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Cold Compresses Reduce the Perception Level of Artery and Vena Insertion in Hemodialistic Patients

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Abstract--*Hemodialysis patients experience pain during cannulation (insertion of arteries and veins) due to large cannula, therefore an intervention modality that can control pain by cold compresses for 3 minutes in the insertion area. This study aims to examine the effect of cold compresses on the level of pain perception of arterial and venous insertion of hemodialysis patients. This study uses a randomized subjects post-test only control group method. The population in this study were all kidney failure patients undergoing hemodialysis in the Hemodialysis Room of NTB Provincial Hospital from January to November 2017 as many as 412 people. The total sample using the Slovin formula was obtained as many as 80 respondents consisting of 40 intervention groups and 40 control groups. Purposive sampling technique. Inclusion Criteria Cooperative respondents, not restless, no hypotension (arrhythmia), normal body temperature. Respondent's research was conducted with an information concern, the intervention group cold compress temperature of 13.5°C was given for 3 minutes in the insertion area using a rubber ice bag. Data collection of pain sensations by observation with the aid of the VAS scale (Visual Analog Scale)). Pain sensation felt after cold compresses were analyzed using a paired-sample t-test. The result of the study was ρ = 0.00, meaning that there was a significant difference in the perception of pain in the arteries and veins of hemodialysis patients who were given cold compresses and those who did not. Cold compresses in the area of venous insertion and arteries of hemodialysis patients reduce the sensation of pain due to puncture using a cannula, so this action is recommended in the hemodialysis chamber.*

Key words--*Cold compresses, reduce, pain, insertion, hemodialysis.*

I. INTRODUCTION

Pain is a subjective sensation, discomfort associated with tissue damage both actual and potential, is protective, causes individuals to avoid a dangerous stimulus, or has no function, such as in chronic pain (Carpenito, 2007). Pain response is an unpleasant sensory and emotional experience of an individual, as a result of tissue damage that is potential or actual (Potter and Perry, 2006). Careful and precise assessment is needed to determine the scale of pain so that it can be overcome with appropriate action (D'Arcy, 2007)

Patients with hemodialysis will experience pain when puncturing the arteries and veins using the arteriovenous fistula needle, this is due to a large cannula. However, although the insertion of arteries and veins causes pain, it is not recommended to do local anesthesia because it will cause vasoconstriction, burning sensation, scars, and infection of the inserted arteries and veins (Abra and Tamura, 2012). Insertion procedures

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in arteries and veins will cause pain during the patient's hemodialysis (Nampiaparampil *et al.*, 2013). Based on a preliminary study conducted in the Hemodialysis Room of NTB Provincial Hospital on November 1, 2017, on 15 patients who were undergoing hemodialysis therapy, it was obtained data that 100% of patients felt pain during arterial and venous insertion despite more than 3 times the action of hemodialysis. Hemodialysis (HD) is often used in critical nursing areas for emergency cases such as excess urea, electrolytes and fluids, as well as some drug overdose events. (Abra and Tamura, 2012).

Now, many studies are conducted on cold compresses that contribute to pain reduction both acute pain and chronic pain. The study was conducted (Mahajan *et al.*, 2008) which is conducting research before insertion of arteriovenous fistula needle in hemodialysis patients with cold compresses for 10 minutes. The result can reduce pain in the insertion area. The study was also conducted by (Chesterton, Foster and Ross, 2002) namely cold compresses, comparing pain relief using temperatures of 10 - 30°C for 10-20 minutes and (Bleakley, McDonough and MacAuley, 2004) conducted research using cold compresses for 20 minutes, the results of cold compresses can reduce pain sensations in acute pain, as well as (Gorji *et al.*, 2014) states that the implementation of cold compresses using cold gel temperature of 13oC for 20 minutes can reduce pain stimulation in patients with Chest Tube Removal Following Cardiac Surgery and research performed by (Pranowo, Prasetyo and Handayani, 2016) cold compresses for 3 minutes in the insertion area proved effective for controlling the patient's pain response during arterial and venous insertion.

The difference between this study and previous research is to use an ice pack with a temperature of 13.5°C for 3 minutes given to the area where arteries and veins will be inserted in hemodialysis patients. This study aims to examine the effect of cold compresses on the level of perception of arterial and venous insertion pain in hemodialysis patients.

II. METHODOLOGY

This research method is an experimental study with randomized subjects design post-test only control group (Dharma, 2011). The population in this study were all kidney failure patients undergoing hemodialysis in the Hemodialysis Room of NTB Provincial Hospital from January to November 2017 as many as 412 people. The number of samples was determined using the Slovin formula (Dharma, 2011). 80 respondents were divided into 40 respondents in the treatment group (intervention) and 40 respondents in the control group. The sampling technique was purposive sampling (Dharma, 2011). The sample in this study was renal failure patients who performed hemodialysis in the Hemodialysis Room of West Nusa Tenggara Provincial Hospital who met the inclusion criteria, namely cooperative and willing to be respondents, not restless, no hypotension (arrhythmia), normal body temperature. Research procedure: the intervention group was given an explanation of the action to be taken then signed an informed consent agreed with this action. Measure the temperature of the rubber Ice Bag (13.5°C). Compress the hemodialysis artery and vein area using a rubber ice bag for 3 minutes or the respondent feels numb. Then perform cannulation actions (insertion of veins and arteries). After the action, the level of perception of pain by observation uses a VAS scale measurement (Visual Analog Scale) range of values from 1 to 10, while for the control group before the insertion of arteries and vein hemodialysis is given an explanation and information concern. At the time the implementation distracted the respondent's attention by inviting conversations about things that were pleasant to the respondent. After the action, the value of the level of pain

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perception by observation uses a measurement of the VAS scale (Visual Analog Scale) range of values from 1 to 10.

III. RESULTS

Respondent characteristics consisted of age, education, and gender. The age of most of the early elderly respondents (46 - 55 years), most education was basic education (elementary - junior high school), the majority of respondents worked and for the sex, there was no difference in number. For more details, see table 1 below.

Table 1: Characteristics of Respondents

Variable	**Intervention Group (n=40)**		**Control Group (n=40)**		**P value**
	∑	**%**	∑	**%**	
Age					
Early adulthood (26 – 35 yrs)	7	17.50	4	10.00	0.002
Late adulthood (36 – 45 yrs)	9	22.50	11	27.50	
Early Elderly (46 – 55 yrs)	14	35.00	15	37.50	
Late Elderly (56 – 65 yrs)	6	15.00	10	25.00	
Old man (> 65 yrs)	4	10.00	0	0.00	
Education					
No school	0	0.00	0	0.00	0.006
Basic Education (SD-SMP)	22	55.00	20	50.00	
Middle Education (SMA)	16	40.00	14	35.00	
Higher Education (PT)	2	5.00	6	15.00	
Profession					
Employee	23	57.50	31	77.50	0.002
Unemployee	17	42.50	9	22.50	
Gender					
Female	19	47.50	23	57.50	0.780
Male	21	52.50	17	42.50	

The next table shows that in the intervention group most experienced mild pain while in the control group most experienced severe pain. For more details can be seen in table 2.

Table 2: Pain Perception in Hemodialysis Patients

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No	Pain perception	Intervention Group		Control Group	
		∑	%	∑	%
1	No pain	0	0.00	0	0.00
2	Mild Pain	31	77.50	3	7.50
3	Moderate Pain	9	22.50	15	37.50
4	Severe pain	0	0.00	22	55.00
5	Very Severe Pain	0	0.00	0	0.00

The results of the study for pain perception in hemodialysis patients who were given cold compresses during arterial and venous insertion using the t-test obtained a significant value of 0.000 meaning $\alpha < 0.005$, this indicates there was a difference in pain perception in hemodialysis patients who were given cold compresses when arterial insertion would be performed and the veins in cannula were compared to those not given cold packs (ice packs), and when viewed from the mean the perceived pain perceived by the intervention group was smaller when compared to the control group. For more details, see table 3.

Table 3: Differences in Pain Perception in Hemodialysis Patients Given Cold Compress

Group	Mean	t	Sig. (2-tailed)
Control	3.4857	33.685	0.000
Intervention	2.3429	21.689	0.000

Chronic kidney failure (CKD) is a progressive and irreversible change in kidney function (Kasiske B, 2013). Although chronic kidney failure is irreversible, the process can be slowed down with medication and diet. In chronic kidney failure, the kidney loses its ability to maintain homeostasis with fluid balance and accumulation of metabolic waste, causing end-stage kidney disease and must be dialyzed. Chronic kidney failure is identified through the glomerular filtration rate (LFG) and divided into 3 stages: decreased kidney reserve, renal insufficiency, and end-stage renal disease (National Kidney Foundation, 2015).

Hemodialysis is often done as long-term therapy in chronic renal failure (CRF), (Nesrallah *et al.*, 2014). Usually, chronic kidney failure is treated at home or in a community-based outpatient clinic; however, patients can also be dialysis in the ICU, especially in critical conditions such as cases of cardiac tamponade, heart failure, and severe anemia. Although critical nursing nurses usually do not operate hemodialysis machines, they must monitor patients, in collaboration with nurses who are trained to use hemodialysis (Terry and Weaver, 2013). Nurses as patient advocates must minimize the emotional and physical effects of painful procedures, so nurses are required to conduct a study of appropriate methods to control pain due to a procedure with cold compresses (cold therapy), as non-pharmacological pain management that is expected to be integrated with modern medical treatment because it is part of complementary therapy (Costello *et al.*, 2012). If the pain is not treated, it can cause anxiety, sleep disturbance, fear, hypertension, tachycardia, neural plasticity (kornudorsalis), nociceptive transmission which is facilitated so as to increase pain sensitivity (Suwanraj, 2010). One strategy to reduce pain by using a non-pharmacological approach is cold compresses. (Potter and Perry, 2006) explain that cold compresses are also effective before the needle prick invasion of the skin. In this study, patients with

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hemodialysis on average experienced pain during the insertion of the arteries and veins. Insertion of the skin is a stimulus to the tissue that will stimulate the nociceptors to release chemicals, consisting of prostaglandins, histamine, bradykinin, leukotrienes, p substances, and proteolytic enzymes. These chemicals will stimulate nerve endings and convey impulses to the brain (Bleakley, McDonough and MacAuley, 2004).

Then the researchers applied a cold compress to the site of insertion with arteriovenous fistula. In this study using cold water with a temperature of 13.5°C at room temperature. When used for ice massage (compress), ice is removed from the freezer and measured with an ice thermometer to a temperature of 13.5°C. Researchers have difficulty when the ice must be at a temperature of 13.5°C it takes 10 minutes after the ice is removed from the freezer. After ice at a temperature of 13.5°C, the ice is put into a rubber ice bag, then do an ice massage (compress) at the insertion site with arteriovenous fistula which will be inserted for 3 minutes or the respondent feels numb in the area. The results showed that after giving a cold compress to the intervention group the pain scale of the majority of respondents showed a pain scale in the mild to moderate range. Whereas in the control group that was not given treatment, the pain scale of the majority of respondents showed pain in the range of moderate to severe pain, this proves that the administration of cold compresses affected the pain response during arterial and venous insertion in hemodialysis patients.

Cold stimulation of the skin in the range of 10°C to 45°C will reduce the conduction of nerve sensory nerve impulses so that pain stimulation to the hypothalamus will be inhibited and accepted longer (Potter and Perry, 2006; D'Arcy, 2007). The effectiveness of cold compresses does not depend on stimulation of A-delta fibers, but ice decreases the conduction velocity of nociceptive nerve fibers, making the fibers unable to transmit pain signals to the spinal cord (Black and Hawks, 2014). Cold impulses specifically affect polymodal nociceptive receptors of type C nerve fibers that work slowly <3 seconds until someone is aware of them. The cold compress will activate the thalamus system to adapt if the skin is exposed to a temperature of 28.7 - 12.5°C, the response of homeostasis will run more slowly at that temperature (Craig, 2003).

Cold compresses can reduce nerve conduction velocity (NCV) and inhibitory nociceptors. Changes in NCV, associated with increased pain threshold or Pain Threshold (PTH) and pain tolerance or Pain Tolerance (PTO). Nerve Conduction Velocity significantly decreases with decreasing skin temperature during cold compresses. A reduction equivalent to 0.4 m / s decreases in NCV for every 1°C decrease in skin temperature (Algafly and George, 2007; Kumar and Saha, 2011). Skin temperature of 13.5°C is needed to reduce NCV by 10%, a skin temperature of 15°C is needed to reduce NCV by 17% and skin temperature of 10°C is needed to reduce NCV by 33%. (Mahajan *et al.*, 2008) recommend cold compresses before venipuncture is very effective in reducing pain due to the insertion of arteriovenous fistula needles in hemodialysis patients and can be adopted as an effective alternative therapy in pain management in hospitals.

Reduction of pain with cold compresses at the insertion site will cause intercellular transduction which will stimulate the somato-visceral cutaneous reflex so that the skin cannot feel pain (numbness). Furthermore, this numbness is delivered by A-delta fibers and C fibers to the spinal cord which will cause the release of endorphin neurotransmitters. With the presence of endorphins will inhibit pain transmission and will also cause changes in the level of pain perception. Cold compresses have been shown to be effective in reducing pain perception in patients with arterial and venous insertion (Gorji *et al.*, 2014). The results of this study are supported by (Mahajan *et al.*, 2008) on the effect of cold compresses on pain reduction in the insertion of

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arteriovenous fistulas showing a decrease in pain. In a study conducted by (Mahajan *et al.*, 2008) compresses were performed with ice massage at a contralateral large intestine 4 location for 10 minutes before insertion showed a very significant decrease in pain.

Research conducted (Costello *et al.*, 2012) states that there is a significant influence of cold compresses on pain intensity after cardiac surgery postoperatively and this is also supported by (Mahajan *et al.*, 2008) application of cold compresses can reduce pain perception in patients with the insertion of an AV shunt in the hemodialysis unit.

(Gorji *et al.*, 2014) mentioned that cold compresses are a common and useful therapeutic modality often used in treating various conditions. It's easy to apply to patients to take action independently. (Movahedi *et al.*, 2006) recommends cold compresses before venipuncture is very effective in reducing pain due to arteriovenous insertion of fistulas in patients with hemodialysis and can be adopted as an effective alternative therapy in pain management in hospitals. Cold compress is a therapeutic modality that can absorb tissue temperature so that tissue temperature decreases past the conduction mechanism. The cooling effect that occurs depends on the type of cold therapy application, duration of therapy, and conductivity. Basically for therapy to be effective, it is necessary to reduce the temperature at the injury site. Changes in tissue temperature vary depending on exposure time, initial temperature and anatomical location. Cold temperatures can inhibit pain pathways in channeling excitatory pain (Bleakley, McDonough and MacAuley, 2004).

(Kumar and Saha, 2011) say the use of cold sensations to inhibit pain is the role of the anatomical and physiological principles of nociceptors (pain) on the skin. When sensory nerve fibers are exposed to pain it will then transmit these pain signals to the brain. A thin delinquent A-delta fibers transmit acute pain. Whereas unielined C fibers transmit chronic pain stimuli and itching. The detector of heat, cold and pain is a transmembrane protein found in the plasma membrane of sensory neurons and around cells. One neuron is able to respond to several stimuli. The signal travels from the axon to the dorsal ganglion root (DRG) of the spinal cord and then to the brain. Because nerve impulses react based on the principle of "all or nothing" capacity, some stimulations that depolarize the nerve temporarily activate other sensations. In this case, the pain transmembrane protein cannot eliminate the action potential when the cold transducer is activated. Through competitive inhibition, cold sensations inhibit the transmission of pain to cause anesthetic effects.

IV. CONCLUSION

Giving a cold compress temperature of 13.5°C for 3 minutes in the area of insertion of arteries and veins can reduce the perception of pain in hemodialysis patients.

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