Differences in Effective Duration of Cold Compress Administration on Reducing Pain Intensity Fracture Patients

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Track Record Article

Accepted: 9 September 2024
Revised: 18 November 2024
Published: 30 November 2024

How to cite :
Hanum, M., Tanjung, D., & Mahcrina, Y. (2024). Differences in Effective Duration of Cold Compress Administration on Reducing Pain Intensity Fracture Patients. *Contagion : Scientific Periodical of Public Health and Coastal Health*, 6(2), 1200–1211.

Abstract

Fracture is one of the problems in health care centers around the world. The condition of the tissue around the fracture will experience damage to its integrity so that it can cause pain, trauma, joint stiffness, and musculoskeletal disorders. Pain is a sensory or emotional experience related to tissue damage. Sharp and stabbing pain is felt due to bone infection due to muscle spasms or pressure on sensory nerves. Non-pharmacological therapies include cold compresses that can reduce pain, reduce inflammatory responses, and reduce blood flow and reduce edema. This therapy is more effectiveand easy to do independently by patients. Cold pack for compresses are also useful for reducing muscle tension and reducing swelling so that patients are more comfortable and relaxed. This study aims to assess the difference in the duration of cold compresses using cold packs on reducing the intensity of acute pain in fracture patients at the Haji Adam Malik Central General Hospital. The research method is Quasi-Experimental with a pretest, posttest group design approach. Sampling using the consecutive sampling technique so that 66 respondents were obtained. The research instrument used the Numeric Rating Scale. The data were analyzed using the Wilcoxon and Mann Whitney U tests. The results showed that the mean value for the 20 minute compress group was 23.85, while the mean value for the 30 minute compress group was 43.15 with a p value <0.05. It can be concluded that giving a cold compress for 30 minutes is much more effective than giving a cold compress for 20 minutes. It is hoped that nurses in providing nursing care can apply a cold compress for 30 minutes using a cold pack as an independent nursing action in managing fracture pain in the hospital.

Keywords: Cold Pack, Pain, Fracture

INTRODUCTION

Fractures are a problem in health care centers around the world (Arif & Sari, 2019). A fracture is a break in the continuity of a bone that can be caused by trauma or non-trauma (Mayenti & Sari, 2020). A complete or partial break in the continuity of bone tissue, which can affect long bones and joints, muscle tissue and blood vessels, caused by stress on the bones, falls from a height, work accidents, sports injuries, degenerative fractures (Suwahyu1, 2021).

Discomfort due to pain must be overcome, because comfort is a necessity basic human principles, as in Maslow's hierarchy. A person experiencing pain will impact on daily activities and rest and sleep. Severe pain and Sudden attacks if not treated immediately will result in an increase in blood pressure, tachycardia, dilated pupils, diaphoresis and medullary adrenal secretion. In certain situations it can There is also a decrease in blood pressure which will result in shock. Fracture pain is acute pain and this pain can cause changes in muscle tone and

response autonomic such as diaphoresis, changes in blood pressure and pulse, pupil dilation, decreased or increased respiratory frequency. Managing fracture pain is not just an effort reduce the client's suffering, but also improve the quality of his life. Pain can be felt occurs in almost every fracture area (Vitri, 2022).

World Health Organization (WHO) In 2020, there was an increase in fracture events, with fractures recorded in approximately 13 million people with a prevalence rate of 2.7% (Permatasari & Sari, 2022). In Indonesia, the incidence of fractures is quite high. The Indonesian Ministry of Health in 2013 reported that around eight million people experienced fractures with different types of fractures and different causes. The results of a survey by the Indonesian Ministry of Health team found that 25% of fracture sufferers died, 45% experienced physical disabilities, 15% experienced psychological stress such as anxiety or even depression, and 10% experienced good recovery. The incidence of fractures is predicted to increase every year, namely 2.1 million in 2005 and could increase to more than 3 million in 2025 (Kepel & Lengkong, 2020).

Fractures tend to occur due to accidents that have a fairly high number of victims, where around 40% of accident incidents occur. The most common cause is traffic accidents. According to WHO, in 2018, the number of traffic accidents recorded that every year 1.35 million people died due to traffic accidents worldwide (Ariana & Wulaningrum, 2023). Based on the results of the 2018 Basic Health Research, the prevalence of injuries in Indonesia was 9.2%, an increase from 8.2% in 2013. The highest incidence of injuries occurred in the lower limbs at 67.9% while the upper limbs were 32.7%. In 2018, it was reported that the most frequent injuries occurred in the home environment with 44%, on the highway 31.4%, workplaces, schools and others (Fajriningtyas et al., 2023).

Broken bones or fractures are conditions that are commonly found in various health care settings, from primary care facilities to referral hospitals. Fractures occur when the continuity of the bone is disrupted due to trauma, excessive pressure, or certain medical conditions that weaken the bone structure, such as osteoporosis. in inpatient services or the operating room, complex fractures, such as open fractures or those involving joints, require further action such as surgery for bone repositioning (reduction) and installation of internal fixation devices. This treatment aims to ensure the bones return to their anatomical position and prevent complications such as infection or malunion.

From the data taken from the Hospital Information System from January to June 2022, the data on fracture patients at the Haji Adam Malik Central General Hospital showed that patients suffering from fractures totaled 180 cases with 110 cases of upper and lower limb

fractures and 70 cases of patients suffering from other fractures such as the vertebrae, scapula, clavicle, malar, and others.

Patients with fractures are limitedin carr ying out daily activities day caused damage to the structure bones due to trauma loss of independence. limitations in carrying out activities on your own causes sufferers to experience stress, which then has an impact on patient psychology and reduce the patient's quality of life (Abdurrahman et al., 2022).

In the case of a fracture or fracture, the tissue around the broken bone will experience soft tissue edema, bleeding into the muscles and joints, joint dislocation, tendon rupture, nerve damage and blood vessel damage (Sandra et al., 2020). Physical function loss due to fractures is one of the potential threats to integrity. Damage to bone integrity causes pain, trauma, joint stiffness, and musculoskeletal disorders (Hermanto et al., 2020). Untreated pain is associated with significant morbidity in adults (Tran et al., 2022).

Various theories about pain that explain the journey of nociceptors to produce pain stimuli. The gate control theory from Melzack & Wall (1965) in Andri et al., (2019) explains that pain impulses are regulated by defense mechanisms throughout the central nervous system. Pain impulses can be controlled by gate mechanisms at the dorsal root of the spinal cord to allow or block transmission. Gating factors consist of the effects of impulses transmitted to fast or slow conduction nerve fibers and the effects of impulses from the brainstem and cortex.

Pain is the most common symptom found in musculoskeletal disorders. Pain is a sensory or emotional experience associated with actual or functional tissue damage, with sudden or slow onset. The pain felt in fracture patients is sharp and stabbing pain (Risnah et al., 2019). The pain felt by fracture sufferers is due to bone infection due to muscle spasms or pressure on sensory nerves (Suryani & Soesanto, 2020).

Pain management can be overcome with pharmacological therapy and non-pharmacological therapy. Pharmacological management using analgesics (Novitasari & Pangestu, 2023). Non-pharmacological therapy does not have many risks which, if carried out, can harm the patient, but is widely used to treat pain in fracture patients. In addition, non-pharmacological therapy does not have side effects (Nurlela et al., 2023). Non-pharmacological therapies that are effective in reducing fracture pain include lavender aromatherapy (Astuti & Aini, 2020), deep breathing relaxation techniques (Lambiombir & Widiati, 2024), Murottal therapy (Isnaani et al., 2022), Mozart's classical music distraction techniques (Firdaus, 2020), autogenic relaxation training (Panjaitan et al., 2023) dan cold compress therapy (Hardianto et al., 2022).

Cold compresses are known to have effects that can reduce pain, reduce tissue inflammatory responses, and reduce blood flow and reduce edema. Cold compress therapy was chosen because it is more effective and easy to do independently by case study subjects in reducing pain. In addition, cold compress therapy is useful for reducing muscle tension by suppressing muscle spasms and can reduce swelling so that patients will feel more comfortable and relaxed (Suryani & Soesanto, 2020).

Experimental research conducted by Mediarti et al., (2019) with a one group pre design test-post test. 15 samples were selected using proportional method. From the research, it was found that the average pain value before the cold compress was 6.40 and after the intervention it decreased to 3.53. Data were analyzed using T-Test. These results indicate the influence of cold advice on pain in fracture patients extremities closed with p value <0.05.

Applying a cold compress can reduce this the process of transmitting impulses from pain receptors to central terminals in the spinal cord and brain. Cold compresses can also reduce blood flow to an area, reducing expected bleeding and edema causes an analgesic effect by slowing the speed of nerve conduction and thus pain impulses less reaches the brain (Malorung & Anggrita, 2022).

Cold compresses work by stimulating the skin's surface to control pain. The cold sensation is applied to the area of pain, to the opposite side of the body to the area of pain, or to an area located between the brain and the area of pain. Each client will have a different response to the area of therapy. Therapy given close to the area of pain tends to work better. Physiologically, in the first 10-15 minutes after the application of cold, vasoconstriction occurs in the blood vessels. This vasoconstriction is caused by the reflex action of smooth muscle that occurs due to stimulation of the autonomic nervous system and the release of epinephrine and norepinephrine (Ramadhan & Inayati, 2021).

The high number of fracture visits to the Emergency Room of the Haji Adam Malik General Hospital reached 290 cases in 2022. Pain is classified as the fifth vital sign and is one of the most common problems in patients who come. Patients usually expect that their pain will be treated with various therapeutic approaches including cold compresses using cold packs. Cold compression is routinely applied immediately after acute injury after the patient arrives at the Emergency Room. Several studies have stated that cold compresses are effective for reducing pain, but evidence regarding the optimal duration of cold compresses in managing fracture pain is still lacking, the author is interested in examining the difference in the duration of cold compresses on reducing fracture pain in the emergency room of the Haji Adam Malik General Hospital.

METHODS

This type of research is Quasi-Experiment with pretest-posttest control group design approach. The population in this study was 180 fracture patients. The purpose of this study was to analyze the difference in the effective duration of cold compresses using cold packs on reducing acute pain intensity in fracture patients with a 20-minute duration group and a 30-minute duration group. The sampling technique used was non-probability sampling, namely consecutive sampling. The sample size was determined using the Slovin formula with a margin of error of 10%, a sample of 65 people was obtained. Based on the researcher's considerations, 33 subjects were determined for each group so that the total sample was 66 people.

The inclusion criteria set by the researcher were: (1) Patients aged 18 years to over 60 years. (2) Patients who experienced fractures. (3) Patients who experienced mild, moderate, and severe pain intensity. (4) Patients who were willing to undergo cold compresses using cold packs. The research instrument used the NRS (Numeric Rating Scale). This study was conducted at the Emergency Room of Haji Adam Malik Central General Hospital in June - September 2023. The study was first approved by the health research ethics committee, Universitas Sumatera Utara.

Subjects signed informed consent as a sign of agreement to be involved in the study. The intervention was carried out in two groups, namely the first group with cold compresses (cold packs) for 30 minutes and the second group was given cold compresses (cold packs) for 20 minutes. Cold compresses were applied around the surface of the skin affected by the fracture. Statistical analysis using SPSS software. Univariate statistical analysis was carried out to assess the frequency or average value of each variable using descriptive data analysis through frequency distribution and percentage of data including age, gender, education, religion data and results of assessment of pain intensity before and after the cold compress intervention. Using the Saphiro-Wilk normality test, it was found that the data were not normally distributed so that data analysis was carried out using Wilcoxon and Mann Whitney U test.

RESULTS

Table 1. Frequency Distribution and Percentage of Demographic Characteristics Data of Respondents in the 20-Minute and 30-Minute Duration Intervention Groups (n=66)

Characteristics	20 minute group		30 minute group	
	F	%	F	%
Gender				
Male	20	60,6	23	69,7
Female	13	39,4	10	30,3
Ethnic group				
Batak	13	39,4	12	36,4
Jawa	11	33,3	9	27,3
Melayu	3	9,1	3	9,1
Nias	1	3,0	0	0
Minang	1	3,0	0	0
Bali	0	0	1	3,0
Karo	4	12,1	8	24,2
Religion				
Islam	20	60,6	15	45,5
Protestant	9	27,3	17	51,5
Catholic	4	12,1	1	3,0
Education				
Elementary school	6	18,2	4	12,1
Junior high school	1	3,0	5	15,2
Senior High School	23	69,7	17	51,5
College	3	9,1	7	21,2
Age (Year)				
18 – 25	11	33,3	7	21,2
26 – 33	6	18,2	5	15,2
34 – 41	7	21,2	5	15,2
42 – 49	1	3,0	7	21,2
50 – 57	6	18,2	9	27,3
>57	2	6,1	0	0
Total	33	100	33	100

Based on table 1, it is known that in the 30-minute group, most of the respondents were male with a total of 23 (69.7%), as well as in the 20-minute group, most of the respondents were male with a total of 20 (60.6%). According to ethnicity, in the 30-minute group, most of them were Bataknese with a total of 12 (36.4%), as well as in the 20-minute group, most of the respondents were Bataknese with a total of 13 (39.4%). According to religion, in the 30-minute group, most of them were Muslim with a total of 15 (45.5%), as well as in the 20-minute group, most of the respondents were Muslim and Christian with the same number of 16 (60.6%). The level of education in the 30-minute group was mostly high school with a total of 17 (51.5%), as well as in the 20-minute group, most of them were high school with a total of 23 (69.7%).

The age of the 30-minute group was mostly 50-57 years old with a total of 9 (27.3%), as well as in the 20-minute group, the majority were 18-25 years old with a total of 11 (33.3%).

Table 2. Mean Pain Scale Of Fracture Patients Before And After Cold Compresses

Applying cold compresses	20 minute group (Mean ± SD)	20 minute group (Mean ± SD)	P-value
Before	4.73 ± 1.875	4.79 ± 1.431	0.943
After	3.61±1.999	1.36±0.783	0.000

Based on table 2 above, it is known that there is no difference in the pain scale before giving cold compresses with cold packs in both treatment groups. The treatment group 20 minutes before the compress was given with a mean of 473 and a standard deviation of 1.875 and the treatment group 30 minutes before the cold compress was given using a cold pack in fracture patients with a mean of 4.79 and a standard deviation of 1.431. Then it was found that there was a significant difference between giving cold compresses using a cold pack for 20 minutes and 30. The 20-minute group with a mean of 3.61 and a standard deviation of 1.999 and the 30-minute treatment group with a mean of 1.36 and a standard deviation of 0.783. Where the pain scale after giving cold compresses in the 30-minute group was lower than 20 minutes.

Table 3. Changes In The Scale Before And After The 20-Minute Duration Group Compress

Pre-test			Post test				P- value
Min	Max	Mean±SD	Min	Max	Mean±SD	Δ skala	
2	8	4.73±1.43	2	7	3.61±0.78	-1.1	0.011

In table 3 it can be seen that cold compress with cold pack for 20 minutes reduces the pain scale by 1.1 in fracture patients.

Table 4. Changes In Scale Before And After 30-Minute Compress

Pre-test			Post test				P value
Min	Max	Mean±SD	Min	Max	Mean±SD	Δ skala	
2	7	4.99±1.43	1	4	1.36±0.78	-3.42	0.000

Based on table 4, it can be seen that cold compresses with cold packs for 30 minutes reduce the pain scale by 3.42 in fracture patients.

Table 5. Statistics Of Pain Scale Of Fracture Patients Before And After Cold Compresses

Variable	20 minute group Mean	20 minute group Mean	Z	P value
Pain intensity	23.85	43,15	-4.139	0,000

Based on table 5, the average value of pain intensity shows a mean value of 20-minute compress group of 23.85 compared to the mean value of 30-minute compress group of 43.15. The results obtained show that there is a difference between 20-minute compress and 30-minute

compress (p value <0.05). This shows that giving cold compresses for 30 minutes is much more significant compared to cold compresses for 20 minutes.

DISCUSSION

Based on the results of the study, it is known that before and after cold compresses in the 20-minute duration group of 33 respondents who were given cold compresses using cold packs with mild pain were 8 people, respondents with moderate pain were 18 people, respondents with severe pain were 7 people. After cold compresses using cold packs for 20 minutes, the results showed that 24 respondents felt mild pain, 9 respondents felt severe pain.

The results of this study indicate that cold compresses with cold packs for 20 minutes showed that the pain scale decreased by 1.1. It can be seen from the number of respondents who had been given cold compresses using cold packs for 20 who felt severe pain increasing from 7 respondents to 9. Before and after cold compresses in the 30-minute duration group of 33 respondents who were given cold compresses using cold packs with mild pain were 7 people, respondents with moderate pain were 21 people, respondents with severe pain were 5 people. After a cold compress was applied using a cold pack for 30 minutes, the results showed that 31 respondents felt mild pain and 2 respondents felt moderate pain.

Cold compresses can relieve pain by reducing prostaglandins which increase the sensitivity of pain receptors and other substances at the wound site by inhibiting the inflammatory process. Research conducted by Arifin et al., (2022) to describe the application of cold compress therapy to reduce the intensity of acute pain in post-operative fracture patients using a descriptive approach. Based on the results of observations of cold compresses for 2 days given during the half-life of the drug, the results were quite accurate because the intervention was carried out starting at 10.00 WIB, while the analgesic was given at 08.00 and would be given again every 16.00. On the first day after the cold compress was applied, there was a decrease in the intensity of the pain scale with an average of 1, then on the second day after the cold compress was applied there was a decrease in the intensity of the pain scale with an average of 2. It was concluded in this study that cold compresses can significantly reduce the intensity of pain.

The results of this study indicate that cold compresses with a 30-minute cold pack showed that the pain scale decreased by 3.42. It can be seen from the number of respondents who have been given cold compresses using a 30-minute cold pack who felt severe pain increased from 5 respondents to no respondents experiencing severe pain and respondents who experienced mild pain increased from 7 respondents to 31 respondents.

Based on the analysis carried out by analyzing the difference in pain intensity in fracture patients with compresses in the 20-minute group and the 30-minute group using the Wicoxon test, there was a decrease in pain intensity where it was seen that cold compresses with a cold pack for 20 minutes reduced the pain scale by 1.1 (p-value 0.011), with moderate and mild pain intensity. In fracture patients and in the 30-minute group using cold compresses using cold packs significantly the pain scale was 3.42 (p-value 0.000) with mild pain intensity in fracture patients. Based on the results above, the researcher concluded that cold compresses are effective in reducing pain intensity in fracture patients.

This research is in line with a quantitative study using the paired t-test statistical test conducted by Anggraini & Fadila, (2021) which aims to determine the effect of cold compresses on reducing the pain scale in post-fracture surgery patients at Siloam Sriwijaya Hospital Palembang in 2020 in 15 respondents obtained by purposive sampling. It is known that the pain scale before giving cold compresses with a moderate category of 9 respondents (60%) and with a severe category of 6 respondents (40%), the pain scale after cold compresses with a mild category of 10 respondents (66.7%) and with a moderate category of 5 respondents (33.3%). The results of the study showed that there was a decrease in the pain scale in post-fracture surgery patients. So it can be concluded that there is an effect of giving cold compresses on reducing the pain scale in post-fracture surgery patients with a p value of 0.000.

Similar research with pre-experiment with pretest-posttest design with consecutive sampling of 42 people. The research instrument used the Visual Analog Scale. Data were analyzed using the Wilcoxon test. Described the majority of male gender (69%), almost half aged 17-25 years (45.2%), most have secondary education (61.9%), the majority are Muslim (97.6%), the majority have never had surgery (97.6%). The results of statistical tests before and after the intervention obtained a p-value <0.000. It was concluded that there was an effect of giving cold compresses on changes in pain intensity in post-fracture surgery patients (Indrawati et al., 2023).

The study results showed that the average pain scale of fracture patients before being given cold compresses with a 20-minute duration group and a 30-minute duration group obtained a p-value of 0.943 indicating insignificant data. After being given cold compresses to fracture patients with a 20-minute duration group and a 30-minute duration group, a p-value of 0.000 was obtained, indicating significant data, where the pain intensity before the compress in fracture patients was more moderate and severe, after the compress the pain intensity mostly changed to mild. Only a small part is at moderate intensity. Even with a 30-minute compress, no more patients were found with severe intensity. Thus, it can be said that a 30-minute cold

compress is more effective than a 20-minute cold compress to reduce pain intensity in fracture patients.

Cold compress is giving a cold sensation to the local area using a cloth dipped in ice water. So that it gives a cold effect to the area. The purpose of giving a cold compress is to relieve pain due to edema or trauma, narrow blood vessels and reduce blood flow. It is thought that cold therapy causes an analgesic effect by slowing the speed of nerve conduction so that fewer pain impulses reach the brain. Cold compress works by stimulating the skin surface to control pain. The cold sensation is given around the painful area, on the opposite side of the body related to the location of the pain, or in the area located between the brain and the painful area. Each client will have a different response to the area given therapy. Therapy given close to the painful area tends to work better. Physiologically, in the first 10-15 minutes after the application of cold, vasoconstriction occurs in the blood vessels. This vasoconstriction is caused by the reflex action of smooth muscles that arises due to stimulation of the autonomic nervous system and the release of epinephrine and norepinephrine (Tuna & Yunus, 2023).

According to researchers, cold compresses work through an effective mechanism to reduce pain, especially in cases of acute pain such as injury or inflammation. When a cold compress is applied, the cold temperature causes the blood vessels in the area to narrow (vasoconstriction). This reduces blood flow to the injury site, so that the swelling and inflammation that often cause pain can be minimized. Apart from that, cold also reduces sensory nerve activity in the area, so that pain signals sent to the brain are reduced. This effect provides a temporary numbing sensation that helps reduce the perception of pain. Cold temperatures also reduce cell metabolism, so that the production of inflammatory chemicals such as prostaglandins is reduced, which ultimately reduces the intensity of pain and inflammation.

Cold compresses are also effective in relaxing tense or spasming muscles, so that pain due to muscle tension can be relieved. With an ideal duration of use of 10-20 minutes, cold compresses are a simple therapy that is often used in treating acute pain. However, it is important to always use a barrier such as cloth between the compress and the skin to prevent tissue damage due to extreme cold temperatures (Janice L. Hinkle, 2018).

CONCLUSIONS

Based on the results of the study, it can be concluded that there is a decrease in pain intensity before and after cold compresses using cold packs in the 20-minute duration group and in the 30-minute duration group, but cold compresses using cold packs for 30 minutes are more effective than those with a duration of 20 minutes. It is hoped that nurses can implement cold compresses using cold packs for 30 minutes as independent nursing actions for nurses in non-pharmacological pain management in hospitals.

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