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Effectiveness of Warm Water Compress on Peripheral Vein Visibility, Palpability, and Cannulation Success: A Pilot Study among Cancer Patients Receiving Chemotherapy in Aizawl, Mizoram

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Abstract ***Background of the study:*** ***Peripheral intravenous cannulation is commonly performed on cancer patients undergoing chemotherapy, but repeated access can hinder vein visibility and palpability, causing discomfort. Moist heat therapy, specifically warm water compresses, may improve this process.*** ***Methodology:*** ***A pilot randomized controlled trial with 10 participants at Nazareth Hospital, Aizawl, Mizoram, was conducted. Participants were split into an intervention group (n = 5) receiving warm compresses and a control group (n = 5) receiving standard care. Vein visibility and palpability were measured using the Vein Assessment Tool (VAT).*** ***Results:*** ***Scores in the intervention group were higher (Mean Rank = 7.20) than in the control group (Mean Rank = 3.80), though not statistically significant (U = 4.00, p = 0.065). Significant improvements in vein visibility and palpability were observed in the intervention group (Z = -2.023, p = 0.043). Eighty percent in the intervention group required only one attempt at cannulation versus 40% in the control group (p = 0.167).*** ***Conclusion:*** ***Warm water compresses enhance vein visibility and palpability, suggesting a safe method for improving peripheral venous access in chemotherapy patients, warranting further research.***

Keywords: Warm water compress, chemotherapy, intravenous cannulation, vein visibility, palpability

1. Introduction

In 2020, the global cancer incidence reached 19.3 million new cases, resulting in 10 million deaths, with projections indicating a 57.5% increase by 2040. This surge presents significant challenges in oncology care, particularly since up to 75% of patients require intravenous treatments for chemotherapy. Safe and accessible intravenous access is critical for effective chemotherapy administration [1].

Establishing and managing vascular access is crucial for patients with malignancies, given the lengthy nature of the disease and the complex treatment regimens involved. Durable vascular access not only provides an effective means for administering intravenous treatments but also enables frequent blood sampling without subjecting patients to multiple painful venipunctures [2]. Moreover, these patients often present with risk factors such as immunosuppression, malnutrition, and complicated treatment requirements, which may increase the risk of severe complications like bloodstream infections (BSI) [3].

To enhance the success of peripheral intravenous catheter (PIVC) insertion, several bedside techniques can be employed, including venodilation, vascular visualization, and methods to identify vein entry. Additionally, effective pain management and the involvement of specialized healthcare professionals, such as a dedicated nursing intravenous team, can significantly improve outcomes [4].

Research has shown that moist heat can enhance vein visibility and facilitate easier intravenous cannulation [5]. It is recommended to apply heat before using a tourniquet for PIVC insertion, as this encourages vein dilation. The application of heat triggers the release of substances that dilate blood vessels, such as nitric oxide, improving blood circulation and causing superficial veins to expand [6]. It is known to be a low-cost, non-pharmacological method that enhances vasodilation, increases blood circulation, and improves vein visibility [7].

1.1 Objectives of the study

- To evaluate the effectiveness of warm water compress on peripheral vein visibility, palpability, and cannulation success among cancer patients receiving chemotherapy for the intervention and the control group.
- To determine the effectiveness of warm water compress on peripheral vein visibility and palpability, among cancer patients receiving chemotherapy for the intervention group.
- To determine the association between the number of cannulation attempts and selected demographic and

clinical variables among cancer patients undergoing chemotherapy.

2. Materials and Methods

The research design adopted for the study was a true experimental pre-test–post-test design, conducted among 10 cancer patients undergoing chemotherapy at the Nazareth Hospital of Aizawl, Mizoram. Purposive sampling technique was used, and the samples were selected based on the inclusion and exclusion criteria.

2.1 Sampling Criteria

Inclusion criteria:
- Adult cancer patients aged 18–60 years
- Patients requiring peripheral intravenous (IV) cannulation for chemotherapy.
- Patients willing to participate in the study.

Exclusion criteria:
- Patients with allergy or intolerance to heat application.
- Patients with severe peripheral vascular disease.
- Patients with lymphedema in the intended limb.

2.2 Development of tools

Data were collected using a patient proforma and a standardized assessment tool.

Patient Proforma: A semi-structured patient proforma was developed by the researcher to collect socio-demographic and clinical variables such as age, sex, diagnosis, and relevant treatment history. The proforma was prepared based on literature review and consultation with experts in the field.

Standardized Tool: A Standardized Vein Assessment Tool was used to assess peripheral vein visibility and palpability, based on Webster et al [11]. The tool has been previously validated and was used as per its original guidelines.

2.3 Data Collection Procedure

Data collection was conducted after obtaining the necessary ethical and administrative approvals. Participants who met the eligibility criteria were recruited through non-probability purposive sampling and were randomly assigned to either the intervention or control group using a lottery system. Baseline information was gathered using a structured form. The intervention group received warm water application before cannulation, while the control group underwent standard care. Vein visibility was evaluated with the standardized vein assessment tool, and the results were documented after the cannulation procedure. Throughout the study, confidentiality was upheld, and standard infection control measures were followed.

2.4 Data analysis

The gathered data were coded and entered into the statistical software SPSS version 22 for analysis. Both descriptive and inferential statistics were employed for data analysis. Descriptive statistics, including frequency and percentage, were utilized to outline the demographic and clinical characteristics of the participants and the study variables.
For comparisons between the intervention and control groups, suitable non-parametric tests were applied due to the limited sample size.

The Mann–Whitney U test was used for between-group comparisons of vein visibility and palpability scores, the Fisher's Exact Test was used to compare cannulation attempts between groups, and the Wilcoxon Signed-Rank Test was used to assess pre-test and post-test changes within the intervention group. Association between the number of cannulation pricks and selected demographic and clinical variables was tested using Mann–Whitney U test (for two-group variables) and Kruskal–Wallis test (for more than two groups).

The level of significance was set at $p < 0.05$. However, findings were interpreted cautiously due to the pilot nature and small sample size of the study.

3. Results

The results of the study are presented under the following sections: demographic characteristics, clinical variables, and study outcomes related to vein visibility and cannulation attempts.

Section I: Demographic and Clinical Characteristics

Table 1. Frequency and percentage distribution of the demographic and clinical variables, n=10

S. No	Demographic and clinical variables	Frequency (f)	Percentage (%)
1	**Age in years**		
	1. 18–28	0	0
	2. 29–38	0	0
	3. 39–48	4	40
	4. 49–60	6	60
2	**Sex**		
	1. Male	5	50
	2. Female	5	50
3	**Occupation**		
	1. Sedentary work	3	30
	2. Moderate work	5	50
	3. Heavy work	2	20
4	**Diagnosis**		
	1. Ca Breast	4	40
	2. Ca Ovary	1	10
	3. Ca Esophagus	3	30
	4. Kaposi Sarcoma	1	10
	5. Ca. Periampullary	1	10
5	**Body mass index**		
	1. Below 18.4	2	20
	2. 18.5–24.9	4	40
	3. 25–29.9	4	40
	4. Above 30	0	0
6	**Number of treatments**		
	1. 1st cycle	1	10
	2. 2nd cycle	3	30
	3. 3rd cycle	0	0
	4. 4th cycle	0	0
	5. 5th cycle	0	0
	6. More than 5 cycles	6	60

7	**Type of chemotherapy**		
	1. Natural	2	20
	2. Irritant	1	10
	3. Exfoliate	0	0
	4. Vesicant	1	10
	5. Combination	4	40
	6. Others	2	20
8	**Chemotherapy cycle duration**		
	1. Every 15 day	0	0
	2. Every 21 day	10	100
	3. Others	0	0
9	**Stages of the disease**		
	1. Stage 1	1	10
	2. Stage 2	0	0
	3. Stage 3	4	40
	4. Stage 4	0	0
	5. Not Documented	5	50
10	**Cannula size**		
	1. 18G	0	0
	2. 20G	0	0
	3. 22G	9	90
	4. 24G	1	10
11	**Cannula site**		
	Inner arm		
	1. Basilic vein	0	0
	2. Cephalic vein	1	10
	3. Medial cubital vein	1	10
	4. Antebrachial vein	0	0
	5. Radial vein	1	10
	Dorsal surface of hand		
	1. Dorsal venous arch	2	20
	2. Basilic vein	2	20
	3. Cephalic vein	3	30
12	**Number of pricks during cannulation**		
	1. 1 prick	6	60
	2. 2 pricks	3	30
	3. 3 pricks	1	1
	4. More than 3 pricks	0	0

The study cohort included participants primarily aged 49–60 years (60%), with 40% aged 39–48 years and an equal gender distribution (50% male and 50% female). Occupationally, 50% were engaged in moderate work, 30% had sedentary jobs, and 20% were involved in heavy labor.

Among clinical diagnoses, breast carcinoma was the most prevalent (40%), followed by esophageal carcinoma (30%). Ovarian carcinoma, Kaposi sarcoma, and periampullary carcinoma each comprised 10% of cases. BMI analysis showed that 40% of participants were normal weight, 40% were overweight, and 20% were underweight, with no obesity reported.

In terms of chemotherapy, 60% received more than five cycles, with combination therapy being the most common (40%). All participants received treatment at 21-day intervals. Staging data revealed that 50% lacked documentation, while 40% of those with data were classified as stage III, and 10% as stage I.

For cannulation, 90% used a 22G cannula and the cephalic vein was the most common site (30%). Most participants (60%) required one attempt for cannulation, 30% needed two attempts, and 10% required three attempts, with no one needing more than three attempts.

Section II: Effectiveness of warm water compress on vein visibility, palpability, and number of cannulation attempts

Table 2. Baseline vein visibility and palpability scores in intervention and control groups, n = 10

Group	n	Mean Rank	Sum of Rank	U Value	P Value
Intervention Group	5	6.20	31.00	9.000	0.439
Control Group	5	4.80	24.00		

Not Significant ($p \geq 0.05$)

Table 2 shows that the mean rank of VAT scores before intervention was 6.20 in the control group and 4.80 in the intervention group. The difference between groups was not statistically significant ($U = 9.00$, $p = 0.439$), indicating baseline comparability between groups.

Table 3. Post-test vein visibility and palpability scores in intervention and control groups, n = 10

Group	n	Mean Rank	Sum of Rank	U Value	P Value
Intervention Group	5	7.20	36.00	4.000	0.065
Control Group	5	3.80	19.00		

Not Significant ($p \geq 0.05$)

Table 3 shows that the intervention group demonstrated a higher mean rank in VAT scores following the intervention (Mean Rank = 7.20, Sum of Ranks = 36.00) compared with the control group (Mean Rank = 3.80, Sum of Ranks = 19.00). The Mann–Whitney U test yielded a U value of 4.00 and a p value of 0.065, indicating that the difference between the two groups was not statistically significant at the 0.05 level. Although the findings suggest that warm water compress may improve the visibility and palpability of peripheral veins, the observed difference was insufficient to establish statistical significance within the study sample.

Table 4: Number of cannulation attempts in intervention and control groups, n = 10

Total no of pricks	Intervention Group, f (n=5)	Control Group, f (n=5)	Chi square ($\chi 2$)/ Fisher's Exact Test	df	P Value
1 Prick	4	2	Fisher's Exact	2	0.167
2 Pricks	0	3			
3 Pricks	1	0			

Not Significant ($p \geq 0.05$)

Table 4 presents the distribution of participants according to the total number of venipuncture attempts required in the intervention and control groups. In the intervention group (n = 5), the majority of participants (f = 4) required only a single prick for successful cannulation, while one participant required three attempts. In contrast, among the control group

participants (n = 5), most participants (f = 3) required two pricks, whereas two participants achieved successful cannulation with one prick. No participants in either group required more than three attempts.

The difference between the two groups was analyzed using Fisher's Exact Test, which yielded a value of 0.167, indicating that the observed difference was not statistically significant at the 0.05 level ($p > 0.05$). Although statistical significance was not achieved, the findings suggest a possible trend toward fewer cannulation attempts among participants who received warm water compress.

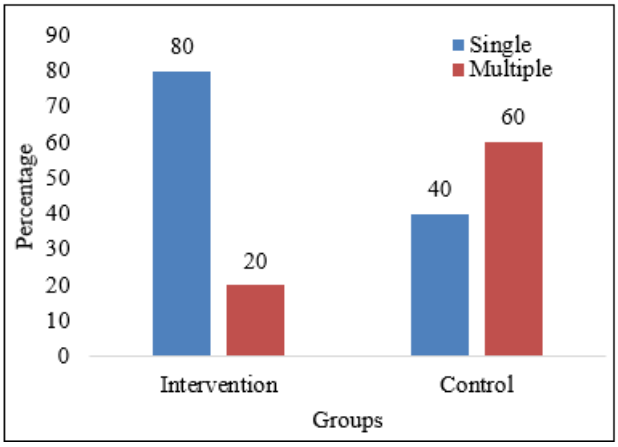

Figure 1: Percentage distribution of the number of cannulation attempts in intervention and control groups.

Table 5: Comparison of pre-test and post-test vein visibility and palpability scores in the intervention group

n = 5

Sl. No	VAT Score Change	n	Mean Rank	Sum of Ranks	Wilcoxon Signed-Rank Test (Z)	P Value
1.	Negative (After < Before)	0	0.00	0.00	-2.023	0.043*
2.	Positive (After > Before)	5	3.00	15.00		
3.	Ties (After = Before)	0	–	–		

***Significant ($p < 0.05$)**

Table 5 displays the findings of the Wilcoxon Signed-Rank Test assessing changes in vein visibility and palpability within the intervention group. All participants (100%) demonstrated an increase in their VAT scores after receiving moist heat therapy. The test results revealed a statistically significant difference ($Z = -2.023$, $p = 0.043$), indicating that warm water compress was effective in enhancing the visibility and palpability of peripheral veins among the study participants.

Section III: Association between the Number of Cannulation Attempts and Selected Demographic and Clinical Variables

Table 6. Association between the number of cannulation attempts and selected demographic and clinical variables among cancer patients undergoing chemotherapy, n=10

S. No	Variable	Group	n	Mean Rank	Mann–Whitney U Value	Kruskal–Wallis (H) Value	df	P Value
1.	Sex	Male	5	5.30	11.500		1	0.811
		Female	5	5.70				
2.	Age	30–48	4	3.50		3.810	1	0.051
		49–60	6	6.83				
3.	Occupation	Sedentary work	3	5.00		0.154	2	0.926
		Moderate work	5	5.70				
		Heavy work	2	5.75				
4.	Diagnosis	Ca. Breast	4	6.25		2.464	4	0.651
		Ca. Ovary	1	3.50				
		Ca. Esophagus	3	5.00				
		Kaposi Sarcoma	1	8.00				
		Ca. Periampullary	1	3.50				
5.	Body mass index	≤ 18.4	2	3.50		2.304	2	0.316
		18.5–24.9	4	6.88				
		25–29.9	4	5.13				
		≥ 30	0	-				
6.	Treatment cycle	1st Cycle	1	3.50		3.810	2	0.149
		2nd Cycle	3	3.50				
		3rd Cycle	0	0				
		4th Cycle	0	0				
		5th Cycle	0	0				
		More than 5 cycles	6	6.83				
7.	Type of chemotherapy	Natural	2	6.75		2.366	4	0.669
		Irritant	1	3.50				
		Vesicant	1	8.00				
		Combination	4	4.63				
		Others	2	5.75				
8.	Duration	Every 15 days	0					
		Every 21 days	10					
		Others	0					
9.	Stages of the	Stage 1	1	3.50		0.921	2	0.631

	disease	Stage 2	0	-				
		Stage 3	0	-				
		Stage 4	4	6.25				
		Not documented	5	5.30				
10.	Cannula size	22G	9	5.22		0.992	1	0.319
		24G	1	8.00				
11.	Cannula site	Inner arm cephalic vein	1	10.00		9.000	5	0.109
		Median cubital vein	1	8.00				
		Radial vein	1	3.50				
		Dorsal venous arch	2	3.50				
		Dorsal basilic vein	2	8.00				
		Dorsal cephalic vein	3	3.50				

Not Significant (p > 0.05)

Table 6 shows the analysis of the relationship between cannulation attempts and various demographic and clinical factors using the Mann–Whitney U test and Kruskal- Wallis test, which found no significant associations ($p > 0.05$).

Although minor variations in mean ranks were observed for factors like age, sex, and chemotherapy cycle, none reached statistical significance, with age being borderline at $p = 0.051$. Overall, the results indicate that demographic and clinical characteristics did not influence the number of attempts needed for successful venous access in this pilot study.

4. Discussion

This pilot trial examined the effects of warm water compresses on vein visibility and palpability in cancer patients. The intervention group showed some improvement post-treatment ($p = 0.065$), with a significant change after therapy ($p = 0.043$); however, results were not statistically significant overall. Although fewer cannulation attempts were noted, this was also not significant. Overall, warm water compress had limited effects on clinical outcomes, with only minor improvements in vein assessment scores.

The findings in this study are consistent with Radwan HR et al [12], which shows that applying moist heat before peripheral intravenous cannulation significantly enhanced vein conditions in chemotherapy patients. The intervention group showed marked improvements in vein visibility and palpability compared to the control group ($p < 0.0001$). Saladi AK [7], whose randomized controlled trial examined the impact of a 10-minute warm compress (40–42°C) prior to peripheral intravenous cannulation in adults experiencing difficult venous access, shows that the warm compress significantly increased the success rate of first-attempt cannulation compared to standard care (85% vs. 62%, $p = 0.006$), but the result differs and is inconsistent with the current study.

The absence of statistically significant results can likely be attributed to the very small sample size ($n = 10$), which reduces statistical power and raises the chances of a type II error. Additionally, variations in patient characteristics and clinical conditions may have led to varying results.

5. Conclusion

The study assessed the effect of warm water compress on vein visibility and cannulation in chemotherapy patients. It improved visibility and palpability, shown by increased vein assessment test (VAT) scores ($p = 0.043$). However, no significant differences were found in post-test VAT scores ($p = 0.065$) or pricks required for cannulation ($p = 0.167$). Overall, while the compress was beneficial for vein assessment, its impact on reducing cannulation attempts is unclear. In conclusion, while the pilot study suggests that moist heat therapy might help improve vein visibility, a larger, well-powered randomized controlled trial is needed to validate these initial findings.

6. Future Scope

The study should be repeated with a larger sample size to enhance statistical power and generalizability. Additionally, larger studies should explore the relationships between demographic and clinical factors and cannulation outcomes, as no significant associations were found in the current pilot study.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this study.

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