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APPLICATION OF VIRTUAL REALITY (VR) ON PAIN SCALE IN POST-OPERATIVE FRACTURE PATIENTS: A CASE STUDY

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ABSTRACT

Background: A fracture is a bone break that is usually caused by trauma or physical force. The force of impact, the condition of the bone, and the soft tissues around it will determine the severity of the fracture. The problem in fracture patients usually arises in postoperative patients, which is pain. The objective of this case study is to understand the nursing care provided to post-operative fracture patients experiencing acute pain through a virtual reality (VR) intervention.
Methods: This research is descriptive, using a case study approach of a single patient post-fracture surgery in the Sakura room at Dr. Soeratno Gemolong Regional General Hospital. Case data collection was conducted for 3 consecutive days, from February 12th to 14th, 2025, with a single 15-minute virtual reality (VR) session featuring a video of natural scenery.
Results: The study shows that virtual reality (VR) reduces pain scores in post-fracture patients, from 6 (moderate pain) to 3 (mild pain).
Conclusion: This virtual reality (VR) intervention is effective in reducing pain levels in post-operative patients.
Keywords: fracture, pain, post-operative, virtual reality

INTRODUCTION

Fractures or broken bones are one form of trauma that often occurs when bones are unable to maintain their structure (Meliana et al., 2024). The fractures can result from accidents, falls, or even daily activities that involve excessive force on the bones (Ewari & Premana, 2021). The incidence of fractures worldwide in 2020 increased, with approximately 13 million people affected and a prevalence rate of 2.7% (WHO, 2020). In Central Java province, 2,700 people experienced fractures, with 56% suffering from physical disabilities, 24% experiencing death, 15% recovering, and 5% experiencing psychological disturbances or depression due to the fracture incident (Noor et al., 2023).

Problems in fracture patients usually arise in post-operative fracture patients, such as physical mobility, infection risk, injury, and pain (Smeltzer & Bare, 2008). Pain is a subjective feeling and discomfort caused by real perceptions such as threats, injuries, and incision/cut wounds. Each person has a unique response to pain, which includes physical, emotional, and cognitive components (Fratama et al., 2024). Pain is distinguished by its duration: acute and chronic. Pain in fracture patients is acute pain. Acute pain is sudden pain, the cause of which can often be identified as tissue injury due to trauma (Suriyati & Zuriati, 2019).

Unmanaged pain can trigger physiological reactions, including hyperglycemia, tachycardia, increased blood pressure, and changes in immune response. Movement is feared by postoperative pain patients, which increases the risk of bowel death, pulmonary

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atelectasis, deep vein thrombosis, and urinary retention (Daulay et al., 2022). If pain is not controlled, it can prolong the healing process, leading to respiratory, excretory, circulatory, and other systemic complications, resulting in some patients potentially dying, decreased quality of life and patient satisfaction, increased length of hospital stay, and higher care costs (Zefrianto et al., 2024).

Pain management can be carried out pharmacologically and non-pharmacologically. The non-pharmacological methods that can be given to postoperative patients include guided imagery, hypnosis, music therapy, relaxation techniques, and distraction techniques. Distraction techniques are often used to manage pain. Distraction is an active coping strategy because patients divert their attention from nociceptive stimuli to reduce awareness of pain (Smerci et al., 2021). The continuous development of technology, such as VR, can be utilized as a non-pharmacological therapy for postoperative patients to reduce pain intensity. VR is a technological tool produced through immersive 3D computers that can make patients feel as if they are part of their virtual environment (Susilowati et al., 2023).

That virtual reality (VR) is highly recommended for patients with acute or chronic pain complaints because it has no side effects, thereby reducing dependence on analgesics or opioids through computer-generated simulations of three-dimensional objects or environments with user interactions that appear realistic, direct, or physical (Prastiwi, 2022) research shows. Supported by the research of Sitopu (2022), VR that displays beautiful natural scenery where users can see visual images in 360 degrees can reduce pain in patients, allowing them to feel the sensation of being in another place without having to get out of bed. In the study by Dewi & Masfuri (2023)Virtual Reality (VR) can be offered as an option to reduce pain because it creates a positive, enjoyable experience by connecting the patient to the external environment and can divert the patient's attention from the sensation of pain. VR is also considered feasible and safe due to its low side-effect profile and low risk of harm.

Based on the above description, in this case study, the author uses virtual reality as an intervention for patients with post-operative fracture pain, with the aim that virtual reality can reduce pain and provide benefits in reducing pain for post-operative fracture patients

RESEARCH METHOD

Descriptive with a case study design using the nursing process approach to explore nursing care issues in pain reduction. The focus of this case study is on post-operative fracture patients with acute pain who were given virtual reality for 15 minutes a day for 3 consecutive days, featuring videos of natural scenery shown before analgesic therapy.

The authors used inclusion criteria including age 18 to 80 years, hospitalization for 1 to 3 days post-operatively, and the ability to follow and understand instructions when given an intervention. The exclusion criteria are inability to cooperate with the research procedure, severe visual or hearing impairments that could affect the intervention to be administered, patients with head, eye, ear, or neck injuries or surgeries, and patients who refuse to participate.

At the implementation stage, the author identified the patient at RSUD Dr. Soeratno Gemolong. Next, the author introduced themselves to the patient and the patient's family, explaining the purpose of the case study. The author requested that the patient's family complete the informed consent form to agree to serve as subjects and to provide the necessary data or information for the case study. The subjects were asked to sign the informed consent form, which had been granted ethical clearance under ethics number 117/I/HREC/2025.

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The tools used in this case study are the Samsung Gear VR device, smartphone, and earphones. The pain scale measurement tool used was the Numeric Rating Scale (NRS). This case study measured the pre-pain scale (NRS) before the intervention. The patient then received a 15-minute virtual reality intervention. Next, the post-pain scale was measured after the virtual reality intervention.

RESULTS

This application was performed on 1 post-fracture surgery patient with acute pain, who underwent pre- and post-tests using NRS for pain scale from day 1 to day 3, with the following results:

Table 1. Patient Pain Levels Before and After Fracture Surgery

Indicator	Day 1	Day 2	Day 3
Pretest	6	5	4
Posttest	5	4	3

Source Data: Processed Data, 2025

Table 1 shows a decrease in pain in post-operative fracture patients from the first day before virtual reality was administered (pain scale 6 [moderate pain]) to the third day after virtual reality was administered (pain scale 3 [mild pain]).

DISCUSSION

During the assessment, it was found that the patient was experiencing acute pain post-operation for a closed fracture of the left radius. The patient is a 78-year-old female housewife with a level of education limited to elementary school. One research has shown that age affects pain sensitivity through physiological factors, biochemical changes, and homeostatic processes that influence the individual's subjective pain perception (Eugenia, 2022) . In the other study, it was revealed that gender affects pain response, especially in women, due to the role of estrogen and progesterone hormones that increase pain sensitivity (Fillingim, 2017). According to Thomtén (2012) theory, educational factors can also influence pain due to a lack of coping strategies or problem-solving skills, making individuals with lower education levels less able to adapt to the pain they experience.

The patient reports pain in the left wrist with a PQRST pain assessment after surgery, P: bone discontinuity, pain felt when moving, Q: like being stabbed, R: the left wrist radiates to the fingers. S: 6 (moderate pain), T: intermittent, pain lasts for 3 minutes and occurs quite frequently. The objective data indicate that the patient grimaces in pain, adopts a protective posture, and is restless. Someone who has undergone a fracture surgery usually experiences pain caused by tissue discontinuity due to the surgery, especially when moving; the pain will be felt, and a person will grimace when the pain increases (Tiyonggo, 2024). In other research, people experiencing pain often adopt a protective posture because the body tries to shield the painful area. This shows a consistency between the facts and the theory obtained by the author, where the patient experiences pain, pain when moved, grimacing, and being protective (Stanton, 2017) .

Based on physical examination, the following vital signs were recorded: BP: 135/77 mmHg, N: 66x/m, R: 20x/m, T: 36°C, SPO2: 98%. The patient's pain can affect the autonomic nervous system, specifically the sympathetic nervous system, leading to vasoconstriction and increased heart muscle contractility, which in turn increases blood pressure (Vita, 2019). Pain will increase if peripheral vascular resistance and cardiac

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output rise, stimulating the sympathetic nerves (Zura, 2016). Thus, pain will react in the body, including increased muscle tension, increased heart rate, and increased blood pressure. This is not in line with the theory of Tarwoto & Wartonah in Dewi (2020), as pulse rate usually increases in post-operative fracture patients. This occurs because the patient's body adapts to pain receptors, so the pain is not severe and is subjective, making it different for each person.

The examination results show swelling from the wrist to the fingers of the left hand and a leukocyte count of 12.26 10^3/µL. This is in line with Deirmengian (2018) study that states the increase in leukocytes after fracture surgery is the body's response to trauma. This occurs because the body releases more leukocytes to aid the healing process, including those that help fight infections around the fracture. Study Tsauroh & Pompey (2023), also revealed that swelling in post-operative fracture patients occurs due to the body's inflammatory response to surgical trauma and bone injury. This is caused by narrowed blood vessels and fluid accumulation, which subsequently leads to swelling. Supported by Cohen (2022)Research shows that both factors are associated with the infection process that can cause pain. This can indicate a correlation between the facts the author obtained during the assessment and the signs and symptoms of post-operative pain in patients.

Pain management is one of the methods used to address the pain experienced by patients, so both pharmacological and non-pharmacological methods must be employed (Sari, 2016). According to Ciftci (2018) pharmacological treatment remains the foundation of postoperative pain management. The commonly used medications are opioids and nonsteroidal anti-inflammatory drugs (NSAIDs). Pharmacological and non-pharmacological treatments should be used simultaneously. With the ongoing development of technology, VR serves as a non-pharmacological treatment to reduce pain in post-operative patients. This is supported by Mawar (2024) research shows that virtual reality can reduce pain in post-operative fracture patients through computer-generated simulations of three-dimensional objects or environments with realistic user interactions. This is also supported by Spiegel (2019) research indicates that, in addition to significantly reducing pain, patients also experience satisfaction when using audio-visuals with virtual reality.

In Table 1, the administration of a virtual reality intervention for 3 consecutive days, once daily for 15 minutes, resulted in a decrease in pain scale scores before and after the intervention in post-operative fracture patients experiencing pain. According to Thippabathuni (2024) research on the use of virtual reality in pain reduction can help shift their focus away from the pain, allowing someone experiencing pain to manage their response to painful stimuli. In Lee (2024) In the study, virtual reality was administered for 15 minutes to enhance user effectiveness and comfort. This duration is sufficient for pain, without causing unwanted side effects such as cybersickness that can occur if virtual reality is used for too long. Putri & Mustofa (2024)Research revealed that virtual reality is administered before analgesic therapy because it can divert patients' attention from pain, thereby reducing subjective pain perception and helping patients be better prepared to receive analgesic therapy.

Wilson & Scorsone (2021) research explains that virtual reality displays natural scenery because it can improve mood, relieve stress, and create a sense of comfort, allowing patients to focus on enjoyable virtual experiences rather than pain. Supported by Chan (2018), which reveals that the mechanism of virtual reality can reduce pain by diverting the brain from pain stimuli originating from specific body parts and blocking pain from reaching the brain. According to Kanschik (2023) research, virtual reality can help enhance the efficacy of medication, especially in pain management. Virtual reality

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can reduce the need for medications by diverting patients' attention from pain, allowing them to feel more comfortable and not requiring high doses of medication, thus avoiding side effects.

In the results of the case study, it was shown that the pain scale of patients decreased after being given a virtual reality (VR) intervention, indicating that virtual reality can reduce post-operative pain in fracture patients, as seen from the decreasing pain scale. In the study by Suharyono (2021)It was found that Virtual Reality (VR) was effective in reducing post-operative pain in patients compared to those receiving standard care. Supported by Wei (2024) research, the reduction of pain after virtual reality intervention proves to be a success in the increasingly advanced management of pain

CONCLUSION

After applying virtual reality (VR) for 3 days, there was a decrease in pain scale from scale 6 (moderate pain) to scale 3 (mild pain) in subjects with post-operative fractures. This virtual reality (VR) intervention can be used as an independent action to reduce post-operative pain in patients, thereby improving their quality of life.

RECOMMENDATIONS

It is hoped that virtual reality can serve as a guideline for standard operating procedures (SOPs) in hospitals to reduce pain levels in post-operative fracture patients experiencing acute pain.

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