



## EFFECTIVENESS OF VIRTUAL REALITY-BASED GUIDED IMAGERY INTERVENTION ON INTRADIALYSIS BLOOD PRESSURE IN PATIENTS UNDERGOING HEMODIALYSIS

Ria Desnita<sup>1\*</sup>, Vivi Syofia Sapardi<sup>1</sup>, Defrima Oka Surya<sup>2</sup>

<sup>1</sup>S1 Nursing Study Programme, Universitas MERCUBAKTIJAYA Padang, Surau Gadang, Nanggalo, Padang, Sumatera Barat 25173, Indonesia

<sup>2</sup>DIII Nursing Study Programme, Universitas MERCUBAKTIJAYA Padang, Surau Gadang, Nanggalo, Padang, Sumatera Barat 25173, Indonesia

\*[ria.desnita@gmail.com](mailto:ria.desnita@gmail.com)

### ABSTRACT

An increase in blood pressure during hemodialysis, known as intradialysis hypertension, if left untreated can lead to death in patients. Guided imagery therapy can provide a relaxing effect on patients to reduce sympathetic nerve overwork. The development of guided imagery therapy with virtual reality technology can project the visualization of objects more real to the patient so that it is expected to further relax the patient during hemodialysis so that blood pressure is stable. The purpose of this study was to determine the effectiveness of virtual reality-based guided imagery intervention on intradialytic blood pressure in hemodialysis patients. The research design was a quasi-experiment using a one-group pre and post-test with a control group approach. The research was conducted in the Hemodialysis Room of dr. Reksodiwiryong Padang hospital. Sampling using purposive sampling technique with a sample size of 13 people in each group. The mean difference in Mean Arterial Pressure in the intervention group before and after the intervention was 5.56, while in the control group, it was 0.51. The study was conducted from July – November 2023, blood pressure data is obtained by direct measurement and then mean arterial pressure was calculated. Data analysis using paired t test. The results of further analysis showed that there was a significant difference in the difference in pre-posttest MAP in the intervention group and control group ( $p = 0.001$ ,  $\alpha = 0.05$ ) so it was concluded that Guided Imagery therapy based on Virtual Reality was effective in controlling intradialysis blood pressure. Guided Imagery therapy intervention based on Virtual Reality can be one of the therapies.

Keywords: blood pressure; guided imaging; intradialysis; virtual reality

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### INTRODUCTION

Chronic kidney disease (CKD) is a progressive and irreversible failure of kidney function. CKD causes the body's function to fail in maintaining metabolism and fluid-electrolyte balance resulting in fluid retention, sodium, and uranium waste in the blood. The disease is characterized by a decreased glomerular filtration rate of  $< 60$  ml/min/1.73 m<sup>2</sup> (Black & Hawk, 2014). The prevalence of CKD continues to increase. Based on data from the Global Burden Of Disease study (GDB), the incidence of CKD in the world reached 9.17% in 2017, in 2018 it was 9.27% and the incidence of CKD increased in 2019 to 9.37% of the total population in the world (GDB, 2023). In Indonesia, based on the results of Basic Health Research in 2018, the incidence of CKD also increased from 2013, from 2.0% to 3.8%. The prevalence of CKD in West Sumatra based on the results of the Basic Health Research in 2018 is in the top 20 of 35 provinces in Indonesia, which is 1.8%. The prevalence of CKD in

West Sumatra is 0.2% of CKD patients in Indonesia. The highest incidence of CKD in West Sumatra province falls in the age group of 45-54 years, which is 0.79% of patients. Regions with the highest CKD in Tanah Datar Regency and Solok City are 0.4%, while in Padang the prevalence of CKD is 0.3% (Kemenkes RI, 2018) Management efforts made to replace kidney function in patients with CKD include peritoneal dialysis, kidney transplantation, and hemodialysis therapy. Hemodialysis is a renal replacement therapy that aims to remove the metabolic waste of protein, water, and electrolytes. Hemodialysis therapy is the therapy of choice for many CKD patients. Based on data from the Global Burden Of Disease study (2019), data on hemodialysis patients in the world were 0.10%. Whereas in Indonesia based on data from the Indonesian Renal Registry (2018) CKD patients undergoing hemodialysis were 132,142 active patients and 66,433 new patients in 2018. In West Sumatra Province, the number of patients undergoing hemodialysis therapy was 1,334 active patients in 2018 (Indonesia Renal Registry, 2018).

Hemodialysis therapy for CKD patients is very beneficial for the survival of patients, but this therapy also has side effects on patients. Side effects of hemodialysis can occur while the patient is undergoing hemodialysis known as intradialysis complications. The most common intradialysis complication experienced by patients is blood pressure changes in the form of intradialysis hypertension. Intradialysis hypertension occurs when blood pressure during dialysis  $> 140/90$  mmHg or mean arterial pressure (MAP) during haemodialysis  $> 107$  mmHg (Sukandar, Enday, 2013) The results of Aji's research (2018) on the description of the incidence of intradialysis hypertension at RSAU Dr. Esnawati Antariksa found that 75% of respondents experienced intradialysis hypertension, where there was an increase in systolic blood pressure  $> 10$  mmHg compared to preanalysis blood pressure. The results of Permana and Sandra's research (2021) also found that 50% of respondents with intradialysis systolic blood pressure were categorized as stage 1 hypertension and 33.3% of respondents with stage 2 hypertension. Based on the results of Armiyati's research (2012), it was found that 70% of patients experienced intradialysis hypertension at PKU Muhammadiyah Yogyakarta Hospital and most were experienced at the 4th hour of hemodialysis.

Intradialysis hypertension can lead to new and more complex problems in patients such as discomfort, increased stress, worsening the patient's condition, and even death. Intradialysis hypertension causes cardiac dysfunction which can lead to heart failure, pulmonary edema, and hypertensive encephalopathy in the brain. Research conducted by Inrig et al. (2007) showed that every increase in blood pressure  $> 10$  mmHg during hemodialysis increases the risk of death 3.68 times. Blood pressure control in intradialysis hypertension can be done pharmacologically and non-pharmacologically. Pharmacological therapy is usually performed by administering antihypertensive agents such as ACE inhibitors and B-blockers. The dialysis procedure may eliminate some antihypertensive drugs, limiting pharmacological therapy. Non-pharmacological therapy in hemodialysis patients can be carried out with the principle of reducing sympathetic nerve overactivity during the hemodialysis process. During hemodialysis, fluid withdrawal occurs which causes increased stress and sympathetic nerve activity, thus increasing blood pressure (Sukandar, Enday, 2013). Non-pharmacological therapy in the form of relaxation therapy can reduce sympathetic nerve stress activity so that it will reduce the pulse rate, heart contractility, and vasodilatation of blood vessels and inhibit the release of the hormone renin which regulates blood pressure.

One of the widely recognized relaxation therapies is guided imagery. Guided imagery is one of the relaxation techniques of individual imagination. This relaxation method involves imagining places and events associated with a pleasant sense of relaxation. Guided imagery

can be developed with virtual reality technology so that the patient's imagination is more real. Virtual reality technology can project a form of visualization, where later the patient seems to be participating and interacting in the virtual world. The results of research by Aprilia et al. (2022) on virtual reality distraction on anxiety levels in hemodialysis patients at the Avio Prima Ciledug Hemodialysis Clinic showed the effect of virtual reality distraction techniques on the anxiety levels of hemodialysis patients.

Several previous studies have examined the effect of guided imagery intervention on blood pressure in patients with generalized hypertension. The results of research by Aji et al. (2022) showed the effect of guided imagery therapy on changes in systolic and diastolic blood pressure in hypertensive patients in the Jayengan Surakarta Health Centre Working Area. The results of Setyani & Rohana's research (2019) also showed that guided imagery relaxation therapy affected reducing systolic and diastolic blood pressure in hypertensive elderly people in Krajan Hamlet, Leban Village, Boja Kendal. The relaxation effect caused by imagination through guided imagery can reduce heart rate and total peripheral resistance by inhibiting the sympathetic nerve stress response. A decrease in sympathetic nerve activity can relax vascular smooth muscle and cause a decrease in blood pressure (Sherwood, 2016).

The results of an initial survey conducted on 5 hemodialysis patients at Dr. M. Djamil Padang Hospital found that the average systolic and diastolic blood pressure of patients while undergoing hemodialysis increased by 10-20 mmHg. The management that has been given in the hemodialysis room of RST Tk. III dr. Reksodiwiryono Padang to control intradialysis hypertension is only in the form of giving hypertension drugs. Giving hypertension drugs is considered less effective because dialysis procedures can eliminate several antihypertensive drugs so that blood pressure does not drop. To overcome this, the room usually stops the dialysis process or reduces the patient's blood flow rate to the hemodialysis machine. From the existing conditions, non-pharmacological therapy is needed to manage this problem, one of which is complementary therapy. Based on the existing phenomenon the aim of this research is to determine the effect of virtual reality-based guided imagery on intradialysis blood pressure in hemodialysis patients.

## **METHOD**

The research design used in this study was a quasi-experiment with a pre and post-approach with a control group design. This research was conducted at RST Tk. III dr. Reksodiwiryono, Padang City. This research was conducted in July - November 2023. The sampling technique used was nonprobability sampling with consecutive sampling based on the inclusion and exclusion criteria set. The inclusion criteria for this study were: a. willing to be a research respondent, b. patients can communicate well, c. Compos mentis patients. The exclusion criteria in this study are patients who experience visual impairment, hearing loss, and uncooperative. As well as the presence of complications during hemodialysis which makes it impossible to provide intervention. The number of samples in this study was 26 people, 13 people in the intervention group and 13 people in the control group. Researchers assessed patients who met the inclusion and exclusion criteria and the divided respondents into 2 groups. Blood pressure data is obtained by direct measurement and than mean arterial ressure was calculated. Blood pressure was measured before and after the intervention.

The intervention is provided in the form of guided imagination with the help of virtual reality tools given to patients during hemodialysis. This exercise was performed for 30 minutes during the first hour of hemodialysis. The intervention was given to patients for 2 times undergoing HD (1 week). Blood pressure was assessed based on mean arterial pressure

(MAP). MAP was assessed before and after the intervention. This study was conducted after obtaining research ethics approval number: 553/KEPK.F1/ETIK/2023. Data analysis to see the difference between pretest and posttest results in the control and intervention groups used paired t-tests because the data was normally distributed. Data analysis to see the difference between pretest and post-test results in the control and intervention groups using the Mann-Whitney test because the data were not normally distributed. The interpretation of the research results is seen based on the p-value obtained in the bivariate test.

**RESULTS**

Table 1.

Mean Arterial Pressure (MAP) Before and After the Virtual Reality-based Guided Imagery Therapy Intervention in the Intervention and Control Groups (n=26)

| Group        | n  | MAP measurement | Mean ± SD     | Min-Maks       |
|--------------|----|-----------------|---------------|----------------|
| Intervention | 13 | Before          | 105,13 ± 6,58 | 96,67 – 113,33 |
|              |    | After           | 99,56 ± 8,77  | 78,67 – 114,33 |
| Control      | 13 | Before          | 101,79 ± 8,88 | 76,67 – 113,33 |
|              |    | After           | 101,28 ± 8,76 | 76,67 – 113,33 |

Table 1. shows that MAP before the intervention was slightly higher in the intervention group where in the intervention group the average was 105.13 mmHg and in the control group 101.79 mmHg. After the intervention, MAP in the intervention group decreased compared to the control group where in the intervention group the average was 99.56 mmHg, and in the control group 101.28 mmHg. The effectiveness of Virtual Reality-Based Guided Imagery therapy on intradialysis blood pressure is seen based on differences in blood pressure results before and after Virtual Reality-Based Guided Imagery therapy in the intervention and control groups as found in table 2 below.

Table 2.

Differences in MAP before and after Guided Imagery Intervention Based on Virtual Reality in the Intervention and Control Groups (n=26)

| Variable | Intervention (n=13) |      | p    | Control (n=13)  |        | p    |      |                 |
|----------|---------------------|------|------|-----------------|--------|------|------|-----------------|
|          | Mean                | SD   |      | Mean difference | Mean   |      | SD   | Mean difference |
| MAP      |                     |      |      |                 |        |      |      |                 |
| Before   | 105,13              | 6,58 | 5,56 | 0,005           | 101,79 | 8,88 | 0,51 | 0,436           |
| After    | 99,56               | 8,77 |      |                 | 101,28 | 8,76 |      |                 |

Table 2, the difference in mean MAP before and after the intervention of Virtual Reality-based Guided Imagery therapy in the intervention group is 5.56, the results of further analysis show that there is a significant difference in mean MAP before and after the intervention of Virtual Reality-based Guided Imagery therapy in the intervention group (p=0.005; α = 0.05). The difference in mean MAP before and after the Virtual Reality-Based Guided Imagery therapy intervention in the control group is 0.51, the results of further analysis show there is no significant difference in mean MAP before and after the Virtual Reality-Based Guided Imagery therapy intervention in the control group (p=0.436; α = 0.05).

To assess the effectiveness of Virtual Reality-Based Guided Imagery therapy on intradialysis blood pressure is also seen based on the difference in MAP difference before and after intervention in the intervention group and control group using the Mann-Whitney test because the data is not normally distributed. The difference in MAP difference before and after intervention in the intervention group and control group can be seen in Table 3 below.

Table 3.

Difference in MAP before and after Guided Imagery Intervention Based on Virtual Reality in the Intervention and Control Groups (n=26)

| Group        | f  | Pre-post MAP mean difference | Pre-post SD difference | p     |
|--------------|----|------------------------------|------------------------|-------|
| Intervention | 13 | 5,56                         | 5,76                   | 0,001 |
| Control      | 13 | 0,51                         | 229                    |       |

Table 3, it is known that the average difference in MAP in the intervention group before and after the intervention is 5.56, while in the control group is 0.51. The results of further analysis showed that there was a significant difference in the difference in pre-posttest MAP in the intervention group and the control group ( $p = 0.001$ ,  $\alpha = 0.05$ ) so it was concluded that Guided Imagery Therapy Based on Virtual Reality was effective in controlling intradialysis blood pressure.

## DISCUSSION

Based on the results of the study, the mean blood pressure based on the MAP value before the intervention in the intervention group averaged 105.13 mmHg, and in the control group 101.79 mmHg. These mean values indicate high blood pressure values during hemodialysis. Intradialysis hypertension is an increase in systolic blood pressure >10mmHg during hemodialysis. Patients who develop intradialytic hypertension have old age, interdialytic weight gain (IDWG), comorbidities, a long history of hemodialysis, and take many anti-hypertensive drugs. Intradialysis hypertension has a prevalence of 5-15% of cases and can cause death. According to Inrig et al, 213 out of 1718 patients (12.2%) had intradialysis hypertension with an increase in systolic blood pressure >10 mmHg from predialysis to post-dialysis. A recent cohort study defined intradialysis hypertension as an increase in systolic blood pressure >10mmHg from predialysis to post-dialysis that occurred over 6 months and occurred in almost (90%) of patients. Analysis conducted by the US Renal Data System Dialysis Morbidity and Mortality Wave II reported every 10 mmHg increase from predialysis to post-dialysis leads to a risk of death (12%) during an average follow-up of 2 years (Inrig et al., 2009). During hemodialysis, fluid withdrawal occurs which causes increased stress and sympathetic nerve activity thus increasing blood pressure (Sukandar, Enday, 2013).

In this study, 100% of respondents involved in the study experienced hemodialysis hypertension. The results of this study are in line with Aji's research (2018) on the description of the incidence of intradialysis hypertension at RSAU Dr. Esnawati Antariksa found that 75% of respondents experienced intradialysis hypertension, where there was an increase in systolic blood pressure > 10 mmHg compared to preanalysis blood pressure. The results of Permana and Sandra's research (2021) also found that 50% of respondents with intradialysis systolic blood pressure were categorized as stage 1 hypertension and 33.3% of respondents with stage 2 hypertension. Based on the results of the analysis of the difference in mean MAP before and after the intervention of Virtual Reality-based Guided Imagery therapy in the intervention group, it is known that there is a decrease in MAP blood pressure after the respondent is given the intervention. Based on the difference in MAP difference before and after intervention in the intervention group and the control group, it is concluded that Virtual Reality-Based Guided Imagery therapy is effective for controlling intradialysis blood pressure.

The results of this study are in line with several previous studies on the effect of guided imagery intervention on blood pressure in general hypertension patients. The results of research by Aji et al. (2022) showed the effect of guided imagery therapy on changes in systolic and diastolic blood pressure in hypertensive patients in the Jayengan Surakarta Health

Centre Working Area. The results of Setyani & Rohana's research (2019) also showed that guided imagery relaxation therapy affected reducing systolic and diastolic blood pressure in hypertensive elderly people in Krajan Hamlet, Leban Village Boja Kendal. Intradialytic hypertension (IDH) is a paradoxical rise in blood pressure (BP) that occurs during or immediately after a hemodialysis (HD) session. It is defined by BP values exceeding those at the onset of dialysis and is associated with increased risk of hospitalization and mortality in hemodialysis patients (Prasad et al., 2022). Several studies have investigated nonpharmacological and pharmacological measures to manage IDH. One such approach is the use of intradialytic exercise and relaxation, which have been shown to stabilize blood pressure in hemodialysis patients (Mufidah et al., 2019). One of relaxation technique is guided imagery.

Guided imagery is a mind-body technique that uses mental images to promote relaxation and feelings of wellness. It can range from visualization and direct imagery-based suggestions to metaphor and storytelling, based on the perspective that the mind and body are interrelated and can have bilateral interactions. In guided imagery, the brain is activated to imagine an event in a positive and proactive manner prior to that an individual experience the actual event. In other words, the patient is guided to develop a desirable image mentally and to focus the imagination to feel, see, hear, and smell the event like a real event (Beizee et al., 2018). The reduction in blood pressure after relaxation and distraction in guided imagery therapy is attributed to muscle relaxation, decreased vascular resistance, and decreased sympathetic system activity in patients (Keshvari et al., 2021). Guided imagery is a powerful technique that involves the use of imagination and visualization to promote relaxation and reduce stress. In the context of patients undergoing hemodialysis, where blood pressure management is crucial, guided imagery interventions can potentially be beneficial. During hemodialysis, patients often experience anxiety and stress due to the procedure itself, as well as concerns about their health. This can contribute to fluctuations in blood pressure, which may not be ideal for the patient's well-being. Guided imagery interventions can help alleviate this stress and anxiety, thereby potentially reducing blood pressure variability during the dialysis session. Guided imagery is believed to work by reducing stress levels and promoting relaxation. It stimulates the release of endorphins, which have a relaxing effect and help to decrease sympathetic activity, leading to a decrease in blood pressure. The technique also helps to increase the response of serotonin hormones, which can affect mood and blood pressure control (Ekawati et al., 2022)

The relaxing effect of guided imagery can reduce heart rate and total peripheral resistance by inhibiting the sympathetic nerve stress response. A decrease in sympathetic nerve activity can relax vascular smooth muscle and cause a decrease in blood pressure (Sherwood, 2016). The relaxing effect decreases sympathetic nerve stress activity so that it will reduce pulse rate and heart contractility, vasodilatation of blood vessels, and inhibit the release of renin hormone which regulates blood pressure. The duration of guided imagery practice can vary from 10 to 30 minutes. For example, a study published in the *Jurnal Kepawatan* found that guided imagery significantly reduced systolic blood pressure by 20 mmHg and diastolic blood pressure by 10 mmHg after a 30-minute intervention (Mantiri et al., 2024). Another study by Lannasari et al. (2023) found that guided imagery-based spiritual care significantly reduced systolic blood pressure and diastolic blood pressure in hypertensive patients after a 20-minute intervention.

The effectiveness of virtual reality techniques in the health sector has been proven based on the results of previous research. The results of a literature review (Eva Yulianti & Sigit

Mulyono, 2021) on the effectiveness of virtual reality in reducing preoperative anxiety levels in patients undergoing anesthetic procedures. The results of 10 studies in various countries in the world with various research designs including 7 studies with RCT designs, 2 studies with prospective cohorts, and 1 study with meta-analysis show that non-pharmacological interventions with the use of virtual reality are significantly effective in reducing the anxiety levels of preoperative patients who will undergo surgery with anesthetic procedures compared to groups receiving standard care or other distraction techniques.

## **CONCLUSION**

Guided imagery therapy based on virtual reality is effective in controlling intradialysis blood pressure in patients undergoing hemodialysis. Virtual Reality-based Guided Imagery therapy intervention can be one of the non-pharmacological therapies that nurses can apply in the hemodialysis room.

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