

Effect of Distraction Technique Using Virtual Reality on Anxiety Level during Needle Insertion in Arteriovenous Fistula among Hemodialysis Patients: A Randomized Controlled Trial

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Received: 13/04/2026

Accepted: 04/06/2026

Published: 30/06/2026

DOI:

[https://doi.org/10.65682/](https://doi.org/10.65682/kjnhs.v2.i2.68-79)

[kjnhs.v2.i2.68-79](https://doi.org/10.65682/kjnhs.v2.i2.68-79)

Abstract

Background: Hemodialysis is a life-sustaining treatment for patients with end-stage renal disease (ESRD). This is a highly stressful procedure in which the needle is repeatedly inserted into the AV fistula. If not managed, anxiety impacts patients' quality of life and compliance. Distraction techniques, such as virtual reality, are a non-pharmacological approach that uses sensory and visual distraction to remove anxiety-inducing stimuli during a procedure.

Objective: To assess the effect of the distraction technique using virtual reality on anxiety level during arteriovenous fistula needle insertion in hemodialysis patient.

Methods: A randomized controlled trial with a pre-test/post-test design was conducted with 74 patients with CKD who were undergoing HD. Participants were selected from eligible patients by simple random sampling at Imam Al-Hussain Medical City in Habib Ibn Mudaher Center and the hemodialysis ward of Imam Al-Hassan Al-Mujtaba Teaching Hospital in Karbala, then allocated into a control group (n = 38) and a virtual reality group (n = 36). The intervention was delivered via a VR box headset connected with Max P9 headphones, which played a three-dimensional immersive nature video before and during needle insertion. Data were collected using a sociodemographic and clinical questionnaire and the Visual Analog Scale for Anxiety and were analyzed using SPSS version 27.0. A probability value of ≤ 0.05 was considered statistically significant.

Results: After the intervention, the mean anxiety score decreased from 6.11 ± 3.49 to 2.06 ± 3.004 , and the proportion of patients reporting no anxiety increased from 8.3% to 63.9%; this reduction was statistically significant ($Z = -5.044$, $P < 0.05$) with a very large effect size (Cohen's $d = 1.625$, 95% CI: 1.120–2.121).

Conclusion: VR distraction reduces procedure-related anxiety during needle insertion in arteriovenous fistulas in hemodialysis patients.

Keywords: Anxiety; Arteriovenous fistula; Hemodialysis; Virtual reality.



1. Introduction

Chronic kidney disease (CKD) is considered a “silent global killer” and is characterized by progressive and irreversible deterioration of renal function. Approximately 800 million people worldwide live with chronic kidney disease (CKD), which imposes a significant and growing burden on healthcare systems (Francis et al., 2024; Grams & Jadoul, 2026).

Kidney replacement therapy (KRT) is used in patients with renal failure. The most common type of KRT is hemodialysis, which is received by 78% of patients worldwide, with 89% of them on an external machine that removes waste and excess fluid from the blood, and 11% receiving peritoneal dialysis (Kovesdy, 2022). Patients experience challenges in role alterations, life involvement, and the performance of activities of daily living (ADLs), which are important skills such as eating, bathing, and mobility that are crucial for self-care and independence (Al-Abedi et al., 2024; Faris et al., 2018).

Patients with CKD need to have hemodialysis sessions, which must be two to three times a week, lasting three to four hours each. Consequently, many patients undergo hemodialysis multiple times weekly, contributing significantly to psychological distress as a result of repeated needle insertion during arteriovenous fistula, the preferred form of vascular access, amounting to more than 300 needle punctures annually for patients on thrice-weekly schedules.

Patients undergoing hemodialysis experience substantial psychological distress, and anxiety is one of the most frequently reported burdens during treatment. A large proportion of adults receiving hemodialysis report clinically meaningful anxiety, which is associated with decreased adherence to treatment, reduced quality of life, and increased mortality (Barello et al., 2023). Anxiety among hemodialysis patients, with somatic fatigue and sleep disturbance as the dominant depressive symptoms and irritability as the principal anxiety manifestation, further confirms the psychological burden experienced by this population prior to any intervention (Ali & Al-Yasari, 2026).

Both pharmacological and non-pharmacological methods are used to manage anxiety during needle insertion, with patients often preferring non-drug approaches because of their favorable safety. Topical pharmacological approaches, including EMLA cream, lidocaine spray, and cryotherapy, have been evaluated for AVF cannulation pain, demonstrating variable and often incomplete efficacy (Al-Jubouri et al., 2024). Distraction techniques, particularly audiovisual methods such as watching videos or listening to music, have been shown to be effective in reducing procedural and anticipatory anxiety (Ramdhanie et al., 2024).

Virtual reality has emerged as a novel, fully immersive distraction modality for managing acute procedural anxiety, with demonstrated benefits in settings such as burn care and percutaneous coronary intervention (Hoffman et al., 2020; Shutnan et al., 2026). By immersing the patient in a multisensory environment, virtual reality redirects attentional resources away from threat-related stimuli and limits the cognitive processing of procedures (Namazinia et al., 2025). Despite research on distraction techniques, evidence regarding the use of virtual reality (VR) during arteriovenous fistula (AVF) cannulation remains limited, particularly in the Iraqi clinical context. Therefore, this study aimed to determine the effect of virtual reality distraction on anxiety levels during AVF needle insertion in patients undergoing hemodialysis.

2. Methods and Materials

2.1. Study Design and Participants

A randomized controlled trial with a pre-test/post-test design was conducted involving 74 patients undergoing hemodialysis. The study was carried out from December 1, 2025, to April 30, 2026. The participants were drawn from a total of 535 eligible hemodialysis patients using simple random sampling: a complete list of patient names was compiled for each center, every eligible patient was assigned a sequential number, and the patients who received odd numbers were selected to enter the study. The sample size was calculated using an online sample-size calculator, with a population of 535, an 85% confidence level, a 5% margin of error, and a 50% response distribution, which corresponded to a calculated minimum of 150 participants; within the available recruitment period, 74 patients who met all eligibility criteria were enrolled. Each selected patient was assigned to a group by drawing a numbered card from an opaque box, where card 1 placed the patient in the control group and card 2 placed the patient in the virtual reality study group, so that every patient had an equal chance of entering either group. No participant withdrew or was lost to follow-up after enrollment.

2.2. Ethical Considerations

The Scientific Research Committee of the College of Nursing, University of Kerbala, approved this study on November 2, 2025 (Research Number UOK.CON.25.0100). The trial was registered at ClinicalTrials.gov on January 9, 2026 (identifier NCT07334522). All participants received an explanation of the purpose and benefits of the study and were informed that they could withdraw from the study at any time. Both verbal and written informed consent were obtained from each patient prior to data collection.

2.3. Data Collection Instruments

The researcher used an instrument consisting of three parts.

Part I: Socio-demographic characteristics, including age, sex, place of residence, marital status, educational level, and occupation.

Part II: Clinical data included weight, height, vascular access site, session hours and sessions per week, AVF use duration (months), and chronic disease.

Part III: The Visual Analog Scale for Anxiety (VAS-A) is a simple and widely used self-rating tool for measuring a patient's current level of anxiety. It consists of a 10-cm horizontal line scored from 0 to 10, where 0 represents "no anxiety at all" and 10 represents "the worst anxiety imaginable." The patient marks the point on the line that best reflects the intensity of their current anxiety, and the resulting score (0–10) is recorded. Scientific evidence has established the Visual Analog Rating Scale (VAS) as a reliable and valid tool for individuals aged 18 and older (Begum & Hossain, 2019). It is free to use, and permission was obtained from the researcher. It is a widely used assessment tool, both nationally and internationally. Furthermore, the instrument was translated into Arabic. Reliability assessments revealed an (α) value of 0.80 for the anxiety scale (Eldesoky & Elesawy, 2021).

2.4. Data collection procedures

1. The study was conducted in two centers. A total of 36 patients in the virtual reality group and 38 patients in the control group were first identified by simple random sampling from the eligible population, in which patients were numbered and those with odd numbers were selected. The selected patients were then randomly allocated to their groups by drawing numbered cards from an opaque box (card 1 = control group; card 2 = virtual reality group). To ensure allocation concealment, the cards were identical in appearance and kept in a sealed

opaque box, and each card was drawn only after a patient was enrolled and consented to participate. The inclusion criteria were as follows: age of at least 18 years; both sexes (males and females); conscious and cooperative patients; patients with an arteriovenous fistula under a year; and no problems in vision or hearing.

- Demographic, social, and clinical information was gathered from the patients in both groups through structured interviews, and anxiety levels were assessed using a visual analog scale. The patient is asked to mark the point on the line that best reflects the intensity of their current anxiety, and the resulting score, ranging from 0 to 10, is recorded.
- Before needle insertion, the patient is instructed to be positioned comfortably (supine or semi-Fowler position). The headset was placed on the patient, the smartphone was connected to the Headphone Max P9 headset and VR box glasses, and the video was played via a virtual reality (VR) application. Three minutes before the arteriovenous fistula (AVF) needle was inserted, the video began, showing a three-dimensional (3D) immersive nature video of an underwater sea journey, accompanied by soothing water sounds. At the end of the third minute, the nurse followed the standard procedure for performing AVF cannulation, which took approximately two minutes to complete. Anxiety was measured and recorded immediately. The control group received standard hemodialysis without any additional interventions.

3. Results

Table 1. Distribution of Patients according to their Socio-demographic Characteristics.

Demographic Data	Subgroup	Study Group (n=36)		Control Group (n=38)		Sig.
		f.	%	f.	%	
Age group	< 25 years	2	5.6	1	2.6	.402 ^a
	25–34 years	4	11.1	4	10.5	
	35–44 years	4	11.1	3	7.9	
	45–54 years	12	33.3	11	28.9	
	55–64 years	8	22.2	14	36.8	
	≥ 65 years	6	16.7	5	13.2	
	Total	36	100.0	38	100.0	
	Min – Max	19–81		21–72		
Mean ± SD	50.06 ± 14.82		52.37 ± 12.97			
Sex	Male	16	44.4	22	57.9	.247 ^b
	Female	20	55.6	16	42.1	
	Total	36	100.0	38	100.0	
Residence	Urban	8	22.2	15	39.5	.109 ^b
	Rural	28	77.8	23	60.5	
	Total	36	100.0	38	100.0	
Marital status	Single	5	13.9	2	5.3	.263 ^b
	Married	29	80.6	36	94.7	
	Widowed	1	2.8	0	0	
	Separated	1	2.8	0	0	
	Total	36	100.0	38	100.0	
Education level	Illiterate	5	13.9	13	34.2	.302 ^b
	Primary school	17	47.2	13	34.2	
	Intermediate school	7	19.4	5	13.2	

Demographic Data	Subgroup	Study Group (n=36)		Control Group (n=38)		Sig.
		f.	%	f.	%	
Occupation	Secondary school	2	5.6	4	10.5	.199 ^b
	Institute	3	8.3	1	2.6	
	College	2	5.6	2	5.3	
	Total	36	100.0	38	100.0	
	Unemployed	16	44.4	19	50.0	
	Student	1	2.8	0	0	
	Housewife	15	41.7	15	39.5	
	Employee	3	8.3	0	0	
	Retired	1	2.8	4	10.5	
	Total	36	100.0	38	100.0	

Min= Minimum, Max = Maximum, f = frequencies, % = Percentages, M = Mean, P = probability value, at $P \leq 0.05$. a= Mann–Whitney U Test, b= Chi-square Test

In Table 1, the average age of the study group was 50.06 ± 14.82 years, and that of the control group was 52.37 ± 12.97 years. The predominant age category was 45–54 years in the study group (33.3%) and 55–64 years in the control group (36.8%). Female patients constituted the majority of the study group (55.6%), whereas males predominated in the control group (57.9%). Most patients were rural residents in the study (77.8%) and control (60.5%) groups. Regarding marital status, the majority of those in the control (94.7%) and study groups (80.6%) were married. Primary school was the most commonly reported educational level in the study (47.2%) and control (34.2%) groups. Regarding occupation status, the majority of patients were unemployed in the control group (50.0%), while 44.4% were unemployed in the study group. No statistically significant differences were observed between the two groups in any of the sociodemographic characteristics ($P > 0.05$), indicating that the groups were comparable at baseline.

Table 2. Distribution of Patients according to their clinical data.

Clinical Data	Subgroup	Study Group (n=36)		Control Group (n=38)		Sig.
		f.	%	f.	%	
HD Duration (months)	Min – Max	3–11		6–11		.882 ^a
	Mean \pm SD	8.19 \pm 2.36		8.18 \pm 1.75		
Vascular access site	Right	14	38.9	13	34.2	.676 ^b
	Left	22	61.1	25	65.8	
	Total	36	100.0	38	100.0	
Sessions/week	Three times	36	100.0	38	100.0	1.000 ^b
	Total	36	100.0	38	100.0	
Session hours	Three hours	36	100.0	33	86.8	.055 ^b
	Four hours	0	0	5	13.2	
	Total	36	100.0	38	100.0	
Chronic diseases	No	5	13.9	8	21.1	.418 ^b
	Yes	31	86.1	30	78.9	
	Total	36	100.0	38	100.0	
Hypertension	No	7	19.4	8	21.1	.863 ^b
	Yes	29	80.6	30	78.9	
	Total	36	100.0	38	100.0	
Diabetes mellitus	No	22	61.1	24	63.2	.856 ^b
	Yes	14	38.9	14	36.8	

Clinical Data	Subgroup	Study Group (n=36)		Control Group (n=38)		Sig.
		f.	%	f.	%	
Heart disease	Total	36	100.0	38	100.0	.911 ^b
	No	29	80.6	31	81.6	
	Yes	7	19.4	7	18.4	
BMI (kg/m ²)	Total	36	100.0	38	100.0	.687 ^a
	Underweight	3	8.3	1	2.6	
	Normal	13	36.1	17	44.7	
	Overweight	13	36.1	13	34.2	
	Obesity Class I	7	19.4	7	18.4	
	Total	36	100.0	38	100.0	
	Mean ± SD	25.66 ± 5.54		25.89 ± 4.91		

Min= Minimum, Max = Maximum, f = frequencies, % = Percentages, M = Mean. P = probability value; P ≤ 0.05; a= Mann–Whitney U Test; b= chi-square test.

Table 2 shows that there was no difference in the duration of dialysis between the two groups (8.19 vs. 8.18 months). Left vascular access was the most common in both groups, with a slight increase in the control group (65.8%) compared with the study group (61.1%). All patients in both groups attended three sessions per week. All patients in the study group received three-hour sessions, whereas 86.8% of patients in the control group received three-hour sessions and 13.2% received four-hour sessions. Regarding comorbidities, chronic diseases were more prevalent in the study group (86.1%) than in the control group (78.9%). Hypertension was slightly more common in the study group (80.6%) than in the control group (78.9%). Diabetes was more common in the study group (38.9%) than in the control group (36.8%). Cardiac disease was present in 19.4% of the study group and 18.4% of the control group patients. A normal body mass index (BMI) was more common in the control group (44.7%) than in the study group (36.1%). The overweight rates were similar in both groups (36.1% vs. 34.2%, respectively). The incidence of class I obesity was 19.4% and 18.4% in the study and control groups, respectively. The study group showed a higher percentage of underweight patients (8.3%) than the control group (2.6%). The BMI was comparable between the two groups, with a mean BMI of 25.66 kg/m² and 25.89 kg/m², respectively.

Table 3. Baseline Pre-Intervention Anxiety Level between the Study and Control Groups.

Anxiety Level	Study group		Control group		Sig.
	f.	%.	f.	%.	
None	3	8.3	6	15.8	.057
Mild	8	22.2	1	2.6	
Moderate	7	19.4	3	7.9	
Severe	18	50.0	28	73.7	
Total	36	100.0	38	100.0	
Mean ± SD	6.11 ± 3.49		7.47 ± 3.75		

f= frequencies, %= percentages, M = mean, P < 0.05 probability value (Mann–Whitney U Test), NS: P ≥ 0.05. Anxiety level = none (0), mild (1–3), moderate (4–6), and severe (7–10).

Table 3 illustrates that the mean anxiety score was 6.11 and severe level 50.0, while the mean anxiety score was 7.47 in the study and control groups with severe level 73.7. No significant

difference was observed between the groups ($P = 0.057$), confirming pre-intervention anxiety and supporting the validity of between-group comparisons.

Table 4. Effect of virtual reality distraction technique on anxiety levels during AVF needle insertion: pre- and post-intervention.

Group	Level	Pre %	Pre M±SD	Post %	Post M±SD	Cohen's d (effect size)	95% CI	Z	Sig.
Study Group	None	8.3	6.11 ± 3.49	63.9	2.06 ± 3.004	1.625	1.120–2.121	-5.044	.000
	Mild	22.2		8.3					
	Moderate	19.4		13.9					
	Severe	50.0		13.9					
Control Group	None	15.8	7.47 ± 3.75	28.9	3.47 ± 2.669	1.449	0.987–1.901	-4.878	.000
	Mild	2.6		15.8					
	Moderate	7.9		42.1					
	Severe	73.7		13.2					

M = Mean, SD = standard deviation, Z = Wilcoxon Signed Ranks Test statistic, Cohen's d = effect size (≈ 0.20 small, 0.50 medium, 0.80 large), CI = confidence interval, P = probability value at $P \leq 0.05$. Anxiety level: none (0), mild (1–3), moderate (4–6), severe (7–10).

In the study group, the mean anxiety score decreased from 6.11 ± 3.49 to 2.06 ± 3.004 , and the proportion of patients reporting no anxiety increased from 8.3% to 63.9%; this reduction was statistically significant ($Z = -5.044$, $P = 0.000$) with a very large effect size (Cohen's d = 1.625, 95% CI: 1.120–2.121). In the control group, the mean anxiety score decreased from 7.47 ± 3.75 to 3.47 ± 2.669 ($Z = -4.878$, $P = 0.000$); Cohen's d = 1.449, 95% CI: 0.987–1.901, a very large effect). Both groups showed significant improvement, but the magnitude of reduction was greater in the study group.

Table 5. Comparison of post-intervention anxiety between the study and control groups.

Comparison	Study (Group 1) Mean ± SD	Control (Group 2) Mean ± SD	Z	Sig. (P)	Mean difference (95% CI)	r (effect size)
Before intervention	6.11 ± 3.49 (32.82)	7.47 ± 3.75 (41.93)	-1.905	0.057 (NS)	-1.36 (-3.05 to 0.32)	0.22
After intervention	2.06 ± 3.004 (32.04)	3.47 ± 2.669 (42.67)	-2.245	0.025	-1.42 (-2.72 to -0.12)	0.26

M = mean, SD = standard deviation, Z = Mann–Whitney U test statistic, P = probability value at $P < 0.05$, and NS at $P > 0.05$. CI = confidence interval. Anxiety level: none (0), mild (1–3), moderate (4–6), or severe (7–10). r = effect size (≈ 0.10 small, 0.30 medium, 0.50 large).

Before the intervention, the anxiety levels of the two groups were statistically comparable (mean rank of study: 32.82; control: 41.93; $Z = -1.905$, $P = 0.057$). After the intervention, anxiety in the study group was lower than that in the control group (mean ranks 32.04 and 42.67, respectively),

and this difference was statistically significant with a small effect size ($Z = -2.245$, $P = 0.025$, $r = 0.26$).

4. Discussion

This study aimed to assess the effect of virtual reality on anxiety levels during arteriovenous fistula needle insertion in patients undergoing hemodialysis. Post-intervention anxiety was significantly lower in the virtual reality group than in the standard care control group ($Z = -2.245$, $P = 0.025$) when immersive virtual reality was applied for three minutes before insertion and during the two-minute cannulation. This finding is consistent with the systematic review and meta-analysis by Kang et al. (2025), who conducted a systematic review and meta-analysis of 12 studies involving 625 dialysis patients and found that virtual reality training produced a significant reduction in anxiety ($P < 0.001$). This effect may be explained by the capacity of virtual reality to redirect attentional resources away from threat-related stimuli, thereby limiting the cognitive processing of anxiety-inducing signals and activating positive emotional responses through immersive engagement, as confirmed by Kodvavi et al. (2023), who conducted a meta-analysis of adults undergoing elective medical procedures and found virtual reality significantly associated with reduced post-procedural anxiety ($P < 0.0001$).

Before needle insertion, anxiety was high in both groups: severe anxiety was reported by 50.0% of the study group and 73.7% of the control group, with mean scores of 6.11 and 7.47, respectively. This is consistent with the findings of Ibrahim et al. (2022), who conducted a cross-sectional study assessing pain and anxiety during arteriovenous fistula cannulation among 117 hemodialysis patients in Saudi Arabia and found that most patients experienced mild-to-moderate pain and anxiety, with a significant positive association between pain and anxiety levels during arteriovenous fistula cannulation ($P < 0.001$). The heightened distress reflects the nature of the procedure, as Czech et al. (2021) showed in a systematic review and meta-analysis that needle-related procedures are a significant and recurrent source of pain, anxiety, and fear across patient groups. This trial included only patients with an arteriovenous fistula in use for less than one year. According to Lok et al. (2020), arteriovenous fistula maturation requires between six and nine months of progressive venous remodeling, a period during which the access vein remains physiologically sensitive and is associated with greater procedural sensitivity, which may partly explain the high baseline anxiety observed.

In the control group, the predominant anxiety level shifted from severe before needle insertion (73.7%) to moderate afterward (42.1%), even though this group did not receive a virtual reality intervention. This reduction is explained by the distinction between two temporally separate states: the high pre-intervention score reflects anticipatory anxiety, the apprehension experienced while awaiting the procedure, whereas the lower post-intervention score reflects procedural anxiety, the distress actually experienced during cannulation, which is typically lower than the threat imagined beforehand. The mere completion of the feared event, together with the reassuring presence and attention of the nursing staff during the brief two-minute cannulation, plausibly accounts for the natural decline observed in the control group in the absence of any active intervention. Chaudhary et al. (2025) similarly described procedural anxiety as the fear or worry associated with undergoing a medical procedure, distinguishing it from apprehension that precedes it. Importantly, although both groups improved, the post-intervention reduction was significantly greater in the virtual reality group than in the control group ($Z = -2.245$, $P = 0.025$), indicating that the additional decrease in the study

group is attributable to the virtual reality distraction rather than to the natural anticipatory-to-procedural transition alone.

The two groups were comparable in terms of all demographic variables, indicating that the patients in both groups were similar at baseline. This is consistent with Elzeky et al. (2024), who conducted a randomized controlled trial with 96 hemodialysis patients at Mansoura University Hospital, Egypt, investigating the effect of virtual reality distraction on pain and anxiety during arteriovenous fistula puncture and reported no statistically significant baseline differences between the groups. Similarly, Şen and Bakar (2024), in a randomized controlled study of 60 hemodialysis patients in Turkey examining virtual reality glasses during arteriovenous fistula cannulation, reported comparable demographic characteristics between the groups.

Both groups were also clinically comparable in terms of hemodialysis duration, vascular access site, sessions per week, chronic diseases, body mass index, and comorbidities, supporting baseline equivalence. These findings agree with Ersoy et al. (2025), whose assessor-blinded randomized trial of 28 hemodialysis patients in Turkey, evaluating a virtual reality video application for fistula puncture-associated pain, confirmed no significant baseline differences in clinical variables such as dialysis duration, access type, and comorbidities. This was similarly reported by Şimşek and Aksoy (2024), who conducted a randomized controlled trial assessing virtual reality glasses during fistula cannulation in hemodialysis patients and found the intervention and control groups to be clinically homogeneous at baseline.

These findings support the promotion of non-pharmacological interventions for patients undergoing dialysis, given their therapeutic efficacy and favorable safety profile. Hosseini et al. (2024) found that immersive virtual reality significantly lowered anxiety in hemodialysis patients before invasive procedures, attributing the effect to the way a multisensory virtual environment occupies the patient's limited attentional capacity and weakens the conscious processing of threats, such as the approaching needle. This attentional mechanism plausibly underlies the present reduction in cannulation anxiety, reinforcing the value of virtual reality distraction as a routine component of arteriovenous fistula care. The marked reduction in mean anxiety in the study group, from 6.11 to 2.06, is clinically meaningful beyond its statistical significance: lower procedural anxiety is expected to improve the patient's quality of life, strengthen adherence to and tolerance of repeated thrice-weekly dialysis sessions, reduce the likelihood of session refusal or premature termination, and lessen reliance on pharmacological anxiolytics and sedatives together with their associated side effects in this population.

Consequently, promoting non-pharmacological interventions for patients undergoing dialysis is essential because of their therapeutic efficacy. While Jabbar & Mahmood (2025) highlighted the beneficial effects of leg exercises on patient fatigue, Shutnan and Athbi (2025) emphasized the significance of integrating virtual reality to reduce anxiety and pain in multiple clinical areas. These studies strongly support the current trial's emphasis on utilizing virtual reality distraction to manage anxiety during arteriovenous fistula cannulation.

5. Conclusion

A distraction technique, such as virtual reality, can be used effectively as a noninvasive, nonpharmacological intervention before and during needle insertion to reduce anxiety levels in patients undergoing hemodialysis.

6. Recommendations

1. Virtual reality (VR) distraction technology should be formally incorporated into standard nursing care protocols for dialysis patients during arteriovenous fistula (AVF) needle insertion to reduce anxiety.
2. Nursing staff should receive structured training in the use of VR equipment, including equipment hygiene protocols, patient preparation, and monitoring for side effects such as dizziness or discomfort during VR use.
3. Research should be conducted involving patients who have had an AVF for less than a year, given their high anxiety levels, to incorporate VR distraction techniques before needle insertion into the AVF.

7. Acknowledgment

The researcher thanks all the patients who participated in the study and the nursing staff at the hemodialysis unit for their cooperation, which contributed to the success of this study.

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