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Original Research Article

Effectiveness of a Stress Ball-Based Distraction Technique on Pain Intensity during Intravenous Cannulation in Hospitalized Children Aged 6–12 Years in Coimbatore, Tamil Nadu

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Abstract: ***Background****:* Needle-related procedures are among the most common sources of pain and distress in hospitalized children. Research evidence suggests that procedural pain can be effectively prevented and managed through appropriate pharmacological and non-pharmacological interventions [1-3]. Distraction techniques have emerged as simple, cost-effective, and child-friendly strategies for reducing anxiety and pain during invasive procedures such as intravenous (IV) cannulation [4, 5]. ***Objectives***: The study aimed to evaluate the effectiveness of a distraction technique in reducing pain among children undergoing IV cannulation. The specific objectives were to assess pain levels before and after the intervention and to determine the association between post-test pain scores and selected demographic variables of children. ***Methodology****:* A true experimental post-test-only control group design was employed. The study was conducted among children aged 6–12 years admitted to a tertiary care hospital in Coimbatore, Tamil Nadu. A total of 80 participants were selected through probability sampling and randomly assigned to either the experimental group (n = 40) or the control group (n = 40) using simple randomization. Children in the experimental group received distraction therapy during IV cannulation, whereas those in the control group received routine care. Pain intensity was measured immediately after the procedure using the FLACC (Face, Legs, Activity, Cry, Consolability) Scale.[6] Data were analyzed using descriptive and inferential statistics. ***Results***: Children who received the stress ball-based distraction technique showed a significantly lower mean FLACC pain score (3.3 ± 1.4) compared to those in the control group (6.9 ± 1.6). There was a statistically significant difference ($t = 10.73$, $df = 78$, $p < 0.001$) between the groups, with a mean difference of 3.6 points. During intravenous cannulation, 19 (47.5%) children in the experimental group reported mild discomfort, 17 (42.5%) reported moderate pain, and only 4 (10.0%) reported severe pain. In contrast, 20 (50.0%) children in the control group had severe pain, 16 (40.0%) had moderate pain, and 4 (10.0%) had mild pain. Age, gender, father's education, mother's education, father's occupation, and mother's occupation did not significantly correlate with pain intensity ($p > 0.05$). However, among children in the experimental group, prior intravenous (IV) cannulation experience was statistically significantly associated with pain intensity ($\chi^2 = 10.79$, $p = 0.004$). ***Conclusion***: The study concludes that distraction therapy is an effective, non-pharmacological intervention for reducing pain during IV cannulation among children. Its simplicity, safety, and ease of implementation make it a valuable strategy in pediatric clinical practice. Integrating distraction techniques into routine nursing care may enhance comfort, minimize procedural distress, and improve the overall healthcare experience of children undergoing invasive procedures.

Keywords: Children, Intravenous Cannulation, Procedural Pain, Distraction Therapy, Non-Pharmacological Intervention, FLACC Scale, Pediatric Nursing, Pain Management.

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INTRODUCTION

Pain is a complex sensory and emotional experience that needs thorough evaluation and management in paediatric health care. Invasive procedures, such as intravenous (IV) cannulation for the delivery of drugs, fluids and other critical therapies, are routinely required for hospitalised children. IV cannulation is a common clinical treatment although needle insertion can be painful and cause fear and anxiety, especially in school-age children 6–12 years [1-7]. Anxiety and previous unpleasant experiences may increase misery and decrease compliance during later treatments. Therefore, effective child-centred pain management is vital to increase procedural comfort and the quality of paediatric nursing care [3-8].

Non-pharmacological therapies, notably distraction strategies, have acquired prominence as adjuncts for the management of procedure pain [4-9]. These therapies divert attention away from the unpleasant input through cognitive engagement, sensory stimulation, or pleasant activities. Advantages include ease of implementation, minimum equipment requirement and potential for integration into everyday nursing care. However, their usefulness may depend on the techniques used, developmental traits, clinical conditions and methods of pain evaluation [5].

There is positive data from international research on therapies based on distraction. Dehnavi and colleagues conducted a randomised controlled research with 90 hospitalised children aged 6 to 12 years in Iran, comparing stress ball squeezing, pinwheel blowing, and standard care after IV catheter insertion. Mean pain scores were 14.5 ± 14.9, 8.0 ± 11.3 and 50.5 ± 34.6 in the stress ball, pinwheel and control groups, respectively. There were significant differences between groups ($p < 0.05$). Both therapies decreased pain and anxiety but blowing the pinwheel resulted in higher decreases in discomfort [1]. The results offer direct evidence that warrants future assessment of stress ball distraction during paediatric IV cannulation.

Evidence from India also lends support for the potential value of non-pharmacological pain therapy. Thomas *et al*., conducted a randomised controlled experiment on children aged 6–12 years in a tertiary care hospital in Kerala. The researchers compared audiovisual animation distraction, topical lignocaine, and standard care during IV cannulation. Mean pain scores in the animation distraction group were lower than the other groups at the time points examined [10]. This study points to ways in which distraction-based therapies could be implemented in Indian paediatric settings.

A study was undertaken in Sri Ramachandra Hospital, Chennai to assess the effectiveness of video game distraction on biophysiological parameters during IV cannulation among hospitalised preschool children in Tamil Nadu [11]. The study demonstrates the significance of techniques focused on distraction in the state's paediatric nursing setting. However, the results from video game interventions cannot be immediately generalised to stress ball squeezing.

The stress ball technique is a simple active distraction technique where youngsters squeeze a soft ball before and during cannulation. The intervention may distract from needle insertion and give tactile stimulation. This is in accordance with the Gate Control Theory of Pain, which states that sensory input and psychological factors can influence the perception of pain [12]. However, its clinical benefit needs to be empirically evaluated in the target population.

The present study was conducted to evaluate the effectiveness of a distraction technique with a stress ball on pain intensity during IV cannulation among hospitalised children aged 6–12 years in a selected children's speciality hospital, Coimbatore, Tamil Nadu, considering the importance of procedural comfort, promising international evidence, and the need for context-based research. The findings have implications for evidence-informed paediatric nursing practice and encourage the use of accessible, non-pharmacological therapies alongside routine pain-management methods.

Aim and Objectives of the Study

The aim of the study was to determine if distraction therapy could help reduce the pain of intravenous cannulation in hospitalised children aged 6 to 12 years at a selected child speciality hospital in Coimbatore. This was achieved by measuring and comparing pain levels between the experimental and control groups and examining how pain scores were related to certain demographic factors.

METHODOLOGY

A quantitative evaluative method was utilized to assess the effectiveness of a stress ball technique in alleviating pain during intravenous cannulation in hospitalized children. A quasi-experimental, post-test-only control-group design was implemented. The independent variable in this study was the stress ball technique, while the dependent variable was the level of pain reported during intravenous cannulation.

The research was conducted in the pediatric wards of a designated specialty hospital for children located in Coimbatore, Tamil Nadu. The target demographic comprised hospitalized children aged 6 to 12 years who required intravenous cannulation as part of their medical treatment.

A total of 80 children were chosen using a non-probability purposive sampling approach. Out of these, 40 children were allocated to the experimental group and 40 to the control group. Eligible participants included conscious children aged 6–12 years capable of communicating pain and following instructions, who were scheduled for intravenous cannulation, and whose parents provided written informed consent.

Data collection involved using a structured demographic questionnaire and the Face, Legs, Activity, Cry, and Consolability (FLACC) Pain Scale.[6] The demographic questionnaire gathered information regarding age, sex, parental education, parental occupation, and previous experiences with intravenous cannulation. The FLACC scale evaluated five behavioral indicators: facial expression, leg movement, activity, crying, and consolability, each component scoring between 0 and 2, resulting in a total pain score ranging from 0 to 10.

After obtaining institutional ethical approval and administrative permission, the eligible children and their parents were briefed about the study. Written consent from parents and child assent, when applicable, were secured. Data collection took place between October 1, 2025, and November 1, 2025. Children in the experimental group were provided with a soft stress ball and instructed to squeeze it with the hand opposite the site of cannulation. This technique commenced one to two minutes prior to cannulation and continued for the duration of the procedure. Children in the control group received standard care without the stress ball. Immediately after cannulation, pain behaviors in both groups were observed and scored using the FLACC scale.

The data collected were coded, entered, and analyzed using both descriptive and inferential statistics. An independent-samples t-test was employed to compare the mean post-test pain scores between the experimental and control groups. Chi-square tests were conducted to assess associations between pain levels and selected demographic variables. A statistical significance level was set at $p<0.05$.

RESULTS

Table I presents the socio-demographic characteristics of the 80 participants. The experimental and control groups were comparable with respect to age, gender, parental education, parental occupation, and previous IV experience, confirming baseline homogeneity.

Table II shows the distribution of pain levels. In the experimental group, 19 (47.5%) children experienced mild pain, 17 (42.5%) moderate pain, and only 4 (10.0%) severe pain. In the control group, 4 (10.0%) had mild pain, 16 (40.0%) moderate pain, and 20 (50.0%) severe pain.

Table III demonstrates a statistically significant difference in mean pain scores between the experimental group (3.3 ± 1.4) and the control group (6.9 ± 1.6), with a mean difference of 3.6 ($t = 10.73$, $df = 78$, $p < 0.001$).

Table IV presents the association between pain intensity and selected sociodemographic variables in the experimental group. Previous IV cannulation experience showed a statistically significant association with pain intensity ($\chi^2 = 10.79$, $df = 2$, $p = 0.004$). Age, gender, parental education and occupation were not significantly associated with pain level ($p > 0.05$). In the control group, no significant associations were observed between pain level and the studied sociodemographic variables.

DISCUSSION

The present study assessed the effectiveness of a distraction method using a stress ball for pain relief during intravenous (IV) cannulation in 80 hospitalised children in Coimbatore. Children who used the stress ball reported a lower mean pain score than those who received routine care (3.3 ± 1.4 vs 6.9 ± 1.6), with a mean difference of 3.6 points ($t = 10.73$, $df = 78$, $p < 0.001$). The findings indicate that use of a stress ball was associated with less procedural pain in this sample.

The findings are consistent with the randomised evidence on ball squeezing as a distraction technique. Dehnavi *et al*., randomly assigned 90 hospitalised children aged 6–12 years receiving IV catheter insertion and found lower pain scores among children who squeezed a stress ball compared to those who received routine care [1]. In an Indian randomised trial, Thuileiphy *et al*., reported lower pain scores in children who used the squeezing ball during cannulation compared to those who received verbal reassurance (4.93 ± 1.83 vs. 7.47 ± 2.33; $p = 0.003$).[2] More generally, among children aged 7 to 12 years undergoing venipuncture, Aykanat Girgin and Göl have shown that ball squeezing, balloon inflation, and coughing all resulted in lower post-procedural pain and fear than routine care ($p = 0.001$) [3]. Collectively, these investigations imply that simple, child-engaging distraction techniques may be a useful adjunct to routine pain management.

However, the evidence is not altogether consistent. In a randomised trial conducted with 120 children, Aydin *et al*., found no statistically significant differences in child-, parent-, or observer-rated pain during phlebotomy among ball squeezing, balloon inflation, and distraction cards [4]. In a similar study, Ali *et al*., did not find a significant reduction in pain or behavioural distress during IV cannulation in 85 children aged 6–11 years with the addition of iPad-based distraction [5]. These findings suggest that the effectiveness of distraction may vary depending on the level of engagement of the child and the overall context of care.

There was a significant association between pain category and previous experience of IV cannulation in the intervention group ($p = 0.004$). Children without prior IV experience were more likely to be classified as having severe pain. Age, gender, parental education and parental occupation were not significantly related to pain category. The use of behavioural pain scores (FLACC) cannot be regarded as equivalent to a child's self-reported pain [6]. Future studies should include assessor blinding, documentation of the number of cannulation attempts, and validated self-report measures in addition to observational scores.

CONCLUSIONS

The study found that using a stress ball as a diversion during IV cannulation in hospitalised children aged 6–12 years reduces discomfort. Children using the stress ball had significantly lower FLACC pain scores (3.3 ± 1.4) compared to the control group receiving usual care (6.9 ± 1.6). The mean difference between groups was 3.6 points, with a highly significant difference ($t = 10.73$, $df = 78$, $p < 0.001$). Experience with IV cannulation was significantly associated with reduced discomfort in children in the experimental group ($\chi^2 = 10.79$, $p = 0.004$). The stress ball-based distraction technique is simple, economical, safe, and straightforward to use, making it suitable for paediatric nursing practice.

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