

An Experimental Study to Assess the Effect of Moist Heat Therapy on Ease of Peripheral Venous Cannulation among Patients Admitted in Selected Hospital of Ambala, Haryana

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ABSTRACT

Peripheral venous cannulation is indispensable in the practice of modern medicine but it is not free of complications and not easy to identify the veins, so it takes time to do cannulation. Objective is to assess the effect of moist heat therapy on ease of peripheral venous cannulation among patients. A randomized control trial was done and 60 patients were selected by convenience sampling technique and randomized into two groups experimental (n=30) and control (n=30) by computer generated code method. The study findings revealed that the post intervention mean rank of visibility and palpability score of vein in experimental group was 38.75 which was significantly higher than mean rank of control group i.e. 22.25 (U=202.50, p=0.001***). The post intervention mean pain score was lower in experimental group than control group (3.63±2.04 versus 6.10±2.09, t=4.62, p=0.001***) respectively. Moreover the number of pricks were significantly reduced in experimental group than control group ($\chi^2=11.46$, p=0.003**). Significant reduction in duration of whole procedure was also seen in experimental group than control group (Mean=133.00 versus 300.13 seconds, t=4.89, p=0.001***) respectively. Moist heat therapy is effective in improving visibility and Palpability score of veins, reducing the pain intensity, number of pricks and duration of whole procedure.

Key words: Moist heat therapy, Peripheral venous cannulation, Cannulation

INTRODUCTION

Peripheral venous cannulation is indispensable in the practice of modern medicine. It is the commonest and frequently used route of drug administration in hospitals, [1] but it is not free of complications. [2] It may lead to mortality and morbidity, increased duration of hospital stay and significant cost. [3]

Over a third of adults and up to half of the children that present to hospital who require a peripheral intravenous catheter, are reported to have difficult venous access (DiVA). Patients with difficult venous access may undergo multiple, painful attempts to gain peripheral venous access. [4]

Technically, cannulation can be easily done and leads to less discomfort to

patients but in some, it is not easy to identify the veins, so it takes time to do cannulation. [5]

First attempt of peripheral intravenous cannulation fails in 12–26% of adults. Factors associated with peripheral intravenous cannulation success include patient's characteristics such as age, gender, race, weight/BMI, co-existing medical conditions and skin/vein characteristics. [6]

The most suitable common veins are the veins of non-dominant forearm, in case the cannula has to be required for long time. [3]

In case of difficulty in identification of a suitable vein for cannulation, various strategies can be used to improve the visibility of veins. [7] Application of moist heat at the intravenous insertion site increases vein visualization. [8] The advantages of providing heat is the vein visualization and successful insertion of the cannula been reported but the information related to the effectiveness of moist heat on the ease of cannulation is very less. [9]

Peripheral venous cannulation is the most commonly performed invasive procedures that nurses perform. [10]

Patients need repeated courses of medication that can cause some allergic or skin reactions at the place of cannulation. [11]

Because of these skin reactions, the veins may get damaged, so the placement of the cannula often becomes a cause of pain to the patient. [12]

The nurses performing the procedure should be competent as there it causes more complications related to the cannulation and provide safety and good care to the patient. [10]

MATERIALS AND METHODS

Research Design

True Experimental i.e. -
“Randomized Controlled Trial: Pretest posttest design”

Setting

Maharishi Markandeshwar Institute of Medical Sciences and Research Hospital Mullana, Haryana.

Sample Size

Power analysis was done with the help of extensive review of literature; consideration of time frame of the study, availability of the samples (includes exclusion and inclusion criteria).

$$N = \frac{\frac{Z^2 \times P(1 - P)}{e^2}}{1 + \left(\frac{Z^2 \times P(1 - P)}{e^2 N}\right)}$$

z Normal standard score

N Population size

p Percentage of population

e Margin of error

Sample Selection

Consent was taken from the patients regarding their willingness to participate in the research project. Total 60 patients were selected by convenience sampling technique and randomized into two groups experimental (n=30) and control (n=30) by computer generated code method.

Inclusion Criteria

- Undergoing peripheral intravenous cannulation on forearm.
- Within 18-60 years of age
- Having Vein assessment score of ≤ 3

Exclusion Criteria

- Having skin disease and bleeding disorders over site of cannulation
- At need of emergency cannulation
- Having excessive hair on cannulation site
- Received analgesics 2 hours prior of cannulation
- Having altered sensorium, agitated
- With pain, bruise, or thrombophlebitis over cannulation site

Ethical Clearance

Ethical approval was obtained from institutional ethical committee of M.M (Deemed to be University), Mullana [IEC-957].

Period of Investigation

October 2017 to December 2017

Hypotheses

All the hypotheses were tested at 0.05 level of significance.

H₁ - There will be a significant difference in the mean rank of visibility and palpability

score of peripheral veins among patients undergoing peripheral venous cannulation in experimental and control group after the administration of moist heat therapy.

H₂ - There will be a significant difference in mean pain score among patients during peripheral venous cannulation in experimental and control group after the administration of moist heat therapy.

H₃ - There will be a significant difference in number of pricks during peripheral venous cannulation among patients in experimental and control group after the administration of moist heat therapy.

H₄ - There will be a significant difference in mean duration of cannulation among patients in experimental and control group after the administration of moist heat therapy.

Operational Definition

- 1. Effect:** - It refers to the improvement in the visibility and palpability of peripheral veins as a result of application of moist heat therapy, measured by vein assessment scale.
- 2. Moist heat therapy:** - It refers to application of Moist heat using a 2 times folded towel (19"×13") [l×h×w = 9.5×6.5×0.4 inch] soaked in warm water at a temperature of 39-40° Celsius and kept 2 time (each for 5 minute) on the selected vein before cannulation.
- 3. Ease of cannulation:** - It is absence of difficulty in cannulation by improving the visibility and palpability of vein and reduction in the number of pricks and pain. Ease of cannulation includes:

Visibility and palpability: -It refers to the degree of perceptibility of peripheral veins being visible to eyes and felt by the fingers using modified vein assessment scale and classified as-

| | |
|--------------------------------------|---|
| Vein neither visible nor palpable | 1 |
| Vein visible but not palpable | 2 |
| Vein is barely visible and palpable | 3 |
| Vein is visible and palpable | 4 |
| Vein is clearly visible and palpable | 5 |

Pain: - It refers to distressed feeling or discomfort felt during intravenous cannulation as reported by patients on numeric pain rating scale and classified as-

| | |
|------|---------------|
| 0 | No Pain |
| 1-3 | Mild Pain |
| 4-6 | Moderate Pain |
| 7-10 | Severe Pain |

Pricks: - It refers to number of times the cannula is inserted to successfully insert intravenous cannula as assessed by researcher.

Duration of cannulation: - It refers to the time required to successfully perform peripheral venous cannulation, starting after application of tourniquet till successfully peripheral venous cannula is inserted (blood backflow in cannula) and measured in seconds using Stop-watch.

- 4. Peripheral venous cannulation:** - It refers to a procedure of inserting appropriate size of intravenous cannula for drug/fluid administration in veins of forearm (like cephalic, median and basilic veins).
- 5. Patients:** -It refers to adult patients within the age groups of 18-60 years undergoing peripheral venous cannulation.

Tools and Techniques

The inter-rater and intra-rater reliability of Modified Vein Assessment Scale was determined by using Spearman's rho and found to be 0.89 and 0.99 respectively. The inter-rater and intra-rater reliability of Numeric Pain Rating Scale was determined by using Pearson Correlation and found to be 1.00. Moist heat therapy was administered in experimental group. Moist heat therapy is an application of Moist heat using a 2 times folded towel (19"×13") [l×h×w = 9.5×6.5×0.4 inch] soaked in warm water at a temperature of 39-40° Celsius and kept 2 time (each for 5 minute) on the selected vein before cannulation. The pre and post interventional visibility and palpability score of veins were assessed in both the groups by using a scale i.e. vein assessment scale and the post interventional pain score were assessed in both groups by numerical pain rating scale. The data was collected by record analysis, observation and self report.

Statistical Analysis

Data was entered in Master Data Sheet and analyzed using SPSS software version 20.0. The data obtained was analyzed in terms of objectives of the study using both descriptive statistics and inferential statistics i.e. mean, median, standard deviation, range, “t” test, ANOVA, chi square test, Mann-Whitney test, and Kruskal Wallis H test. A statistical significance was considered at P<0.05.

RESULTS

Sample Characteristics and clinical variables of patients:

Out of 60 patients, 1/3rd of the patients in experimental group (33.3%) and control group (30%) were in the age group of 18-28 years. Most of the patients in experimental group (66.7%) and half of patients in control group (50%) were male. Most of the patients in both the experimental group (63.3%) and in control group (70%) were from lower/upper lower socio-economic class. Majority of the patients in experimental group (96.7%) as well as in control group (90%) were having active life style pattern.

More than half of the patients in experimental group (56.7%) and control group (56.7%) were having medical diagnosis. Most of the patients in

experimental group (63.3%) and in control group (66.7%) were having acute illness. Most of patients in experimental group (66.7) and in control group (60%) were having healthy BMI. Majority of patients in experiment group (93.3%) and control group (90.0%) were cannulate with cannula size number 22-24G. Half of the patients in experimental group (50%) and more than half of patients in control group (66.7%) were cannulated on the right arm. More than half of patients in experimental group (53.3%) and in control group (66.7%) were cannulated on cephalic vein. Majority of the patients in experimental group (73.3%) and in control group (80%) were having Whitish skin color. Most of the patients in experimental group (60%) and in control group (70%) were having moist skin condition. As per skin turgor, majority of the patients in the experimental group (96.7%) and all patients in control group (100%) were having normal skin turgor. More than half of the patients in experimental group (60%) and in control group (56.7) were having no/sparse hairs at the site of cannulation.

Chi square was applied and findings show that both groups were homogeneous with respect to sample characteristics and clinical variables.

Table 1: Visibility and palpability score of vein before and after application of Moist Heat Therapy. N=60

| Level of visibility and palpability | Before Application Of Moist Heat Therapy | | After Application Of Moist Heat Therapy | |
|--|--|-------------------------------|---|-------------------------------|
| | Experimental Group n=30 f(%) | Control Group n=30 f(%) | Experimental Group n=30 f(%) | Control Group n=30 f(%) |
| 1(Vein neither visible nor palpable) | 1(3.3) | 1(3.3) | 00 | 01(3.3) |
| 2(Vein visible but not palpable) | 17(56.7) | 16(53.3) | 05(16.7) | 16(53.3) |
| 3(Vein is barely visible and palpable) | 12(40.0) | 13(43.3) | 15(50.0) | 13(43.3) |
| 4(Vein is visible and palpable) | --- | --- | 10(33.3) | 00 |
| 5(Vein clearly visible and palpable) | --- | --- | --- | --- |

Vein assessment score 4 and 5 were excluded before application of Moist Heat Therapy

In experimental group (n=30), half of the patients i.e. 17(56.7%) had pre interventional vein assessment score 2 (vein visible but not palpable) followed by 12(40.0%) with score of 3 (vein barely visible and palpable) and only 1(3.3%) patient had vein assessment score 1 (vein neither visible nor palpable). While in control group (n=30), nearby half of patients

i.e. 16(53.3%) had vein assessment score 2 (vein visible but not palpable) followed by 13(43.3%) with score of 3 (vein barely visible and palpable) and only 1(3.3%) patient had vein assessment score 1 (vein neither visible nor palpable).

The post-interventional Vein assessment scores of patients improved to score range of 2-4, in which half of patients

i.e. 15(50.0%) had scored 3 (Vein is barely visible and palpable) followed by one third i.e. 10(33.3%) with score 4 (Vein is visible and palpable) and 5(16.7%) had scored 2 (Vein visible but not palpable). While in control group (n=30), nearby half of patients 16(53.3%) had vein assessment score 2 (vein visible but not palpable) followed by nearby half i.e. 13(43.3%) with score of 3 (vein barely visible and palpable) and only 1(3.3%) patient had vein assessment score 1 (vein neither visible nor palpable).

Table 2: Mann-Whitney Test showing comparison of Visibility and Palpability score of vein before administration of Moist Heat Therapy in Experimental and Control Group N=60

| Group | n | Mean Rank | Sum of Rank | U value | p value |
|--------------------|----|-----------|-------------|---------|--------------------|
| Experimental Group | 30 | 30.02 | 900.50 | 435.50 | 0.80 ^{NS} |
| Control Group | 30 | 30.98 | 929.50 | | |

^{NS}Not Significant (p≥0.05)

The data presented in Table 2 shows the mean rank of visibility and palpability score of vein in experimental group was 30.02 and 30.98 in control group. Therefore, it can be inferred that the patients in

experimental and control group were homogenous and comparable (U=435.50, p=0.80).

Table 3: Mann-Whitney Test showing comparison of Visibility and Palpability score of vein after administration of Moist Heat Therapy in Experimental and Control Group N=60

| Group | n | Mean Rank | Sum of Rank | U value | p Value |
|--------------------|----|-----------|-------------|---------|----------|
| Experimental Group | 30 | 38.75 | 1162.50 | 202.50 | 0.001*** |
| Control group | 30 | 22.25 | 667.50 | | |

***Very Highly Significant (p≤0.001)

The data presented in Table 3 shows the mean rank of visibility and palpability score of vein in experimental group (Mean Rank=38.75, Sum of Rank=1162.50) was higher than control group (Mean Rank=22.25, Sum of Rank=667.50). The Mann-Whitney test was applied and computed 'U' value obtained (202.50) was found statistically very highly significant (p=0.001) at 0.05 level. It was inferred that the moist heat therapy is an effective intervention in improving the visibility and palpability of peripheral veins.

Table 4: Mean, Mean difference, Standard error of Mean Difference and 't' value of pain score among patients after Moist Heat Therapy in Experimental and Control Group N=60

| Group | Mean±SD | M _D | SE _{MD} | t value | df | p value |
|--------------------------------------|-----------|----------------|------------------|---------|----|----------|
| Experimental group (n=30) | 3.63±2.04 | 2.46 | 0.53 | 4.62 | 58 | 0.001*** |
| Control group (n=30) | 6.10±2.09 | | | | | |
| ***Very Highly Significant (p≤0.001) | | 't' (58)=1.67 | | | | |

The data presented in Table 4 shows the mean pain score of patients was 3.63±2.04 in experimental group and 6.10±2.09 in control group with a mean difference of 6.10±2.09. The unpaired 't' test was applied and the computed 't' value obtained (4.62) was found to be statistically very highly significant (p=0.001). This reveals that the mean difference in pain scores between experimental and control group was a true difference but not by chance. It was concluded that the moist heat therapy was an effective intervention in reducing the pain level of the patients undergoing peripheral venous cannulation.

Table: 5. Chi-square showing comparison of number of pricks during cannulation among patients in Experimental and Control Group N=60

| Sr. no. | Total no of pricks | Experimental Group (n=30) f(%) | Control Group (n=30) f(%) | Chi square (χ ²) | df | p value |
|---------|--------------------|--------------------------------|---------------------------|------------------------------|----|---------|
| 1.1 | 1 | 28 (93.3) | 17 (56.7) | 11.46 | 2 | 0.003** |
| 1.2 | 2 | 02 (06.7) | 07 (23.3) | | | |
| 1.3 | 3-4 | 00 | 06 (20.0) | | | |

** Highly Significant (p<0.001)

The data presented in Table 5 shows that majority of the patients (93.3%) had one

prick of cannulation in experimental group whereas more than half (56.7%) had one

prick in control group. Only 2 patients (06.7%) had two pricks of cannulation in experimental group whereas 7 patients (23.3%) had two pricks in control group. None of the patient in experimental group had to undergo prick for 3-4 times, whereas 6(20%) of patients had 3-4 pricks in control group.

The Chi square (χ^2) test was applied and the computed ' χ^2 ' value obtained (11.46) was

found to be statistically highly significant ($p=0.003$). This reveals that the difference in number of pricks between experimental and control group was a true difference but not by chance. It can be concluded that the moist heat therapy is an effective intervention in reducing the number of pricks among patients undergoing peripheral venous cannulation.

Table: 6. Mean, Mean difference, Standard error of Mean Difference and 't' value of duration of whole procedure score among patients after Moist Heat Therapy in Experimental and Control Group N=60

| Group | Mean | M _D | SE _{MD} | t value | df | p value |
|---|--------|----------------|------------------|---------------|----|----------|
| Experimental group (n=30) | 133.00 | 167.13 | 34.15 | 4.89 | 58 | 0.001*** |
| Control group (n=30) | 300.13 | | | | | |
| ***Very Highly Significant ($p \leq 0.001$) | | | | 't' (58)=1.67 | | |

The data presented in Table 6 shows the mean duration of whole procedure was 133 seconds in experimental group and 300.13 seconds in control group with a mean difference of 167.13 seconds. The unpaired 't' test was applied and the computed 't' value obtained (4.89) was found to be statistically very highly significant ($p=0.001$). This reveals that the mean difference in duration of cannulation between experimental and control group was a true difference but not by chance. It was concluded that the moist heat therapy is an effective intervention in reducing the duration of cannulation.

DISCUSSION

The present study shows that the mean age of patients admitted in medical and surgical wards was 36.72 ± 12.21 years with range of 18-60 years. In the present study, more than half of the patients i.e. 35/60 (58.3%) were male and 63.33% (38/60) were having normal body mass index (BMI), majority of the patients 98.3% (59/60) were having normal skin turgor.

The present study shows that in experimental group, most of the subjects 17(56.7%) had pre interventional vein assessment score 2 (vein visible but not palpable) followed by 12(40.0%) with score of 3 (vein barely visible and palpable). A

study showed that prior to intervention all the patients undergoing chemotherapy (n=60) had vein assessment score 1 (neither visible not palpable).^[9] In this study 100% patients were having vein assessment score 1 while in the present study only 3.3% patients had vein assessment score 1. The difference in findings may be due to the difference in sample as patients undergoing chemotherapy were not included in the present study.

The present study shows that the post-interventional visibility and palpability score of veins in experimental group was significantly higher than control group (U=202.50, P=0.001). This finding is consistent with Rainer Lenhardt et al who reported that 70% patients in active warming (mitt warmed to 52°C) and 30% patients in passive insulation (mitt not heated) group were having vein assessment score > 3 (Score 4 - Vein is visible and palpable and score 5 - Vein is clearly visible and palpable) which shows significant difference between visibility and palpability score of vein in both the groups ($p \leq 0.0001$).^[13] The results are also supported by another study which showed that after the intervention 40% patients had vein score 5 (vein clearly visible and easily palpable), 33.3% had the vein score 4 (veins visible

and palpable) and 11.7% patients had vein score 2 (veins visible but not palpable). [9]

The present study showed that the mean pain score of experimental group (3.63 ± 0.04) was significantly ($p=0.001$) lower than the mean pain score of control group (6.10 ± 0.09). The findings are consistent with an experimental study conducted by Biyik Bayram S et al to assess the effect of local heat application before intravenous catheter insertion in chemotherapy patients which showed that Local application of heat decreased patients' pain ($p=0.011$). Biyik Bayram S et al reported that local heat application before intravenous catheter insertion in chemotherapy patients decrease pain and other difficulties by increasing venous dilation and visibility. [14]

In the present study, 93.3% patients in experimental group required only 1 prick for IV cannulation as compared to 56.7% in control group. The failure rate of first attempt cannulation was statistically high ($p=0.003$) in control group (43.3%) as compare to experimental (6.7%) group. Results are supported by Rainer Lenhardt et al, who conducted a crossover study in patients with leukaemia showed failure rates at first attempt were 6% with warming and 30% with passive insulation ($P < 0.001$). [13] Roberge et al. reported the local application of heat improves venous dilatation, which may result in fewer IV insertion attempts. [15]

The present study shows that the mean duration of intravenous cannulation in experimental group (133 seconds) in experimental group was significantly ($p=0.001$) lower than the control group (300.13 seconds) with a mean difference of 167.13 ± 34.15 . Results are supported by Regina M Fink et al who reported that the difference in mean insertion time between dry heat (98.5 ± 57.6) was less than moist heat (127.6 ± 86.1). [16] Another study done by Rainer Lenhardt et al, showed that in neurosurgical patients, it took 36 seconds to insert a cannula in the active warming group

and 62 seconds in the passive insulation group ($P=0.002$). [13]

CONCLUSION

Moist heat therapy is effective in improving visibility and palpability score of veins, reducing the pain intensity, number of pricks and duration of whole procedure of peripheral venous cannulation.

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