Original Article

The Effect of Contrast Therapy on Phlebitis Severity in Toddlers and Preschoolers: A Clinical Study at Cibabat Hospital, Cimahi

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Abstract

Background: Phlebitis remains a prevalent complication associated with intravenous therapy in pediatric populations, particularly among toddlers and preschool-aged children. Managing phlebitis effectively is essential to minimize discomfort and prevent further complications. Non-pharmacological interventions, such as contrast therapy which involves alternating applications of warm and cold compresses have shown potential in reducing local inflammation and improving patient outcomes.
Objective: This study aimed to assess the effectiveness of contrast therapy in reducing phlebitis severity among young children receiving intravenous treatment at a public hospital in Indonesia.
Methods: A quasi-experimental study was conducted using a non-equivalent control group design with pretest and posttest assessments. A total of 30 pediatric patients diagnosed with phlebitis were recruited and allocated to either the intervention group (contrast therapy) or the control group (cold compress only). Phlebitis severity was evaluated using the Visual Infusion Phlebitis (VIP) Scale. Statistical analyses included the Wilcoxon signed-rank test and Mann–Whitney U test for bivariate comparisons, and logistic regression for multivariate analysis.
Results: The application of contrast therapy significantly reduced the phlebitis grading scale within the intervention group. However, when comparing the intervention and control groups, the difference in mean phlebitis score reduction was not statistically significant.
Conclusion: Contrast therapy serves as an effective non-pharmacological approach to managing phlebitis in pediatric patients. Nonetheless, its clinical effectiveness in comparison to cold compress therapy alone appears comparable. Further research with larger sample sizes and randomized designs is recommended to validate these findings and optimize clinical practice.

Keywords: Cold compress, contrast therapy, pediatric nursing, phlebitis, warm compress

INTRODUCTION

Children who are hospitalized generally receive intravenous therapy as a general treatment that is often given (1). Infusion therapy is the administration of fluid or medication into a vein in a certain amount and time (2). Phlebitis is the most common complication of infusion

compared to extravasation, ecchymosis, hematoma and infection (1,3,4). Phlebitis is inflammation that occurs in veins caused by catheters or chemical irritants of additives and drugs given intravenously (5). Phlebitis is typically characterized by pain at the insertion site, tenderness, swelling, erythema, redness, and the presence of a hardened venous cord. If left unmanaged, phlebitis can lead to the formation of a thrombus, potentially progressing to thrombophlebitis. Although the condition is generally benign, there is a risk that the thrombus may dislodge and enter the bloodstream. If it reaches the heart, it can act as a ball-valve obstruction between the atria and ventricles, leading to sudden cardiac blockage and potentially fatal outcomes (6).

According to the Infusion Nurses Society (INS), the acceptable incidence rate of phlebitis is 5% or less. In contrast, the national standard reference recommends a target rate of no more than 1.5%(7). A study conducted in an Indian hospital reported a rising trend in phlebitis incidence, increasing from 3.7% at the time of catheter insertion to 21.2% after 24 hours, and reaching 27.5% after 48 hours (8). These findings are consistent with research from a hospital in Italy, which showed an increase in phlebitis signs from 12% within the first 24 hours to 34%, and up to 65% after 48 hours (9). In Indonesia, data from the Ministry of Health (2015) revealed a significantly higher incidence of phlebitis—50.11% in government hospitals and 32.70% in private hospitals (10).

Research on the prevention and management of phlebitis has been widely conducted. Common nursing interventions for treating phlebitis include the application of warm water compresses, alcohol compresses, and normal saline compresses. The treatment of phlebitis that is commonly done by nurses is to compress using warm water, alcohol and normal saline (10). A study conducted by (11) reported that alternating warm and cold compresses for 15 to 20 minutes, every 4 hours for 1 to 2 days, can effectively reduce tissue injury caused by infusion-related complications. Both warm and cold compresses have been shown to alleviate pain, erythema, and induration, with cold therapy having a more immediate effect in reducing visible signs of inflammation (12,13). Another study conducted by (14) states that the Contrast Bath sequence starts with 4 minutes of heat application and ends with 1 minute of cold application for 20 minutes able to increase arterial blood flow in the lower leg by 100 mL / minutes compared to hot and cold applications which are carried out separately. However, the negative impact of phlebitis can cause trauma to children as well as hamper treatment time, so nurses need to be careful in preventing the occurrence of phlebitis (14,15).

Despite growing evidence supporting the use of contrast therapy, most studies have focused on adult populations or specific body regions, and evidence in pediatric patients, particularly toddlers and preschoolers, remains limited. Moreover, the negative impact of phlebitis in children can lead to emotional trauma, treatment delays, and increased healthcare burden. Therefore, nurses must adopt evidence-based approaches to prevent and treat phlebitis effectively in pediatric settings. Addressing this gap, the present study aims to investigate the effect of contrast therapy on reducing phlebitis severity in children treated at a public hospital in Indonesia.

METHODS

Research Design

This study employed a quasi-experimental design, in which participants were assigned to the intervention and control groups without randomization. Specifically, a non-equivalent control group design with pretest and posttest was used to compare the outcomes between the intervention and control groups (16). his design enables the evaluation of the intervention's effectiveness by measuring changes before and after the treatment in both groups. In this study, the intervention involved the application of contrast therapy, and the objective was to assess its effect on reducing the severity of phlebitis in pediatric patients.

Population and Sample

The population in this study were toddlers and preschoolers who had infusions treated in the children's room at the Cibabat Hospital. This research was carried out in the inpatient ward of the C6 building at the Cibabat Hospital, as one of the Referral Hospitals in Cimahi City.

The sample was selected using consecutive sampling. This subject was included in the study until a certain period of time, so that the required number of respondents was met. In this study divided into 2 intervention groups

which have homogeneous sample requirements in both groups, so the research sample criteria are needed. Inclusion criteria were children who have phlebitis, toddler and preschool age children, cooperative child, the family is willing if the child is made a respondent, families are able to read, write, communicate verbally and cooperatively. The exclusion criteria were children with phlebitis due to other complications are children who have edema of their extremities, children with phlebitis who are not cooperative (fussy) after a cycle of compress. Based on the calculation results, the sample size in this study was 14 samples of the intervention group and 14 samples of the control group so that the total sample was 28 samples.

Measures

Evaluation of phlebitis degree using VIP Score is done before and after the compress action by observation using inspection and palpation techniques. Assessment after the compress is carried out follow-up once every 4 hours for 2 days to find out the condition of the area that has phlebitis as well as a decrease in the degree of phlebitis in children given infusion therapy and drugs through intravenous access. The nutritional status assessment observation sheet in this study uses the an topometric standard table for nutritional status assessment that refers to the World Health Organization Standards (WHO 2005). The pain assessment observation sheet in this study uses the FLACC Scale, where the rating scale is based on Face, Legs, Activity, Cry and Consolability (FLACC Scale).

Data analysis

In univariate analysis categorical data, namely, sex, nutritional status, disease status, and medication therapy are presented in frequency and percentage distribution. Whereas numerical data namely, age, degree of phlebitis before and after intervention are presented in the difference in mean and standard deviation. Bivariate analysis is performed to determine the differences between the two variables. Before conducting bivariate analysis, researchers conducted data normality tests and homogeneity tests to see the equality and distribution of data between the intervention and control groups. This multivariate analysis uses logistic regression analysis, where the aim is to see the relationship between several independent variables with one dependent variable. All data were analysis using SPSS software version 22 (17).

Ethical consideration

The study was carried out after passing the ethical test by the Hospital ethics committee as well as from LPPM STIKES Ahmad Yani Cimahi.

RESULTS

Table 1 show the comparison of age, gender, nutritional status, disease status, different type of compress between children with and without phlebitis. Preschool children tend to have high risk of phlebitis than toddler.

Table 1. Comparison of Age, Gender, Nutritional Status, Disease Status, Medication Therapy and Compress Interventions both group (N=28)

Variable		Phlebitis		Non-Phlebitis		*p-Value*	Odd Ratio	CI 95%	
		n	%	n	%			Min	Mx
Age	Toddler	0	0	18	100	0.018	1.500	1.005	2.238
	Preschool	4	33.3	8	66.7				
Gender	Female	2	11.8	15	88.2	1.000	0.733	0.089	6.041
	Male	2	15.4	11	84.6				
Nutritional Status	Good	4	15.4	22	84.6	1.000	0.846	0.718	0.997
	Less	0	0.0	4	100				
Diseases Status	Infection	0	0.0	15	100	0.100	1.364	1.005	1.850
	Non-Infection	4	26.7	11	73.3				
Compress Intervention	Contrast Compress	1	6.7	14	93.3	0.598	0.286	0.026	3.121
	Cold Compress	3	20.0	12	80.0				

There were no differences in the gender, nutritional status, disease status, different type of compress between children with and without phlebitis. The mean of degree of phlebitis was similar in the warm and cold compress (contrast therapy) and cold compress before the intervention, while after intervention there was reduction of phlebitis degree in group contrast therapy (mean: 0.07, p-value=0.031) (Table 2).

Table 2. Comparison of Average Phlebitis Scores Before and After Intervention Between Contrast Therapy and Cold Compress Groups (N = 32)

Variable	Contrast Therapy n = 16)	Cold Compress n = 16)	*p-value*
Phlebitis Score Before Intervention			
Mean	2.80	2.73	0.703
Median	3.00	3.00	
Highest	3.23	3.12	
Lowest	2.37	2.34	
Phlebitis Score After Intervention			
Mean	0.07	0.20	0.031*
Median	0.00	0.00	
Highest	0.21	0.43	
Lowest	−0.08	−0.03	

*Significant at p < 0.05

Table 3 shows the significance of the difference in the mean score of phlebitis in pre and post levels in the compress group with a value of p-value = 0.001, before and after the intervention Warm and Cold Compress Alternately (Contrast Therapy) to decrease the degree of phlebitis.

Table 3. Differences in Phlebitis Scores Before and After Intervention Between Contrast Therapy and Cold Compress Groups (N = 32)

Group	Time	Mean ± SD	*p-value* (Within Group)
Contrast Therapy (n = 16)	Before Intervention	2.80 ± 0.14	
	After Intervention	0.07 ± 0.19	0.001*
Cold Compress (n = 16)	Before Intervention	2.73 ± 0.13	
	After Intervention	0.20 ± 0.13	0.000*
Comparison Between Groups	Pre-Intervention	Post-Intervention	
p-value	0.840	0.290	

*Significant at p < 0.05
Note: Wilcoxon test used for within-group comparison; Mann–Whitney U test used for between-group comparison.

DISCUSSION

This study showed that the application of warm and cold alternately compress (contrast therapy) can reduce the degree of phlebitis. The degree of phlebitis of children before getting warm and cold compress therapy alternately (contrast therapy) varies, ranging from a range of 2 to 4. The difference in the decrease in the degree of phlebitis before and after being given compress ranges between 3 and 2. Decreasing the degree of phlebitis occurs in respondents who previously were degree 4 decreased to degree 1 whereas respondents who were previously at degree 2 decreased to degree 0. The act of alternating warm and cold compress basically uses the principle of "Contrast Bath" is a thermal modality therapy that combines the application of hot and cold water to increase blood flow, reduce pain, stiffness, and edema

with the process of transferring heat and cold temperatures to produce an effect vasodilation and external vasoconstriction (18). Giving hot and cold compress locally in injured body parts can be useful for treatment as well as giving hot and cold compress to the body aiming to improve tissue repair and recovery (Potter & Perry, 2006). In line with previous study states that the action of warm compress and cold compress alternating for 15 to 20 minutes, every 4 hours, for 1 to 2 days can reduce injuries due to infusion complications (11,14)

Treatment of phlebitis through alternating warm and cold compress (contrast therapy) is an inexpensive and safe intervention for children and does not have a high risk. Based on the measurement results of the significance of the difference in the average score of phlebitis between groups obtained pre- intervention results (P value = 0.840) while the results of post-intervention (P value = 0.291) where P > 0.05, statistically there is no significant difference between warm compress intervention and alternating cold (contrast therapy) and cold compress. Therefore, it can be concluded that alternating warm and cold compress (contrast therapy) and cold compress have the same effectiveness in reducing the degree of phlebitis. Based on observations on pediatric patients in C6 room of Cibabat Hospital who have phlebitis, most are at the age of toddler and preschool. Phlebitis in pediatric patients is mostly in the range of degrees 2 to 4, which is characterized by pain, redness, swelling and hardening of the veins along the stabbing area (19–21).

The results of studies conducted on pediatric patients who have phlebitis in which pain, redness and swelling are found due to phlebitis, resulted in the finding that the action of warm and cold compress alternately (contrast therapy) carried out for 20 minutes gives a reduced pain effect compared to before being given compress. In addition, swelling in the area affected by phlebitis is also reduced. In line with the results of research that has been conducted by (18) in a previous study of the benefits of contrast therapy explained that pain, stiffness, and edema can be reduced after a warm compress and alternating cold (contrast therapy), where this application can induce blood vessels to increase the effects of vasodilation and vasoconstriction. The effect of vasodilation and vasoconstriction produced by warm and cold compress in contrast (contrast therapy) in the healing process due to phlebitis has a "pumping" effect and causes fluctuations in blood flow velocity (18). An increase in the speed of blood flow causes the intake of oxygen and nutrients to repair soft tissues to also increase, resulting in a decrease in local inflammation of tissue trauma (22,23).

The advantage of alternating warm and cold compress interventions (contrast therapy) when compared with cold compress in an effort to reduce the degree of phlebitis is the collaboration of warm and cold thermal applications simultaneously at one time, where the sequence of contrast compress starts with 4 minutes of application of heat and ends with 1 minute application of cold application for 20 minutes, can increase arterial blood flow in the lower leg as much as 100 mL / min compared to hot and cold applications which are done separately (24). In addition, the advantage of contrast therapy is that the longer the administration of warm compresses can cause fluctuations in arterial blood flow velocity which is more adequate.

Study Limitations

This study has several limitations that should be acknowledged. First, the sample size was relatively small (N = 32), which may limit the generalizability of the findings to broader pediatric populations. A larger sample size would provide greater statistical power and more robust conclusions. Second, the study was conducted at a single public hospital in Indonesia, which may not represent clinical practices or patient characteristics in other healthcare settings or regions. Third, the use of a quasi-experimental design without randomization may introduce selection bias, despite efforts to match groups. Additionally, the short duration of follow-up limited the ability to assess long-term effects of contrast therapy on phlebitis progression or recurrence. Lastly, observational bias could not be entirely ruled out, as the assessment of phlebitis relied on visual grading, which may vary slightly among observers despite the use of standardized tools. Future research should consider using randomized controlled designs, multi-center trials, and longer follow-up periods to strengthen the evidence and applicability of contrast therapy in pediatric phlebitis management.

CONCLUSION

There are significant differences in the degree of phlebitis in children before and after alternating warm and cold compress interventions (contrast therapy). There is a significant difference in the degree of phlebitis in children before and after cold compress intervention is given. No significant difference in the average degree of phlebitis in children receiving alternately warm and cold compress interventions (contrast therapy) and cold compress interventions. Nurses can apply alternately warm and cold compress therapy (contrast therapy) as a non-pharmacological therapy to reduce the degree of phlebitis in children. Compress therapy is a therapy that is inexpensive and easy to apply to children, so nurses in their nursing services can collaborate with families in monitoring the administration of compress for optimal reduction in the degree of phlebitis. The results of research on warm and cold compress alternately (contrast therapy) still need to be developed again related to the procedure for implementing compress. The action of warm and cold compress alternately requires more energy and time due to the use of warm water media with a stable temperature, as well as the time to do the compress that is required on time. Therefore, based on the results of this study, to improve the effectiveness of services in treating phlebitis, the administration of cold compress is more recommended than the provision of warm and cold compress alternately (contrast therapy). In addition, it is necessary to develop other media that can be used to compress, where the temperature provided must be more stable so that it can support the provision of nursing care to children who have phlebitis.

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Author Contributions

DA : Conceptualization, data collection, analysis, manuscript writing, Supervision, review, and editing.
ED : Conceptualization, data collection, analysis.
AS : Conceptualization, data collection, analysis, manuscript writing.
DA : Conceptualization, data collection, analysis, manuscript writing

Conflict of Interest Disclosure

The authors declare no conflicts of interest related to this study.

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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