The Effect of Cutaneous Stimulation on the Pain Level of Infusion Installation

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Abstract. Children who are treated undergo medical and non-medical procedures, some of which cause pain, resulting in situational stress which creates an unpleasant atmosphere for the child . One of the media procedures that has a pain effect is the installation of an infusion. Actions usually taken by nurses include approaches with psychological modulation, one of which is cold compresses (cutaneous stimulation). This study aims to determine the effect of cutaneous stimulation on the level of pain of infusion installation. This type of research *is Quasy Experiment* with *One group pre-post test design*. Population of preschool aged children undergoing infusion. The sampling technique was *accidental sampling*, so the sample size was 24 respondents. The research instrument uses the FLACC checklist (*face, activity, legs, cry, consolability*). Data analysis used the *Wilcoxon test*. The research results showed that before the cutaneous stimulation procedure, the average pain level for infusion was 6.62 and after the procedure it was 5.08. The results of the *Wilcoxon* analysis obtained a p value of 0.008. The conclusion is that there is a significant influence of *cutaneous* stimulation on the pain level of infusion because the p value is 0.008 < 0.05.

Key words: Infusion, Pain Relief, Cutaneous Stimulation

INTRODUCTION

Current pediatric nursing has experienced very basic developments. Children are unique individuals and are miniature adults who have specific and different needs from adults. Children have the right to receive optimal individual health services (Yuliastati & Amelia, 2018). The condition of children being treated in hospital is known as hospitalization. The effects of hospitalization occur as a result of the child being treated in hospital. Children who are treated in hospital undergo medical and non-medical procedures, some of which cause pain, thereby causing situational stress which creates an unpleasant atmosphere for the child. The reactions shown between each child differ according to their age. One of the medical procedures carried out is the installation of IV line (Wong & Whaley, 2018).

The child undergoes therapy and treatment until he finally recovers from his illness and returns home (James and Ashwill, 2020). The population of children being treated in hospitals is currently increasing. WHO stated that this increase was 40% compared to the previous year. Approximately 5% of children in the United States are hospitalized each year. Nearly four million children a year are hospitalized (World Health Organisation; WHO 2021). In Indonesia, based on Riskesdas, 35 out of 100 children or 15.86% were hospitalized. On average, children receive care for 4 days (Kemenkes RI, 2022). Data on children being treated in hospitals in Central Java is 27% and in Kudus Regency there are 3,890 people (Dinkes Jateng, 2023).

When compared to other ages, child care tends to take longer. The causative factor is that the child cannot cooperate during the treatment and care period (Supartini, 2020). Children who are hospitalized must have an IV installed for the therapy process. The main response that occurs in children who receive an IV is pain. This pain response is due to the insertion of the needle from the infusion (Yuliastati & Amelia, 2018). Pain in children is a complex, individual, subjective, and common occurrence (Asmadi, 2021). Infusion is the act of inserting electrolyte fluids, medicine or nutrients into a vein in a certain amount and at a certain time using an infusion set (Kyle and Carman, 2021). The appearance of pain is related to receptors and the presence of stimulation. One stimulation that can stimulate pain that is often experienced when in hospital, especially in children, is when an IV is being installed (Hidayat and Uliyah, 2020).

The pain response experienced by the child results in the child rebelling, becoming restless and trying to remove the IV tube. Some children experience crying reactions, hiding their hands, screaming, or pushing health workers and other reactions. The child's uncontrolled movements often cause the infusion to become stuck (extravasation of blood vessels). As a result, the child will have IV injections repeatedly and this can cause anxiety, fear and discomfort due to the pain felt every time it

is injected. This will also cause trauma to the child so that the child will experience anxiety and stress (Setiani *et al*., 2023). Another impact that arises is that not having an IV installed can of course cause problems such as fluid and electrolyte imbalances, nutritional intake being inadequate, and drug therapy that should be given being hampered (Wong & Whaley, 2018).

Intervention is needed to reduce pain in children, namely through non-pharmacological approaches. Non-pharmacological therapy is an effort by nurses to overcome trauma and pain due to infusion procedures, this includes accompanying parents, giving gentle strokes, preparing the child physically and psychologically, distraction and stimulation techniques that provide a sense of security and prevent children from experiencing physical and psychological trauma (Kyle and Carman, 2021). Actions commonly taken by nurses include approaches with psychological modulation of pain such as relaxation and distraction (Andarmoyo, 2018). Actions through visual distraction are effective in diverting children's pain stressors through animation, cards and pictures, which have been proven to reduce the pain of infusions (Haris, Nurafriani, and Asdar, 2019). Research Akhyar *et al*. (2021)found that there was an influence of visual distraction techniques (watching animated cartoons) on children's pain levels when installing an IV. Stimulation to reduce the child's pain scale is focused on providing a sense of comfort (Enawati *et al*., 2022).

Another stimulation that is often used is through cold compresses (cutaneous). Cutaneous stimulation is a therapy that aims to increase tissue recovery and repair based on temperature, which can be in the form of cold compresses or hot compresses. The cold effect can relieve pain and relax muscles by inhibiting nerve impulses and slowing nerve conduction speed (Kozier *et al*., 2018). Compress (*cutaneous)* stimulation is often used to reduce the pain of infusion. This is shown by the difference in the pain scale in the control and intervention groups of -2.07 (Nugroho, 2022). The role of health workers in minimizing the pain of children in the infant category is so that the baby can behave cooperatively and adapt easily during procedures, namely by providing stimuli that make the baby calm (Trottier *et al*., 2019).

Based on this background, the aim of this study was to determine the effect of cutaneous stimulation on the level of pain from infusion installation.

METHODS

This type of research *is Quasy Experiment* with a *One group pre-post test design approach* . Population of preschool age children undergoing infusion at Mardi Rahayu Kudus Hospital. The sampling technique was *accidental sampling*, so the sample size based on calculations was 24 respondents. The research instrument uses the FLACC checklist (*face, activity, legs, cry, consolability)*. Data analysis used the *Wilcoxon test*.

RESULTS AND DISCUSSION

1. Pain Before Procedure

Table 1. Distribution of Pain Levels Before Cutaneous Stimulation Procedures

Variable	Mean	SD	Min	Max
Pain After Cutaneous Stimulation	6.62	0.576	6	7

The results of the research before the cutaneous stimulation procedure showed that the average pain level for infusion was 6.62 with the highest scale being 7 and the lowest scale being 6. This shows that when installing an infusion the patient can feel pain due to the needle entering the blood vessel . This needle insertion causes tissue damage, causing a painful sensation. Pain is one form of the body's response to damage to nociceptor tissue. Children usually respond to bodily pain with aggressive behavior such as lip biting, crying, clenching their teeth, widening their eyes, biting, hitting, kicking, and struggling (Wong & Whaley, 2018). Previous research found that the average pain scale before intervention in children undergoing infusion was (Maruanaya and Supriyanti, 2020).

Another study by Irmayani (2018) obtained a pain scale before intervention with an average of 7. Another study by Laksmi, Suryati, and Yanti (2018) obtained an average pain level of children in the control group of 6.4, including moderate pain. This pain scale is caused because when the nurse injects the needle, it stimulates small nerve fibers (pain receptors) thereby causing *inhibitory neurons.* t is inactive and the gate opens which gives rise to pain sensations. The scale of

pain felt by respondents is influenced by experience factors. The level of pain of respondents who had never experienced an infusion before experienced a higher level of pain, namely in the most painful pain category compared to respondents who had experienced an infusion before (Setiani *et al*., 2023).

Previous research found that the pain scale before the intervention in children undergoing infusion was on a scale of 7. When the needle was inserted, the pain response was assessed using the FLACC scale. The items studied were, *Face* (face): score (1) grinning and frowning, *Leg* (legs): score (1) looked tense, *Activity* (activity): score (1) looked tense, *Cry* (crying): score (2) keeps crying and shouting, Consability: score (2) difficult to persuade. From the details of these items, the applicator can conclude that the patient's pain scale is severe pain (Putri and Roslita 2023). Another study found that pain before intervention was moderate pain (46.7%), severe pain (16.7%) (Hastomo and Suryadi, 2019). Pain in children is influenced by past pain experiences changing sensitivity to pain. Individuals who experience pain personally or who see the suffering of those closest to them are often more threatened by the possibility of pain than individuals who have no experience of pain (Kyle and Carman, 2018).

One of the pain experienced by children due to invasive procedures is a procedure that is often carried out while children are hospitalized. Infusion installation is one of the invasive measures used to provide fluids, nutrition, continuous administration of medication and is very useful for administering medication to children who are dehydrated, children who need *parenteral medication* for a long time, and children who need treatment. When infusion is also accompanied by pain, the client must be given pain management intervention (Akriansyah and Surahmat, 2021). The pain experienced by children can cause other more complex problems and slow down the healing process if not treated immediately, such as causing behavioral disorders such as stress, anxiety, fear, sleep disorders and developmental regression (Suriadi and Yuliani, 2020).

Previous research found that the pain scale for children who had IVs was in the severe category. The most common responses shown by children when installing an IV include clenching their jaw, some kicking, looking tense, and crying loudly, some children even find it difficult to calm them down so they can be given an IV. Pain is an unpleasant sensory and emotional experience associated with tissue damage. The pain that is felt is caused by a disturbing stimulus that activates pain receptors. Nociceptors stimulated by a disturbing stimulus stimulate the afferent pain pathway to release substance P which will activate the ascendin pain pathway so that pain can be processed in the brain (Fatriansari, 2019).

In theory, it is stated that pain is an unpleasant sensory and emotional experience that arises due to actual or potential tissue damage or is described as damage (*Interpersonal association for the study of pain*) that is sudden or slow from mild to severe intensity with an anticipated end. or predicted (Potter and Perry, 2020). Pain that is not treated in time can affect the patient. Pain can interfere with patients in their activities and patients find it difficult to interact with other people because they are focused on the pain. Other effects of pain include difficulty sleeping, decreased interest in activities, and increased anxiety. The inability to relieve pain can lead to feelings of helplessness and hopelessness (Judha and Sudarti, 2018).

2. Pain After Cutaneous Stimulation Procedures

Table 2. Distribution of Pain Levels After Cutaneous Stimulation Procedures

Variable	Mean	SD	Min	Max
Pain After Cutaneous Stimulation	5.08	0.654	4	6

The results of the research after cutaneous stimulation showed that the average pain scale was 5.08 with the lowest scale being 4 and the highest scale being 6. These results indicate a decrease in the pain scale after applying a cold compress. Previous research Putri and Roslita (2023) found that the pain scale after the procedure decreased to 4. This expression of pain indicated an increase in the child's sense of comfort during treatment. Cold compression is one type of therapy that can cause vasoconstriction in the area of pain and reduce capillary permeability, resulting in edema in the injured area. As a result of vasoconstriction, blood flow decreases and the release of pain-causing substances, such as histamine and serotonin, also decreases (Kyle and Carman, 2018).

Previous research found that there was a reduction in the pain scale after intervention in patients who underwent infusion (Hastomo and Suryadi, 2019). This is also proven by research Maruanaya and Supriyanti (2020) which obtained results that after carrying out the cold compress action there was a decrease in the pain scale (scale 4). Cold compress is a non-pharmacological pain management that functions to reduce blood flow to an area and reduce bleeding and edema. It is thought that cold therapy produces an analgesic effect by slowing the speed of nerve transmission of pain impulses that reach the brain less (Tamsuri, 2020). The purpose of a cold compress is to reduce body temperature in *hyperthermia*, prevent inflammation from spreading, reduce congestion, reduce local bleeding, reduce local pain, and make the wound clean (Suriadi and Yuliani, 2020).

Previous research Fatriansari (2019) found that the pain scale after being given cold compress intervention decreased the pain scale (2.7). This is due to reduced nerve sensitivity resulting from pain stimulation which penetrates the skin more easily as a result of applying a cold compress which causes a numbing effect which is suitable for use as a local anesthetic for surface lacerations or stab wounds which is effective for relieving pain. Wong & Whaley (2018) stated that applying a cold compress will cause numbness which is suitable for use as a local anesthetic for surface lacerations or stab wounds which is effective for relieving pain.

Previous research found that the average level of pain during infusion in the treatment group was 2.7, including mild pain, minimum pain 1 and maximum pain 4 (Laksmi, Suryati, and Yanti, 2018). During the cold compress process, the child seemed to like placing the cool pack on the area of the hand where the IV was to be installed because of the cold sensation from the *cool pack*, which then the nurse carried out the process of installing the IV so that the child became more comfortable. This action is also carried out after the child has had an IV installed, which results in the child feeling more relaxed (Putri and Roslita, 2023). *Cutaneous* stimulation is a physical form of the skin that can reduce pain such as warm compresses and cold/ice compresses (Arovah, 2018).

3. Effect of Cutaneous Stimulation on the Pain Level of Infusion Installation

Table 3. Analysis of the Effect of Cutaneous Stimulation on the Pain Level of Intravenous Infusion

Pain Level		N	Mean Rank	Sig. (2 Tailed)
Post	Negative Ranks	23 [a]	12.00	
Pain –	Positive Ranks	0 [b]	.00	
Pre Pain	Ties	1 [c]		0.00 0
	Total	24		

The research results obtained a p value of 0.008, which means it exists There is a significant influence of *cutaneous* stimulation on the pain level of infusion because the p value is 0.008 < 0.05. This is because when the IV needle pierces the skin, it will cause a disturbing stimulus that will activate pain nociceptors. Pain nociceptors will stimulate afferent nerve endings to release substance P. The released substance P will affect nociceptors outside the trauma area which will cause a wider circle of pain. Pain impulses will be transmitted to the spinal cord via the ascending pathway. When pain impulses enter the posterior horn of the spinal cord, interactions will occur between the endogenous analgesia systems produced by the body. If pain is not inhibited in this process, the pain felt will last longer and become more widespread. Pain impulses will be transmitted from the spinal cord to be transmitted to the brain and pain perception will occur. The perception of pain that occurs in the thalamus will be transmitted to the somatosensory cortex so that pain will be felt in the area where the IV is pierced (Fatriansari, 2019)

Previous research by Akriansyah and Surahmat (2021) on cold packs showed significant differences between the group that received cold compress intervention and the control group that did not receive cold compress intervention. And the statistical test results obtained using the Independent T Test obtained a P value = 0.000 ($p \leq 0.05$), so there was an influence of the Cold Pack (*Cool Pack*) on pain when installing IV fluids in children. The effect of giving cold compresses on reducing the level of pain from infusions in children is due to the fact that cold compresses can inhibit the process of transmitting pain to the brain (Akriansyah & Surahmat, 2021).

The results of this research are in line with Fatriansari's research in 2019, which found that

there was an effect of cold compresses on reducing the pain scale for infusion installations in pre-school children at Bhayangkara Hospital, Palembang with a P value of 0.011 (Fatriansari, 2019). Previous research using cold packs *was* not proven to significantly relieve pain in preschool children who received IV drips in the treatment room (Putri and Roslita, 2023). A cold compress is an action to maintain body temperature which is carried out using small blocks of ice with the aim of numbing pain and stopping bleeding (Asmadi, 2021). Cold compress causes vasoconstriction and changes capillary permeability, leading to decreased edema in the injured area. As a result of vasoconstriction, flow blood is reduced and the release of pain-causing substances such as histamine and serotonin is also reduced (Kyle and Carman, 2018).

Previous research by (Laksmi, Suryati, and Yanti 2018)found the effect of cold compresses in reducing the pain scale. This stimulation will block the transmission of pain stimuli. Cold compresses using ice slow down the conduction of peripheral nerve fibers and reduce the release of inflammatory mediators and nociceptors, resulting in a relatively fast skin anesthetic effect. Cold compresses can reduce pain levels, reinforced by theory Tamsuri (2020) which states that giving cold compresses is believed to increase the release of endorphins which block the transmission of painful stimuli, providing the effect of reducing the sensation of pain. Cold compresses also have physiological effects such as reducing tissue inflammatory responses, reducing blood flow and reducing edema.

The research found that after the distraction procedure, the pain scale was 4. This is because when the distraction technique is carried out, it stimulates large nerve fibers, causing *inhibitory neurons* and active *projections*. *Inhibitory* therapy *neurons* prevent *projection neurons* from sending signals to the brain, so that the gate is closed and pain stimulation is not received to the brain and there is a decrease in the pain scale (Irmayani, 2018). Providing cutaneous stimulation therapy with cold compresses is a form of blocking pain receptors to the central nerve, so it is effective in reducing the pain scale (Arovah, 2018). Research Indriyani, Hayati, and Chodidjah (2013) found that giving compresses was effective in reducing the pain scale. Based on *gate control* theory, cold compresses are something harmless that is delivered quickly by small myelin fibers and nonmyelin C fibers are inhibited thereby reducing the increase in the number of *nociceptive stimuli*. Based on the results of research and previous studies, it was found that giving cold compresses had a greater effect on reducing the pain scale.

CONCLUSION

The research results showed that before the cutaneous stimulation procedure, the average pain level for infusion was 6.62 and after the procedure it was 5.08. There is There is a significant influence of *cutaneous* stimulation on the pain level of infusion because the p value is 0.008 < 0.05.

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