



THE EFFECT OF VIRTUAL REALITY (VR) RELAXATION ON THE PAIN SCALE DURING VASCULAR ACCESS CANNULATION PROCEDURES

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ABSTRACT

Cannulation is an act of inserting a needle through the skin into a blood vessel (AV Shunt or Femoral) as a means of connecting the vascular circulation and the dialysis machine during the hemodialysis process, cannulation is a procedure that causes psychological problems in the form of anxiety and physical problems in the form of pain due to the insertion of a large needle during hemodialysis. Relaxation training can be done for a limited period of time and usually has no side effects. One of them can use the Guided imagery technique. The purpose of this study was to determine the effect of Virtual Reality (VR) relaxation on the pain scale during the Vascular Access Cannulation procedure for Hemodialysis Patients at Maguan Husada Pracimantoro Hospital. This study used a Pre-experimental research type with One group pretest-posttest design, conducted in the Hemodialysis Room of Maguan Husada Pracimantoro Hospital in March 2024. This study uses purposive sampling technique. The sample used was 56 people. The data collection tool used a numeric rating scale pain assessment sheet. The data analysis used was the Wilcoxon analysis. The results of the study showed that pain before Virtual Reality (VR) relaxation was carried out, the average pain of respondents was 5.96. Pain after Virtual Reality (VR) relaxation for 10 minutes 38 seconds was known to have an average pain of respondents on a scale of 3.36. The results of the Wilcoxon Strained Rank Test with a significant value (p value) of $0.000 < 0.005$. There is an effect of virtual reality (VR) relaxation on the pain scale during the procedure of installing vascular access cannulation for hemodialysis patients at Maguan Husada Pracimantoro Hospital.

Keywords: pain; relaxation; virtual reality (vr)

How to cite (in APA style)

Yulianti, E., Putri, D. S. R., & Hapsari, H. I. (2024). The Effect of Virtual Reality (VR) Relaxation on the Pain Scale During Vascular Access Cannulation Procedures. *Indonesian Journal of Global Health Research*, 7(2), 1-10. <https://doi.org/10.37287/ijghr.v7i2.4308>.

INTRODUCTION

Chronic kidney failure is a condition in which the kidneys are unable to filter waste products from the blood or regulate endocrine and metabolic functions, resulting in disturbances in the balance of electrolytes and acid-base fluids (Fitria & Blandina, 2023). In patients with Chronic Kidney Disease, if kidney function is severely reduced with a Glomerular Filtration Rate (GFR) of less than $15 \text{ ml/minute}/1.73 \text{ m}^2$, then this condition is called Chronic Kidney Failure (Anggraini & Fadila, 2023). According to research by Romaniah & Sunarno (2022), the prevalence of chronic kidney failure worldwide is estimated to reach 13.4% or 8-16% of the global population. In Indonesia, the incidence of CKD is highest in the age group of 65-74 years with a percentage of 8.23%. Central Java Province in 2018 ranked third in CKD cases based on doctor's diagnosis with a percentage of 0.31% (Ministry of the Republic of Indonesia, 2020).

Research by Suwariyah & Rachmawati (2023) shows that in the hemodialysis procedure, a device is required to obtain vascular access connected to the hemodialysis machine, known as cannulation. This procedure can cause psychological problems such as anxiety and physical

problems such as pain due to large needle insertion. The results of this study are in line with research conducted by Ibrahim (2022) that 32.5% of hemodialysis patients studied experienced moderate pain and 30.8% experienced mild pain, while 27.4% of them experienced severe pain. Pain management through relaxation measures is usually carried out for a limited period of time and generally has no side effects. One technique is Guided imagery, which uses the power of the mind to direct the body in the healing and relaxation process by involving all the senses (visual, touch, sight, and hearing) (Firmada et al, 2021). In this modern era, virtual reality (VR) technology has been developed to maximize the results of pain management in patients with various diseases (Gupta et al, 2022).

Virtual reality (VR) is a technological innovation that facilitates users to enjoy a realistic three-dimensional visual experience, thus inhibiting visual stimuli and sound perception from real life and reducing pain (Prastiwi, 2022). Virtual reality is a set of technologies supported by computers or mobile devices that can perform 3D visualization interactively and easily controlled. Virtual reality devices are usually installed on the user's head (Kyraana & Arafat, 2023). The results of observations conducted by researchers in November 2023 showed that during the installation of vascular access cannulation, out of 10 hemodialysis patients who were assessed, 8 patients experienced moderate to severe pain (scale 6-9), appeared to grimace and scream in pain. Efforts that have been made by nurses in pain management are deep breathing relaxation and some patients bring ethyl chloride spray to reduce pain. However, according to patients, these efforts are less effective in reducing pain. Based on this background, the researcher is interested in taking the title of the effect of Virtual Reality (VR) relaxation on the pain scale in the procedure of installing vascular access cannulation for hemodialysis patients at Maguan Husada Pracimantoro Hospital. The purpose of this study was to determine the effect of Virtual Reality (VR) relaxation on the pain scale during the Vascular Access Cannulation procedure for Hemodialysis Patients at Maguan Husada Pracimantoro Hospital

METHOD

This type of research is a pre-experimental study with One group pretest-posttest design. The population in this study was 129. The sampling technique used purposive sampling, namely 56 patients. This study was conducted in March 2024 in the Hemodialysis Room of Maguan Husada Pracimantoro Hospital. The inclusion criteria are as follows: patients who are willing to be respondents, patients with AV shunts, patients who experience pain, patients who participate in the study and intervention until completion, patients with full consciousness and cooperation. The research tool used was the SOP for implementing Virtual Reality (VR) interventions sourced from Saputra (2020). NRS pain assessment sheet. This scale uses a range of 0-10. "0" means no pain and "10" indicates severe pain. In order to use the measuring tool, users are advised to select a mark on the pain scale that they feel, the interpretation is seen from where the pain scale mark is placed (Ustinerz, 2023). Researchers assessed pain in patients after vascular access cannulation and recorded it on the numeric rating scale pain assessment sheet (pre-test data), researchers provided Virtual Reality (VR) for 10-15 minutes in the form of underwater views, researchers assessed pain after vascular access cannulation with Virtual Reality (VR) intervention and recorded it on the NRS pain assessment sheet (post-test data). Analysis of research data using Wilcoxon analysis.

RESULTS

Table 1.
Respondent Characteristics Based on Gender (n=56)

Gender	f	%
Male	37	66,1
Female	19	33,9

Table 2.
Respondent Characteristics Based on Age (n=56)

Age	f	%
26-35 years old	2	3,6
36-45 years old	20	35,7
46-55 years old	26	46,4
56-65 years old	8	14,3

Table 3.
Respondent Characteristics Based on Education (n=56)

Education	f	%
SD	10	17,9
SMP	22	39,3
SMA	19	33,9
College	5	8,9

Table 4.
Pain Before Virtual Reality Relaxation (n=56)

Pretest	Value
Minimal	4
Maximal	8
Mean	5,96
Median	6
Standart Deviasi	1,144

Table 5.
Pain After Virtual Reality Relaxation (n=56)

Posttest	Value
Minimal	3
Maximal	6
Mean	3,37
Median	3
Standart Deviasi	0,724

Table 6.
Normality Test (n=56)

Data	Statistik	Sig
Pretest	0,192	0,000
Posttest	0,457	0,000

Table 7.
Uji Wilcoxon (n=56)

Data	Median (Min-Max)	Sig
Pain scale before administration of Virtual Reality (VR)	6 (4-8)	0,000
Pain scale after administration of Virtual Reality (VR)	3 (3-6)	

DISCUSSION

Respondent Characteristics Based on Gender

Based on Table 1, the majority of gender is male, namely 37 people (66.1%). This study is in line with research conducted by Pranandhira et al (2023) that the majority of patients undergoing dialysis are male, as many as 58 people (58%). The results of another study conducted previously by Salsabila et al (2023) showed that chronic kidney failure patients have a higher number of men with a percentage of 68.9%, namely 2 patients out of 90 patients, while women are only 28 patients out of 90 patients with a percentage of 31.1%. Another study conducted by Ipo et al (2020) found that out of 89 respondents, most of the respondents were male (52.8%) compared to female (47.2%). Women tend to experience greater pain than men because they have a smaller trigeminal nerve volume. In addition, the hormones estrogen and progesterone in women play a significant role in pain sensitivity. Estrogen can increase pain sensitization both centrally and peripherally, while progesterone contributes to a decrease in the pain threshold (Hidayati et al, 2021). Women tend to have a lower pain threshold than men, which is influenced by differences in the nervous system and the processing of pain signals in the brain. Estrogen in women can increase sensitivity to pain, while testosterone in men may have an analgesic effect that reduces pain (Fillingim et al, 2020). The menstrual cycle in women also plays an important role in pain response. Fluctuating levels of estrogen and progesterone hormones during the menstrual cycle can affect the pain threshold and sensitivity to pain (Racine et al, 2020). According to researchers, this is because clinically men have a greater risk of developing kidney failure than women. This tendency is likely due to lifestyle factors such as smoking and consuming alcohol which tend to be more common in men.

Respondent Characteristics Based on Age

Based on Table 2, the characteristics of respondents based on age are known to be the most, namely 46-55 years, as many as 26 people (46.7%). The results of this study are in line with research conducted by Tempake & Doho (2021) most of the respondents were in the early elderly age category (46-55 years) namely 38 respondents (36%), and a small portion were in the late teenage age category namely 6 respondents (6%). Another study conducted by Hasanah et al (2023) most patients with chronic kidney failure were in the 46-55 year age group with a total of 28 people (35%). The results of another study from Tuloli et al (2020) which stated that chronic kidney failure patients undergoing HD at Toto Kabila Hospital were mostly aged 46-55 years and 56-65 years with a percentage of 30.23%. At the age of 40, the glomerular filtration rate (GFR) decreases progressively, reaching about 50% of normal values at the age of 70 due to the loss of nephrons.

This decline reduces the kidneys' ability to absorb food and can lead to decreased kidney function and the risk of kidney failure, which is part of the natural aging process (Prasetyo et al, 2020). Smith et al's (2021) study showed that older people reported lower pain intensity than younger people, even though the pain stimulus was the same, possibly due to neurophysiological changes such as decreased pain receptor density and sensory nerve function with age. According to Sugathot & Nugrahaningtyas (2020), age affects pain perception, with children and older people responding to pain differently. Adults experience neurophysiological changes that can reduce sensory perception and increase pain thresholds. According to researchers, age is closely related to disease prognosis and life expectancy, especially for those over 55 years of age. The likelihood of various complications that can worsen kidney function is much greater than those under 40 years of age.

Respondent Characteristics Based on Education

Based on Table 3, the highest education was junior high school, 22 people (39.3%). This study is in line with research conducted by Komariyah and Aini (2024) that the majority of respondents in this study, namely 12 people (37.5%), were educated up to junior high school. Hartini's research (2020) found that the highest proportion of education in the low/basic education category (elementary school & junior high school) was 64 respondents (47.8%). Individuals with basic education often have difficulty understanding health information and pay less attention to health issues, which can lead to chronic diseases such as chronic kidney failure. Respondents with low levels of education also have limitations in accessing health services to manage their chronic diseases (Aditya, 2023). According to Johnson & Davis (2020), patients with higher education tend to be more proactive in managing pain, using non-pharmacological therapies, seeking timely medical care, and complying with treatment plans, so that their pain response is better.

According to researchers, the level of education is related to a person's health condition, the higher a person's level of education, the greater their knowledge of how to improve the quality of life to maintain health. This includes daily health behaviors, healthy diet patterns, exercise, and the ability to search for and access health information. The relationship between education level and pain is believed by researchers to have a relationship, especially regarding pain management, which is very important for patients. This not only helps them cope with physical pain but also supports them during invasive procedures. Therefore, increasing health education for patients needs to be encouraged.

Pain Before Virtual Reality Relaxation

Based on Table 4, the pain before Virtual Reality (VR) relaxation was known, the average pain of respondents was 5.96. The results of this study are in line with research conducted by Ibrahim (2022) that 32.5% of hemodialysis patients studied experienced moderate pain and 30.8% experienced mild pain, while 27.4% of them experienced severe pain. Non-pharmacological pain management for kidney patients includes pain management related to fistula cannulation (Gerogianni, 2023). Approximately 20% of patients undergoing hemodialysis experience severe pain during cannulation, even though they have used topical analgesics (Inamaya et al, 2022). Approximately 48% of dialysis patients are afraid of the pain when the needle is inserted into the fistula. The pain experienced is mostly related to the puncture of the fistula and can trigger symptoms of depression. Pain is a common problem in dialysis patients. This pain often causes sleep disturbances, decreased compliance with hemodialysis treatment, frequent hospitalizations, decreased quality of life, and high mortality rates. Non-pharmacological pain management for kidney patients includes pain management related to fistula cannulation (Gerogianni, 2023). According to Smith et al (2022) visual and audio stimulation from VR affects the activity of the amygdala, which is involved in emotions such as fear and anxiety. The brain processes stimuli as if they were real, thereby increasing or decreasing emotional responses according to the content presented.

Physical stimuli are converted into electrical currents by differences in potassium and sodium ions, which are sent through the vestibulocochlear nerve to the brain in the auditory area. Action potentials generated by the auditory nerve are forwarded to the auditory cortex in the temporal lobe to process sound. The thalamus forwards impulses to the amygdala, part of the limbic system that influences emotional memory, emotions, and behavior (Risnawati, 2020), thereby helping to reduce feelings of stress and increase a relaxed state (Hidayat & Prijotomo, 2020).

Pain After Virtual Reality Relaxation

Based on Table 5, it is known that pain after Virtual Reality (VR) relaxation is known that the average pain scale of respondents is 3.37. Pain can be interpreted as an unpleasant sensation that is emotionally and sensually related to tissue damage and the presence of other factors that make a person suffer and feel depressed, namely daily psychological activities or affecting others (Ardiansyah, 2022). Research conducted by Pranowo et al (2020) the pain scale of patients during cannulation (femoral access inlet) hemodialysis without action has an average of 7 and previously given a cold compress, has an average of 4. There is a significant difference in the pain scale between before giving a cold compress and after giving a cold compress during cannulation (femoral access inlet) hemodialysis. In this study, what researchers did in non-pharmacological pain management during access installation was to provide relaxation interventions with VR media. Virtual reality (VR) is a technological innovation that facilitates users to enjoy a realistic three-dimensional visual experience, thereby inhibiting visual stimuli and sound perception from real life and being able to reduce pain (Prastiwi, 2022). According to Smith et al (2022) visual and audio stimulation from VR affects the activity of the amygdala, which is involved in emotions such as fear and anxiety. The brain processes stimuli as if they were real, thereby increasing or decreasing emotional responses according to the content presented, thereby helping to reduce feelings of stress and increase a relaxed state (Hidayat & Prijotomo, 2020).

Bivariat Analysis

Based on Table 6, it is known that the data normality test using Kolmogorov-Smirnov shows a p value <0.05 , so the data is declared not normally distributed so the data is analyzed using an alternative test from the paired sample test, namely the Wilcoxon test. Based on Table 7, it is known that the p value <0.05 , then H_0 is rejected and H_1 is accepted, meaning that there is an effect of virtual reality (VR) relaxation on the pain scale in the vascular access cannulation procedure for hemodialysis patients at Maguan Husada Pracimantoro Hospital. Another study using VR media was also conducted by Alemanno et al (2020) that the non-pharmacological VR approach is able to overcome the multidimensional aspects of pain and improve the quality of life of patients, pain intensity, mood, and functional abilities of patients. The research study by Jones et al (2020) showed that VR designed for meditation and relaxation can reduce chronic pain by allowing patients to "escape" to a calm environment and accompanied by breathing exercises and relaxation music, which helps modulate the nervous system and improve quality of life. VR creates an immersive virtual environment, helping to distract patients from pain. Studies show that VR is effective in reducing pain perception in postoperative patients and in painful medical procedures by providing a rich visual and auditory experience, thereby reducing awareness of pain (Garrett et al, 2020). Mathever's (2020) research also provides evidence that distraction using VR is effective in reducing pain intensity during exercise in patients with LBP. This happens because VR presents virtual visualizations that provide a distraction effect, thereby helping to reduce pain.

According to Smith et al (2022) visual and audio stimulation from VR affects the activity of the amygdala, which is involved in emotions such as fear and anxiety. The brain processes stimuli as if they were real, thereby increasing or decreasing emotional responses according to the content presented. Physical stimuli are converted into electrical currents by differences in potassium and sodium ions, which are sent through the vestibulocochlear nerve to the brain in the auditory area. The action potential generated by the auditory nerve is forwarded to the auditory cortex in the temporal lobe to process sound. The thalamus forwards impulses to the amygdala, part of the limbic system that affects emotional memory, emotions, and behavior (Risnawati, 2020), thereby helping to reduce feelings of stress and increase a relaxed state

(Hidayat & Prijotomo, 2020). Meanwhile, according to Brown & Anderson (2021), VR can modulate activity in the hippocampus, which is the center of memory and spatial orientation in the limbic system. The experience felt in VR can help in memory processing and storage, as well as in trauma therapy, where repetition and narrative control in VR can reduce negative emotional responses associated with traumatic memories. The VR process can reduce pain by replicating the device's depiction of three-dimensional space through users who seem real either directly or through physical touch (Hayasi et al, 2020). Now VR is equipped with equipment that is able to present imagination for users as if they are dissolved or in the digital world so that it has an impact on shifting concentration. When VR is adapted according to the patient's ability level, it increases in the right intensity, this allows patients to be fully involved in the application, which has a positive impact on their self-management. It also helps reduce anxiety about certain movements (Alemano et al, 2020). According to researchers, the VR approach can reduce pain by creating interactive and real three-dimensional simulations, providing a distraction effect that makes users feel immersed in the virtual world. VR tailored to the patient's functional level can increase patient engagement in the application and have a positive impact on self-management. VR can be considered an adjunct to pain management and has been shown to be effective in the treatment of both acute and chronic pain.

CONCLUSION

There is an effect of virtual reality (VR) relaxation on the pain scale during the procedure of installing vascular access cannulation for hemodialysis patients at Maguan Husada Pracimantoro Hospital.

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