

An Experimental Study to Evaluate the Efficacy of Selected Topical Applications on Induration caused by IV Infiltration among Hospitalized Children in a Tertiary Care Hospital, Pune

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Abstract: ***Objectives:** To assess the induration caused by IV infiltration among children. To evaluate and compare the efficacy of selected topical applications i.e. glycerine, MgSO₄ and combination of glycerine and MgSO₄ paste on induration caused by IV infiltration in hospitalized child. **Methodology:** A quasi- experimental study was conducted among 40 hospitalized children below the age of 5 years in a tertiary care setting of Pune, of which 10 each were assigned to three respective experimental groups and one control group. The three experimental groups received glycerine, MgSO₄ and combination of glycerine and MgSO₄ respectively as topical application whereas the control group received placebo treatment. The assessment of IV induration was done using standardized IV Infiltration Scale by Infusion Nurses Society. The resolution of IV induration in experimental groups were measured and compared against the placebo treatment in control group. **Results:** Most of the children who developed induration were male, below the age of 1 year and had IV cannula present at the sites like right arm, right forearm or left wrist and left arm with maximum children developing IV induration on 2-3 day of IV therapy. Experimental group who received combination of glycerine and MgSO₄ was seen to produce statistically significant difference in reduction of signs of IV induration - blanch, induration, skin temperature and pain as compared to other groups **Conclusion:** Findings of the study indicate that combination of glycerine and MgSO₄ paste was more effective than other experimental and control groups in reducing IV induration among sample population.*

Keywords: Induration, IV infiltration, selected topical applications

1. Introduction

An intravenous infiltration injury to a child while in a hospital can be devastating. When we place an infant in the care of a nursing professional, we trust that every precaution will be taken to ensure the child's safety. Often children cry because of the presence of the IV line as it hurts, but the health team members usually attribute their crying to something else and fail to initiate measures to monitor the IV sites periodically. As a result, induration caused by IV infiltration can go undetected for a longer period of time, if timely assessment of IV site is not done. Moreover, IV infiltration injuries in children are difficult to detect as compared to injuries in adults owing to children's inability to express.

Infusion therapy is one of the most common procedures performed in the hospitalized patient. Particularly in neonatal intensive care units almost 100% patients receive infusion therapy.¹ With advancement in medical practice intravenous therapy is now considered to be the portfolio for nurses having to manage intravenous cannulation, maintaining patency of IV line, monitoring infusion preparations, drug administrations, etc.

In hospital practice, intravascular lines are used for various purposes in order to administer routine and emergency drugs and fluids in those children who are expected to have gross fluid and electrolyte imbalance. As nurses have a growing responsibility in intravenous therapy and its management, it is important that they anticipate the associated health risks, particularly those associated with peripheral intravenous cannulation.

One of the common problems encountered in intravenous fluid administration is the infiltration of the fluids into tissues near the point of entry of the catheter into the vein. Effects of fluid and drug infiltration from peripheral IV lines vary depending on the following points:-

- 1) The agent, concentration and volume of the drug or solution infiltrated.
- 2) Length of exposure after infiltration occurs, especially when the child is unable to verbalize the discomfort of pain, edema or pressure.
- 3) Anatomical position of the IV cannula (site of cannula insertion whether in joints, dorsal palm, etc.).
- 4) Mechanical compression caused by electronic infusion pumps.
- 5) Age group of the child (whether premature infants, neonates, young children), as children are more susceptible to IV infiltration injuries than adults.²

The first sign of possible leakage of IV fluids or drugs into the tissues are pain and discomfort. Among other health team members nurse has the key role in reducing the risk of infiltration and extravasation, through prompt and alert monitoring of children with IV cannulation and those receiving intravenous administration of drugs by bolus injection or infusion. The nurse must also be able to recognize the early signs and symptoms of infiltration and extravasation and act swiftly and effectively to limit tissue damage.

2. Literature Survey

A survey in 2004 of regional neonatal intensive care units in the United Kingdom recorded the prevalence of infiltration

injury resulting in skin necrosis as 38 per 1,000 neonates with 70 % of these injuries occurring in infants of 26 weeks' gestation or less.³

Robin CK in his study mentioned that preterm newborns are at increased risk for extensive wounding owing to fragile vessels, thin epidermis, and limited subcutaneous tissue over common sites for placement of peripheral IV cannulas. When prevention techniques fail, immediate recognition of the infiltration, prompt intervention and initiation of wound care are important nursing interventions to limit tissue damage. There exists no consensus regarding immediate treatment or optimal wound care after an IV infiltration in the newborn, information in the literature is limited to anecdotal or descriptive case reports. This lack of scientific evidence results in regional and unit-based protocols that vary greatly from hospital to hospital.⁴

Warren D conducted a study in 2011 on implementation of a protocol for the prevention and management of extravasation injuries in the neonatal intensive care unit to determine nurses' understanding and management of young infants with intravenous therapy. There were three specific aims: improve identification and management of extravasation injuries in neonates, ensure management of extravasation injuries in neonates as classified according to IV extravasation staging guidelines and develop a protocol that outlined actions required to manage extravasations. The study observed poor compliance of management of extravasation among the nurses and also identified five barriers related to education of staff and the development of a protocol for the prevention and management of extravasation injuries in the neonatal population.⁵

In a prospective study conducted in the year 2007 in Iran, Nassaji-Zaverah M, et al aimed to investigate the incidence of phlebitis and important related factors causing them. The study inferred that phlebitis occurred in 26 % of patients but was not significantly related to age and catheter bore size, but the risk factors included gender, site and type of insertion of catheter as well as presence of infectious diseases.⁶

3. Materials and Methods

A quasi-experimental study was conducted among 40 hospitalized children below the age of 5 years in a tertiary care setting of Pune, of which 10 each were assigned to three respective experimental groups and one control group. The three experimental groups received glycerine, MgSO₄ and combination of glycerine and MgSO₄ respectively as topical application whereas the control group received placebo treatment. The assessment of IV induration was done using standardized IV Infiltration Scale by Infusion Nurses Society (2006). The resolution of IV induration in experimental groups were measured and compared against the placebo treatment in control group.

4. Results

- Out of 40 sample, 47.50 % (19) were of the age group less than 1 yr, 37.50 % (15) were between 4-5 yrs of age and 15 % (6) were of the age group 2-3 yrs. This data indicates

that children below the age group of 1yr and between 4-5 yrs are more prone for developing IV induration.

- Majority i.e., 70 % (28) of sample were male, while rest i.e., 30 % (12) were female.
- The most common infiltrated site of IV cannula (17.5 %) were dorsal aspect of right arm and forearm, the second most common being left wrist, dorsal and ventral aspect of arm (15 %) whereas few i.e., 2.5 % were present in right wrist, dorsum of right and left feet and ankle. These data highlights that IV site more prone for IV induration is right forearm and right dorsal aspect of arm.
- Maximum i.e., 20(50 %) sample who developed IV induration with IV fluids received isotonic solutions while minimum i.e., 4(10 %) received hypotonic solutions. This data describes that isotonic solution was more contributing towards IV induration as compared to other types of IV fluids in the study sample.
- Among sample who were treated with IV antibiotics, 32.5 % (13) received Inj Cefotaxime, 27.5 % (11) received Inj Gentamicin and only 2.5 % (1) were treated with Inj Vancomycin. The above data signifies the role of Inj Cefotaxime in causing IV induration as compared to other IV antibiotics in the study.
- Most of the sample i.e., 40 % (16) had IV therapy for 2 days, 37.5 % (15) had IV therapy for 3 days, whereas only 10 % (4) had IV therapy for more than 3 days. These data infers that maximum sample who developed IV induration were on IV therapy for 2-3 days whereas sample who were on IV therapy for less than 3 days developed minimal IV induration.
- The mean and SD of pre treatment blanch in group II and Group III was (M= 0.90, SD= 0.32) and (M= 0.80, SD= 0.42) respectively which reduced significantly on post treatment Day 1(M= 0.30, SD= 0.48) and Day 2(M= 0, SD= 0) in Group III whereas in Group II the respective values were (M= 0.90, SD= 0.32) on Day 1 and (M= 0.10, SD= 0.32) on Day 3. Thus it can be stated that there is significant difference in reduction of blanch caused by IV infiltration between experimental Group III (combination of glycerine- MgSO₄) and Group II (MgSO₄) as p< 0.05.
- There is highly significant difference in reduction of induration between Group III and Group IV on post treatment day 2 and 3 as p< 0.0001, which is also evident from difference in mean and SD of pretreatment induration of Group III (M= 3.55, SD= 0.86) and Group IV (M= 3.30, SD= 0.59) with post treatment Day 2 in both the groups.
- The mean and SD of pre treatment skin temperature in group II and Group III was (M= 1.70, SD= 0.48) and (M= 1.40, SD= 0.69) respectively which reduced significantly on post treatment Day 1(M= 0.50, SD= 0.85) and Day 2(M= 0, SD= 0) in Group III whereas in Group II the respective values were (M= 1.70, SD= 0.48) on Day 1 and (M= 0.10, SD= 0.32) on Day 3. Thus it can be stated that there is significant difference in reduction of skin temperature caused by IV infiltration between experimental Group III (combination of glycerine-MgSO₄) and Group II (MgSO₄) on day 1 as p< 0.05.
- There is significant difference in reduction of pain between Group III and Group IV on post treatment day 1 as p< 0.05, which is also evident from difference in mean and SD of pretreatment pain of Group III (M=0.90, SD=

0.32) and Group IV (M=0.90, SD= 0.32) and with post treatment pain difference on Day 1 in both the groups were: Group III (M= 0.30, SD= 0.48) and Group IV (M= 0.90, SD= 0.32) respectively.

5. Discussion

Total number of sample included in the study was 40 of which 10 each were assigned to three respective experimental groups and one control group. Most of the sample were below the age of 1 year, male and had IV cannula present in right arm, forearm or left wrist and arm. The most common IV fluid received was isotonic solution and commonest IV antibiotic administered was found to be Inj Cefotaxime and Inj Gentamicin with maximum sample developing IV induration on day 2-3 of IV therapy.

Experimental group III i.e. combination of glycerine and MgSO₄ was seen to produce highly significant difference in reduction of signs of IV induration: blanch, induration, skin temperature and pain as compared to other experimental treatments and placebo treatment, thus rejecting the null hypothesis (H_{0c}) and accepting the null hypothesis (H_{0a}), (H_{0b}), (H_{0d}) at a level of significance of p< 0.05.

6. Conclusion

Following findings were drawn from the findings of the study:-

- a) Maximum sample in the study were of age group less than 1 year and most of them were male.
- b) The prominent IV cannula site for occurrence of IV induration in most of the study sample was right dorsal aspect of arm and forearm and wrist, dorsal and ventral aspect of left arm.
- c) Commonest IV fluid causing induration among the sample was isotonic solution and IV injection most responsible was found to be Inj Cefotaxime and Inj Gentamicin.
- d) Development of IV induration was more among sample who received IV therapy for more than 2-3 days.
- e) Experimental group III i.e. combination of glycerine and MgSO₄ was seen to produce highly significant difference in reduction of signs of IV induration: blanch, induration, skin temperature and pain as compared to other treatment and control group.

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