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ORIGINAL ARTICLE

THE EFFECT OF COLD COMPRESS ON PAIN INTENSITY IN FRACTURED PATIENTS

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ABSTRACT

Fracture occurs due to the damage of the shape and function of the bone, and the fractured patients generally experience pain. One of the interventions to reduce pain intensity in fracture patients is cold compress. This study aims to identify the effectiveness of cold compress on pain intensity in fracture patients in H. Adam Malik Hospital Medan. This is a quantitative study with a quasi-experimental design approach with an equivalent control group pretest-posttest design. The number of samples is 70 respondents consisting of 35 people for each intervention and control group, respectively, which was collated by consecutive sampling. Data analysis used paired t-test and independent t-test. The results showed that there was a significant influence before and after cold compress intervention on pain intensity (p value 0.001 (p = <0.05)). There is a significant difference between the intervention with cold compresses and the hospital standard intervention on pain intensity in fracture patients (p value 0.001 (p = <0.05)). It can be concluded that cold compress has a significant effect on the pain intensity in fracture patients. Cold compress is one of the nursing interventions that can help to reduce the intensity of fracture pain.

Keywords: Cold compress; fracture; pain intensity

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INTRODUCTION

Fracture is the loss of continuity of bone tissue, either completely or partially caused by physical trauma, angular force, injury around soft tissue, muscle damage, tendon rupture, injury to body organs, or damage to blood vessels (Shaik et al., 2016; Siregar et al., 2020). Data from the World Health Organization in 2012 recorded that 1.3 million people worldwide suffer from fractures due to traffic accidents. In Indonesia, fractures of the extremities due to accidents have the highest prevalence among other fractures (around 46.2%). The results of the Health Research and Development Agency (2018) in (Siregar et al. (2020) showed that the common cause of injury was traffic accidents (67.9%) with physical disability in the limbs.

Fractures can be a potential or actual threat to a person's integrity because they may experience physiological and psychological disorders (Minick et al., 2012). The form and function of the bone in fractures are damaged with the common complaint being pain (Shaik et al., 2016; Siregar et al., 2020).

Pain is a subjective condition in which a person shows both verbal and nonverbal discomfort. Feeling comfortable is one of the basic needs of individuals and is the goal in providing nursing care to patients being treated in a hospital (Minick et al., 2012). Fracture patients came to the hospital with the main complaint of severe pain. Despite the prevalence of severe pain, only 35.7% of patients received analgesics and only 12.5% of patients received adequate analgesic pain management so that more than two-thirds of fracture patients still had moderate to severe pain (Pan, Hou, Liang, Fei, & Hong, 2015). The pain intensity in fracture patients ranges from moderate to severe pain (pain scale > 5), which occurs during the first week after the fracture, which can cause complications and be difficult to treat (Modabber et al., 2013).

Surgical intervention is the main choice to treat fractures so that the patient experiences severe pain after surgery, covering pain levels ranging from moderate to severe intensity. Inadequate postoperative pain management can

lead to psychological complications. This can also result in patients being hospitalized for a longer time, so they have to pay higher health care costs and the quality of life is also reduced and can lead to death. Postoperatively also hinders rehabilitation and reduces mobilization in patients due to pain. Analgesics can control postoperative pain but also have side effects such as nausea, vomiting, or respiratory problems, so they can limit the patient's activity (Bech et al., 2015).

It is recommended that nurses provide non-pharmacological interventions in pain management in patients to help overcome the pain experienced by fracture patients. Pharmacological management alone is not sufficient to overcome the pain of fracture patients because given analgesic drugs alone may only relieve pain for 4-5 hours, so patients still need additional non-pharmacological therapy to strengthen analgesic therapy in reducing pain intensity so that fracture patients can reduce their consumption, analgesic drugs (Pan et al., 2015).

Demoulin et al.'s (2012) study showed a high percentage of fracture patients who still feel pain despite receiving analgesics for more than 6 months even for 12 months. Analgesic drugs can present a risk of dependence and a propensity for drug abuse because pain management with analgesics alone allows pain to come back. Nurses have an important role in providing pain relievers such as adequate analgesics coupled with complementary therapies to relieve pain optimally and evaluate its effectiveness.

Effective pain management in fracture patients is an important aspect of nursing care that can be done pharmacologically and non-pharmacologically. Pharmacologically is done by using drugs, while non-pharmacologically can be done by providing cutaneous stimulation which involves stimulation of nerves via skin contact. Cutaneous stimulation in fracture patients who acquire pain is done by providing cold compress therapy to the body.

Cold compress aims to relieve pain by slowing down nerve conduction speed and inhibiting nerve impulses (Waterman et al., 2012). Cold temperature is useful for removing heat from the body, causing vasoconstriction, decreasing metabolism, reducing inflammation, and reducing pain (Leegwater et al., 2016). Cold compress therapy can also suppress the soft tissue metabolic rate associated with decreased enzymatic activity and can also prevent tissue damage caused by hypoxia. Local hypothermia induces vasoconstriction and decreases microcirculation by more than 60% so that vasoconstriction causes reduced extravasation of blood into the tissue environment and pain is finally reduced. The effect of a cold compress can last up to 30 minutes after the cold compress is stopped (Murgier & Cassard, 2014).

Shaik et al., (2016) stated that hand immersion in cold water with a water temperature of 12°C for 5-10 minutes can reduce the pain of patients with distal radius fractures. The results showed that immersing the fractured area in cold water can reduce the speed of conduction of pain signals to nerves. Garra et al. (2010) also showed that the pain intensity in patients with sprains in the neck area can be reduced or even disappeared by cold compresses. Saini, (2015) also said that cold compresses are effective for limiting pain because ice has an analgesic effect so that it can reduce the intensity of pain in acute injuries such as fractures. Meanwhile, Eid & Bucknall (2008) also reported effective results when doing cold compresses on postoperative knee joint replacement patients using cold packs compared to using other tools. All mentioned studies recommended that fracture patients use cold compresses with cold packs to reduce pain as well as to save costs.

Cold packs have the advantage of being water-resistant and not stiff. Cold packs can be used many times by simply refrigerating them back into the freezer because cold packs are very flexible, can be in the form of plastic plates or plastic bags, as needed (Francis & Pradeepa, 2016).

Based on the explanation above, it is important to apply a cold compress to reduce fracture pain in combination with analgesic therapy. The purpose of this study was to identify the effectiveness of cold compresses on pain intensity in fracture patients at RSUP Haji Adam Malik Medan.

METHOD

Study design

This is a quantitative study with a quasi-experimental design approach with the equivalent control group pretest-posttest design method. This design involves intervention and control groups and data are collected before and after the intervention (Polit, D.F. & Beck, 2015).

Respondents conducted a pretest related to the pain intensity they felt before being given the intervention, then after the intervention, the pain intensity felt by the respondent was reassessed with a posttest to see the difference in pain intensity between the two groups before and after being given the cold compress intervention.

Sample

This research was conducted at RSUP Haji Adam Malik Medan. from 10 September 2019 to 21 October 2019. The sampling technique used was nonprobability sampling with the consecutive sampling method. This method is a sample selection method that is conducted by selecting all individuals encountered and meeting the sample criteria until the desired sample size is met (Polit, D.F. & Beck, 2015).

The initial step in dividing into two groups is to identify patients with fractures according to the inclusion criteria. The number of samples in this study was calculated using the formula for estimating the sample size for the mean difference of the two groups. To anticipate the drop out, 10% was added so that the sample size was 35 people for each intervention group and control group. So the total number of samples is 70 people. The inclusion criteria were: (a) aged > 18 years, (b) postoperative fracture patients in the upper or lower limb who were treated in the operating room on day 2, (c) patients who experienced pain intensity more than a scale of 4, (d) awareness of compos mentis, and (e) patients who are willing to do cold compresses in addition to receiving analgesic therapy.

Instrument

The instrument used in this study is the Numeric Rating Scale (NRS), which has been tested for validity by Leegwater et al. (2016) so that the validity test for the instrument is no longer done. This study has also demonstrated good validity and reliability for assessing musculoskeletal pain intensity (correlation coefficient: r = 0.941). Data collection was performed using the Numeric Rating Scale instrument to measure the intensity of pain in fracture patients.

Intervention
The standard operating procedures for installing cold compresses were modified from the research conducted by Francis & Pradeepa (2016) titled "comparative effect of crushed ice and elastogel cold wrap on ankle sprain". After the assessment of preintervention pain intensity, the researchers gave intervention to the respondents who were included in the intervention group by placing a cold pack wrapped in a thin cotton cloth over the fracture area transversely and wrapped with an elastic bandage to prevent it from moving. Cold compress was applied for 30 minutes using a cold pack that has been frozen in a freezer to a temperature of <18^{o}C and were applied to the respondents three times a day after 4-5 hours of the patient receiving analgesics. In the control group, patients only received analgesic therapy that had been given by the hospital.

After 15 minutes, the application area of cold compress was monitored to see any inflammation or redness of the skin which can cause nerve damage on the surface of the skin around the cold compress. The procedure continues for 3 days.

Data collection
Before giving the intervention, the researcher first assessed the respondent's pain intensity using the NRS (Numeric Rating Scale) then explained to the respondent about the content contained in the instrument and how to fill it out. Measurement of pain intensity is done by showing the NRS (Numeric Rating Scale) to the respondent, then the respondent chooses the value of the intensity of pain they feel by pointing to one of the numbers on the NRS. The pain intensity scale in the NRS is in the 0-10 range, where 0 (no pain), 1-3 (mild pain), 4-6 (moderate pain) and 7-10 (severe pain) after the respondent's pain intensity value is obtained. then the researcher documented it in the observation sheet.

In the control group, the researchers first assessed the respondent's pain intensity using the NRS (Numeric Rating Scale) then explained to the respondent about the content contained in the instrument and how to fill it out. Measurement of pain intensity is done by showing the NRS (Numeric Rating Scale) to the respondent, then the respondent chooses the value of the intensity of pain they feel by pointing to one of the numbers on the NRS. The pain intensity scale in the NRS is in the 0-10 range, where 0 (no pain), 1-3 (mild pain), 4-6 (moderate pain) and 7-10 (severe pain) after the respondent's pain intensity value is obtained. then the researcher documented it in the observation sheet. After the patient was given the appropriate intervention given by the hospital, the researchers measured the intensity of back pain using the NRS (Numeric Rating Scale).

Data analysis
The data were analyzed using univariate and bivariate analysis. Univariate analysis determines the characteristics of respondents which are displayed in the form of frequency distribution and a percentage consisting of age, gender, and education. Bivariate analysis was conducted to identify the effectiveness of cold compresses on pain intensity in fracture patients. Categorical data were assessed using bivariate analysis. After doing the normality test with Kolmogorov Smirnov, the data were not normally distributed and was categorically measured, therefore the data analysis used nonparametric tests using the Wilcoxon Signed Rank Test.

Ethical consideration
Before the data collection process, the ethical consideration had been approved by the ethical committee, Faculty of Nursing, North Sumatera University, ethical clearance number 1884/VIII/SP/2019. Informed consent was signed by all respondents who were willing to participate in this study.

RESULTS

Table 1 shows the distribution of respondent characteristics by age in the intervention group with the highest proportion at aged 17-25 years (31.4%). In the control group, the majority of respondents were aged 26-35 years (48.6%). The distribution of respondents by gender in the intervention group was mostly male (82.9%), as well as in the control group (54.3%). The distribution of respondents according to education in the intervention group was mostly high school graduates (77.1%) and in the control group (88.6%). The distribution of respondents by occupation in the intervention group was mostly unemployed (80.0%), while in the control group most respondents were private employees (60.0%).

Table 1. The distribution of frequency and percentage of characteristic demographic data in the intervention and control group (n=70)

Data	Intervention	Control
	n (%)	n (%)
Aged (years old)		
17-25	11 (31.4)	3 (8.6)
26-35	6 (17.1)	17 (48.6)
36-45	3 (8.6)	10 (28.6)
46-55	6 (17.1)	3 (8.6)
56-65	5 (14.3)	1 (2.9)
>65	4 (11.4)	1 (2.9)
Gender		
Male	29 (82.9)	19 (54.3)
Female	6 (17.1)	16 (45.7)
Education		
Junior high school	8 (22.9)	4 (11.4)
High school	27 (77.1)	31 (88.6)
Occupation		
Not working	28 (80.0)	13 (37.1)
Entrepreneur	0 (0.0)	1 (2.9)
Private employees	7 (20.0)	21 (60.0)

Based on Table 2, the majority of fracture patients in the intervention group before being given a cold compress was in moderate pain with pain intensity of 4-6 as many as 34 respondents (97.1%) and 1 respondent with severe pain intensity 7-10 (2.9%). While in the control group, before being given nursing intervention according to hospital standards, the majority of the pain was also moderate with pain intensity between 4-6 as many as 33 respondents (94.3%) and severe pain with the intensity of 7-10 as many as 2 respondents (5.8%)

After giving cold compresses, the majority of respondents in the intervention group were in the mild pain category, with pain intensity 1-3 as many as 33 respondents (94.3%) and those who had moderate pain intensity 4-6 were 2 respondents (5.7%). In the control group, after being given nursing intervention according to hospital standards, the majority of respondents acquired moderate pain with pain

intensity 4-6 as many as 28 respondents (80.4%) and the rest of 7 respondents (19.6%) experienced mild pain with intensity 1-3.

Table 2. Pain intensity of fracture patients in the intervention and control groups before and after cold compress

Group	Pain intensity		
	Light	Mild	Severe
	n (%)	n (%)	n (%)
Control			
Pre-test	0 (0.0)	33 (94.2)	2 (5.8)
Pos-test	7 (19.6)	28 (80.4)	0 (0.0)
Intervention			
Pre-test	0 (0.0)	34 (97.1)	1 (2.9)
Post-test	33 (94.3)	2 (5.7)	0 (0.0)

Table 3. Differences in pain intensity of fracture patients in the intervention and control groups before and after cold compress (n = 70)

Group	Median	Min-max	*p* value
Control			
Pre-test	5	5-7	0.982
Post-test	3	3-5	
Intervention			
Pre-test	5	5-7	0.001
Post-test	2	2-4	

Based on the results of bivariate analysis using the Wilcoxon Signed Rank statistical test, it was found that the p value was not significant (p value 0.982 (p > 0.05) in the control group before and after the standard hospital intervention on the pain intensity of fracture patients. Therefore, it can be said that there is no difference before and after being given standard hospital interventions on the intensity of pain in fracture patients. While in the intervention group, cold compress is significant to reduce pain intensity (p value 0.001).

Table 4. Differences in pain intensity of fracture patients after the interventions in the intervention and control groups (n = 70)

Group	Median	Min-max	*p* value
Control	3.00	3-5	0.001
Intervention	2.00	2-4	

The difference in pain intensity between the intervention and control group in Table 4 can be seen by comparing the difference in pain intensity values for the control group which only received the intervention according to hospital standards against the intervention group which received the cold compress intervention which was tested using the Mann Whitney Test. The results of the Mann Whitney Test obtained a p value of 0.001, which means that the intervention group experienced changes in pain intensity before and after cold compress. Therefore, it can be concluded that cold compress significantly influences the pain intensity of fracture patients.

DISCUSSION

Supporting data in the study results were obtained from the assessment of pain intensity where before the intervention, the respondents were in the moderate and severe pain intensity category. This study is in line with the results of Modabber et al. (2013) study which reported that fracture patients came to the hospital with primary complaints of pain and did not receive adequate pain management with analgesics so that more than two-thirds of fracture patients still have moderate to severe pain.

The difference in pain intensity between the intervention and control groups can be seen by comparing the difference in the pain intensity values of the control group who only received an intervention according to hospital standards with the intervention group who received standard pharmacological therapy in combination with the cold compress intervention which was tested using Mann Whitney U. The results of the test obtained a p value of 0.001, which means that patients experienced changes in pain before and after the intervention. It means that that cold compress has a significant effect on the reduction of pain intensity in fracture patients so that the patients felt more comfortable. This study result is similar to the study of Minick et al. (2012) that reported that cutaneous stimulation by providing cold compress therapy on the body can relieve pain by slowing down nerve conduction speed and inhibiting nerve impulses. Saini (2015) also supported the notion by stating that cold compress by immersing the fractured hand in cold water with a water temperature of 12°C for 5-10 minutes can reduce pain because ice has an analgesic effect and therefore reducing the intensity of pain in acute injuries such as fractures.

In this study, a cold compress was applied for 30 minutes using a cold pack that has been frozen in a refrigerator at a temperature of <18^{o}C and given to the respondents after 4-5 hours after the patient received analgesics. After 15 minutes of applying, we monitored the area given the cold compress to see any inflammation or redness of the skin which can cause nerve damage to the surface of the skin around the cold compress. After 3 days of the intervention, the majority of respondents acquired a decrease in their scores on pain intensity level when assessed using the NRS (Numeric Rating Scale) instrument. This result is in accordance with Bech et al.'s (2015) study who reported that cold compress was effective to reduce pain intensity (p 0.01). Waterman et al. (2012) also found that the pain intensity score in the intervention and control groups obtained significantly different results on the first, second, and third day after the patient was given a cold compress (p 0.05). It can be concluded that cold compress has an analgesic function that can reduce the pain intensity level.

Research conducted by Eid & Bucknall (2008) has shown that the mechanisms of cold therapy can increase the pain threshold, including decreased nerve conduction and muscle spasm, and prevent of edema after injury. The analgesic effect of cold therapy can be explained by the gate control theory that the application of cold activates inhibitory neurons which prevent nociceptive neurons from rising to send pain signals to the brain, thereby closing the gates of pain.

The majority of respondents experienced a decrease in the pain scale from moderate to mild, this was influenced by a good individual response to the quality of pain felt by the patient. This pain intensity response is influenced by the individual's level of coping, anxiety, and emotion (Francis & Pradeepa, 2016).

This study has the following limitations, including the researchers did not assess the intensity of pain every 15 minutes during the application of a cold compress. At the time of the study, a cold compress was placed over the fracture area. Cold compresses were carried out for 30 minutes using a cold pack that had been frozen in a refrigerator with a temperature of <18^{o}C and given to the respondent after 4-5 hours the patient received analgesics. The intensity of pain was assessed given for 30 minutes.

CONCLUSION AND RECOMMENDATION

Pain intensity after cold compress in the intervention group of fracture patients after surgery decreased. It is hoped that nursing practitioners can use the results of this study as information and consideration in providing care to postoperative fracture patients through a complementary therapeutic approach, that is, cold compresses. Further research is expected to add criteria for sample selection in accordance with the criteria and is expected to increase the number of samples again.

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