

Strategies for Management of Needle-Related Procedural Pain and Distress in Children: A Literature Review

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Abstract

Background: Pain is a highly prevalent problem in children. It is a predominantly subjective emotional distress that also leads to impairment in the quality of life. Medical procedures that are applied using a needle, such as venipuncture and immunization are the most common and important sources of pain for children, causing anxiety, distress and fear. Pain management before the first painful medical procedure in children may reduce pain-related negative emotional and social experiences, reduce anxiety, fear and distress, and contribute to having emotionally less complicated future medical procedures. There are various researches carried out for pharmacological and nonpharmacological management of procedural pain. **Objective:** To report the results of a systematic review of researches' on interventions for needle related procedural pain and distress in children. **Methods:** Studies related to various interventions for needle related procedural pain and distress in children. The Outcome measures included were pain and distress as assessed by Physiological measures, self-report, observer report, behavioral observational tools and procedural anxiety scale. **Results:** Out of 122 studies 16 studies met the inclusion criteria for review. The criteria for inclusion were studies pertaining to interventions for needle related procedures among children age group infancy to eighteen years, published after 2002. The studies were reviewed, these studies included total 1,532 participants divided into experimental and control group. There were significant difference found in pain relief as well as anxiety relief by use of Interventions like Local anesthetic, Distraction, Vibration and cold as well as combined cognitive-behavioral interventions. Few studies also reported procedure success rate using such interventions. **Conclusions:** Recommendations for Additional studies to replicate these findings, evaluate the extent of its efficacy, and explore use with other painful procedures are been given, but these findings are promising significantly for pediatric pain management more than standard care.

Keywords: children, distress, evidence-based practice, needle related procedures, interventions

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INTRODUCTION

Pain is one of the most misunderstood, under diagnosed, and under treated or untreated medical problems, particularly in children.^[1] Whereas Pain is the most common reason for seeking healthcare

presenting either alone or as co morbidity.^[2] At some point in life, virtually everyone experiences some type of pain.^[3] Children of all ages, including newborns experience pain. Pain a subjective experience is a highly prevalent

problem among children. Medical procedures using a needle, such as venipuncture and immunization are the most common and important sources of pain for children, causing anxiety, distress and fear.^[4] Venipuncture is a frequent and significant source of children's medical pain.^[5] Painful medical procedures are routinely performed on children for diagnostic and therapeutic reasons. Pain experienced during the needle-related medical procedures commonly performed in hospitals, such as phlebotomy and immunization, may cause stress, fear and anxiety in children.^[6,7] These procedures may also cause anxiety and fear in families for their children.^[8] Although procedural pain and anxiety levels may be influenced by the type of the procedure applied,^[9] they are also associated with a number of individual factors including children's and their parents' emotional status, previous experiences and physicians' skills. The provision of analgesia for these procedures, however, remains uncommon. Untreated pain has both short-term and long-term consequences. In the short term, there is pain during the actual procedure.^[10] This contributes to a lack of cooperation by the child, unsuccessful procedure attempts, repeated attempts, additional pain and a prolonged total procedure time. In the long-term, repeated painful procedures can lead to conditioned anxiety responses and increased pain perception.^[11] Inadequate analgesia during an initial procedure may diminish analgesic effectiveness at subsequent procedures. Moreover, there is a relation between painful procedures^[5] in childhood and blood-injection-injury phobia, a condition that affects up to 10% of adults and may cause people to avoid medical care. In light of the cumulative evidence of the negative consequences of untreated pain in childhood, interventions are needed to diminish pain among children undergoing medical procedures and to facilitate successful completion of procedures.^[5]

Pain management before the first painful medical procedure in children may reduce pain-related negative emotional and social experiences, and contribute to having emotionally less complicated future medical procedures.^[12] There are various researches carried out for pharmacological and nonpharmacological management of procedural pain.^[13] The American Society for Pain Management Nursing recommends that optimal pain control before and during painful procedures needs to be provided.^[14] Therefore, pharmacological and nonpharmacological approaches should be used to control acquired pain and the resulting future anxiety behavior. Currently, a number of interventions are used to reduce pain perception during medical procedures and distraction is one of the most commonly used and the most effective one.^[15]

METHODS

Study Identification

A comprehensive search strategy was developed by author to identify studies matching such terms related to following Randomized control trial, pain, pain management, pain in children, needle-related distress, children, needle-related procedures, procedural pain, distress, interventions, evidence-based practice. In an attempt to capture the dimension of procedural pain management factors affecting pain behavior of child in pain were also searched. Each key term was combined with intervention or children and searched simultaneously in Pub Med, Cochrane Library, MEDLINE, Science Direct, Clinical Key, Google Scholar, etc. published in English from 2002 to 2015.

Study Selection

Titles and abstract were screened to determine whether the studies found in search meet the following inclusion criteria. Each study had to include (a) Original research, (b) Experimental method/Randomized controlled trial, (c) Needle related procedural pain

management, (d) Studies involving children (infancy to school age), and (e) Using appropriate outcome measure for pain and anxiety.

The initial search result was screened independently by author where the screening of the article title was used to eliminate article that did not meet inclusion criteria. Titles were also reviewed to find out whether the similar studies recurred and excluded. Abstract of potentially relevant articles were reviewed to verify whether each study met the inclusion criteria. If a question persisted even after reviewing the abstract, the full article was retrieved and reviewed to find out eligibility for inclusion. References of studies also were reviewed to identify relevant studies.

Main reason for exclusion was if study was not an experimental study, only included neonates and premature babies or children with cognitive impairment, inappropriate or no randomization procedure. Studies with inappropriate outcome measures, inappropriate intervention or inappropriate control/comparison group and fewer than 10 participants per condition were excluded. Articles were also excluded if the interventions were described but result was not reported.

Data Extraction

The complete articles meeting the inclusion criteria were reviewed and data were extracted to obtain study characteristics, data about sample description, intervention component, and outcome.

The methodological characteristics were selected based on hypothesis, method, result, findings external validity, internal validity related to performance bias, and selection bias.

Study Characteristics

All studies (N=16) evaluated the effectiveness of a technique on pain. Five studies focused on anxiety among children and 4 on behavioral distress of the child. Few studies also evaluated procedure success rate.

Sample Characteristics

The age group in most of the studies was 1 month to 18 years. Highest number of the sample was 206^[16] lowest was 20.^[17] Most of the studies provided the data related to demographic characteristics of child, gender, previous experiences, etc. In 15 trials the distribution was similar.

Outcome Measures

Evidence-based age appropriate assessment of pain is critical to planning of pain management^[8] and also to assess the effectiveness of intervention. Various pain scales are used to assess pain in children. Three main methods are currently used to measure pain intensity: self-report, behavioral, and physiological measures.

Self-Report Measures

These are optimal and the most valid.^[18] Both verbal and nonverbal reports require a certain level of cognitive and language development for the child to understand and give reliable responses. Most of the studies in this review utilized self-report as outcome measure. Faces pain scale was developed by Wong and Baker and is recommended for children ages three and older. It requires nurses to point to each face and describe the pain intensity associated with it, and then ask the child to choose the face that most accurately describes his or her pain level. 80% of studies utilized faces pain scale for measurement of pain during the procedure.^[16,17,19–25]

Visual Analogue Scale (VAS)

It is a horizontal line. The children are

asked to mark on the line the point that they feel represents their pain had used Visual analogue scale to assess the pain level.^[5,6,19,20,26,27]

Behavioral Measures

It consists of assessment of crying, facial expressions, body postures, and movements. They are more frequently used with neonates, infants, and younger children where communication is difficult. The Faces Legs Activity Cry Consolability Scale (FLACC) includes five indicators (face, legs, activity, cry, and consolability) with each item ranking on a three point scale (0–2) for severity by behavioral descriptions resulting in a total score between 0 and 10. In this review, FLACC scale was utilized by Secil (2014) to evaluate the efficacy of vibration on venipuncture pain scores.^[24]

Physiological Measures

According to Bearden 2012 physiological measures include assessment of heart rate, blood pressure, respiration, oxygen saturation, palmar sweating, and sometimes neuro-endocrine responses.^[28] In this review, cortisol level was used as outcome measure by Vagnoli 2015.^[19] Heart rate (Hartling 2013) pulse rate and oxygen saturation via pulse oxymeter (Ahn, 2013) was considered to evaluate physiological response as a response to pain.^[21,26]

Anxiety

In this review, anxiety was measured by trait anxiety scale and children anxiety scale.^[19,21]

Behavioral Distress

Behavioral distress during the procedures were measured by Observational Scale of Behavioral distress (OSBD)^[19,21,26] and by analysis of video recording.^[29] Cohen 2002 included The Child-Adult Medical Procedure Interaction Scale-Short Form (CAMPIS-SF) for assessing children's, parents', and nurses' behavior.^[30]

Effectiveness of Intervention

The researches reviewed by the author included pharmacological as well as nonpharmacological interventions to reduce pain and anxiety caused by needle-related procedures among children and parents. Pharmacological approach includes analgesics and anesthetic. Complementary therapies are the nonpharmacologic methods of pain control that can be used with or without analgesics. The Gate Control Theory by Melzack and Wall (1996) helps to explain why complementary pain management techniques are effective in helping to control pain. Stimulation of the larger A-delta fibers by nonpainful touch and pressure such as massage causes the substantia gelatinosa in the dorsal horn of the spinal cord to “close the gate” and decrease the transmission of pain impulses to the brain.^[31]

The studies aimed at reducing the pain level and anxiety among children during needle-related procedure. Total 16 studies were included with variety of pharmacological and nonpharmacological intervention.

Distraction Intervention

Out of 16 studies (n=656) six focused on effectiveness of Distraction Technique on reducing pain.^[16,17,19,20,23,26] The age of children ranged from 1 to 16 years and all these studies included school age children as participants.

Canbulat *et al.* evaluated the effectiveness of distraction cards and kaleidoscope in reducing the pain and anxiety.^[23] Guducu *et al.* also assessed the effectiveness of kaleidoscope in reducing the procedural pain and anxiety.^[16]

Gold *et al.* used virtual reality as intervention. Whereas Hartling *et al.* 2013 and Balan *et al.* evaluated the effectiveness of music therapy in reducing the pain.^[17,21,26] Effectiveness of animal

assisted intervention was assessed by Vagnoli *et al.* 2015 by presence of dog as intervention.^[19]

Distraction Intervention for Procedural Pain

Distraction technique was found effective significantly in reducing pain at 0.05 level of significance. Pain level for distraction card (2.14±2.49), kaleidoscope (3.10±2.16 Canbulat 2014),^[20] (3.14±1.41 Guducu 2009),^[16] virtual reality (−2.74 Gold 2006).^[17] Music therapy was found to be more effective during venipuncture (Balan, 2009)^[26] than intramuscular injection (Hartling, 2013).^[21] Pain level in control group remained higher than experimental group (mean ranging from 2.40 to 8.15). Presence of dog was not found to be a distractor reducing pain ratings significantly (Vagnoli *et al.*, 2015).^[19]

Effect of Distraction Technique on Procedural Anxiety and Distress

Distraction technique using distraction card as well as kaleidoscope found to be effective in reducing anxiety.^[20] Animal assisted intervention is found to reduce distress among children. Whereas with music therapy no significant difference was found in the level of distress. Parental anxiety was not significantly changed with the presence of a distractor.^[19]

Distraction involves engaging a child in a wide variety of activities to help him or her focus attention on something other than pain and the anxiety associated with the procedure. Select activities that are developmentally appropriate for the child. Children in severe pain cannot be distracted, but do not assume the pain is gone if a child can be distracted. Distraction cards, Music therapy, toys, kaleidoscope, virtual reality are effective in reducing pain as well as needle related distress among children. It is considered

as easy economical approach which can be implemented with limited training.

Cold and Vibration Intervention

Out of 16 trials 5 focused on effect of cold, vibration and/or vapocoolant spray on procedural pain and anxiety.^[22–25,32]

The age group varied from 4 to 18 years except Secil (2014) focused on efficacy of vibration on venipuncture pain among infants.^[22–25,32] The total number of participants was 517.

Effect of Cold and Vibration Intervention on Procedural Pain

Baxter 2009 found vibrating and cold device effective in reducing pain both self-reported (0.029) and parent reported (0.005). Similar findings were obtained by Inal and Kelleci 2012 and Canabulat 2015 at 0.001 level of significance for needle related procedures like venipuncture and blood specimen collection.^[23,25]

Only one study (N=1) found vibration did not reduce the pain score in infants during and after venipuncture procedure.^[29]

Effect of Cold and Vibration Intervention on Procedural Anxiety, Distress, and Fear

Cold and Vibration stimulation were found to be effective on reducing anxiety level at 0.001 level of significance and behavioral distress (0.036) during needle related procedures.^[22,23] Vapocoolant spray is found to be effective in improving procedure success rate.

The application of cold is believed to slow the ability of pain fibers to transmit pain impulses. Cold also controls pain by decreasing edema and inflammation and by causing partial or complete anesthesia or numbness of the skin. When cold is applied, assess the skin for redness or signs of irritation. Studies indicate that

Vibration and cold in combination as well as vapo-coolant spray is considered as effective in reducing needle related pain in intervention as well as procedural anxiety. These are inexpensive reusable, requiring little time and easy to use interventions.

Local Anesthetic as Intervention

Three trials (n = 191) out of 16 evaluated the effect of Local anesthetic on reducing pain during needle-related procedures.^[5,26,27] These studies did not evaluate anxiety. Age group varied from 1 to 17 years. There were no significant differences found in general characteristics of children.

Effect of Local Anesthetic as Intervention on Procedural Pain

Taddio 2005 studied the effect of Liposomal lidocaine whereas Ahn 2013 found Eutectic mixture of Local anesthetics effective in reducing the perceived pain on Faces pain rating scale as well as Visual analogue scale at 0.001 level of significance.^[5,26]

Liposomal lidocaine was also found to be having higher cannulation success rate (74% with first attempt) as well as it shorter procedure time (mean 6.7 min for total procedure) it decreased pain response in intervention group.

There was no significant change in physiological responses of pain like pulse and SpO₂ with the use of eutectic mixture of local anesthetics.^[26]

Application of local anesthetics cream before venipuncture appears to be an effective method of pain relief for children. Various strategies to improve the usage of local anesthetics cream prior to venipuncture should be developed and implemented to enhance the quality of medical care for hospitalized children. It is found to be effective in reducing pain, improving procedure success rate and reducing procedure time.

Child and Parent Focused Interventions

The author came across 3 studies (n=168) on Child Focused intervention (Cohen 2002 n=61) psychological interventions (Sikorrova 2011 n=60) and parent training interventions (Sliffer and Demore 2009 n=47).^[29,33,34] Cohen found that children demonstrated understanding of training but did not use coping skill during procedure.^[33]

Structures psychological consultation was found to be effective among children aged 5–10 years in reducing pain.^[34] Slifer and DeMore (2009) found that across group minimal or no distress at baseline during parent administered needle procedure.^[29] The groups were found to be homogenous.

Children who are prepared for the procedure using education, demonstration on a doll, distracting the child during the procedure, and giving them a reward, reported lower pain behavior during the actual Venipuncture than children who received standard treatment. Psychological consultation is effective among children in reducing pain.

DISCUSSION

The methodological quality of studies may be compromised often by incomplete reporting of concealment of group's assignment procedure. Difficulty in ensuring internal validity of studies limits ability to determine the effectiveness of intervention.

In all the studies the intervention aimed at reducing pain and anxiety procedures. Intervention such as Distraction Technique, Cold Application Vibration, Vapocoolant Spray, Local Anesthetic as well as child and parent focused interventions were effective in reducing pain response among children undergoing needle-related procedures.

Intervention focused primarily on anxiety, fear and behavioral distress were

distraction technique, cold application Vibration. Child and parent focused interventions. According to McGrath, the behavior of children during invasive procedures is widely individual and depends on degree of perceived pain. Perception of pain is affected by emotional and situational factors. It also varies according to age, sex, cognitive level, temperament, culture, parental support and other situational factors such as previous experience with painful exercise, suppression or alleviation of pain using pharmacologic and nonpharmacologic means.^[35] But in most of the studies reviewed by the author these factors did not show any significant difference and though age is the significant predictor of self-reported pain.^[22] In most of the studies demographic variables were reported to be normally distributed.

The use of non-pharmaceutical procedures to cope with pain behavior is, according to Jacobson, less costly and most of these procedures can be administered by a nurse. These studies also emphasized the feasibility and they have been shown to reduce the perception of pain and make the intervention more bearable. The task of the nurse is to choose an appropriate method and ensure a comfortable environment for the intervention.

LIMITATION

Studies were limited to Randomized Controlled Trial whereas Nonrandomized Quasi Experimental approach and Prospective controlled studies also suggest casual relationship and explain the effect of various interventions on Pain Anxiety. However data from Randomized Controlled Trial provide robust evidence for developing a guideline for Pain management.^[36] This review was limited to the articles available to the author. There are varieties of other interventions which can be taken into consideration.

These techniques are effective for other age groups like infant, adolescent and adult even to children with specific needs like intellectual disability. Limited search term was used. Further evaluation tool can be used for finding out the methodological quality as well as effectiveness of study. Finally, it was not the goal to determine the overall effect size of all interventions in this review. Thus it was not possible to conduct an analysis because of inadequate number of studies addressing and one aspect of health promotion.

NURSING IMPLICATION

Pain management is the key responsibility of a pediatric nurse. Walco *et al.* (1994) suggested that the principle within medical care-to do no harm presents an ethical conflict.^[37] Since pain has been proven harmful to child. Beneficence as ethical principle compels a nurse to perform procedures which are essential for the recovery of child at the same time a nurse should remember the right of child "right to feel no pain." Thus, nurses' must utilize pharmacological and nonpharmacological interventions to provide pain relief and to reduce the discomfort among children undergoing needle related procedure.^[38]

Based on the positive results, it is recommended to properly prepare each child individually through appropriate child focused psychological interventions such as explanation, demonstration, and story. Application of local anesthetic prior to procedure should be practiced.

During the procedure application of distraction, cold or vibration will help to reduce impact of pain. The results should serve as a source of information for comparison with other studies. Parental anxiety is also a source of distress thus utilization of these measures is recommended. Nurse plays major role in selecting and implementing

nonpharmacological interventions. Select most appropriate and most effective method. Ensure that child and parents use these methods before pain occurs as well as before pain increases. Assist in using these techniques. Ensure the techniques are used correctly offer suggestions and modifications or adaptation as necessary. Involve parents and use them as coach during these procedures. Nurses can significantly reduce pain and distress of procedures using behavioral and pharmacological approaches.^[39] Thus, evidence based non pharmacological pain relieving measure must be incorporated in daily nursing care of child.^[40] It is the responsibility of health care professionals to educate their peers and advocate for appropriate pain treatment in children

RECOMMENDATIONS

Further studies on more techniques to minimize the pain and anxiety during needle related procedure should be done. Developing cost effective feasible strategies will help in achieving the goal of atraumatic care. Similar studies can be replicated on wide variety of sample. Effect of various demographic characteristics, cultural factors and other variables can be explored. Further similar reviews on studies from different sources, studies including variety of interventions conducting meta-analysis will help to generalize the findings.

CONCLUSION

Pain is a commonest manifestation. Although there are many studies regarding effective pediatric pain assessment and management, it is often not being effectively applied. Pain is both prevalent and distressing among children. Current review demonstrates various pain management strategies which can be applied by the nurses for children to reduce pain and distress particularly caused by medical procedure Distraction, application of cold and vibration, local anesthetic application are few measures

which can be easily implemented. Infants and children present a unique challenge that necessitate consideration of their age, developmental level, cognitive and communication skills, previous pain experiences, and associated beliefs. There is a need for more research to illuminate optimal pain management strategies that take these special needs into consideration, to improve the treatment of pain in children.

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