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Does virtual reality affect breast cancer patients' pain?: A literature review

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Abstract

Purpose: To comprehensively analyze scientific evidence regarding the effect of virtual reality on pain in breast cancer patients.

Method: This is literature study using PubMed, ScienceDirect and Cochrane Library databases. The inclusion criteria in this literature review are articles published in the last 5 years (2020-2024), articles using Indonesian and English in journals of national or international reputation and research articles. The selected articles are articles that the author can download or open access.

Result: Of the total 493 articles, there were 9 articles that were duplicates or the same article. After that, it was found that the titles of 457 articles did not match the topic. There were 14 articles that did not meet the inclusion criteria and 7 articles had inappropriate interventions and methodology. Finally, 5 articles were obtained that were suitable for analysis.

Conclusion: The use of VR can effectively reduce levels of pain, anxiety, fatigue and depression in breast cancer patients, as well as improve their quality of life. These findings suggest that VR has the potential to be a valuable adjunct in the pain management of breast cancer patients.

Keywords*: breast cancer; pain; virtual reality*

INTRODUCTION

Within 2-6 years after surgery, the majority of breast cancer survivors report one or more symptoms of persistent pain, exhaustion, and significant levels of psychological anguish (Bjerkeset et al., 2020). According to the Biobehavioral Family Model, caregiver and patient psychosocial distress before treatment is related to pain interference throughout the first year of chemotherapy (Roberson et al., 2024).

According to WHO figures, breast cancer killed 685,000 people worldwide in 2020. Patients and their families experience psychological, physical, social, economical, and spiritual anguish as a result of breast cancer. Breast cancer treatment with chemotherapy, surgery, and radiation can result in side symptoms such as nausea, pain, vomiting, exhaustion, dyspnea, constipation, and depression. Cancer and the treatment itself can have an influence on the mental and spiritual well-being of patients and their families. Adding palliative care to breast cancer treatment programs appears to be the greatest way to alleviate this pain (Sunilkumar et al., 2021).

Pain is the most significant acute consequence that affect cancer patients' quality of life. The use of complementary and alternative medicine to treat chronic disorders is highly prevalent nowadays. Tai chi/qi gong, acupressure/acupuncture, meditation, hypnosis, yoga, music therapy, massage, Reiki, and reflexology all help breast cancer patients with pain (Behzadmehr et al., 2020).

Virtual reality (VR) is utilized for information, education, and patient rehabilitation. The term alludes to a groundbreaking technological bundle that combines a PC or mobile device with an interactive 3D visualization-capable graphics card, a controller, and a head-mounted display (HMD) with position tracking. As technology progresses, more immersive and engaging virtual worlds may be constructed, assisting learning, medicine, and healthcare to surpass traditional restrictions (Liu et al., 2022).

Although research into the usefulness of virtual reality in relieving pain in cancer patients is limited, preliminary findings indicate tremendous promise. However, there is an urgent need to learn more about how VR therapies might especially affect the pain experience of breast cancer patients. Thus, this study aims to explore the effect of VR intervention on pain levels in breast cancer patients.

METHOD

This study employed a literature review research approach. Literature study research is a process or activity of gathering data from diverse sources, such as books and journals, to compare the outcomes of one research study with another.

This study's literature search made use of the PubMed, Science Direct, and Cochrane Library databases. When searching for articles or journals, keywords and Boolean operators (AND, OR, and NOT) are utilized to broaden or specify the search, made it simpler to decide which article or journal to employ. In this literature study, the keywords used to search for evidence-based research are "virtual reality" AND "breast cancer" AND "pain". The inclusion criteria for this literature study include publications published during the previous five years (2020-2024), works written in English and Indonesian in journals of national or worldwide renown, and research articles. The papers chosen are chategorized as open access.

Table 1
PICO Table

PICO	Inclusion	Exclusion
Population	Cancer patients	Beside cancer patients
Intervention	Virtual reality	Beside virtual reality
Comparation	None	None
Outcome	Pain, anxiety, vital sign	None

The search was carried out using the PRISMA diagram literature selection. The search results obtained 18 articles from PubMed, 19 articles from the Cochrane Library and 456 articles from Science Direct. Of the total 493 articles, there are 9 articles that are duplicates or the same article. After that, we found that the titles of 457 articles did not match the topic. There were 14 articles that did not meet the criteria of inclusion and 7 articles had inappropriate interventions and methodology. Finally, 5 articles were obtained that were suitable for analysis.

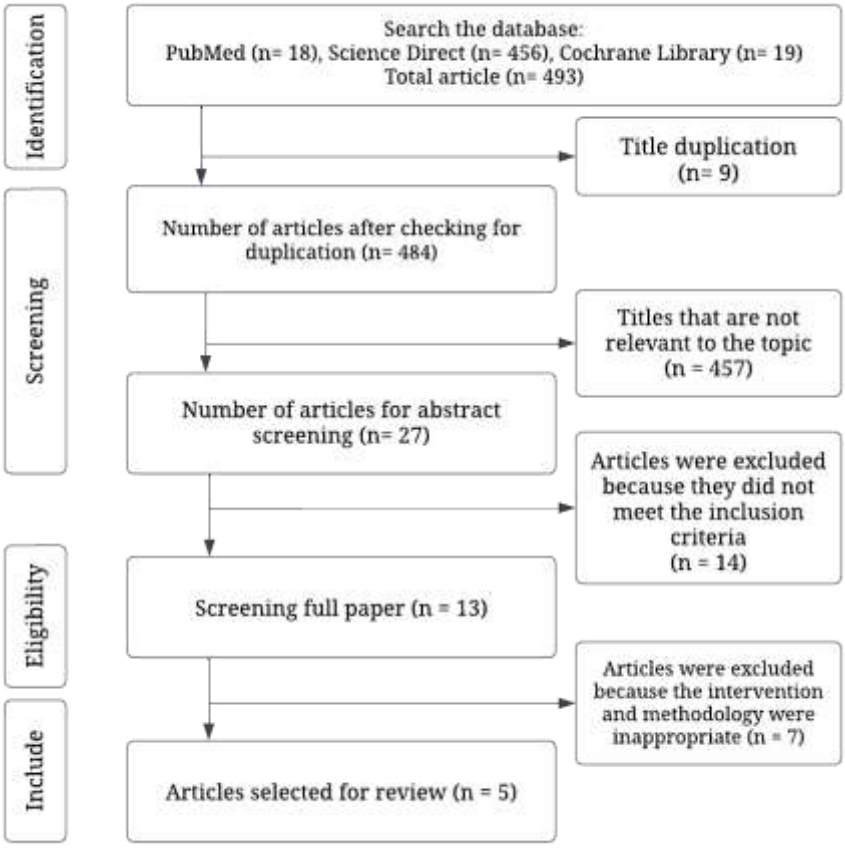

Figure 1. PRISMA diagram article search.

RESULT

The study's findings revealed that delivering virtual reality intervention lowered anxiety, pain, exhaustion, depression, systolic and diastolic blood pressure, respiration rate, and heart rate in breast cancer patients and those having breast surgery. Virtual reality can increase SpO2 levels and life quality in patients with breast cancer. The review results are explained in the synthesis table, as follows:

Table 2

Article Search Results

Title	Purpose	Design	Sample	Result
The Effect of Using Virtual Reality Glasses on Anxiety and Fatigue in Women with Breast Cancer Receiving Adjuvant Chemotherapy: A Pretest-Posttest Randomized Controlled Study (Uslu & Arslan, 2023).	To investigate the impact of virtual reality glasses on anxiety and tiredness in patients with breast cancer receiving adjuvant chemotherapy.	Randomized Controlled Study with pretest-posttest parallel groups.	n= (66)	This study found that using virtual reality glasses effectively reduced anxiety and tiredness scale ratings, as well as their subscales in breast cancer patients.

Title	Purpose	Design	Sample	Result
The Effect of Using Virtual Reality During Breast Biopsy on Pain and Anxiety: A Randomized Controlled Trial (Karaman & Taşdemir, 2021).	This study aims to assess the impact of VR to distract the pain and anxiety during fine needle aspiration (FNA) breast biopsy procedures.	Randomized Controlled Study.	n= (60)	VR that used in FNA breast biopsy reduces discomfort and anxiety.
Effectiveness of Immersive Virtual Reality in People with Cancer Undergoing Antiblastic Therapy: A Randomized Controlled Trial (Burrai et al., 2023).	This study will look at how immersive VR affects anxiety, exhaustion, and pain in cancer patients undergoing antiblastic treatment.	Randomized Controlled Study with 3 parallel groups with an allocation ratio of 1:1:1, pre-post and longitudinal tests.	n= (74)	Virtual reality can reduce fatigue and anxiety in cancer sufferers effectively.
The Effect of Virtual Reality Distraction Intervention on Pain, Anxiety, and Vital Signs of Oncology Patients Undergoing Port Catheter Implantation: A Randomized Controlled Study (Menekli et al., 2022).	To investigate the impact of a VR intervention on anxiety, pain, and vital signs in cancer patients undergoing port catheter placement.	Randomized Controlled Study.	n= (139)	VR distraction intervention was proven to be an effective technique to lower discomfort, anxiety, systolic and diastolic blood pressure, respiration rate, and heart rate while increasing SpO2 in patients undergoing port catheter installation.
The benefits and acceptability of virtual reality interventions for women with metastatic breast cancer in their homes; a pilot randomised trial (Reynolds et al., 2022).	To determine if VR should be used as a practical and appropriate supplementary therapy to alleviate psychological and physical symptoms in breast cancer patients.	Randomized Controlled Study.	n= (38)	VR nature therapies may help with tiredness, depression, and quality of life in people with metastatic breast cancer.

DISCUSSION

Virtual reality interventions have significant potential in reducing pain in patients with breast cancer. Various studies show that VR can be effective tools to reduce the levels of anxiety, pain, fatigue, depression, as well as lowering blood pressure and respiratory rate in breast cancer patients undergoing various types of treatment and medical procedures, including chemotherapy, biopsies and catheter placement. Immersive VR technology offers pain control effectively across a wide range of medical procedures, despite statistical heterogeneity (Teh et al., 2024). VR is considered more successful than traditional distraction techniques because its immersive nature causes patients to actively interact with the live virtual environment, thereby requiring greater attention. Additionally, emotional regulation is a key process. Negative emotions common in postoperative patients, such as fear and worry, may make them more sensitive to the perception of pain and discomfort because they stimulate greater activity of brain in the emotion-related medial pain system. Furthermore, researchers tried to know the neurobiological processes behind VR analgesia, and recent findings imply that patient (VR user) suppress pain signals in crucial parts of the pain matrix, however these findings need to be verified. The intense pain associated with major surgery may obscure the positive impacts of virtual reality in pain reduction. As a result, we must decide whether to utilize pharmaceutical or non-pharmacological analgesia, such as virtual reality, for various levels of post operative pain. When faced with moderate or mild pain after minor surgery, VR is one of the good alternatives to pharmaceutical analgesia, because it is not only has efficiency in saving the analgesics, but can also provide a calming experience for patients, than having side effects when using pharmacological analgesics (Ding et al., 2020).

Based on the author's review article, VR can be given 1 minute before the procedure until the procedure is finished. VR can also be provided as a 30-minute intervention during the procedure. Based on the another supporting research, active VR reduces the amplitude of the pre-perceptual evoked potentials (EP) component in response to pain stimulus, which is related to the early modulation of sensoric stimulus, and the late EP component, which is related to the processing of perceptual pain through evaluation that related to emotional, psychological, and cognitive factors. from nociceptive stimulation. Pain regulation processing during VR was demonstrated by participants reporting lower pain levels. Other findings provide evidence for the effectiveness of VR analgesia, showing that the used of VR dramatically decreases pain perception (NRS) and objectively through changes in EP in response to painful electrical stimulation. These findings imply that virtual reality has the potential to be an effective non-pharmacological pain management alternative, particularly in elderly individuals (Lier et al., 2020).

To develop and deliver effective VR solutions that depend on: (1) pain’s type, patient demographics, and medical history; (2) the subjective experience of the patient during medical process; (3) patient daily activities and interests. So, to achieve effectivity and feasibility for VR solution, the system must combine relevant features with: (1) a distracting environment, with relaxing scenes; (2) feedback in a real time way; (3) a personalized experience related to the needs of the patients; (4) physiological response; (5) comfort; (6) low-cost and affordable VR devices (Pittara et al., 2020).

These findings underscore VR's potential as a non-pharmacological alternative for pain management, particularly in scenarios where pharmaceutical analgesia may not be preferable or feasible. Moreover, VR solutions tailored to individual patient needs, incorporating elements such as relaxing environments, real-time feedback, and personalized experiences, enhance the efficacy

and feasibility of VR-based pain management strategies. Despite the promising evidence supporting VR's effectiveness in reducing pain, further research is warranted to elucidate its mechanisms of action and long-term effectiveness, as well as to address issues of affordability and accessibility, ensuring widespread integration into holistic care models for patients undergoing medical procedures, including those with breast cancer.

VR and hypnosis-induced analgesia are similar with reality, and the contextual cues serve as a distraction, making the decrease of painful signals, and transport them to an imaginary world with perceptual dissociation. Susceptibility to hypnotic suggestions is a key factor in determining whether hypnosis is powerful enough to produce hypnoanalgesia. However, low-quality research shows that VR alone can alleviate pain without hypnotizability, but the efficacy combination of VR and hypnosis is unknown. Although experimental pain studies indicate that VR affects several cortical representational regions of pain and improves opioid-induced analgesic, solid mechanistic evidence is missing (Shanthanna et al., 2024).

With rising data backing VR and its broad use in medicine, each of institution will able to access high-quality VR equipment. However, due to financial limits, a cost-benefit analysis is required to find the most cost-effective VR gear and software. Cost is presently a key concern for clinical providers and may provide a substantial obstacle to VR's presence in clinical medicine (Ang et al., 2021).

Additionally, these findings suggest that VR can improve the life quality of breast cancer patient, as well as provide a more enjoyable and refreshing experience during medical procedures. The emotional regulation and distraction offered by VR can help patients overcome perceptions of pain and discomfort, as well as provide a more positive experience during their treatment. Thus, the integration of VR interventions in pain management of breast cancer patients may be a valuable addition to a holistic and multidimensional treatment approach. VR technology has the potential to be integrated into a multidimensional and holistic treatment paradigm for cancer patients who suffer pain and/or anxiety (Chow et al., 2021).

CONCLUSION

In summary, VR shows promise in easing pain for breast cancer patients during various medical procedures. It's effective because it distracts patients, helps them manage emotions, and even changes how their brains process pain. Customizing VR experiences for each patient's needs, like using calming scenes, makes it even more helpful. But, making VR accessible and affordable is still a challenge. Despite this, integrating VR into patient care could greatly improve their experience and quality of life. However, more researchs need to be done to understand further regarding the mechanisms of action and long-term effectiveness of these VR interventions, as well as to develop VR solutions that are more affordable and accessible to all patients.

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