Evaluation of the effect of proximal massage and palm fisting in reducing the risk of peripheral venous catheter-related phlebitis: Randomized control study

Short Title: Proximal massage and palm fisting in reducing the risk of phlebitis

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ABSTRACT

Aim
Peripheral venous catheter is a clinical procedure often performed by nurses in hospitals. Phlebitis can be prevented with more nursing care by applying peripheral venous catheter by trained nurses and using preventive methods. The aim of this study was to investigate the effect of proximal massage and palm fisting on the prevention of phlebitis in patients with a peripheral venous catheter (PVC).

Methods and results
This randomized controlled study was conducted with patients who were hospitalized in the orthopedics and traumatology service of a state hospital and had PVC. While the study group (n=36) received...
proximal massage and palm fisting on the side with a peripheral venous catheter, the control group (n=36) received standard care for PVC. The data were collected by using the "Patient Demographics and Clinical Information Form", "Risk Scale for Peripheral Venous Catheter-related phlebitis", "Visual Infusion Phlebitis Assessment Scale". There were no statistically significant differences between the groups regarding phlebitis development based on age, sex, chronic disease status, peripheral venous catheter insertion site, devices in the PVC, or fluids administered from the PVC. However, there was a significantly higher risk of PVC-induced phlebitis in patients who received proximal massage and palm fisting at 48 and 96 hours, when the severity of phlebitis was evaluated on daily basis.

Conclusion

The study showed promising results, suggesting that proximal massage and palm fisting may be a simple and inexpensive technique to prevent the occurrence of phlebitis in PVC patients.

Registration: NCT05714137

Keywords: Phlebitis, thrombophlebitis, vascular catheter, exercise, massage, nursing care.

1 INTRODUCTION

Peripheral venous catheterization (PVC) is a medical practice commonly carried out by nurses within healthcare facilities to administer medications, fluids, blood, and blood products, aiding in the diagnosis and treatment of patients. Evidence shows that PVC was inserted in about 58.7 – 86.7% of patients during their hospital stay. Use of PVC is recommended if intravenous (IV) treatment will take less than 6 days. In addition, the use of PVC, a common nursing practice, can lead to various complications such as phlebitis, infiltration, extravasation, ecchymosis, thrombophlebitis and embolism. These complications can be seen during PVC application or may develop 24-96 hours after removal. Phlebitis refers to the inflammation of the tunica intima layer of a vein. Common symptoms observed in the PVC region include swelling, redness, pain, edema, and a palpable venous cord. There are three groups of factors which have an impact on the development of phlebitis. The first group concerns patient-related symptoms, including age, gender, comorbidities and existing diseases. The second group involves chemical factors, like the dose and osmolarity of the administered drugs. Finally, mechanical factors such as the size,
location and material of PVC also play a role.\textsuperscript{6,7} Whilst the Infusion Nurses Association recommends a phlebitis rate of less than 5\%, studies have shown a phlebitis risk rate ranging from 2\% to 80\%.\textsuperscript{8,9} The onset of phlebitis has detrimental effects on patients' quality of life and the efficacy of treatment, resulting in longer hospital stays and increased hospital costs.\textsuperscript{4}

Phlebitis can effectively be prevented by enhancing nursing care of peripheral venous catheters (PVC) when administered by trained nurses using preventive methods.\textsuperscript{1} In order to reduce the risk of phlebitis and other complications, methods such as hot application, sesame oil, palm fisting, proximal massage have been supported in the literature.\textsuperscript{10,11} Hand exercise is the simplest way to enhance the blood circulation. The muscles of the hands and surrounding blood vessels allow more oxygenated blood to flow while performing hand exercises.\textsuperscript{12} It has been reported that massage has a preventive effect on phlebitis in patients with PVC by improving blood circulation, in addition to exercise.\textsuperscript{11} Massaging the proximal insertion side of the PVC and performing palm fisting are simple and non-invasive methods.\textsuperscript{13} Studies indicate limited evidence for the effectiveness of both proximal massage and palm fisting exercise in reducing phlebitis amongst patients with PVC. Further studies are required to establish more conclusive evidence.\textsuperscript{12,14} Based on this information, our study aimed to examine the impact of proximal massage and palm fisting in preventing phlebitis in patients with PVC.

The hypothesis of this study is: $H_0$: Proximal massage and palm fisting are effective in reducing the risk of peripheral venous catheter-related phlebitis in patients with PVC.

\textbf{2 METHOD}

\textbf{2.1 Study Design}

This study had a randomized controlled trial design to examine the occurrence of phlebitis in patients undergoing peripheral venous catheter (PVC) insertion, comparing those receiving standard nursing care in the orthopedics and traumatology service (control group) with those receiving a combination of proximal massage and palm fisting (study group).
2.3 Study Setting and Sample Size

The study was conducted within the orthopedics and traumatology service of a state hospital, focusing on patients who had PVCs inserted.

The study group consisted of 252 patients who were being treated in the orthopedics and traumatology service of a state hospital. The patients had peripheral intravenous catheters (PIVCs) placed in their veins.

The inclusion criteria for this study are being patients from the orthopedics and traumatology service of a state hospital who were hospitalized, having their PVC in place for at least 48 hours, and agreed to participate. Patients who experienced vascular access interruption for less than 48 hours or were unwilling to participate were excluded. Self-administered palm fisting and proximal massage were also included in the criteria. The sample size of the study was determined using the G*Power computer program, assuming equal groups with 80% power and a 95% confidence interval. The t-test was used to assess the difference in mean phlebitis incidence. Reference was made to Bai’s study, whereby a total of 72 patients (36 per group) with an effect size of 0.6 were included in the sample.\textsuperscript{11} The study and control groups' patients were selected using a random sampling method by choosing numbers from the random numbers table.

2.4 Data Collection

The data were collected through direct interactions and observation techniques by the researchers within the orthopedics and traumatology service from October to November 2022 among the study groups. The data collection process was conducted with patients who met the research criteria and gave informed consent. The patients were then allocated to either the study group or the control group. Due to the distinctive visual features of the massage and exercise, it was not possible to blind the participants or the researcher. To prevent any potential influence from patients in different study groups, they were carefully selected from their respective separate rooms to ensure that they did not have any visual contact with each other.

2.4.1 Study group: In addition to standard PVC care, 36 patients in the study group received proximal massage and palm fisting after PVC catheter insertion. The applications were explained to all patients in the intervention group by the researcher. Patients were checked again by demonstration to ensure they
were performing the exercise/massage correctly. Patients who were confident that they were doing the
palm fisting and proximal massage correctly were included in the study. Patient Demographics and
Clinical Information Form, Peripheral Venous Catheter-Related Phlebitis Risk Scale and VIPAS were
applied immediately after PVC (0. hour). At 24, 48, 72 and 96 hours, the patient's vascular access was
evaluated by VIPAS. Some patients experienced ineffective PVC and others developed phlebitis, leading
to the PVC's removal by the nurse at 24, 48, 72, and 96 hours.

*Proximal massage:* Proximal massage is a stroking technique used in massage therapy that consists of
gentle strokes in the direction of fluid flow, performed proximal to the PVC insertion site, approximately
two to three centimeters from the insertion site of catheterization (but not directly on the IV cannula
itself).\(^{11,13}\) Using the palm surface of the fingers, a light massage is performed twice a day for 4 days, for a
total of 5-10 minutes, approximately 20 stroking massage in each session. This massage was taught to the
patients by the researcher and applied by the patients under the supervision of the researcher; under the
heading of proximal massage. \(^{13}\) Proximal massage was initiated by teaching the patients immediately
after the insertion of PVC. No complaints were reported from the patients in the intervention group
regarding the massage.

*Palm fisting:* It is an exercise performed twice a day for 4 days, approximately 20 times in each session,
by fisting palm in the hand with PVC for 30 seconds - 1 minute, for 5-10 minutes, under the supervision
of the researcher. Palm fisting was taught to the patients by the researcher and the practice of the patients
was provided under the supervision of the researcher. \(^{12}\) Palm fisting exercise was initiated by teaching the
patients immediately after the insertion of PVC.

**2.4.2 Control group:** In the control group, 36 patients received standard PVC nursing care. Patient
Demographics and Clinical Information Form, Peripheral Venous Catheter-Related Phlebitis Risk Scale
and VIPAS were applied immediately after PVC (0. hour). At the 24th hour, 48th hour, 72nd hour and
96th hour, the patient's vascular access was evaluated with VIPAS. The nurse removed the PVC after 24,
48, 72, and 96 hours because it was ineffective in certain patients and caused phlebitis in others.
Standard PVC nursing care: No intervention was made other than standard PVC care and follow-up. Measures were implemented to ensure that patients were not housed in the same room and were not exposed to one another. Standard PVC nursing care followed a specific protocol which entailed the selection of a suitable entry site located on the upper extremity. A disposable tourniquet was securely fastened approximately 10 cm above the entry point for the catheter, ensuring it was properly positioned to avoid direct contact with the skin and did not cause any disruption of arterial circulation. The suitability of the target vein for catheterization was assessed by light palpation. A cotton wool soaked in 70% alcohol was used to wipe the palpated area of the vein, while gently pressing it from top to bottom in a single motion. Proper hand hygiene was ensured, and appropriately sized non-sterile disposable gloves were worn. Once an appropriate catheter size was selected, the protective sheath at the catheter tip was removed, and the introducer and needle tip inside the catheter were checked for accuracy. Next, the operator accessed the vein and removed the introducer part of the catheter after loosening the tourniquet. Following this, an appropriate vein valve was attached to the catheter and then flushed with saline solution before being closed. The PVC was secured in place using a plaster. The date and time of the procedure, along with the name, surname, and initials of the person performing the catheter insertion, were recorded on the flap. During the catheter insertion period, the patient was monitored closely for any possible complications. The PVC was assessed every 8 hours as a minimum. The dressing on the catheter was replaced if it became damp, loose (with compromised integrity), or visibly contaminated. The study flow diagram created by the researchers was based on the Consolidated Standards Of Reporting Trials (CONSORT) Statement (Figure 1). The study was registered in the ClinicalTrials.gov database (https://clinicaltrials.gov/) with the registration no “NCT05714137”.

2.5 Data Collection Instruments

2.5.1 Patient Demographics and Clinical Information Form

The patient demographics information form, which was created by the researchers using the literature, consists of 13 statements, including socio-demographic data of the patient such as age and gender, Body Mass Index (BMI), alcohol use, smoking use and clinical information data of the patient such as chronic...
disease status, medical diagnosis, patient's height and weight, hospitalization day in the orthopedics and traumatology service, region of PVC, equipment in PVC, infusion status through PVC, fluids received from PVC.

2.5.2 Peripheral Venous Catheter-Related Phlebitis Risk Scale

The Peripheral Venous Catheter-Related Phlebitis Risk Scale, developed by Berşe et al. (2021), consists of 14 items organized into three sub-dimensions. This scale is designed to assess the risk of phlebitis linked to the utilization of peripheral venous catheters. A total score below 20.5 indicates a low risk, whereas a score exceeding 20.5 suggests a high risk. For specific risk factors such as age, chronic illness, and palpation of veins, the sub-dimension scores range from a minimum of 3 to a maximum of 6. Chemical risk factors, which include infusion administration status and medication, have a minimum score of 6 and a maximum score of 12. Mechanical risk factors, such as catheter and three-way tap statements, have a range of scores from a minimum of 5 to a maximum of 10. A higher score is associated with an increased risk of developing phlebitis caused by peripheral venous catheters.

In the study conducted by Berşe et al. (2021), the reliability coefficient of the scale was assessed using the Kuder Richardson test and determined to be 0.823. In the context of this study, the Cronbach's α coefficient was recalculated to evaluate the reliability for this sample and was found to be 0.705.

2.5.3 "The Visual Infusion Phlebitis Assessment Scale (VIPAS),

The Visual Infusion Phlebitis Assessment Scale (VIPAS), developed by Gallant and Schultze in 2006 and widely endorsed by the Infusion Nurses Association, is specifically designed for assessing phlebitis in patients with PVC. The VIPAS, with its comprehensive approach, encompasses five distinct degrees for a nuanced assessment.

Degree 1: No signs of phlebitis; recommended to observe the catheter.
Degree 2: Early signs with redness <2.5 cm; pain on palpation; recommended to remove and insert a new catheter.
Degree 3: Moderate phlebitis with redness ≥2.5 cm and <5 cm; pain, stiffness; recommended actions include catheter removal, insertion of a new catheter, physician notification, and potential treatment.
Degree 4: Initial stage of advanced phlebitis or thrombophlebitis with redness ≥5 cm; pain, stiffness; recommended actions similar to Degree 3.

Degree 5: Advanced thrombophlebitis with signs of advanced phlebitis and purulent drainage; recommended actions similar to Degree 4.

In this study, phlebitis development was assessed by using VIPAS, where any observed degree of phlebitis was recorded.¹⁶

2.6 Data analyses
Statistical analyses were conducted using IBM SPSS Statistics 22 software (IBM Corp., Armonk, NY, USA). Frequency tables and descriptive statistics have been used for the presentation of results. Non-parametric methods were used for the measurement values that did not conform to the standard distribution. To comply with non-parametric methods, Pearson-χ², Mann-Whitney U test, Fisher's Exact Test were used. Statistical significance was accepted at the p<0.05 level.

2.7 Ethical Considerations
Ethical approval was obtained before the start of the study from the Health Sciences Non-Interventional Ethics Board at a university (resolution XXX, number XXX) and from the institution where the study was carried out (resolution XXX, date XXX). All aspects of the research adhered to the principles of research and publication ethics outlined in the Declaration of Helsinki. During the study period, written consent was obtained from patients who met the study's acceptance criteria and willingly participated. Data related to the study were then collected.

3 RESULTS
The study included a total of n=72 patients, with n=36 patients allocated to each group. No significant difference (p>0.05) was observed at baseline in terms of gender, body mass index (BMI), alcohol and smoking status, presence of chronic diseases, phlebitis development risk scores, inpatient treatment day, mean patient age, PVC insertion site, devices attached to the PVC, and type of IV fluids administered through the PVC. Comorbidities of patients include high blood pressure, high cholesterol, diabetes,
chronic kidney disease, asthma, thyroid disease, coronary heart disease and rheumatoid arthritis. All patients belonged to the high-risk group in the context of developing phlebitis. The groups were homogeneous and independent based on the specific characteristics (Table 1.).

When the phlebitis development status of the patients was analyzed, there was no statistically significant difference between the study group and the control group at the 24 and 72-hours (p>0.05). At 48 and 96 hours, there was a significant difference in the incidence of phlebitis in patients. The control group experienced a notably higher occurrence of PVC-related phlebitis in comparison to the study group (p=0.026, 95% CI: 1.126-8.706; p=0.029, 95% CI: 1.122-12.536, respectively). It was determined that both proximal massage and palm fisting proved effective techniques in preventing the development of phlebitis. Phlebitis development status was found to be 0.471, 3.132, 2.538 and 3.750 times higher in the control group than the study group at the 95% confidence interval, after 24, 48, 72 and 96 hours, respectively (Table 2).

When analyzing the degree of phlebitis in the patients who developed the condition during the daily assessments, it was found that degree 2 phlebitis was present in 8.3% of the study group and 5.6% of the control group at 24 hours. After 48 hours, Degree 2 phlebitis was found in 19.4% of the study group and 47.2% of the control group, illustrating a statistically significant difference between the two groups (p = 0.034). After 72 hours, 31.4% of the study group and 50% of the control group were found to have developed degree 2 phlebitis. Furthermore, 5.7% of the study group and 10% of the control group developed degree 3 phlebitis after 72 hours. When assessing the daily phlebitis degree, no patients in the study group showed degree 3 phlebitis after 96 hours. In contrast, 4.2% of the control group had degree 3 phlebitis, indicating a statistically significant difference between the two groups (p=0.031). The nurse removed the PVCs at 72 and 96 hours due to their dysfunction and the development of phlebitis in some patients (Table 3.).
Our statistical analyses strongly demonstrate that proximal massage and palm fisting are effective in reducing the risk of peripheral venous catheter-induced phlebitis at the end of the 48 and 96 hours (p < 0.05).

4 DISCUSSION

PVC is one of the most common invasive procedures performed by nurses and one of the most common complications is phlebitis. In order to prevent phlebitis, nurses should include some simple and applicable methods as well as risk assessment. In this randomized controlled study, the effectiveness of proximal massage and palm fisting in reducing phlebitis, a complication of peripheral venous catheterization, was evaluated.

At the beginning of the study, the descriptive characteristics of the patients were analyzed. They were found to be comparable. In particular, all patients were in the high-risk category in terms of the probability of phlebitis. The allocation of these patients to the study and control groups ensured the homogeneity of the groups at baseline.

The study showed that patients in the study group who received proximal massage and palm fisting had significantly lower rates of phlebitis compared with the control group at 48 and 96 hours after PVC insertion. The catheter occupying a large space in the venous lumen causes friction with the venous vessel, leading to reduced blood flow. After three weeks of prophylactic handgrip exercises with an elastic ball, Doppler ultrasound showed an increase in flow velocity in the axillary veins. The study also showed that venous blood flow velocity in the arm was highest when the frequency of handgrip exercises was 25 times per minute for two minutes. Furthermore, it was stated that massage has a positive impact on blood circulation and may aid in lowering the risk of phlebitis in individuals with PVC. Another study showed that proximal massage and palm fisting were effective in reducing the risk of thrombophlebitis, supporting the findings of this study. Similarly, palm fisting with an elastic ball was found to be beneficial in preventing the onset of phlebitis in a study of patients undergoing chemotherapy. Based on the given information, it is possible that the proximal massage and palm fisting implemented in this research could have mitigated the onset of PVC-induced phlebitis in the examined patient cohort.
An examination of the degree of phlebitis in patients who performed proximal massage and palm fisting at 48 and 96 hours showed that the levels were lower than in the control group. Additionally, the majority of patients who performed these exercises did not develop phlebitis, whereas the control group experienced up to a 4th degree of phlebitis. Another study found that palm fisting with the elastic ball prevented the majority of patients from developing phlebitis, while most patients in the control group developed degree 3 phlebitis. In this case, it can be concluded that proximal massage and palm fisting performed after PVC insertion prevent the development of phlebitis and slow its progression. Phlebitis risk was low in the first 24 hours. Additionally, since both palm fisting and proximal massage were recently started, it may suggest that their impact on phlebitis within the initial 24 hours was not fully investigated.

4.1 Limitations

This study has several limitations. First, our sample size calculation was based on previous research. However, the possibility of patient attrition during the study was not anticipated. This unforeseen development could have resulted in bias or impacted the overall applicability of our findings. Nevertheless, we have presented our outcomes objectively, and we are of the opinion that acknowledging this limitation will augment overall comprehension of the research domain. Future research should take into account the potential for patient dropout and incorporate strategies to address it in their study designs to improve the reliability of the findings.

It is essential to acknowledge that this study was solely conducted among patients within a clinic that has a frequent patient turnover rate in the orthopedics and traumatology service. Future studies incorporating multiple patient care units where patients receive long-term inpatient treatment may result in different findings.

Additionally, the efficacy of proximal massage and palm fisting interventions couldn't be separately assessed in this study. Additionally, this study is limited by the lack of assessment of the impact of proximal massage and palm fisting using objective measuring tools like doppler or ultrasound.
5 CONCLUSIONS

It was found in this study that employing proximal massage and palm fisting exercises were effective in averting the emergence of PVC-associated phlebitis. Additionally, the degree of phlebitis was lesser in the group that underwent proximal massage and palm fisting after 48 and 96 hours. Though the findings originate from a small sample, they are encouraging. The implementation of cost-effective and efficient measures can certainly contribute to the reduction of PVC-related phlebitis, a condition that can significantly impact patients, healthcare professionals, and health organizations. Therefore, it is recommended to conduct studies examining the effects of proximal massage and palm fisting exercise on diverse groups of patients with varied samples, as well as investigations that involve observing the phlebitis development in multiple PVCs over a prolonged period.

CRediT statement: Conceptualization (BT, SG, EA, SA), data curation (BT, SG), formal analysis (BT, SG, EA), investigation (EA), methodology (BT, SG, SA), project administration (BT), Resources (EA), Supervision (BT), validation (BT), visualization (BT, SG, SA), writing – original draft (BT, SG, SA), writing – review & editing (BT, SG, SA).

Financial Support

The researchers received no grant for this study conducting.

Conflict Interest

Authors mention no conflict interest.

Data availability

The datasets used for analysis in this study will be made available upon reasonable request to the corresponding author.
References


Table 1. Comparison of the proximal massage and palm fisting group (study group), with the receiving standard PVC care group (control group), based on certain descriptive characteristics at the initiation of the study

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Study group (n=36)</th>
<th>Control group (n=36)</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>24 (66.7%)</td>
<td>21 (58.3%)</td>
<td>$\chi^2=0.533$</td>
<td>p=0.465</td>
</tr>
<tr>
<td>Male</td>
<td>12 (33.3%)</td>
<td>15 (41.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BMI Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal (18.5-24.9 kg/m²)</td>
<td>6 (16.7%)</td>
<td>3 (8.3%)</td>
<td>$\chi^2=1.143$</td>
<td>p=0.478</td>
</tr>
<tr>
<td>Overweight (≥25.0 kg/m²)</td>
<td>30 (83.3%)</td>
<td>33 (91.7%)</td>
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<tr>
<td><strong>Alcohol use status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>35 (97.2%)</td>
<td>36 (100.0%)</td>
<td>$\chi^2=1.014$</td>
<td>p=1.000</td>
</tr>
<tr>
<td>No</td>
<td>1 (2.8%)</td>
<td>0 (0.0%)</td>
<td></td>
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<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Yes</td>
<td>1 (2.8%)</td>
<td>3 (8.3%)</td>
<td>$\chi^2=3.956$</td>
<td>p=0.107</td>
</tr>
<tr>
<td>No</td>
<td>35 (97.2%)</td>
<td>33 (91.7%)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Chronic disease status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>20 (55.6%)</td>
<td>27 (75.0%)</td>
<td>$\chi^2=3.003$</td>
<td>p=0.083</td>
</tr>
<tr>
<td>No</td>
<td>16 (44.0%)</td>
<td>9 (25.0%)</td>
<td></td>
<td></td>
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<tr>
<td><strong>PVC region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cephalic veins</td>
<td>3 (8.3%)</td>
<td>7 (19.4%)</td>
<td>$\chi^2=2.726$</td>
<td>p=0.430</td>
</tr>
<tr>
<td>Basilic veins</td>
<td>3 (8.3%)</td>
<td>2 (5.6%)</td>
<td></td>
<td></td>
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<tr>
<td>Metacarpal veins</td>
<td>11 (30.6%)</td>
<td>13 (36.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antecubital region</td>
<td>19 (52.8%)</td>
<td>14 (38.9%)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Equipment at PVC</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Triple faucet</td>
<td>1 (2.8%)</td>
<td>1 (2.8%)</td>
<td>$\chi^2=0.000$</td>
<td>p=1.000</td>
</tr>
<tr>
<td>Extension Valve</td>
<td>35 (97.2%)</td>
<td>35 (97.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IV fluids given through PVC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV Drug/s (Antibiotic)</td>
<td>3 (8.3%)</td>
<td>1 (2.8%)</td>
<td>$\chi^2=1.059$</td>
<td>p=0.614</td>
</tr>
<tr>
<td>IV Drug/s (Analgesic)</td>
<td>33 (91.7%)</td>
<td>35 (97.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flebitis risk tool</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Low risk (&lt;20,5)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk (≥20,5)</td>
<td>36 (100.0%)</td>
<td>36 (100.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean±SD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PVC Risk scale</td>
<td>25.30±1.283</td>
<td>25 (1.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual risk factors</td>
<td>4.86±0.886</td>
<td>5 (2.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical risk factors</td>
<td>9.52±0.696</td>
<td>10 (1.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical risk factors</td>
<td>10.91±0.280</td>
<td>11 (0.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of stay of the patient in the service (days)</td>
<td>2.758±31.29</td>
<td>2 (1.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>58.53±13.24</td>
<td>61 (15.0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Examination of the phlebitis development status of the proximal massage, palm fisting group (study group) and standard PVK care group (control group) according to the follow-up days

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study group (n=36)</th>
<th>Control group (n=36)</th>
<th>Test ($\chi^2$)</th>
<th>OR (%95 CI Upper-lower)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phlebitis development status after 24 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No phlebitis</td>
<td>32 (88.9%)</td>
<td>34 (94.4%)</td>
<td>$\chi^2=0.727$</td>
<td>55.91 (0.081-2.748)</td>
</tr>
<tr>
<td>Phlebitis detected</td>
<td>4 (11.1%)</td>
<td>2 (5.6%)</td>
<td>p=0.674</td>
<td></td>
</tr>
<tr>
<td>Phlebitis development status after 48 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No phlebitis</td>
<td>28 (77.8%)</td>
<td>19 (52.8%)</td>
<td>$\chi^2=4.963$</td>
<td>3.132 (1.126-8.706)</td>
</tr>
<tr>
<td>Phlebitis detected</td>
<td>8 (22.2%)</td>
<td>17 (47.2%)</td>
<td>p=0.026*</td>
<td></td>
</tr>
<tr>
<td>Phlebitis development status after 72 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No phlebitis</td>
<td>22 (62.9%)</td>
<td>12 (40.0%)</td>
<td>$\chi^2=3.383$</td>
<td>2.538 (0.932-6.913)</td>
</tr>
<tr>
<td>Phlebitis detected</td>
<td>13 (37.1%)</td>
<td>18 (60.0%)</td>
<td>p=0.066</td>
<td></td>
</tr>
<tr>
<td>Phlebitis development status after 96 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No phlebitis</td>
<td>15 (65.2%)</td>
<td>8 (33.3%)</td>
<td>$\chi^2=4.778$</td>
<td>3.750 (1.122-12.536)</td>
</tr>
<tr>
<td>Phlebitis detected</td>
<td>8 (34.8%)</td>
<td>16 (66.7%)</td>
<td>p=0.029*</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05 statistical significance, $\chi^2$: Pearson Chi-Square, OR : Odds Ratio, CI: Confidence Intervals

Table 3. Frequency distribution of phlebitis severity in the proximal massage, palm fisting group (study group) and standard PVK care group (control group) by time interval

<table>
<thead>
<tr>
<th>Degree / hours</th>
<th>24 hours n (%)</th>
<th>48 hours n (%)</th>
<th>72 hours n (%)</th>
<th>96 hours n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Study Group</td>
<td>Control Group</td>
<td>Study Group</td>
<td>Control Group</td>
</tr>
<tr>
<td>Degree 1</td>
<td>33 (91.7%)</td>
<td>34 (94.4%)</td>
<td>28 (77.8%)</td>
<td>19 (52.8%)</td>
</tr>
<tr>
<td>Degree 2</td>
<td>3 (8.3%)</td>
<td>2 (5.6%)</td>
<td>7 (19.4%)</td>
<td>17 (47.2%)</td>
</tr>
<tr>
<td>Degree 3</td>
<td>0</td>
<td>0</td>
<td>1 (2.8%)</td>
<td>0</td>
</tr>
<tr>
<td>Degree 4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Degree 5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>

Test ($\chi^2$) $\chi^2=0.285$ p=0.643

*p<0.05 statistical significance

$\chi^2$: Fisher’s Exact test
Assessed for eligibility

Patients with PVK treated in the orthopedics and traumatology service (N=252)

Excluded (n=180)

- hospitalized less than 48 hours (n=103)
- PVC removed before 48 hours (n=67)
- did not consent to participate in the study (n=10)

Randomized (n=72)

Proximal massage and Palm Fisting Exercise Group (n=36)
Proximal massage and Palm Fisting Exercise

Control group (n=36)
Standard nursing PVC care

Follow-Up

Observed for patients PVC at the 24th hour, 48th hour, 72nd hour and 96th hour.

Developing phlebitis
24th h: (n=0)
48th h: (n=1)
72nd h: (n=2)
96th h: (n=0)

PVC dislodged/ not working
24th h: (n=0)

Analysed: (n=36)
24th hour: (n=36)
48th hour: (n=36)
72nd hour: (n=35)
96th hour: (n=23)

Analysed (n=36)
24th hour: (n=36)
48th hour: (n=36)
72nd hour: (n=30)
96th hour: (n=25)

* The vascular access was removed spontaneously (due to the patient), because of not working, or development of phlebitis.
Figure 1. Study Flow Diagram (CONSORT)

Evaluation of the effect of proximal massage and palm fisting in reducing the risk of peripheral venous catheter-related phlebitis: Randomized control study

Patient-related symptoms such as age, gender, comorbidities and existing diseases, chemical factors such as dose and osmolarity of administered drugs and mechanical factors such as size, location, material of PVC affect the formation of phlebitis

Aim
To investigate the effect of proximal massage and palm fisting on the prevention of phlebitis in patients with a peripheral venous catheter

Methods
- Patient demographic characteristics
- Phlebitis risk scale due to peripheral venous catheter
- Visual infusion phlebitis assessment scale

Conclusions
The study showed promising results, suggesting that proximal massage and palm fisting may be a simple and inexpensive technique to prevent the occurrence of phlebitis in PVC patients

Graphical Abstract
180x118 mm (x DPI)
Novelty Box

- This study is one of the rare works contributing to the literature by evaluating the
effectiveness of proximal massage and palm fisting exercises, simple and applicable
methods, in preventing phlebitis after peripheral venous catheterization.
- The study adds a new perspective to the existing knowledge by demonstrating the
potential effectiveness of proximal massage and palm fisting exercises in reducing the
development of phlebitis in patients with peripheral venous catheters.
- The evaluation of proximal massage and palm fisting exercises as a new preventive
strategy, supported by this study, offers a potential innovation in clinical practices for
reducing the incidence of phlebitis.