Transpore Tape and Transparent Film Dressing on the Incidence of Early-Stage Phlebitis: A Comparative Randomized Trial

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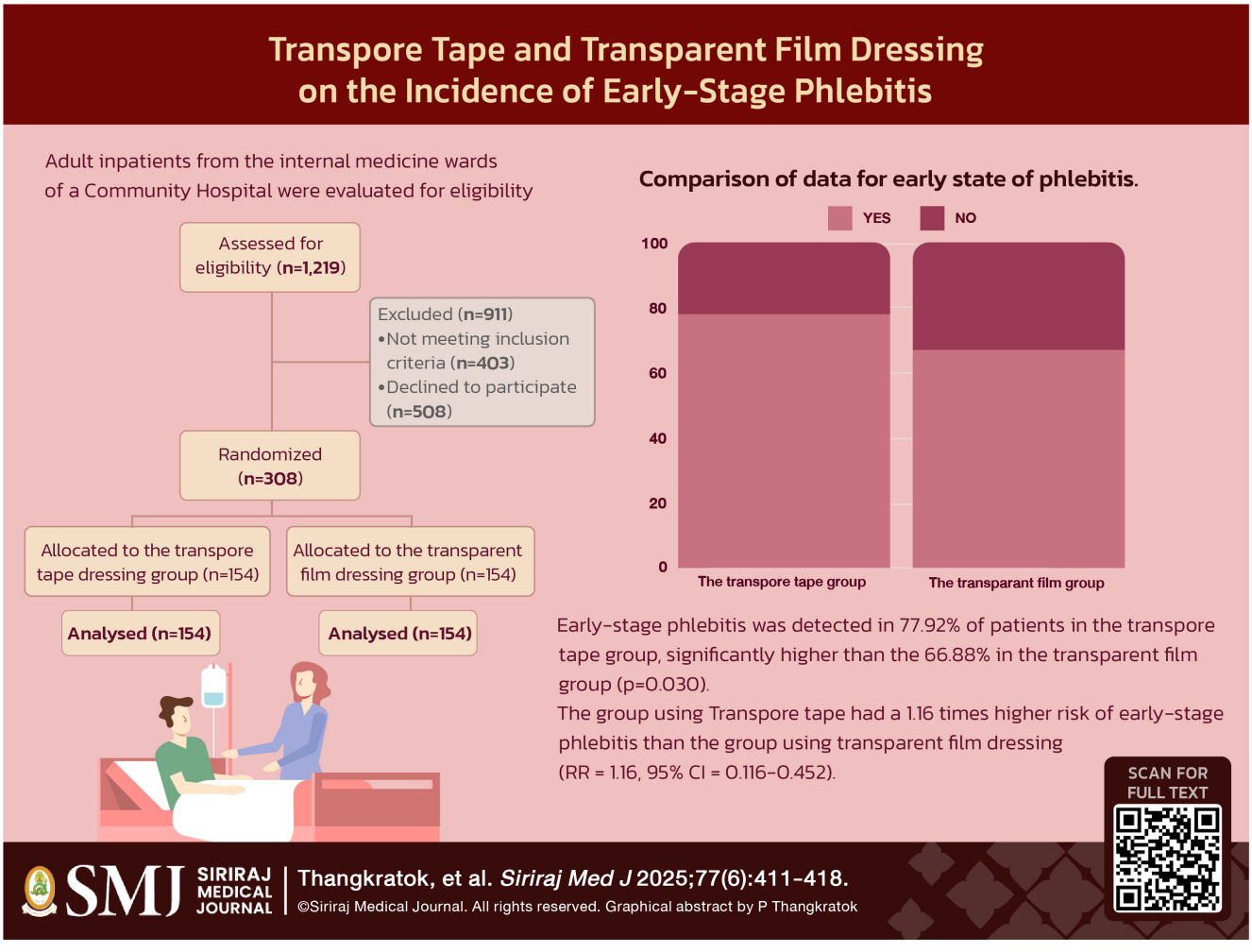

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ABSTRACT

Objective: This study compares the effectiveness of transpore tape and transparent film dressing on the incidence of early-stage phlebitis among patients with peripheral venous catheters.

Materials and Methods: We conducted a randomized controlled prospective study on 308 inpatients in the internal medicine wards of a community hospital in Thailand, from November 2020 to March 2021. The visual infusion phlebitis scale was employed for assessments by registered nurses at least every eight hours.

Results: Demographic and health factors were similar in both transpore tape and transparent film dressing groups. Notably, early-stage phlebitis was detected in 77.92% of patients in the transpore tape group, significantly higher than the 66.88% in the transparent film group (p=0.030). The group using transpore tape had a 1.16 times higher risk of early-stage phlebitis than the group using transparent film dressing (RR = 1.16, 95% CI = 0.116-0.452). Statistical analysis showed a significant difference in catheter removal time between the two groups.

Conclusion: Transparent film dressings demonstrated greater efficacy in reducing early-stage phlebitis incidences in patients with peripheral venous catheters, suggesting their preferable use in clinical settings.

Keywords: Peripheral venous catheter; transparent film dressing; transpore tape; phlebitis (Siriraj Med J 2025; 77: 411-418)

INTRODUCTION

Peripheral intravenous catheters (PIVCs) are a standard invasive nursing procedure used for administering fluids, medications, and blood components.[1] In the United States alone, annual usage ranges between 200 to 300 million,[2] and global estimates indicate approximately 2 billion catheters are utilized annually.[3] A substantial proportion, between 50% to 90%, of hospitalized patients undergo catheter implantation. Despite its necessity, this procedure can lead to complications such as phlebitis.

Phlebitis, the inflammation of veins, can result from the chemical properties of administered substances or bacterial infection.[3-5] The reported incidences of phlebitis range between 0.1% and 63.3%, with symptoms including fever, redness, swelling, pain, localized warmth or coldness, pus formation, and more severe complications like reduced fluid flow, visible vein tracks, tissue damage, organ dysfunction, and blood clots.[6-8] The choice of cannula insertion practices, including the selection of appropriate devices and dressings, is critical in preventing phlebitis.[9] Previous studies have shown divergent outcomes regarding the effectiveness of different dressing types, with some suggesting that transparent film dressings could reduce complications,[10] while others indicate no significant difference or even superiority of gauze and tape dressings.[11,12] To the best of our knowledge, there is no evidence indicating a direct association between the use of transpore tape or transparent film dressing and the incidence of phlebitis. However, further investigation is necessary to confirm this finding.

Given the conflicting evidence and the absence of specific data comparing transpore tape and transparent film dressing in early phlebitis, this study aims to bridge this gap. Additionally, considering the varied costs of these dressings, a comprehensive cost-effectiveness analysis is essential.[13] This study seeks to evaluate the efficacy of transpore tape and transparent film dressing on the incidence of early-stage phlebitis in patients with peripheral venous catheters, potentially offering new insights and strategies for early management of the phlebitis.

MATERIALS AND METHODS

Study design

This study was a randomized controlled trial with a parallel-group design, conducted on inpatients in the internal medicine wards of a community hospital in Thailand. The trial spanned from November 2020 to March 2021.

Ethical considerations

All participants provided written informed consent. The study received ethical approval from the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University (COA No.1037/2020, IRB No.332/63) on August 27, 2020. The trial was officially registered in the Thai Clinical Trial Registry (TCTR20210801004).

Participants

The study included adult patients over the age of 18 years who underwent IV therapy with osmolality less than 820 mOsm/L via a PIVC during their hospital stay. Participants were required to have a body mass index (BMI) ranging from 18.50 to 22.90 kg/m^2 and be

communicative, cooperative, and willing to engage in the study. The study excluded patients on immunosuppressive therapy, those with hypercoagulability disorders, patients experiencing diaphoresis, those with peripheral nervous system disorders, or a known allergy to transparent dressings.

Randomization

Participants were divided into two groups through block randomization, utilizing blocks of two based on a table of random numbers. The groups were 1) the transpore tape dressing group, and 2) the transparent film dressing group. Enrollment and assignment of participants to each group were conducted by a registered nurse (RN). Participants could not be blinded to the intervention due to the nature of the dressing types, as they were able to visibly identify the type of dressing applied.

Interventions

The PIVCs were administered by an RN to patients meeting the inclusion criteria. To minimize the risk of phlebitis, the smallest gauge and shortest length PIVC compatible with the prescribed therapy were selected.[14] Preferred sites for catheter insertion included the basilic, cephalic, dorsal metacarpal, and dorsal venous arch veins on the dorsal forearm.[14,15]

The PIVC insertion followed a strict aseptic protocol. This process began with routine hand hygiene, a practice repeated as necessary, especially after handling any invasive medical devices.[14] Skin preparation for catheter insertion involved using a 70% alcohol solution for antiseptic purposes.[16] After PIVC insertion, a separate RN, who was not involved in the initial procedure, applied the dressing. In the transpore tape group, a transpore tape was used to secure the catheter.

Outcome measures

The primary outcome of this study was the incidence of early-stage phlebitis, assessed using the Visual Infusion Phlebitis Scale. Post-insertion of the catheter, an RN conducted evaluations at least every eight hours. The outcome assessment was performed by an independent registered nurse (RN). The RN was not involved in the clinical trial procedures or group allocation, ensuring that the assessment of phlebitis outcomes was unbiased. The phlebitis grading at the insertion site was independently reviewed by two researchers, who then collaborated to reach a consensus on the visual infusion phlebitis score. Early-stage phlebitis was defined as a level 2 on a scale ranging from 0 to 5, where 0 represents no signs of phlebitis and 5 indicates an advanced stage, characterized by the presence of two or more symptoms such as pain, erythema, or swelling.[17]

Sample size calculation

The sample size for this non-inferiority or superiority trial was calculated using a specific statistical formula. This calculation resulted in a requirement of 138 participants per group. To accommodate potential dropouts and other unforeseen contingencies, an additional 10% was factored in, bringing the total to 308 patients. Consequently, the study included 154 patients in the transpore tape dressing group and 154 in the transparent film dressing group, each with attached peripheral venous catheters.

Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0 for Windows. This included descriptive statistics, chi-square tests, and Fisher's exact test. Fisher's exact test was used to analyze categorical data because it is particularly appropriate when sample sizes are small or when the expected frequencies in any of the cells of a contingency table are below 5. In our study, certain subgroups had relatively small frequencies, which could have violated the assumptions of the Chi-square test (i.e., expected frequencies should be at least 5 in each cell). As a result, Fisher's exact test was chosen because it is more reliable for determining the significance of associations in these cases, without the risk of invalid conclusions due to small sample sizes. We performed a multivariable analysis to control for potential confounding factors that could influence the comparison of the two interventions. This analysis allowed us to adjust for relevant determinants, such as patient characteristics (e.g., age, gender, comorbidities) and baseline conditions that could impact the outcomes related to early state of phlebitis. Relative risk (RR) was calculated using SPSS 23.0. The threshold for statistical significance was set at a p-value of less than 0.05. The relative risk (RR), or risk ratio, is the ratio of the risk of an event in the transpore tape dressing group (e.g., exposed group) versus the risk of the event in the transparent film dressing group (e.g., nonexposed group) and the confidence interval (CI). A p-value of less than 0.05 in this analysis indicated a statistically significant association between the groups. In addition to the intention-to-treat (ITT) analysis, a per-protocol analysis was conducted as a secondary approach. The per-protocol analysis included only those participants who adhered strictly to the assigned intervention protocol and completed the study as per the predefined procedures. This analysis was performed to assess the outcomes based on the

participants who followed the treatment plan without any deviations.

RESULTS

Participant characteristics

Between November 2020 and March 2021, 1,219 adult inpatients from the internal medicine wards of a Community Hospital were evaluated for eligibility. Of these, 403 were excluded due to IV therapy with osmolality <820 mOsm/L via PIVC and having a BMI below 18.5 or above 22.90 kg/m^2. Additionally, 508 chose not to participate. Consequently, 308 adult patients were recruited and evenly divided into two groups of 154 each (Fig 1).

Table 1 reveals that both transpore tape dressing group and the transparent film dressing group were comparable in terms of gender, average age, highest level of education, presence or absence of chronic diseases, smoking habits, number of insertion attempts, PIVC site, use of IV medication, and IV fluid utilization. No significant differences were observed between the two groups.

Table 2 presents the incidence of early-stage phlebitis between the groups. The transpore tape dressing group exhibited a 77.92% incidence, while the transparent film dressing group showed a 66.88%. A statistically significant difference in phlebitis incidence between the groups was observed. The group using transpore tape had a 1.16 times higher risk of early-stage phlebitis than the group using transparent film dressing (RR = 1.16, 95% CI = 0.116-0.452).

Table 3 shows the comparison of data for catheter dwell time. In this table, 53.25% of catheters in the transpore tape dressing group had a catheter dwell time of 49–72 h, whereas 61.69% of catheters in the transparent film dressing group had a dwell time of 73-96 h. The analysis showed that catheter dwell time of 49–72 h and 73-96 h varied by the groups, which was statistically significant ($p < 0.001$)

DISCUSSION

Peripheral Intravenous Catheter (PIVC) administration, globally used to deliver fluids, medications, or blood components, frequently results in phlebitis due to the procedure's invasive nature. Therefore, ensuring the catheter's stability is vital to reduce complications. This research compared the effectiveness of transpore tape and transparent film dressing on the incidence of early-stage phlebitis in patients with a PIVC. We found that early-stage phlebitis developed in 77.92% of the transpore tape group, in contrast to 66.88% in the transparent film dressing group. A statistically significant difference in the

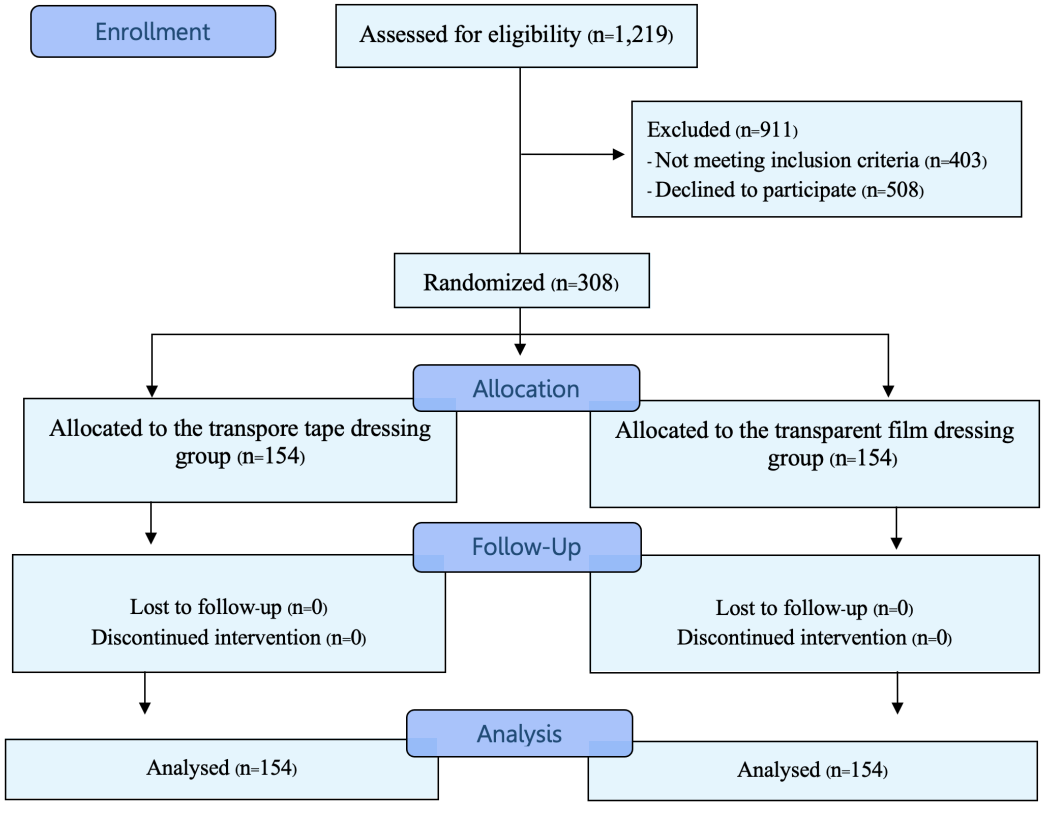

Fig 1. CONSORT 2010 flow diagram of the clinical trial.

TABLE 1. Participants characteristics.

Individuals' characteristics	The transpore tape dressing group (n=154)		The transparent film dressing group (n=154)		Statistical significance
	N	%	N	%	
Gender					x^2 = 0.468, p = 0.494
Female	82	53.25	76	49.35	
Male	72	46.75	78	50.65	
Age	**Mean ± SD**		**Mean ± SD**		t = -0.123, p = 0.902
	57.57 ± 18.34		57.84 ±19.53		
Highest educational					x^2 = 2.399, p = 0.310
Primary School	5	3.25	8	5.19	
Secondary School	133	86.36	123	79.87	
Bachelor Degrees	16	10.39	23	14.94	
Having a chronic disease					x^2 = 2.561, p = 0.110
Yes	111	72.08	123	79.87	
No	43	27.92	31	20.13	
Use of Smoking					x^2 = 0.120, p = 0.729
Using	20	12.99	18	11.69	
Not in use	134	87.01	136	88.31	
Number of attempt					x^2 = 0.151, p = 0.698
1 time	42	27.27	39	25.32	
> 1 time	112	72.73	115	74.68	
The site of PIVC					x^2 = 5.956, p = 0.114
Basilic vein	15	9.74	29	18.83	
Cephalic vein	101	65.58	91	59.09	
Dorsal metacarpal veins	34	22.08	28	18.18	
Dorsal venous arch	4	2.60	6	3.90	
Use of IV medication					x^2 = 0.024, p = 0.876
Using	130	84.42	129	83.77	
Not in use	24	15.58	25	16.23	
Use of IV fluid					x^2 = 1.903, p = 0.168
Using	124	80.52	133	86.36	
Not in use	30	19.48	21	13.64	

TABLE 2. Comparison of data for early state of phlebitis.

The early state of phlebitis	The transpore tape dressing group (n=154)		The transparent film dressing group (n=154)		Statistical significance
	N	%	N	%	
Yes	120	77.92	103	66.88	$x^2 = 4.696$, $p = 0.030$
No	34	22.08	51	33.12	
Total	**154**	**100.00**	**154**	**100.00**	

TABLE 3. Comparison of data for catheter dwell time.

Catheter dwell time	The transpore tape dressing group (n=154)		The transparent film dressing group (n=154)		Statistical significance
	N	%	N	%	
24–48 h	1	0.65	3	1.95	*p = < 0.001*
49–72 h	82	53.25	5	3.25	*Fisher's Exact Test*
73-96 h	37	24.03	95	61.69	

incidence of phlebitis was observed between the groups.[18] Despite these variations, both investigations underscore a significant difference in complication rates between the groups. Transparent film dressing is an adhesive dressing made of thin, transparent film placed over the PIVC. It is designed to be breathable and waterproof, allowing for easy wound monitoring without needing to remove the dressing. Transpore tape, on the other hand, is a perforated medical tape with strong adhesive properties, making it ideal for securing thicker dressings and tubing. It is hypoallergenic, latex-free, and customizable in width, often used for covering PIVC.[10,19]

Our results align with previous studies,[10,19] which advocate for the use of transparent film dressings in PIVC applications due to fewer complications. The consistency across these studies suggests that the enhanced catheter stabilization capabilities of transparent film dressings play a pivotal role in reducing the incidence of phlebitis. Transparent film dressings act as a protective barrier against external contaminants and pathogens, reducing the need for frequent dressing changes, thereby preserving skin integrity and minimizing the risk of infection.[12,20-24] The ease of use associated with these dressings reduces complications such as skin damage from repeated changes, leading to reduced pain and lower infection probabilities.[10,19,25] The study results revealed a statistically significant difference between the group that received the transparent film dressing and the group that received the transpore tape. This suggests that the transparent film dressing was more effective in securing PIVC than the transpore tape. It is important to note that the study was conducted under controlled conditions and may not necessarily reflect real-world scenarios.

In the study comparing catheter dwell times between the transpore tape dressing group and the transparent film dressing group, it was found that 53.25% of catheters in the transpore tape dressing group had a dwell time of 49–72 hours, while 61.69% of catheters in the transparent film dressing group had a dwell time of 73-96 hours. The analysis revealed a statistically significant variation in catheter dwell times between the two groups. This discrepancy in dwell times suggests that the type of dressing used has an impact on how long catheters remain in place. Specifically, a higher percentage of catheters in the transparent film dressing group had a longer

dwell time of 73-96 hours compared to the transpore tape dressing group, where more catheters had a dwell time of 49–72 hours. The statistical significance of this difference indicates that it is unlikely to have occurred by chance alone. It may be attributed to the properties of the dressings and their influence on catheter stability and adhesion.[26,27]

These findings have implications for clinical practice and may inform decisions regarding the selection of dressing types for catheter securement. Healthcare providers should consider the potential impact of dressings on catheter dwell times when making choices about patient care. Additionally, these results contribute to the body of knowledge in catheter-related research and may guide future studies investigating optimal catheter management strategies. One limitation of our research was its limited scope, involving a small participant pool from a single hospital clinic. Future studies should expand the sample size and encompass multiple settings for a more comprehensive analysis.

CONCLUSION

The early-stage phlebitis incidence was 77.92% in the transpore tape dressing group and 66.88% in the transparent film dressing group. This difference was statistically significant, suggesting transparent film dressing may reduce phlebitis occurrence when attaching peripheral venous catheters. The study compared catheter dwell times between two groups, one using transpore tape dressing and the other using transparent film dressing. Statistical analysis demonstrated a significant difference in catheter dwell times between the two groups, suggesting that the type of dressing used influences how long catheters stay in place.

Data Availability Statement

The data supporting this study are available from the corresponding author upon reasonable request.

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DECLARATION

Grants and Funding Information

None.

Conflict of Interest

All authors declare no conflicts of interest.

Registration Number of Clinical Trial

The trial was officially registered in the Thai Clinical Trial Registry (TCTR20210801004).

Author Contributions

Conceptualization and methodology, P.T and K.P. ; Investigation, P.M., K.P., J.S. ; Formal analysis, P.T. and K.P. ; Visualization and writing – original draft, P.T. ; Writing – review and editing, P.T., K.P., J.S. ; Supervision, P.T. All authors have read and agreed to the final version of the manuscript.

Use of Artificial Intelligence

Not applicable.

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