Effect of Dry Heat Application on Peripheral Intravenous Catheter Insertion Parameters and Discomfort among Patients Undergoing Chemotherapy

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Abstract:

Background: Peripheral intravenous catheter (PIVC) insertion is usually technically easy and causes only mild discomfort for patients. However it could become difficult and complicated in certain situations, mainly in patients receiving chemotherapy due to the recurrent exposure to venous catheterization, in addition to the damaging effects of chemotherapeutic drugs on the vessel wall. Thus, an easy, available, and fast method is required to facilitate the venous cannula insertion. Application of heat at the PIVC insertion site is one of the beneficial methods that increase the vein visualization consequently improves the insertion of PIVC. **Aim:** to evaluate the effect of dry heat application on PIVC insertion parameters, and discomfort among patients undergoing chemotherapy. **Design**: A quasi experimental pre-posttest nonequivalent groups design was utilized. **Setting:** the study was carried out in the oncology department at EL-Manial University Hospitals-Egypt. **Sample**: A purposive sample of 70 adult male and female patients divided into two equal groups, study and control (35 patients each). **Tools:** four tools were utilized, Patient's demographic and Medical background data form (tool I); Vein Assessment Scale (tool II); Two questions related to the length of the procedure and number of attempts or pricks (tool III); and Discomfort visual analogue scale (tool IV). **Results**: the study findings indicated that there was a statistical difference between study and control groups in relation to vein assessment scores, insertion duration, and number of attempts (p- value = 0.000) for all parameters after intervention. Moreover, there was a statistical significant difference in patients' discomfort level total mean scores between the study and control groups (p- value=0.000) after intervention as well. **Conclusion**: study concluded that dry heat application at the IV insertion site increased vein visibility, reduced the insertion time, reduced the number of pricks, and reduced discomfort among patients receiving chemotherapy. **Recommendation**: the application of local heating at the insertion site for chemotherapy patients is an effective, easy, and economical way, therefore it is recommended before IV cannulation to improve patients' satisfaction and the quality of care provided.

Key words: heat application, dry heat, Intravenous catheter, vein assessment, IV insertion duration, IV insertion attempt, PIVC discomfort

Introduction

Peripheral intravenous catheter (PIVC) insertion is a repeatedly and commonly used invasive procedure in clinical settings. Literatures highlighted that a considerable percentage estimated as 70% to above 80% of all hospitalized patients exposed to a PIVC insertion to give fluids and/or medications throughout the body rapidly. Worldwide, the insertion of peripheral venous catheter is performed more than 500 million times a year **(Liu et al., 2022; Paterson et al., 2022; Heydari et al., 2021; Samra, & Kumar, 2018).** PIVC insertion is usually technically easy and may lead to only mild discomfort for the patients, nevertheless sometimes it is problematic and time consuming. In fact, PIVC insertion is notoriously difficult and complicated in some situations, as for oncology

patients, who receive different courses of intravenous treatment over a number of years. They commonly require long and repeated sessions of chemotherapy, leading to endothelial damage, loss of vasorelaxant effects, as well as suppressed the anti-inflammatory effect and vascular reparative functions **(Santos-Costa, et al., 2022; Heydari, et al., 2021; Homayouniet, et al., 2019).**

Moreover, due to the irritant and vesicant nature of the chemotherapeutic drugs, the patients with cancer often pose significant increase of complications related to PIVC **(Simarpreetet et al., 2018).** Additionally, the extreme pH and osmolarity of chemotherapy drugs could lead to extravasations of the drug, pain, urticaria, erythema, ecchymosis, infiltration at the PIVC site, and sympathetically induced vasoconstriction, with prevalence rates varying between 34.9% and 50%. Consequently, these complications reduce the enlargement and visibility of the veins, making further PIVC insertion very difficult and representing a major challenge for nurses **(Santos-Costa et al., 2022; Bayram & Caliskan, 2016).**The rate of complications resulting from PIVC can be deceased by proper visualization and palpation of the vein before PIVC insertion. Palpation of the vein is important in determining the condition of the vein. The criteria for proper vein are: being bouncy and soft well supported, refilling when depressed, visible and straight, and having a large lumen (Samra & Kumar, 2018).

Nurses can use various non-pharmacological measures independently in their practice to increase the visibility and palpability of veins and making the veins suitable for PIVC insertion in case of difficult catheter to prevent and manage its complications. Such methods are used to enable successful PIVC insertion, minimize pain and anxiety, and increase patient comfort; in addition it reduces number of attempts taken to insert PIVC. Measures include: light tapping over the site, putting on tourniquets 5–10 cm proximal to the selected site, asking the patients to clench and relax their hands and by dangling the arm down **(Heydari et al., 2021; Bertoglio et al., 2017).** In addition to the previous methods, application of heat on the extremity prior to catheter insertion is recommended in the literature for those cases in which the veins are hard to see and palpate **(Sharaf et al., 2018; Atabek Asti & Karadag, 2012).**

Application of heat at the PIVC insertion site is one of the beneficial methods that increase the vein visualization which improves the insertion of PIVC **(Bertoglio, et al. 2017). Korkut et al. 2020** found that local hot application versus no application increased vein visibility, patient satisfaction and shortened the insertion time. It has been reported that the local application of heat before catheter insertion provides muscles relaxation and vasodilation by stimulating beta receptors and venous distension **(Yamagami et al., 2017).**

Significance of the study

According to previous reports, the PIVC insertion is a frequent procedure with a relatively high failure rate in the first-time (33% to 69%), which is a matter of concern. One of the reasons inducing this failure is the condition of the patient's veins **(Shourav et al., 2022; Heydari et al., 2021).** Unfortunately, multiple attempts may be needed, which may cause patient's discomfort, distress , anxiety and increase costs as a result of additional supplies and nursing time, also such actions are embarrassing for the provider **(Sharafet et al. 2018).** Furthermore, failed attempts can generate a portal of entry for micro-organisms, and force nurses to look for alternative sites, where cannulation may be more difficult or unsafe **(Mörgeliet et al., 2022).** Therefore it is important that a PIVC is inserted efficiently on the first attempt. Nurses currently use various techniques, including dry heat, to improve the success rates of PIVC insertion. Active local warming facilitates the insertion of peripheral venous PIVC, reducing both the time and number of attempts required, as well as reducing supply costs, and improve patient comfort.

Moreover, finding a safe, reliable, and economical evidence-based approach to improve PIVC insertion for patients receiving chemotherapy treatment is clinically important

for reducing patients' pain, increasing patients' comfort, and improve the quality of nursing care offered. Many studies were done involving PIVC insertion methods that increase the visibility and palpability of veins and focus on decreasing the pain associated with the procedure and improving patients' comfort; however, few studies touched on this in our region. Hopefully, the findings of the current study could provide evidence-based practice on the beneficial use of local heat applications for such group of patients. Therefore, the aim of the present study is to evaluate the effect of local heat application on peripheral PIVC insertion parameters and the discomfort experienced among patients undergoing chemotherapy.

Operational Definitions

Dry Heat Application:

Dry heat application was done by using heating lumbar pad pre warmed at 40- 50°C. The heating pad is designed for warming the human body. The heating pad has a safety system in-built. This prevents overheating by automatically switching off in the event of a fault. It has an adjustable temperature setting. The heating lumbar pad wrapped in a disposable towel before applying it on patient's skin, then, placed over the hand or the forearm for 10 minutes.

Peripheral Intravenous Catheter Insertion Parameters:

Peripheral intravenous catheter insertion parameters included the following:

a) The visibility and palpability of veins as measured by Vein Assessment Scale, b) The number of attempts/pricks and, C) The insertion duration, the time from application of the tourniquet to the moment of achieving vascular access without infiltration measured with a stopwatch. If a second IV insertion attempt was required, the time continued to accrue until insertion was successful.

Discomfort:

Level of patient's discomfort as measured by a visual analog scale that is developed by the researchers ranged from 0-10, in which (0) score indicates no discomfort while, (10) score indicates the highest level of discomfort.

Aim of the study

The aim of the current study was to evaluate the effect of dry heat application on peripheral PIVC insertion parameters, and discomfort among patients undergoing chemotherapy.

Research Hypotheses

H1: The study group who will use the dry heat application will demonstrate a higher mean vein assessment score than the control group who will receive only routine hospital procedure for intravenous catheter access.

H2: The study group who will use the dry heat application will demonstrate a lower mean insertion duration time than the control group who will receive only routine hospital procedure for intravenous catheter access.

H3: The study group who will use the dry heat application will demonstrate a lower intravenous catheter insertion mean attempts than the control group who will receive only routine hospital procedure for intravenous catheter access.

H4: The study group who will use the dry heat application will demonstrate a lower discomfort mean score than the control group who will receive only routine hospital procedure for intravenous catheter access.

Methods

Research Design:

A quasi experimental pre-posttest nonequivalent groups design was utilized to meet the aim of the present study.

Setting:

The current study was carried out in the oncology department at EL-Manial University Hospitals-Egypt.

Sample:

A purposive sample of 70 adult male and female patients over 6 consecutive months divided into two equal groups (35 patients each): 1) the study group who received heat application in addition to the routine hospital care, and 2) the control group who received the routine hospital care were constituted the study sample. The inclusion criteria were as the following: age ranged from 18-60; undergoing chemotherapy sessions; having vein assessment score of 1, or2 (according to Vein Assessment Scale); PIVC insertion sites are dorsum of hands or forearms. On the other hand, the following exclusion criteria were adopted: patients with diabetes or peripheral neuropathy; sensitivity to heat; on anticoagulant treatment; phlebitis; and patients with acute trauma, inflammation, ecchymosis, hematoma, extensive scar tissue or edema at the extremity site.

Tools:

Data pertinent to the current study was collected using the following tools:

Tool (I); Patient's demographic and Medical background data form that was developed by the researchers and it consists of questions regarding to patient's gender, age, marital status, level of education, , medical history,.....etc

Tool (II); Vein Assessment Scale (VAS). This scale was adopted from Sanderson et al (2007). It is a five points assessment scaleto evaluate the visibility and palpability of the patients' veins either before or after dry heat application to the vein site as follows: 1= veins are neither visible nor palpable, 2= veins are visible but not palpable, 3= veins are barely visible and palpable, 4= veins are visible and palpable, 5= veins are clearly visible and easily palpable. The inter-rater and intra-rate reliability of Modified Vein Assessment Scale was determined by using Spearman's rho. Two raters independently observed the patients to assess the visibility and palpability of vein. The inter-rater reliability was found 0.82. The intra-rater reliability was found 0.95 (Samra, & Kumar, 2018).

Tool (III); Two questions related to the duration of the procedure and number of attempts or pricks completed by the researchers.

Tool (IV); Discomfort visual analogue scale: it was developed by the researchers, composed of numerical levels ranging from 0–10. The patient is asked to indicate the numeric value on the segmented scale that best describes his discomfort level. Scoring will be as follows: 0= No discomfort, 1-3 Mild discomfort, 4-6 Moderate discomfort, 7-10 severe discomfort. It measures comfort level focusing on discomfort related to pain. Reliability of the tool was established using Cronbach's Alpha and it was 0.71.

Tools validity

Developed tools were submitted to a panel of five experts in the field of Medical Surgical Nursing as well as Oncology and Nuclear Medicine to evaluate its content validity. No modifications were done.

Ethical Considerations

An official approval was obtained from the Research Ethics Committee at Faculty of Nursing, Cairo University (IRB2019041701). All subjects were provided with information forms describing the aim; significance; and process of the study. They were also be given the opportunity to ask questions about the research; and fully assured that they can withdraw from the study at any time without any negative consequences. Participant informed consent was obtained prior to commencement of data collection. Anonymity and confidentiality of the collected data were assured through coding as well as keeping the documents in a safe locked place.

Pilot study

A pilot study was conducted on 10% of the participants to test the feasibility of the study and the study tools. No modifications were needed; hence the pilot samples were included in the study.

Procedure

Once official permission was granted to proceed with the study, the study was conducted, and in accordance with the inclusion and exclusion criteria the potential subjects were recruited to the control and study groups by the researchers. Data was collected through three phases as follows:

First phase; (Assessment/ pre-intervention); the researchers explained the nature and purpose of the study and written informed consent was obtained from the participants and all ethical considerations were affirmed, then the demographic and medical data was gathered using tool (I) by interviewing the patient for 15 minutes and reviewing the medical records . Assessment of visibility and palpability of veins for both the experimental and control groups was done by using VAS (Tool II) to meet the criteria of inclusion and as a pre intervention assessment. First the researchers recruited and completing the control group and then started recruiting the study group.

Second phase; (Intervention ; study group was asked to sit in a comfortable position, dry digital heating pad (padded with a disposable towel) adjusted at 40-50°C was applied to the hand and the forearm for 10 minutes (Scott Curtis, 2021; Heydari et al., 2021) in addition to the hospital routine care before PIVC insertion.

On the other hand, the control group received only the routine hospital care before PIVC insertion. Visibility and palpability of veins was assessed again in both groups just before insertion of PIVC. Peripheral intravenous catheter insertion was done for control and study groups by the same nurse practitioners (two) with more than five years of experience in the related clinical practiceusing a PIVC with 14-gauge

Third phase; (Evaluation); furthermore, number of pricks/ attempts and duration of insertion in a seconds using stopwatch was assessed and documented by the researchers. In the third phase, (Post- intervention) both groups were assessed for discomfort level experienced using the discomfort visual analogue scale after completing the procedure of PIVC insertion.

Statistical Analysis

The collected data was tabulated, computed, and analyzed using the new version of Statistical Package for Social Science (SPSS) version 20 (Social Science, IBM, USA, 2020). Data was presented using descriptive statistics in the form of frequencies, percentage, etc. As well inferential tests were utilized such as t test, $\chi 2$ test …etc. Statistical significance was considered at P-value < 0.05.

Results

Table (1) illustrates that (37.1%) of the control group their age ranged between 30 to less than 40 year old, while (40%) of the study group their age were 50 years old and above. Female gender represents (80%) and (62.9%) among the control and study groups respectively. Regarding to the place of residence (65.7%) of the control group and (60%) of the study group were from rural areas. Concerning educational level, approximately more than half of the control and the study groups can't read or write (54.3%) and (74.2%) respectively. In relation to marital status, around more than two thirds of the control and the study groups were married (77.1%) and (65.7%) respectively. Concerning occupation, (45.7%) of the control group and (34.3%) of the study groups were housewives. There were no significant statistical differences between the study and control groups in relation to demographic characteristics, so both groups are homogeneous.

Table (2) clarifies that the vast majority of the control and study groups had chronic diseases (94.3%). Regarding to the diagnosis, (45.7%) of the control group and (31.5%) of the study group were breast cancer. Concerning schedule session, (51.4%) of the control group and (42.9%) among the study group had weekly session, while (42.9%) of both groups had session every 21-28 days. In relation to cannula site, (97.1%) of the control group and (100%) of the study group had the cannula insertion in the dorsum of the hands (Rt/Lt). Concerning BMI, (37.1%) among the control group and (57.1%) of the study group was 25-30 kg/m^2, while (54.3%) of control group and (40%) of the study group were 30 kg/m^2 and above. There were no significant statistical differences between the study and control groups in relation to medical background.

Regarding vein assessment before the intervention, table (3) portrays that (57.1%) of the control group and (74.3%) of the study group had vein score one (neither visible nor palpable). While, (42.9%) of the control group and (25.7%)

of the study group had vein score two (visible but not palpable). Concerning vein assessment after the intervention, (57.1%) of the study group had vein score four (visible and palpable).

Table (4) illustrates that, There was no statistical significant difference regarding the mean VAS scores between the studied groups before intervention (p = 0.135).While the mean VAS score in the second measure for the study group (post-intervention) and the control group (immediate before IV insertion) were (3.800 ± 0.632 & 1.428 ± 0.502) respectively with statistically significant difference with (p < 0.01).

Table (5) highlights that, there was a statistically significant difference in the PIVC parameters total mean scores immediately before PIVC insertion among the control group and after the intervention among the study group respectively as follows: insertion duration (2.2343±1.2166 and 0.6774 ± 0.3615), number of attempts (2.4857± 1.2688 and 1.0571±0.2355), and discomfort (7.514±1.9746 and 3.2571± 1.1464), as P-value in the three parameters = 0.000.

Table (6) shows that 71.4% of the control groups had severe discomfort level after cannula insertion while 0% of the study group had severe discomfort after cannula insertion. Moreover, (2.9%) of the control group had mild discomfort level however (71.4%) of the study group had mild level of discomfort. There was a statistically significant difference regarding discomfort level between the study and control groups, with p-value =0.000**.**

Table (1): Frequency and Percentage Distribution of Demographic Characteristics among the control and study groups (n= 70 (35/each).

Variables	No.	%	No.	%	χ^2	P-value
Age:						
18 < 30	3	8.6	2	5.7	3.269	0.352
30 < 40	13	37.1	7	20		
40 < 50	10	28.6	12	34.3		
50 - 60	9	25.7	14	40		
Gender:						
Male	7	20	13	37.1	2.520	0.112
Female	28	80	22	62.9		
Place of residence						
Rural	23	65.7	21	60	0.245	0.621
Urban	12	34.3	14	40		
Educational Level:						
Can't read or write	19	54.3	26	74.2	4.232	0.238
Read and write	5	14.3	1	2.9		
Secondary School	7	20	5	14.3		
University	4	11.4	3	8.6		
Marital status						
Married	27	77.1	23	65.7	2.320	0.509
Divorced	3	8.6	2	5.7		
Widow	3	8.6	7	20		
Single	2	5.7	3	8.6		
Occupation:						
House wife	16	45.7	12	34.3	0.960	0.619
Worker	8	22.9	10	28.6		
Not work	11	31.4	13	37.1		

Table (2): Frequency and Percentage Distribution of Medical Background among the control and study groups (n= 70) (35/each).

Variables	Control group		Study group			
	No.	%	No.	%	χ^2	P-value
Chronic Diseases						
Yes	33	94.3	33	94.3	0.00	1
No	2	5.7	2	5.7		
Diagnosis						
Breast Cancer	16	45.7	11	31.5	21.126	0.174
Lymphomas	2	5.7	6	17.1		
Lung Cancer	1	2.9	5	14.3		
Bone Cancer	2	5.7	3	8.6		
Leukemia	4	11.4	0	0		
Liver Cancer	2	5.7	2	5.7		
Uterine Cancer	1	2.9	2	5.7		
Others	7	20	6	17.1		
Schedule Session						
Every 21-28 days	15	42.9	15	42.9	1.558	0.459
Weekly	18	51.4	15	42.9		
Twice a week	2	5.7	5	14.2		
Cannula site						
Hands (Rt/Lt)	34	97.1	35	100	2.307	0.316
Forearms (Rt/Lt)	1	2.9	0	0		
BMI						
18 < 25	3	8.6	1	2.9	3.242	0.198
25 < 30	13	37.1	20	57.1		
30 +	19	54.3	14	40		

Table (3): Comparison between Vein Assessment (Scores) before and after intervention among the control and study groups (n= 70) (35/each)

Vein Characteristics (Score)	Before				After			
	Control group		Study group		Control group		Study group	
	N	%	N	%	N	%	N	%
Neither visible nor palpable (1)	20	57.1	26	74.3	20	57.1	00	00
Visible but not palpable (2)	15	42.9	9	25.7	15	42.9	00	00
Barely visible and palpable (3)	00	00	00	00	00	00	11	31.5
Visible and palpable (4)	0	00	00	00	00	00	20	57.1
Clearly visible and palpable (5)	00	00	00	00	00	00	4	11.4
	χ^2 = 2.283				**χ^2 = 70.00**			
	P= 0.131				**P= 0.000****			

*** Significant ≤ 0.05 **high Significant ≤ 0.01**

Table (4): Comparison between means of Vein assessment scores (VAS) before and after the intervention among the control and study groups (n= 70) (35/each)

Vein assessment	Control group		Study group			
	Mean	(SD)	Mean	(SD)	t-test	P-Value
Before intervention	1.428	0.502	1.257	0.443	1.514	0.135
After intervention	1.428	0.502	3.800	0.632	17.373	0.000**

*** Significant ≤ 0.05 **high Significant ≤ 0.01**

Table (5): Comparison between means of the PIVC Parameters, and Patient's Discomfort after the intervention among the control and study groups (n= 70) (35/each)

Vein parameters	Control group		Study group			
	Mean	(SD)	Mean	(SD)	t-test	P-Value
Insertion duration	2.2343	1.2166	0.6774	0.3615	7.25	0.000**
Number of attempt	2.4857	1.2688	1.0571	0.2355	6.54	0.000**
Discomfort	7.5714	1.9746	3.2571	1.1464	11.17	0.000**

*** Significant ≤ 0.05 **high Significant ≤ 0.01**

Table (6) Frequency and Percentage of Discomfort Level among the control and study groups (n= 70) (35/each)

Discomfort level	Control group		Study group		χ^2t-test	p-value
	N	%	N	%		
Mild	1	2.9	25	71.4	47.206	0.000**
Moderate	9	25.7	10	28.6		
Severe	25	71.4	0	00		

*** Significant ≤ 0.05 **high Significant ≤ 0.01**

Discussion

Intravenous catheter insertion is an arduous task for equally patients and nurses, especially in oncology settings where catheterization is difficult due to veins depletion. However, nurses could utilize several techniques to make the veins more suitable for the PIVC to prevent and manage its complications. Therefore, the aim of the current study was to evaluate the effect of dry heat application on PIVC insertion parameters and discomfort among patients undergoing chemotherapy.

Concerning the demographic data of the study participants, the current study results revealed that nearly two-thirds of the control group were in the age group between (40- 50 years old) and (30-40 years old), while nearly half of the study group were between (40- 50 years old) and (30-40 years old). These findings could be a reflection of the current study sample, where the female patients with breast cancer comprised most of the sample. Incidentally, National Health Services (NHS) **Digital (2020) and Abo-Touk (2019)** highlighted that breast cancer was the most frequent cancer in female patients aged from 40–54 years old. These findings are congruent with the age of study sample in a study done by **Radwan et al. (2022),** who reported that the mean age of the study sample was (46.68±8.99) years old among the intervention group and (48.18±10.65) years old among the control group. However, the findings are incompatible with those findings of **El-seadi et al. (2020),** who mentioned that the majority of their study sample was between the ages of (40-60 years old).

According to the current study, the majority of the study groups were female. These findings matched with the findings of **Abo-Touk (2019),** who reported that among 2620 cancer patients, 1146 male (43.7%) and 1474 females (56.3%). This high cancer prevalence in female patients than male patients may be explained by the high percentage of patients who are in age groups 30-55 years old, when female patients outnumber males. Because of the comparatively high burden of breast cancer among young female, coinciding with the chance of getting invasive cancer in the United States from 2010 to 2012 was higher for female (5.4%) than for male (3.4%) among individuals aged less than 50 years old. Furthermore, these results were supported by the findings of **Chagani et al. (2017),** who cited that 66% of the adult patients with cancer undergoing chemotherapy treatment in Pakistan were female.

Regarding the place of residence, the present study showed that two-thirds of both groups were from rural areas. These results were in line with **Choenyi et al. (2016),** who stated that most of the patients with cancer (58%) belonged to rural areas, while 42% were

from urban areas. Moreover, two-thirds of the current study group and more than half of the control group cannot read or write. This could be the reason why more than two-thirds of both groups were housewives and not working. These findings are incompatible with the **El-seadi et al. (2020)** who reported that nearly half of their participants had secondary education. However, these results are in equivalence with the same study result, which reported that more than half and one-third of the study and control patients were housewives. These discrepancies may result from population differences.

In relation to medical background, this study showed that the majority of both groups had an associated chronic illness. This finding is not in agreement with **Bayram & Caliskan (2016),** who reported that the majority of the study sample didn't have chronic illnesses. Apparently, the majority of both groups in the current study were diagnosed with breast cancer. These results match the study findings of **El-seadi et al. (2020),** which revealed that one-third of the patients in both groups, were diagnosed with breast cancer. The results also correspond with **Pearce et al. (2017),** who stated that more than half of the studied chemotherapeutic patients were diagnosed with breast cancer. Feasibly, these results could be explained in light of the fact that most of the current study sample was female. These findings could also be justified by the findings of the National Population-Based Cancer Registry Program and Cancer Registry Report in Mansoura University Hospital, Egypt,which revealed that breast cancer is the most common cancer type in Egypt among females, accounting for 32.0%to 47.2% of all cases **(Ibrahim, 2014; Abo-Touk, 2019).**

It is clear from the results of the current study that BMI in half of the control group and nearly half of the study group were above 30 (obesity), while one-third of the control group and more than half of the study group BMI were between 25 and 30 (over weight). These findings are inconsistent with **Bayram & Caliskan (2016),** who revealed that the mean BMI of the study group was 26.72 and 27.33 for the control group. These results could be explained in light of the fact that most of the sample consisted of females and housewives, in addition to the fact that most of them had chronic illnesses that added to their condition. This may cause a lack of physical activity. Moreover, stress related to the disease which could be another factor.

The current study results showed that nearly half of the control and study groups were having weekly chemotherapy sessions, while less than half of both groups were having sessions every 21–28 days. In addition, the present study findings illustrated that the IV Cannuala was inserted in the dorsum of hands (right or left) among the majority of both groups. While in a study done by **Mörgeli et al. (2022),** reported that the majority of venous catheters were placed on the back of the hand (78.7%). These results are not in agreement with **Sharaf et al. (2018)** study, which revealed that both cephalic and basilic veins were the most commonly used sites for both intervention and control subjects. It is possible that this disparity could be related to the fact that the majority of the current study group was obese or overweight, making the identification of the cephalic and basilic veins more challenging. In conclusion, the present study found that there were no significant statistical differences between the studied groups regarding their demographic and clinical characteristics at the beginning of the study. In other word they were homogeneous, which control the external variables that may impact the explanation of the study outcomes.

It is worth mentioning that, the results of the study on hands illustrated a statistically significant difference in peripheral intravenous catheter insertion parameters and discomfort among patients undergoing chemotherapy. Consistent with that, a local warm compress is a safe, easy, and cost-effective nursing practice that facilitates the cannulation of veins in patients undergoing chemotherapy. The present study revealed that there was a significant improvement regarding vein assessment scores after dry heat application among the intervention group compared with scores before the intervention.

In this regards, more than half of the study group had a score of 4 (vein visible and palpable) after intervention, while one third of

them had a score of 3 (Barely visible and palpable). Moreover, the current study results showed a statistical difference regarding vein assessment scores between the study and the control group after applying the dry heat with (p = 0.000**). These findings are in a harmony with several studies **(Sharaf et al.2018; Samra, & Kumar, 2018; Bayram, & Caliskan, 2016; and Fink et al. 2009)** who found that heat application improved the vein assessment scores. This could be attributed to a great extent to the effect of the dry heat that was used for the study group. Accordingly, the first study research hypothesis was accepted.

Concerning the other peripheral intravenous catheter parameters after the intervention, the present study declared that there was a statistical difference between the study and the control group in relation to: insertion duration, number of attempts, and patient's discomfort (p = 0.000**). This could be related to the vasodilatation effect of heat application before cannula insertion which enhanced the visibility of the veins allowing for easy and successful insertion. These findings are in accordance with **Heydari et al. (2021),**who revealed that local warm compression improve vein status within the intervention group. The results are supported by **Bayram & Caliskan (2016),** who observed a significant reduction in the duration of catheter insertion among the intervention group after heat application.

Moreover, the present findings are supported also by **Simarpreet et al. (2018),** study findings which revealed that local warming of the hand and lower arm increased the rate of successful insertion of peripheral venous cannula, decreased duration of the whole procedure, and reduced the number of pricks. Furthermore, **Samra & Kumar (2018)** in their study concluded that the heat therapy was effective in improving the visibility and palpability of veins, decreasing the number of attempts taken to insert intravenous cannula along with decreasing patient's pain. These findings are consistent with the present study findings. Likewise, the present study findings supported by the systematic review study that was done by **Heydari et al. (2021)** and revealed that using local warming at IV insertion site increases vein score, the insertion success rate in the initial attempt, patient's satisfaction, relaxation and reduces the catheterization time, reduces pain intensity, reduces difficulty perceived by the nurse, and reduces the number of pricks. Thus, the second and third study research hypotheses were also accepted.

In relation to discomfort level, the present study findings indicated a statistically significant difference between the study and control groups after intervention. Two- thirds of the study group reported mild level of discomfort compared with two thirds of the control group who reported severe level of discomfort after catheter insertion with (p= 0.000**). This results are supported with most of the related studies which done by **(Heydari et al. 2021; Korkut et al., 2020; Samra, & Kumar, 2018).**

After all, the present study findings supported the proposed study hypotheses and revealed that dry heat application prior to PIVC insertion significantly improves peripheral cannula insertion parameters and reduces the discomfort perceived by the patient.

Conclusion:

The present study concluded that application of dry heat on cannula insertion site has an obvious effect in increasing vein visibility, reducing the insertion time, reducing the number of pricks, and decreasing patient's discomfort among patients receiving chemotherapy.

Implication of the study: This study displays that, nurses could apply dry heat in nursing intervention to diminish the possibility of multiple IV insertion attempts ,thus reducing procedure insertion time and enhancing patient quality of care which in turn improve patient's comfort and satisfaction.

Recommendation:

ž 1- Duplication of the study on a large sample size from different geographic areas in Egypt.

ž 2- Heat application therapy could be a part 0f the protocol of nursing care for patients undergoing chemotherapy.

3- Further study assessing causes that could interfere with difficult peripheral intravenous cannulation.

4- Educational programs regarding heat application before IV catheter insertion should be provided for oncology nurses to improve their practice.

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