



“Effectiveness of Dry Heat Application on Venous Access among Children Undergoing Intravenous Procedures in a Tertiary Care Hospital, Karad”.

Article History:

Name of Author:

Mrs. Sarika Promod Satpute¹, Mr. Ajay Jyotiram Kavar^{2*}, Mrs. Ashwini Amol Patil³, Ms. Rupali Santaram Watharkar⁴

Affiliation:

¹Assistant Professor, Hirai Institute Of Nursing Education Malwadi, Masur

^{2*}Assistant Professor, Hirai Institute Of Nursing Education Malwadi, Masur

³Assistant Professor, Hirai Institute Of Nursing Education Malwadi, Masur

⁴Clinical Instructor, Hirai Institute Of Nursing Education Malwadi, Masur.

Corresponding Author:

Mr. Ajay Jyotiram Kavar*

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ABSTRACT:

Problem statement - “Effectiveness of Dry Heat Application on Venous Access among Children Undergoing Intravenous Procedures in a Tertiary Care Hospital, Karad”.

The Objectives of the Study:

1. To assess the venous access among the children undergoing intravenous procedures in control group.
2. To assess the venous access among the children undergoing intravenous procedures after heat application among experimental group.
3. To evaluate the effectiveness of dry heat application on venous access among children.
4. Find an association between the venous accesses among children with the selected demographic variables.

METHODOLOGY: Evaluatory research approach and post test only control group design was used for the study. The study was conducted in Tertiary care hospital Karad. 60 children aged 8-12 years were selected, 30 children in experimental and 30 in control group were the sample selected by Non probability purposive sampling technique. The purpose and procedure of the study were explained to the children and their parents. Formal consent was obtained from the parents. The heat application refrigerator the application of heating pad at 40 degree Celsius for 3 minutes at the site of intravenous procedure prior to venous access. After 3 minutes of hot application, vein was assessed by using vein assessment scale. **RESULTS:** The present study was conducted to assess the effectiveness of hot application on vein access prior to intravenous procedures among children. The study aimed to evaluate the effectiveness of hot application in assessing the vein. The result shows the mean assessment score of the experimental group was 3.93 and control group was 1.93. Mean score of vein accessibility was higher than control group. The Mann-Whitney (Non-Parametric) test was used and it was found that there was statistically extremely significance experiment and control group p 0.0001. There was no significant association between vein assessment score and selected demographic variables of children in control group. There was a significant association between vein assessment score with previous exposure to IV cannulation of children in the experimental group. **CONCLUSION:** The study concluded that hot application is very effective method for vein accessibility before IV cannulation & it can be practice regularly as it saves time, energy & anxiety among children's & parents.

KEYWORDS – Effectiveness, Heat Application, Venous Access, Intravenous Procedures.

INTRODUCTION

Intravenous cannulation is defined as the placement of a device within a vein to allow access to the venous system. These devices can then be used to deliver drugs and fluid to the patient. The main advantage of venous access is the speed with which the drug or fluid reaches systemic circulation. Insertion of intravenous cannula is probably the most commonly performed invasive medical procedure and also a potentially lifesaving intervention. A 1998 study from an urban paediatric teaching hospital reported an 83% success rate for IV nurses and a 50% success rate for staff nurses. A 2003 study reported a 53% success rate on the first catheterization attempt of paediatric inpatients, with 9% of patients requiring more than four attempts to obtain peripheral IV access. Intravenous therapy (abbreviated as IV therapy) is a medical technique that delivers fluids, medications and nutrition directly into a person's [vein](#). The intravenous route of administration is commonly used for rehydration or to provide nutrition for those who cannot consume food or water [by mouth](#). It may also be used to administer [medications](#) or other medical therapy such as [blood products](#) or [electrolytes](#) to correct [electrolyte imbalances](#). Attempts at providing intravenous therapy have been recorded as early as the 1400s, but the practice did not become widespread until the 1900s after the development of techniques for safe, effective use. Venipuncture and other needle-related procedures can distress children and have a lasting negative impact. Dry heat increased blood circulation and improved oxygen supplies to the skin with increased core body temperature and improved exchange of nutrients into cells and the discharge of toxins. Heat applications have four main effects on body tissues, including pain relief, muscle relaxation, blood vessel dilatation, and connective tissue relaxation. The intervention has an Improving comfort and safety for patients by simply applying heat prior to cannulation warrants practice consideration. The application of heat prior to cannulation /catheterization is not a new technique, though this research has provided evidence to promote change and review of current practices. Nurses often apply heat to the IV insertion site to as-to the IV insertion site to assist with the vein visualization and increase the likelihood of a successful insertion, but the technique has rarely been studied. Cutaneous blood flow increases up to 70% during periods of heating because of an increase in sympathetic vasodilator activity.

NEED FOR STUDY: Intravenous (I.V.) access is sometimes a difficult, time-consuming, and highly frustrating procedure. Obesity is widely believed to be associated with difficult peripheral intravenous access (PIV) placement. This study examined the relationship between body mass index (BMI) and ease of venous access in children undergoing non cardiac surgical procedures. Although difficult peripheral intravenous cannulation (DPIVC) occurs in 10%–24% of adults and in up to 37% of children who require a peripheral route during hospital treatment, in many respects it is still insufficiently studied. Research findings shows that the Dry heat application before IV line insertion significantly improves the ease of venipuncture and reduces the pain perceived by the patient. This method of IV cannulation can be adopted in children with problematic IV access. It is difficult to find the vein

and the children have to be pricked many times. This causes more pain and stress in already distressed children and reduces the confidence level of nurses performing the procedure. Hence the investigator felt a need to apply dry heat on intravenous sites among children undergoing intravenous procedures which may help for easy vein access & reducing the pain and stress in children. also it might help to minimize prick the veins. Hot application may helpful to increases the venous blood flow and dilates the veins.

STATEMENT OF THE PROBLEM: "Effectiveness of Dry Heat Application on Venous Access among Children Undergoing Intravenous procedures in a tertiary care hospital, Karad.

The Objectives of the Study: To assess the venous access among the children undergoing intravenous procedures in control group.

OPERATIONAL DEFINITIONS:

EFFECTIVENESS- In this study, effectiveness refers to the easy venous access in children with the heat application prior to intravenous procedures as measured by modified vein assessment scale.

HEAT APPLICATION- In this study, heat application refers to the application of heating pad at 40 degree Celsius for 3 minutes at the site of intravenous procedure prior to venous access.

VENOUS ACCESS- In this study, venous access refers to the easy accessibility of veins in terms of visibility, palpability. The number of pricks and total time taken for intravenous procedures in children admitted in a selected tertiary care hospital, Karad.

INTRAVENOUS PROCEDURE- In this study, intravenous procedure refers to insertion of intravenous needle/ cannula for the purpose of drawing blood samples or administering medications.

CHILDREN'S- In this study, children refer to 8 to 12 years of age admitted in the selected tertiary care hospital, Karad.

TERTIARY CARE HOSPITAL- According to Johns Hopkins Medicine Health Library: Specialized care usually on referral from primary or secondary medical care personnel by specialists working in a centre that has personnel and facilities for special investigation and treatment. In this study it refers to tertiary care hospital is the hospital which provides specialists care after referral from primary care and secondary care.

REVIEW OF LITERATURE:

1.A randomized controlled trial was conducted in the pediatric wards of a tertiary care hospital in a Metropolitan city in South India. Based on inclusion and exclusion criteria, children in the age group of 5–18 years were randomized into intervention and control groups of 42 children each. The purpose of this study was to assess the efficacy of dry heat application in children with difficult intravenous (IV) access. The result of the study was regression analyses supported the unadjusted outcomes comparisons between the two groups.^[24]

2.This cross over clinical trial study was conducted by [Leticia Carmen Simon Lopez](#) et al on benefits of the application of heat and pressure on peripheral venous

cannulation in adults. A randomized controlled trial; to evaluate the effectiveness of the application of topical heat, high pressure or a combination of both on ante brachial venous cannulation. The study result revealed that all the interventions were more effective than comparator. Vein perception was optimized in about all individuals. Moreover, pain relief was significantly higher when high pressure was applied. Haemolysis was not affected in any of the three interventions. In addition, no serious adverse events appeared. The study concludes that the High pressure is determined to be the most effective in vein catheterization, pain relief, vein perception and quality of blood sample inalterability. Moreover, it is safe considering that only one adverse event appeared. [25]

RESEARCH METHODOLOGY:

A collection of methods and methodologies that researchers apply systematically to produce scientifically based knowledge about the social world. RESEARCH APPROACH Evaluator approach In present study Quasi-experimental post test only control group design. In present study the investigator, selected 60 children's for control and experimental group. Vein assessment is done and given the total 5 scores.

RESEARCH VARIABLES:

A variable is a concept that has measurable changing attributes. Variables are qualities, properties or characteristics of persons, things or situations that change or vary.

Independent Variables: Electric Heating Pad

Dependent Variables : Intravenous procedure

Hypothesis:

H₁: The mean venous access score of experimental group after the dry heat application will be significantly higher than the mean venous access score of control group.

H₂: There will be significant association between the venous access among children and the selected demographic variables.

SETTING OF THE STUDY

Setting refers to the area where the study is conducted. It may be natural setting or laboratory setting depending upon the study topic and the researcher's choice.

The present study was conducted by the paediatric ward of Krishna Hospital, Karad.

POPULATION: According to Talbot (1994) Population is a group whose member possesses specific attributes that a researcher is interested in the study. In the present study, the population consisted of 8-12 years of children undergoing intravenous procedures and who are admitted to paediatric ward.

SAMPLE: The children with age group 8-12 years undergoing IV procedures & admitted in paediatric ward at KH Karad. The sample consist total 60 children, in experimental group 30 & in control group 30.

SAMPLING TECHNIQUE: Sampling technique is the procedure which the researcher adopts in selecting the sample for the study. Non-Probability Purposive sampling

technique was used for the study. This sampling is based on the belief that researchers knowledge about the population can be used to handpick the cases to be included in the sample.

Inclusion criteria: Children

- Within the age group of 8-12 years
- Admitted in paediatric ward and undergoing intravenous procedures in Krishna hospital, Karad
- Who were willing to participate in the study.

Exclusion Criteria: Children

- Who were chronically ill.
- Who were admitted with burns.
- Who was admitted with surgical conditions.
- Who were affected with skin problem at IV access site.

DATA COLLECTION TOOL: The tool consist of two sections. SECTION I: Demographic Performa of children. SECTION II: a) Vein Assessment Scale b) Total the Number of attempt required for IV Cannulation in Control and Experimental group. C. Total time required for IV cannulation in Control and Experimental group.

SUMMARY: This chapter has dealt with research methodology which included the research approach, setting, population, variables under the study, and the development of the tool, content, data collection method & analysis of data. Research methodology gives an idea of entire process of hot application a research problem in a systematic and scientific manner.

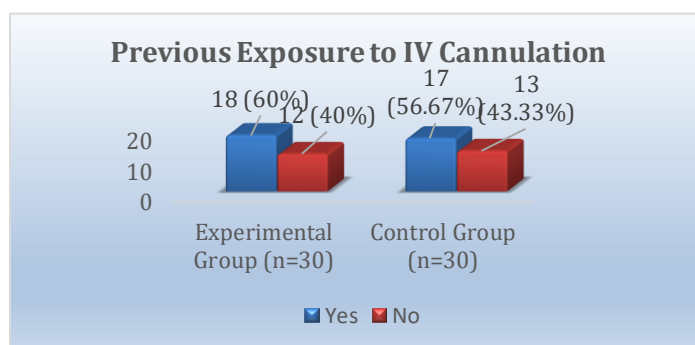


Figure: Column chart showing comparison of previous exposure to IV cannulation of the children in Experimental group & Control group.

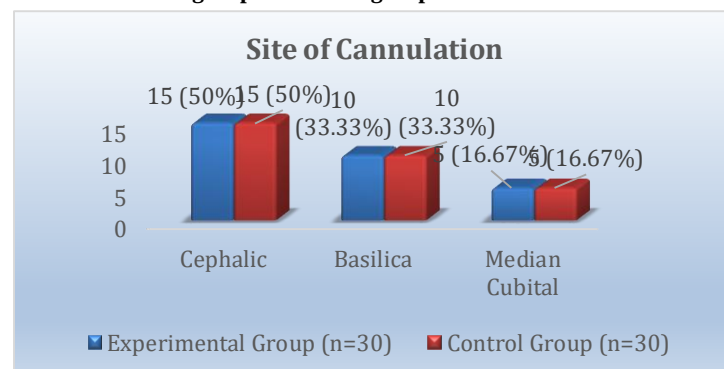


Figure: Column chart showing comparison of site of cannulation of the children in Experimental group & Control group.

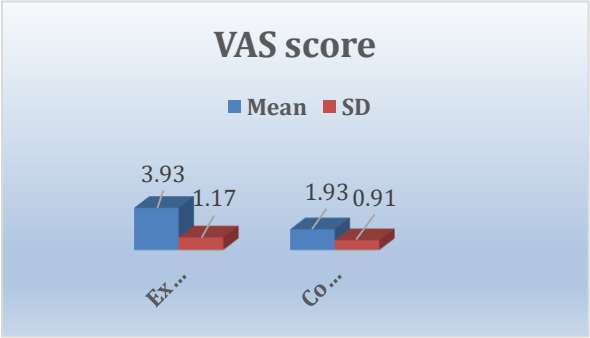


Figure: Column chart showing mean and SD of vein assessment score between experimental group and control group of the children.

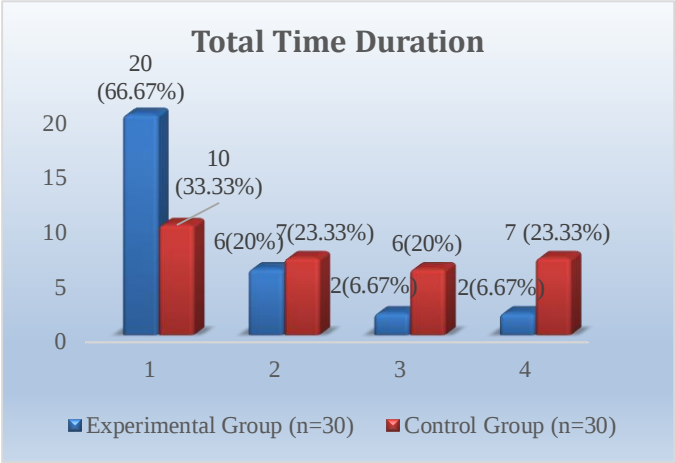


Table 12: Comparison of total time duration required of the children in Experimental group & Control group.

RESULT AND DISCUSSION:

Among the 30 (100%) children’s in the control group, 18(60%) were in the age group of 8-10 years whereas 12(40%) children’s were in the age group of 11-12 years. The average age of children’s was 10.23±1.22 years respectively. The mean & SD weight among the children’s of experimental group was 29.96±4.67Kg. Whereas in control group mean score was 28.86±4.51 respectively. Among 30 (100%) children’s in control group, majority 15(50%) children’s site of cannulation was cephalic, 10(33.33%) children’s site of cannulation was basilica and remaining 5(16.67%) children’s site of cannulation was median cubital

Among 30 (100%) children’s in control group, majority 12(40%) children’s cannula size was 24, 13(43.33%) children’s cannula size was 22 and remaining 5(16.67%) children’s cannula size was 20.

Out of 30 (100%) children’s in experimental group, 18(60%) children’s had previous exposure to IV cannulation whereas 12(40%) children’s had no previous exposure to IV cannulation.

On the other hand in experimental group major findings were as follows:

Out of 30 (100%) children’s in experimental group, majority 15(50%) children’s site of cannulation was cephalic, 10(33.33%) children’s site of cannulation was basilica and remaining 5(16.67%) children’s site of cannulation was median cubital. On the other hand among

30 (100%) children’s in control group, majority 15(50%) children’s site of cannulation was cephalic, 10(33.33%) children’s site of cannulation was basilica and remaining 5(16.67%) children’s site of cannulation was median cubital.

Out of 30 (100%) children’s in experimental group, majority 19(63.33%) children’s cannula size was 24, 9(30%) children’s cannula size was 22 and remaining 2(6.67%) children’s cannula size was 20. Out of 30(100%) samples in the experimental group, majority of the children’s13 (43.33%) were having veins clearly visible and palpable. Regarding the control group, majority 17(56.67%) of the subjects had vein visible and not palpable. The association of vein assessment scale between experimental and control group was found statistically significant with $p<0.05$.

In the present study comparison of number of attempt required among the children found that the difference of control group and experimental group was found statistical significant with $p= <0.0001$. Present study findings supported by [Eva Suchitra](#) [Ranjini Srinivasan et al](#), Effectiveness of dry heat application on ease of Venipuncture in children with difficult intravenous access: A randomized controlled trial. With respect to the number of attempts taken to achieve an IV access, all children in the intervention group only required one attempt, whereas only 29% of those in the control group required a single attempt ($p < .001$), $X^2 (1, 84) = 43.67, p < .001$. The mean time (in seconds) to insert an IV line was lower in the intervention group ($M = 64.56$, standard deviation $[SD] = 28.32$) than in the control group ($M = 110.70, SD = 51.54$), $t (82) = 5.09, p < .001$. Children in the intervention group were 45.2 percentage points more likely to experience a discomfort level of “little hurt” as compared to their counterparts in the control group, $X^2 (1, 84) = 18.02, p < .001$.

In the present study result shows that was children’s in experimental group, majority 22(73.33%) children’s had required only 1 attempt,6(20%) children had required 2 attempts and 2(6.67%) children’s had required 3 attempts to complete intravenous procedure. In control group majority 12(40%) children’s had required only 3 attempts, 10(33.33%) children’s had required 2 attempts 5(16.67%) children had required more than 3 attempts and 3(10%) children’s had required1 attempt to complete intravenous procedure. The difference of control group and experimental group was found statistical significant with $p<0.05$. The result showed that the respect to the number of attempts taken to achieve an IV access, all children in the intervention group only required one attempt, whereas only 29% of those in the control group required a single attempt ($p < .001$), $X^2 (1, 84) = 43.67, p < .001$. The mean time (in seconds) to insert an IV line was lower in the intervention group ($M = 64.56$, standard deviation $[SD] = 28$. than in the control group ($M = 110.70, SD = 51.54$), $t (82) = 5.09, p < .001$. Children in the intervention group were 45.2 percentage points more likely to experience a discomfort level of “little hurt” as compared to their counterparts in the control group, $X^2 (1, 84) = 18.02, p < .001$. Results from regression analyses supported the unadjusted outcomes comparisons between the two groups.

SUMMARY & CONCLUSION

The main study was conducted in 6 weeks of Paediatric ward at tertiary care hospital, Karad. Hot application was simple intervention used to test effectiveness by post-test only control group design. Children were selected as per their inclusion criteria. The heating pad applied on the site of venipuncture prior to intravenous procedures for 3 minutes. After 3 minutes of heat application was assessed by the Vein Assessment Scale.

The data gathered were analyzed and interpreted according to the objectives of the study. Descriptive statistics were used to calculate mean, median and standard deviation with graphical presentation of data. The mean score of vein assessment among experimental group was 3.93 ± 1.17 whereas in control group mean score was 1.93 ± 0.91 respectively. The Mann-Whitney (non-parametric) test was used and it was found that there was statistically extremely significance experiment and control group with $p < 0.05$.

It was observed that there was no significance in almost all study variables except Previous Exposure to IV cannulation to complete intravenous procedure and experimental group = 2.319 and p value = 0.028*

CONCLUSION: following conclusions were drawn on the basis of the findings of the study.

The present study was conducted to "Effectiveness Of Dry Heat Application On Venous Access Among Children Undergoing Intravenous Procedures in tertiary care hospital, Karad.

The statistical analysis of the study showed that there was number of IV insertions was reduced by the dry heat application. This study helps to children's early IV cannulation, it prevents pain and discomfort at early stages. The study findings concludes that dry heat application before IV cannulation was a safer, economic method as it saver time & energy of health workers ultimately which can utilized for caring other children.

NURSING IMPLICATIONS AND RECOMMENDATION IMPLICATIONS:

he nurses can incorporate dry heat application as one of the best non-pharmacologic intervention for easy intravenous cannulation. The present study findings have several implications in nursing practice, nursing education, nursing research and nursing administration.

NURSING PRACTICE: This study helps to provide awareness regarding the application of dry heat prior to intravenous cannulation. This finding can be utilized as a non-pharmacologic intervention for easy intravenous cannulation.

NURSING EDUCATION: This study helps the students to acquire knowledge regarding the application of dry heat for easy intravenous cannula insertion. The nurse educator can give an in service education to nurses about methods of reducing the intravenous cannulation attempts. The nursing management can teach the children's about dry heat application to reduce the number of IV insertion attempts, discomfort and anxiety of patient's.

NURSING RESEARCH: This study can be conducted on a large population in order to generalize the efficacy of dry heat application. This study result can be tested among various population and different settings. This study result motivates the nurses to conduct research on other forms of

non-pharmacological intervention for easy intravenous cannulation.

NURSING ADMINISTRATION: Nurse administrators can formulate the policies for using dry heat application for easy intravenous cannulation. Nurse administrator can arrange in service education based on this study findings. Nurse administrator can motivate nurses to repeat the same study on large sample.

LIMITATION: This study can be combined with other non-pharmacological interventions for reducing the insertion attempts, discomfort and anxiety of patient's. The study was conducted very few hospitals in our country.

RECOMMENDATIONS

- A similar study can be conducted with a large sample size.
- The similar study can be conducted in to some other areas of nursing.
- A descriptive study can be conducted to find out the incidence of the number of IV insertion attempts, vein assessment status etc.
- A comparative study can be done with hot application and other modalities.

The findings of the study suggest that the effectiveness of dry heat application on venous access is very effective for vein visibility and children's satisfaction and shortened the insertion time.

SUMMARY

A present evaluative study conducted to "effectiveness of dry heat application on venous access among children undergoing intravenous procedures. Sample of 60 children 30 in experimental group and 30 in control group were selected by Non-Probability Purposive sampling technique. It was concluded that there was the number of IV insertions was reduced by the dry heat application. This study helps to children's early IV cannulation it prevents pain and discomfort at early stages.

REFERENCES:

1. Lenhardt R, Seybold T, Kimberger O, Stoiser B, Sessler DI. Local warming and insertion of peripheral venous cannulas: single blinded prospective randomised controlled trial and single blinded randomised crossover trial. *Bmj*. 2002 Aug 24;325(7361):409.
2. Riker MW, Kennedy C, Winfrey BS, Yen K, Dowd MD. Validation and refinement of the difficult intravenous access score: a clinical prediction rule for identifying children with difficult intravenous access. *Academic Emergency Medicine*. 2011 Nov;18(11):1129-34.
3. Intravenous therapy [Internet]. Wikipedia. Wikimedia Foundation; 2021 [cited 2021 Jun 7]

4. Thompson S, Ayers S, Pervinac C, Maloney L, Seddon P. The association of children's distress during venepuncture with parent and staff behaviours. *Journal of child health care*. 2016 Sep; 20(3):267-76.
5. Jennifer Zwink RN. The impact of dry versus moist heat on peripheral IV catheter insertion in a hematology-oncology outpatient population. In *Oncology nursing forum* 2009 Jul 1 (Vol. 36. No. 4, p. E198). Oncology Nursing Society.
6. Suchitra E, Srinivasan R. Effectiveness of dry heat application on ease of venepuncture in children with difficult intravenous access: A randomized controlled trial. *Journal for Specialists in Pediatric Nursing*. 2020 Jan;25(1):e12273.
7. Fink RM, Ellen , The impact of dry versus moist heat on peripheral IV catheter insertion in a hematology-oncology outpatient population. In *Oncology nursing forum* 2009 Jul 1 (Vol. 36, No. 4, p. E198). Oncology Nursing Society.
8. Robinson-Reilly M. Application of heat prior to intravenous catheter insertion to improve comfort and safety for patients requires further research. *Evidence-based nursing*. 2017 Jan 1;20(1):15-.
9. Simón-López LC, Luquero-Bueno S, Ovejero-Benito MC, Cuesta-Lozano D, Goodman-Casanova JM, Vargas-Castrillón E, Mazarro DO, De Miguel-Cáceres A, Posada-Moreno P, Zaragoza- García I, Ortuño-Soriano I. Benefits of the application of heat and pressure on peripheral venous cannulation in adults: A randomized controlled trial. *Journal of Advanced Nursing*. 2021 Mar;77(3):1533-45.
10. Kaur M, Kaur S. Methods to increase peripheral veins visualization in patients getting chemotherapy. *International Journal of Nursing Education*. 2012 Jul;4(2):1-3.
11. Beer J. Local warming does help when inserting cannulas. *Bmj*. 2002 Nov 2;325(7371):1038.
12. Robinson-Reilly M. Application of heat prior to intravenous catheter insertion to improve comfort and safety for patients requires further research. *Evidence-based nursing*. 2017 Jan 1;20(1):15-.
13. Chiao FB, Resta-Flarer F, Lesser J, Ng J, Ganz A, Pino-Luey D, Bennett H, Perkins Jr C, Witek B. Vein visualization: patient characteristic factors and efficacy of a new infrared vein finder technology. *British journal of anaesthesia*. 2013 Jun 1;110(6):966-71.
14. Nafiu OO, Burke C, Cowan A, Tutuo N, Maclean S, Tremper KK. Comparing peripheral venous access between obese and normal weight children. *Pediatric Anesthesia*. 2010 Feb;20(2):172-6
15. Rodriguez-Calero MA, Fernandez-Fernandez I, Molero-Ballester LJ, Matamalas-Massanet C, Moreno-Mejias L, de Pedro-Gomez JE, Blanco-Mavillard I, Morales-Asencio JM. Risk factors for difficult peripheral venous cannulation in hospitalised patients. Protocol for a multicentre case-control study in 48 units of eight public hospitals in Spain. *BMJ open*. 2018 Feb 1;8(2).
16. Morales-Asencio JM. Risk factors for difficult peripheral venous cannulation in hospitalised patients. Protocol for a multicentre case-control study in 48 units of eight public hospitals in Spain. *BMJ open*. 2018 Feb 1;8(2).
17. Fink RM, Ellen Hjort RN ND, Barbara Wenger RN, Mary Cunningham RN, Aimee Orf RN, Wendy Pare RN, Jennifer Zwink RN. The impact of dry versus moist heat on peripheral IV catheter insertion in a hematology-oncology outpatient population. In *Oncology nursing forum* 2009 Jul 1 (Vol. 36, No. 4, p. E198). Oncology Nursing Society.
18. Australian Nursing Journal Local warming improves cannulation. | November 1, 2002 | COPYRIGHT 2008 Available from URL <http://business.highbeam.com/84/article-1G1-94061510/localwarming-improves-cannulation>
19. Rafael Ortega, M.D., Pavan Sekhar. et al. Peripheral Intravenous Cannulation The new England journal of medicine n engl j med 359;21 available from: URL [www.fcmmg.br/lat/arquivos/Biblioteca/acesso % 20venoso.pdf](http://www.fcmmg.br/lat/arquivos/Biblioteca/acesso%20venoso.pdf)
20. Suchitra E, Srinivasan R. Effectiveness of dry heat application on ease of venepuncture in children with difficult intravenous access: A randomized controlled trial. *Journal for Specialists in Paediatric Nursing*. 2020 Jan;25(1):e12273.
21. Kaur M, Kaur S. Methods to increase peripheral veins visualization in patients getting chemotherapy. *International Journal of Nursing Education*. 2012 Jul;4(2):1-3.
22. White EG. Child guidance. Review and Herald Pub Assoc; 2002.
- 23., Bansal P, Khan F, Husain M. A quasi-experimental study to assess the effectiveness of hot fomentation versus cold compress in reducing infiltration among patients undergoing IV infusion in a selected hospital of Delhi. *Research & Reviews: Journal of Surgery*. 2016 May 9;5(1):24-30.
24. Polit D, Hungler B. *Nursing Research Principles and Methods*. 7th ed. Philadelphia: JB Lippincot Company; 2006. P.289
25. Suchitra, Eva, and Ranjini Srinivasan. "Effectiveness of dry heat application on ease of venepuncture in children with difficult intravenous access: A randomized controlled trial." *Journal for Specialists in Pediatric Nursing* 25.1 (2020): e12273.)
26. Simón-López LC, Luquero-Bueno S, Ovejero-Benito MC, Cuesta-Lozano D, Goodman-Casanova JM, Vargas-Castrillón E, Mazarro DO, De Miguel-Cáceres A, Posada-Moreno P, Zaragoza-García I, Ortuño-Soriano I. Benefits of the application of heat and pressure on peripheral venous cannulation in adults: A randomized controlled trial. *Journal of Advanced Nursing*. 2021 Mar;77(3):1533-45.
27. Kaur M, Kaur S, Patel FD. Effect of moist heat therapy on the visibility and palpability of peripheral veins before peripheral venous cannulation of patients undergoing chemotherapy. *Nursing and Midwifery Research Journal*. 2011;7(3):99-105.
28. Yamagami Y, Tomita K, Tsujimoto T, Inoue T. Tourniquet application after local forearm warming to improve venodilation for peripheral intravenous cannulation in young and middle-aged adults: A single-blind prospective randomized controlled trial. *International journal of nursing studies*. 2017 Jul 1;72:1-7.
29. Samra AS, Kumar CN. Effectiveness of Moist Heat Therapy on Visibility, Palpability, Pricks and Pain Experienced While Undergoing Peripheral Intravenous Cannulation of Patients)
30. lessly Pramila, S P (2012 A study to evaluate the effectiveness of hot compress in reducing the signs and symptoms of phlebitis among toddlers with IV infusion

31. Sharaf AY, Fatah MM, Soliman M. The effects of local warm compresses on peripheral intravenous cannulation of patients undergoing chemotherapy. *Journal of Nursing and Health Science*. 2018;7(6):1-3.
32. Dalvandi A, Ranjbar H, Hatamizadeh M, Rahgoi A, Bernstein C. Comparing the effectiveness of vapocoolant spray and lidocaine/procaine cream in reducing pain of intravenous cannulation: A randomized clinical trial. *The American journal of emergency medicine*. 2017 Aug 1;35(8):1064-8.)
33. Taddio A, Soin HK, Schuh S, Koren G, Scolnik D. Liposomal lidocaine to improve procedural success rates and reduce procedural pain among children: a randomized controlled trial. *Cmaj*. 2005 Jun 21;172(13):1691-5.}
34. Taddio A, Soin HK, Schuh S, Koren G, Scolnik D. Liposomal lidocaine to improve procedural success rates and reduce procedural pain among children: a randomized controlled trial. *Cmaj*. 2005 Jun 21;172(13):1691-5.)
35. Waterhouse MR, Liu DR, Wang VJ. Cryotherapeutic topical analgesics for pediatric intravenous catheter placement: ice versus vapocoolant spray. *Pediatric emergency care*. 2013 Jan;29(1):8.
36. Keogh S, Flynn J, Marsh N, Mihala G, Davies K, Rickard C. Varied flushing frequency and volume to prevent peripheral intravenous catheter failure: a pilot, factorial randomised controlled trial in adult medical-surgical hospital patients. *Trials*. 2016 Dec;17(1):1-0.
37. Cottrell JT, Chang T, Baird J, Barreras J, Elkhunovich MA. Ultrasound-guided placement of peripherally inserted intravenous catheters increase catheter dwell time in children. *The Journal of Vascular Access*. 2020 Jun 24;1129729820929826.)
38. Simhi E, Kachko L, Bruckheimer E, Katz J. A vein entry indicator device for facilitating peripheral intravenous cannulation in children: a prospective, randomized, controlled trial. *Anesthesia & Analgesia*. 2008 Nov 1;107(5):1531-5.
39. Ranganath B, Dutt RD, Varma YS, Gaur A. 132 To compare effectiveness of infrared spectroscopic technology with conventional peripheral venous access in children: randomized control study.}
40. Bergomi P, Scudeller L, Pintaldi S, Dal Molin A. Efficacy of non-pharmacological methods of pain management in children undergoing venipuncture in a pediatric outpatient clinic: a randomized controlled trial of audiovisual distraction and external cold and vibration. *Journal of pediatric nursing*. 2018 Sep 1;42:e66-72.
41. L, D'Souza A, George A. Effectiveness of video assisted diversional therapy and application of local anaesthetic agent on pain, behavioural response and physiological parameters among children during Intravenous (IV) cannulation. *Manipal Journal of Nursing and Health Sciences (MJNHS)*. 2015;1(1):14-8.