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THE EFFECTIVENESS OF THREE-SIDED SPLINTING ON THE DEGREE OF PAIN IN PATIENTS WITH CLOSED FRACTURES OF THE LOWER EXTREMITIES IN THE EMERGENCY ROOM

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ABSTRACT
Trauma from accidents that cause fractures can lead to complications including epistaxis, internal organ injury, injury inflammation and respiratory syndrome. The occurrence of a fracture causes destruction of nerves and blood vessels which causes pain. Pain then increases in severity until the bone is immobilized. Pain in a fracture is not caused by the fracture itself, but by the injury to the tissue around the broken bone and the movement of the bone fragments. Correct dressing of the fracture can reduce pain in patients, especially for closed fractures. Three-sided splinting is one option to minimize movement in long bones because it is felt to be stronger to withstand movement because the broken bone is flanked from three opposite sides of the broken bone. Objective: To determine the effectiveness of three-sided splinting on the degree of pain in patients with closed fractures of the lower extremities. Methods: The research design used quasy experimental with pre-test and post-test control group design. The research sample was 30 respondents, the sample selection method used purposive sampling which was divided into control and intervention groups. The control group used two-sided splinting while the intervention group used three-sided splinting. Data analysis used demographic characteristics and research variables, namely three-sided splinting and pain levels. Bivariate analysis used Wilcoxon and Mean Withney. Results: Both groups of respondents experienced a decrease in pain levels after treatment but the decrease in pain levels was greater in the intervention group using three-sided splinting. The results showed that the three-sided splinting action was very effective in reducing the degree of pain with p=0.000. Conclusion: Three-sided splinting is proven to be more effective in reducing the degree of pain in patients with closed fractures of the lower extremities.

Keywords: closed fracture; degree of pain; lower extremity; splinting; three-sided

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INTRODUCTION

Trauma from accidents causing fractures is still very high in various countries, both developed and developing countries. Based on data from the Central Statistics Agency (BPS) from 2019 to 2021, Indonesia experienced an increase in traffic accidents and touched 103,645 incidents in 2021. Indonesia is one of the Association of Southeast Asian Nations (ASEAN) countries that has a high fatality rate due to road accidents.(Ferdianto & Prastawa, 2023) Of the total number of accidents, 5.8% experienced fracture injuries with the fracture category being very common in the lower extremities followed by the upper extremities. The results of the Basic Health Study also say that in Indonesia, femur fracture cases are very common, amounting to 39 percent, accompanied by humerus fractures 15 percent, tibia and fibula fractures 11 percent, where the most triggers for femur fractures are accidents that are

generally caused by car, motorcycle or other transportation accidents (62, 6%), other accidents (37, 3%) and mostly men (63, 8%). 4.5% of femur fracture cases often occur at age (15-34 years).(Faidah & Alvita, 2022)

Fractures can cause complications, prolonged morbidity and damage if not treated properly. Complications that arise from fractures include epistaxis, internal organ injury, injury inflammation, fat embolism and respiratory syndrome.(Andri, Febriawati, Padila, J, & Susmita, 2020) Patients who experience fractures (broken bones) whether caused by accidents or shocks fall into the category of chronic pain. Pain can also arise from various stimulants such as physical stimulation due to exposure to temperature, machinery, electricity and surgery.(Wirawan, Azis, & Witarsa, 2018) The occurrence of a fracture leads to the destruction of nerves and blood vessels which creates pain. The pain then penetrates and increases in severity until the bone is immobilized. Spasm of the muscles flanking the fracture is a natural splint designed to minimize activity between the bone fragments. The pain that arises in a fracture is not just due to the fracture itself, but due to the tissue injury around the broken bone and the movement of the bone fragments. To reduce the pain, painkillers can be given as well as immobilization (not moving the fractured area). Immobilization can be achieved by placing a splint or cast.(Fakhrurrizal, 2015)

Splinting is a technique used to immobilize or stabilize a fractured extremity. Immobilization can reduce pain, swelling, muscle spasm, tissue epistaxis, and the risk of fat embolism.(Faidah & Alvita, 2022) Correct dressing of the fracture can reduce the patient's pain, especially for closed fractures. Pain is a condition in the form of an unpleasant feeling, which is very subjective. The feeling of pain in each person is different in terms of scale or level and only that person can explain or evaluate the pain they experience.(Fakhrurrizal, 2015) Based on medical records at Umbu Rara Meha Waingapu Hospital in 2022 there were 124 patients who suffered fractures and in January 2023 there were 17 patients who suffered fractures. Every case of trauma suspected with a fracture that comes to the hospital, especially to the Emergency Room, complains of pain caused by muscle, joint and bone injuries. One of the efforts to reduce or reduce pain in fracture patients is the act of bandaging. Initial handling of fracture patients in the emergency room at Umbu Rara Meha Hospital is done by bandaging using spalks (plywood splints wrapped in cotton and bandages). The current practice is to use two spalks to bandage a lower limb fracture.

The establishment of splinting procedures in the Emergency Room of Umbu Rara Meha Hospital for all patients who experience fractures that occur in long bones, such as fractures of the femur, tibia, fibula and radius and ulna, both in closed and open fractures. This aims to prevent more severe damage to bone fragments or tissue. The function of splinting, which can reduce pain in patients, was not studied further. There has been no assessment that includes the pain scale felt by the patient, as well as the effect of the splint on the intensity of the pain, whether it decreases or increases. So far, the pain felt by patients has only been followed up with analgesics. From the results of preliminary studies at Umbu Rara Meha Hospital, out of 17 patients who experienced closed fractures in January 2023, there were still 10 patients who on average experienced pain between scale 8 to scale 9, described as cramping, stiffness, pressure, difficulty moving and feeling like being stabbed. After being given the action of installing two-sided spalks (left and right) the pain was reduced not too significantly, namely from 6 respondents starting from scale 9 reduced to scale 8 and 4 respondents starting from scale 8 reduced to scale 7. This insignificant level of pain reduction is thought to be due to the bandaging that has been carried out still using only two sides, namely on the left and right sides only so that there is still a possibility that the broken bone can still shift from position

after bandaging, especially if it is a long bone fracture such as the tibia and fibula. In most cases, increased pain in lower limb fractures occurs when moving or lifting for supporting examinations such as X-rays and moving between beds or to the operating room.

Three-sided splinting is one of the options offered to minimize movement in long bones because it is felt to be stronger to withstand movement because the broken bone is flanked from three opposite sides, namely the left and right sides and the bottom of the long bone. This three-sided dressing itself is recommended only for closed fractures because if it is an open fracture, it will hamper the wound care process caused by the broken bone. Whereas in open fractures it is more advisable to install a cast because a window can be made in the cast without having to interfere with the bone immobilization process. However, the Emergency Room at Umbu Rara Meha Hospital has not implemented this three-sided dressing principle due to several limitations such as resources and there has also been no previous research to assess the effectiveness of this three-sided dressing and its effect on reducing pain levels. The general objective of this study was to determine the effectiveness of three-sided splinting on the degree of pain in patients with closed fractures of the lower extremities in the emergency room of Umbu Rara Meha Waingapu Hospital, while the specific objectives were two, namely to determine the difference in the degree of pain in patients with closed fractures of the lower extremities before and after two-sided splinting in the control group and to identify the degree of pain in patients with closed fractures of the lower extremities before and after three-sided splinting in the intervention group.

METHOD

This type of research is Quasy Experiment research with pretest-posttest control group design. The population in this study were all fracture patients who came to visit the emergency room of Umbu Rara Meha Waingapu Hospital from October to November 2023. Calculation of the sample size using the Lemeshow formula, with a numerical measurement scale of two groups of paired data with a sample size of 30 respondents consisting of 15 respondents in each group. The sample selection method uses purposive sampling method, namely by determining the sample with certain considerations because not all samples have criteria that match the criteria studied but have characteristics that can represent the entire population. The sorting of the two groups was carried out based on the inclusion criteria where the researcher prioritized the intervention group to carry out the bandaging action and assess the degree of pain before and after the intervention, then continued in the control group so that both groups were in the same condition to be assessed for a decrease in the degree of pain. Before treatment, researchers assessed the degree of pain using the Numeric Rating Scale (NRS) scale in the intervention group and control group. The post test was conducted 15 minutes after the treatment of three-sided bandaging in the intervention group and two-sided bandaging in the control group. Univariate data analysis included demographic characteristics, namely age, gender, history of analgesic drug administration and data on three-sided bandaging research variables and pain levels. The data normality test used the Shapiro-Wilk test, because the data was not normally distributed, the bivariate analysis used non-parametric tests, namely using the Wilcoxon and Mean Withney tests to determine the level of difference in reducing the degree of pain in each group.

RESULTS

Mean Decrease in Pain Level Before and After Bandaging in the Control Group and Intervention Group

Table 1.
Mean reduction in pain levels before and after bandaging in both groups

Variabel	Rank	N	Mean ±SD	Mean Ranks	Sum Ranks	ρ-value
Kelompok Kontrol:						
Pre-test *Post-test*	*Negative*	10[a]	4.00±0.000	5.50	5.50	0.002
	Positive	0[b]	3.33±0.488	0.00	0.00	
	Ties	5[c]				
Kelompok Intervensi:						
Pre-test *Post-test*	*Negative*	15[d]	4.00±0.000	8.00	120.00	0.000
	Positive	0[e]	3.00±0.000	0.00	0.00	
	Ties	0[f]				

Table 1, it is known that in the control group the average degree of pain before two-sided bandaging is 4.00 with a standard deviation of 0.000 and the average degree of pain after two-sided bandaging is 3.33 with a standard deviation of 0.488. This shows that there is a significant difference in the degree of pain before and after the intervention of two-sided bandaging in the control group, namely with a value of p = 0.002. In the intervention group before the three-sided bandaging, the average decrease in the degree of pain was mean 4.00 and standard deviation 0.000 and after the bandaging to mean 3.00 and standard deviation 0.000. This shows that there is a significant difference in the degree of pain before and after the three-sided bandaging intervention with a value of p = 0.000.

Difference in Reduction of Pain Degree in Each Group

Table 2.
Difference in Decrease in Pain Degree in Each Group

Derajat Nyeri	f	Kelompok		*ρ-value*
		Kontrol *Mean ±SD*	Intervensi *Mean ±SD*	
Pre test	15	4.00 ±0.000	4.00 ±0.000	1.000
Post test	15	3.33 ±0.488	3.00 ±0.000	0.016
Selisih / Δ		0.67	1.00	

Table 2 shows that from the results of the Mann Whitney test there is a difference in reducing the degree of pain in the two groups before and after treatment. In the control group, the measurement results obtained before the two-sided bandaging action were mean 4.00 and standard deviation 0.000 and after the bandaging action was mean 3.33 and standard deviation 0.488 with the mean difference between before and after the bandaging action was 0.67, while in the intervention group, the measurement results obtained before the three-sided bandaging action were mean 4.00 and standard deviation 0.000 and after the bandaging action was mean 3.00 and standard deviation 0.000 with the mean difference between before and after treatment was 1.00. The difference in significant values before the bandaging action in the two groups was p = 1.000 and the difference in significant values after the bandaging action in the two groups was p = 0.016, which means that there is a difference in reducing the degree of pain in the two groups of patients with closed fractures of the lower extremities after treatment.

Effect Size Differences in Pain Degree Reduction in Each Group

Table 3.
Effect size of the difference in reducing the degree of pain in each group

Kelompok	Post Test Derajat Nyeri		*Cohen's d Effect*
	Mean	SD	
Kontrol	3.33	0.488	0.957
Intervensi	3.00	0.000	

Table 3 shows that the effect size test on the difference between the mean and standard deviation of the control group and the intervention group after the intervention is 0.957 (large effect size). This shows that three-sided bandaging has a greater effect than two-sided bandaging on reducing the degree of pain in patients with closed fractures of the lower extremities.

DISCUSSION

Mean Decrease in Pain Level Before and After Bandaging in the Control Group and Intervention Group

The main problem complained of by patients with closed fractures of the lower extremities is pain. Pain that is not addressed adequately can lead to dangerous complications beyond the discomfort it causes, so the first step in handling this pain is to perform a bandage.(Sartono, 2016). Smeltzer (2009) explains that the bandaging will make the skeletal muscles that experience spasm slowly relax, so that it can reduce the intensity of the pain scale. When a fracture occurs, parts that cannot be used and tend to move unnaturally (extraordinary movements) instead of being rigid like normal. Muscles will respond naturally by contracting, the purpose of which is to wrap and protect the injured area. Continued contraction will cause pain. The muscle spasm that accompanies a fracture is also a form of natural splinting designed to minimize movement between bone fragments.(Risnah, HR, Azhar, & Irwan, 2019) Physiologically, pain arises when nerve endings called nociceptors are affected by a noxious stimulus, creating a nerve impulse, which travels rapidly to the spinal cord via the sensory nerves. This impulse will be immediately driven to the brain, and the brain will process the pain sensory, then respond through motor pathways to stop the action that causes pain.(Rahmawati, 2018)

The pain felt by respondents before the bandaging was done was due to damage to nerves and blood vessels which caused pain. Pain arising in fractures is not solely due to the fracture itself, but due to the movement of bone fragments. The pain felt by respondents varies depending on the cause of the pain. In this study, the lowest pain scale felt by respondents was 5 (moderate pain) caused by closed fractures of the lower extremities. The moderate pain scale is because the fracture that occurs does not cause complications to the skin or there is no connection between the bone fragments and the outside world, so the pain felt by respondents is purely due to a break in bone continuity without pain due to injury or tearing of the skin and no arterial damage. The highest pain scale felt by respondents was 9 (severe pain can be controlled). This pain is also influenced by the respondent's anxiety about the fracture that occurred because with the fracture, the respondent can no longer carry out activities as usual so that anxiety arises about his health condition, which affects the degree of pain.(Asrizal, 2014)

Pain is defined as a condition that affects a person and its extension is known when someone has experienced it. From the above statement it can be concluded that pain is unpleasant and from the results of the study the average pain scale before action was 7 while the highest perceived pain scale report was 10 people who were severe pain, this is in accordance with the

theory of Smeltzer & Bare (2002) that pain is an unpleasant sensory and emotional experience resulting from actual and potential tissue damage. When a fracture occurs, the parts cannot be used and tend to move unnaturally (extraordinary movements) instead of remaining rigid as normal. The muscles will respond naturally by contracting, the aim being to splint and protect the injured area. Continued contraction will cause pain.(Tamsuri, 2007)

Difference in Reduction of Pain Degree in Each Group

The results of this study are in line with Fakhrurisal's research (2015) on the Effect of Bandaging on Decreasing Pain in Closed Fracture Patients in the Emergency Room of the A.M Parikesit Tenggarong Regional General Hospital, that there is a significant influence between bandaging and decreased pain in closed fracture patients.(Fakhrurrizal, 2015) (A. Potter, P., & Perry, 2015). Splinting is an action and an attempt to rest the broken part. Bandaging is a method of first aid in musculoskeletal system injury/trauma to rest (immobilize) the injured body part using a tool. This dressing aims to reduce and relieve pain, prevent fracture movement which can result in damage to the surrounding soft tissue. Splints are used to immobilize and position one or more joints. In fractures, splints are used to protect partially healed fractures when weight bearing or movement is allowed. Splints are also used to immobilize the fracture and prevent pain from occurring during movement.(Faidah & Alvita, 2022).

There is an effect of three-sided bandaging on the degree of pain in closed fracture patients because with the bandaging, the movement in the bone / broken area can be reduced, so that it does not cause pain to the respondent. Splinting will make the skeletal muscles that experience spasm slowly relax, so that it can reduce the intensity of pain.(Sovia, Daryono, Mashudi, & Dewi, 2020). Splinting can also support or hold body parts so that they do not shift or change from the desired position, thus avoiding body parts from shifting from their place and can reduce / eliminate pain. In addition, splinting is also useful for returning the position of the broken bone to its original position (repositioning) and maintaining that position during the fracture healing period (immobilization), so that it can affect the pain felt by the patient.(Joko Afrianto, 2023).

Effect Size Differences in Pain Degree Reduction in Each Group

The reason why three-sided splinting is more effective in reducing pain levels is because it is proven to minimize movement in broken long bones by using a splint consisting of three sides because it is felt to be stronger to withstand movement because the broken bone is flanked from three opposite sides, namely the left and right sides and the bottom of the broken bone and the lower side is made to resemble the anatomy of the lower body extremities so that it can flank more strongly and the side of the splint is not easily shifted.(Bayusentono, S. and Farhadi, A. and Suwondo, A. and Adyaksa, G. and Kusuma, B.W.A. and Widodo, R.A. and Susatyo, A.Y.R. and Wardana, R.M.A.W. and Yudistira, 2021). However, not all respondents experienced a significant decrease in pain levels. Respondents who did not experience a decrease in pain levels may be due to past experiences with pain, where they have felt pain related to fractures. For respondents who experienced a decrease in pain levels, it could be influenced by the patient's perception of pain, where their anxiety was reduced after the bandaging because they believed that the bandaging had a positive impact on their pain.(Amran, Dewobroto, & Guntoro, 2020).

The intervention mechanism carried out in each group was given once, namely the installation of a two-sided splint in the control group and the installation of a three-sided splint in the intervention group, which had previously been assessed for pain and reassessed after 15

minutes of intervention. The intervention in each group was carried out based on the same procedure and carried out by the same enumerator. The results of the analysis showed that the decrease in the degree of pain was more significant in the intervention group, this proves that three-sided bandaging is effective in reducing the degree of pain in patients with closed fractures of the lower extremities compared to two-sided bandaging. Based on the discussion above, researchers can conclude that three-sided bandaging is proven to be more effective in reducing the degree of pain in patients with closed fractures of the lower extremities compared to two-sided bandaging so that the hypothesis of this study is accepted.(Bayusentono, S. and Farhadi, A. and Suwondo, A. and Adyaksa, G. and Kusuma, B.W.A. and Widodo, R.A. and Susatyo, A.Y.R. and Wardana, R.M.A.W. and Yudistira, 2021).

CONCLUSION

Based on the results of the analysis and discussion of the effectiveness of three-sided splinting on the degree of pain in patients with closed fractures of the lower extremities, it can be concluded that there is a difference in the degree of pain in patients with closed fractures of the lower extremities before and after two-sided splinting in the control group, namely with a significant value of p = 0.002 and there is a difference in the degree of pain in patients with closed fractures of the lower extremities before and after three-sided splinting in the intervention group, namely with a significant value of p = 0.000. Three-sided splinting as a novelty in this study proved to be more effective in reducing pain levels compared to two-sided splinting measures previously performed in patients with closed fractures of the lower extremities with a significant difference in value before treatment in both groups p = 0.000 and after treatment in both groups, p = 0.016.

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