			
-	1 month – <1 year	8	5.5
-	1 year – <2 years	40	27.7
-	2 years – <3 years	12	8.3
-	3 years – <4 years	12	8.3
-	4 years – <5 years	12	8.3
-	5 years – <6 years	12	8.3
-	6 years – <7 years	28	19.4
-	7 years – <8 years	8	5.5
-	8 years – <9 years	8	5.5
-	9 years – <10 years	4	2.7
Sex			
-	Male	64	44.4
-	Female	80	55.6
Medical diagnosis			
-	Gastroenteritis	60	41.6
-	Dengue Hemorrhagic Fever	48	33.3
-	Convulsion	16	11.1
-	Upper respiratory tract infection	8	5.5
-	Typhoid	8	5.5
-	Phariyngitis	4	2.7

Table 2 shows that most of the infusion sites were in the dorsal metacarpal vein (69.44%), the size of the intravenous catheter used for infusion was mostly using number 24 (72.22%), the duration of infusion was mostly less than 72 hours (58.33%), and the most common type of dressing used was hypafix dreesing (75.00%).

Table 2: Characteristics of phlebitis based on location of infusion, size of intravenous catheter, duration of infusion pairing, and type of dressing (N=144)

Variable	N	%
Location of intravenous (IV)		
- Dorsal metacarpal vein	100	69.4
- Cephalic vein	44	30.6
Intravenous Catheter Size		
- 24	104	72.3

- 22	40	27.7
Duration of intravenous (IV)		
- < 72 hours	60	41.6
- > 72 hours	84	58.4
Type of Dressing		
- Transparent film dressing	36	25.0
- Hypafix	108	75.0

Table 3 shows that there was an effect of the location on the catheter installation and the length of catheter placement that could affect the incidence of phlebitis. The Linear Regression test (= 0.048) shows that the duration of the infusion coefficient was more influential on the incidence of phlebitis in children aged 6-10 years than the dressing coefficient type, catheter size and location of installation. Moreover, the location of the installation showed more influence than catheter size and type dressings, due to greater coefficient value. Therefore, Y = 1,737 + 0,600 X1 + 2,427X2 + 0,400X3 + 4,601 X4, whereby Y is the incidence of phlebitis, 1,737 is the value of coefficient, X1 (0,600) is the location of installation, X2 (2,427) is the catheter size, X3 (0,400) is the length of installation and X4 (4,601) is the type of dressing. According to the summary table, the R value of 0.726 means that the closeness of the relationship between the variable location of the supply and the duration of intravenous (IV) with the phlebitis event variable was very strong, where R was the value of the multiple correlation coefficient. If the value was closer to -1 or 1, the relationship becomes stronger. If the value was closer to 0 (zero), the relationship becomes weaker.

Table 3: Factors influencing the incidence of phlebitis in children aged 6-10 years who are hospitalized (n = 144).

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	1.737	0.199		0.000	1.000
intravenous (IV) location	0.600	0.292	0.561	2.056	0.048
Catheter Size	2.427	0.393	0.000	0.000	1.000
Duration of intravenous (IV) access	0.400	0.114	0.400	3.521	0.001
Type of Dressing	4.601	0.293	0.000	0.000	1.000
R=0.726; Adjusted R^2=0.690					

DISCUSSION

Based on the research data, most of the locations of intravenous catheter placement were in the metacarpal vein location (69.44%). The location of intravenous (IV) had an influence on infusion events (p = 0.048). The location of intravenous placement in the metacarpal vein has the advantage of allowing arm movement, and being easily seen and palpated. However, it has a disadvantage in active patients, especially at the age of children who have not been able to cooperate with intravenous (IV) because it could shift the catheter, and the venous puncture site could jam if wrist restraints were installed. Therefore, it was what often caused phlebitis. The location of intravenous access of the catheter cephalic vein was located on the radial side of the arm (thumb). Installation of the cephalic vein had the advantage that it could be used for large catheter placement, especially in some cases that required fast droplets, and were preferred for infusion with irritating solutions. However, placement in the cephalic vein tends to be more difficult because of the more curved position of the metacarpal vein [6, 13]

The incidence of phlebitis mostly took place in the metacarpal vein, due to the high mobility of pediatric patients, especially in children aged 1 year to 5 years of age. In this study, the highest placement at that age was located at the location of the metacarpal vein. At the age of 1 to 5 years, the child cannot cooperate with the nurses, the child cannot bed rest, or the condition of the child was fussy, which made it easy for the intravenous catheter to shift. Very often the nurse took the act of detention in the form of excessive fixation at the intravenous catheter insertion site, to keep the catheter position from shifting due to excessive child mobility. The position of installing an intravenous location in the metacarpal vein also made it easier for the dressing to become wet when the child was washing hands or eating and drinking, so this was what caused the high incidence of phlebitis at the location of the metacarpal vein. The choice of location in the metacarpal vein is the nurse's first choice in the installation of intravenous catheters, since it was easier for nurses to insert intravenous catheters from the location of the cephalic vein, which was more curved, and intravenous catheter placement in the cephalic vein requires special expertise. Not all nurses were able to install on site cephalic vein [6, 13, 14].

Based on the research data, most of the intravenous catheter placement was carried out using number 24 (72.22%). The choice of intravenous catheter size did not affect the incidence of phlebitis (p = 1,000). The use of large catheter sizes in small blood vessels could potentially irritate the

venous walls (The Centers for Disease Control and Prevention, 2007). The shortest selection of catheters with the smallest number was appropriate for the type and duration of infusion. The larger the number of the vein catheter size, the smaller the number of times required [13].

Most phlebitis events occurred in infusion by using a catheter size of 22. The choice of use of intravenous catheters with size 22 was often given to children over the age of 5 years. The installation of catheter number 24 with droplets of 13ml / min is sufficient for parenteral fluid administration, but not all nurses understand the meaning of droplet parameters on the intravenous catheter label. Some nurses chose catheter size based on the age of the child, without looking at the condition of the child's vein. The most popular selection of catheter size was number 22, which was given to children over 5 years of age. Age cannot be used as a benchmark in the selection of intravenous catheters, because the use of a large catheter size in a small vein can irritate the vein wall, which triggers phlebitis. However, the condition of nutritional status and type of disease also affected the occurrence of phlebitis.

Catheter size 22 had a parameter of 42ml / min that could be given under certain conditions that required large amounts of rehydration fluid or fast drops. In this research, the most common selection of intravenous catheter size was number 24, and the incidence of phlebitis in the use of catheter size number 24 was also still found, although the number was smaller compared to the incidence of phlebitis by using intravenous catheter size number 22 [8,13].

Based on research data, the duration of infusion was mostly less than 72 hours (58.33%). Indeed, the duration of infusion has an influence on infusion events (p = 0.001). The installation of an intravenous catheter that exceeds 72 hours can facilitate the inoculation of germs into the blood vessels, which are the causative factors for inflammation of the veins or phlebitis. Observations showed that catheter placement exceeding 72 hours was caused by the patient's parents refusing to replace the location of the infusion for reasons of pity, or there were plans to go home and wait for a doctor's visit. Some even refused to change the location of intravenous catheter placement because parents were afraid their children would become fussy again. Therefore, the role of nurses as motivators is required to provide Health Education to families of pediatric patients, in order to provide an understanding of the purpose of changing the location of the intravenous catheter every 3 days [15].

Based on the research data, the majority of pediatric patients used the hypafix dressing type (75.00%). The type of dressing had no effect on the incidence of infusion (p = 1,000). The use of transparent film type dressings made it easier to observe phlebitis signs earlier, without manipulation. The installation of a type of transparent film dressing is more often done in pediatric patients aged over 6 years of age, in which children are more cooperative with the infusion procedure. Installation of dressings with hepatic was mostly performed in children less than 5 years of age, or in children who were active on the grounds to maintain infusion fixation. Certainly, this is not in accordance with the Standard Operating Procedure (SOP) of infusion in private hospitals in Sidoarjo Indonesia, which stipulated the use of dressings from transparent films. The use of dressings that were not transparent made it difficult to observe the signs of phlebitis that occurred. Therefore, the manipulation was often done if the infusion was a problem which ultimately facilitated the occurrence of phlebitis. The researcher also found that nurses sometimes forgot about washing their hands before carrying out intravenous catheter placement, and some nurses even did intravenous catheter installation without using PPE.

The selection of dressings for infusion was indeed not an absolute necessity to prevent phlebitis, because the method of disinfection during intravenous catheter installation and sterility of the device also greatly affected the occurrence of phlebitis. Besides that, nurses also had to do hand hygiene before performing catheter installation and using the right PPE [16].

CONCLUSION

This research aimed to determine the predictor of the influence of phlebitis in children aged 5-10 years. The factors tested were the location of the infusion, catheter size, duration of infusion, and type of dressing. The results showed that the duration of infusion and the length of installation had the most effect on the incidence of phlebitis in children aged 6-10 years, rather than catheter size and type of dressing, because of greater coefficient. The results yielded by the experiments were promising, and future work on determining the predictor of the influence of phlebitis in children merits further investigation.

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CONFLICT OF INTEREST

The authors have no conflicts of interests to declare.

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