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THE EFFECT OF COMBINED MUSIC THERAPY AND STRESS BALL ON PAIN DURING VASCULAR ACCESS CANNULATION IN HEMODIALYSIS PATIENTS

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ABSTRACT
Hemodialysis remains the main therapy for patients with kidney failure. During the cannulation process, which is the insertion of a needle into a vascular access, hemodialysis patients often experience pain. The combination of music therapy and the use of stress balls is an example of a non-pharmacological intervention that can be used to overcome pain during cannulation. Objective to identify the effectiveness of the combination of music therapy and stress balls on pain in hemodialysis patients during the vascular access cannulation process. This study used a phased cross-over design, where each respondent received both treatments alternately. A total of 42 respondents were divided into two groups: the experimental group (n = 21) received music therapy and stress balls , while the control group (n = 21) received standard hospital therapy, namely deep breathing relaxation. Furthermore, the two groups exchanged treatments. The level of pain was measured using a VAS (Visual Analog Scale). The results showed that the combination of music therapy and stress balls was effective in reducing pain during the cannulation process, with significant changes in pain levels after insertion ($p < 0.001$). Cohen's d effect size of -0.632 indicates that combination therapy has a stronger effect in reducing pain than deep breathing relaxation therapy.

Keywords: hemodialysis patients; music therapy; pain; stress ball; vascular access cannulation

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INTRODUCTION

Hemodialysis is still the main therapy for patients with kidney failure. Based on the results of the WHO report in 2021 , at least four million people underwent hemodialysis therapy (Bello et al ., 2022) . The hemodialysis process lasts for four to six hours. During this procedure, some patients experience complications. One of the most common effects is pain during cannulation. Vascular access cannulation in hemodialysis patients is the act of inserting a needle through the skin into a blood vessel (AV Shunt) to connect the vascular circulation to the hemodialysis machine. Vascular access itself is the most important part of the hemodialysis process. (Inayama et al., 2022) .

According to Rahman et al ., (2020) the prevalence of pain during cannulation in patients undergoing hemodialysis reached 58.5% moderate pain, 50% severe pain, and 11.5% mild pain during cannulation with an average pain on a scale of 4-6. Another study reported that around 20% of patients undergoing hemodialysis experienced quite severe cannulation pain, even though they had been given topical analgesics, 12% of other patients experienced mild to moderate pain during the needle insertion and removal procedure (Suramadhan, Khoiriyah, Sukraeny, & Armiyati, 2024) .

Pain is common in hemodialysis patients due to painful procedures, acute complications, and pain syndromes, which can result in sleep disturbances, reduced adherence to treatment, frequent hospitalizations, decreased quality of life, and high mortality rates (Gerogianni, 2023) .

This study highlights the need to explore the combination of non-pharmacological methods to improve the effectiveness of pain reduction and its impact on other psychological and physiological parameters. Non-pharmacological interventions such as relaxation techniques, distraction, stimulation and massage, guided imagery, hypnosis, and music therapy can be applied to overcome pain during cannulation (Buyukyilmaz, 2014; Lindquist et al ., 2018; Pellino et al. , 2005) . Meanwhile, other studies have shown that the use of anti-stress balls can reduce pain perception, but this study was limited to the use of one distraction tool without considering the potential combination with other interventions that may be more effective (Dinis & Sousa 2023) . T his study aims to identify the effectiveness of the combination of music therapy and stress balls on pain in hemodialysis patients during the vascular access cannulation process.

METHOD

This study used the single-blind cross-over phase method, this study was conducted at An-Nisa Hospital, Tangerang in December 2024. In determining the sample with *GPower* , the researcher set the α value at 0.05 (error level I) *power* 80%. The researcher used a one-way test (*one tail*) *one independent group* with a correlation coefficient that had been determined by Cohen (1988). It is known that the number of samples for each intervention group and control group is 21 people so that the total number of samples is 42 people. Respondent data filled in included age, gender, comorbidities, and duration of illness. Visual Analog Scale (VAS) observation sheet according to the pain scale felt by respondents ranging from 0-10, Hemodynamic observation sheet for measuring patient hemodynamics, namely systolic and diastolic blood pressure, pulse, and before and after the intervention. The research output will be measured before, during and after the vascular access insertion intervention. After going through the preparation stage starting from administrative procedures, permits and ethical tests, the next stage the researcher took primary data obtained by looking at the results on the observation sheet. The data obtained from the completed observation sheet was intervened using a standard *visual analog scale* (VAS) instrument. Data were analyzed using Jamovi version 2.3.28, an open statistical software (Team, 2021; Jamovi Project, 2022). Univariate is a statistical analysis involving one variable to understand its distribution. Mean is the total number of variable values divided by the number of data, while standard deviation (SD) measures how far the data is spread from the average. Significance level 5% ($\alpha = 0.05$) Statistical Test: To compare the difference in the average pain scale between the experimental group and the control group, Independent t-test and Mann-Whitney were used. This research has been reviewed and approved by the Nursing Research Ethics Committee, Faculty of Health Sciences, Muhammadiyah University of Jakarta.

RESULT

The characteristics of the intervention group and control group consisting of age, gender, comorbidities, and duration of illness are presented in Table 1.Based on Table 1, it shows that the experimental group (mean age 52.4 years) and the control group (52.9 years) were dominated by men (16 and 11 people, respectively) and had a history of Type 2 DM (12 and 15 people, respectively). The average duration of illness was 8 months, with a distribution that was not significantly different between groups ($p = 0.622$).Pain evaluation after two weeks of intervention, Table 2 shows that both therapy methods, namely the combination of music therapy and stress ball and deep breathing relaxation, are effective in reducing pain ($p < 0.001$). Although there was no significant difference between groups ($p > 0.05$), the

combination group showed a tendency for a stronger effect (Cohen's d = -0.631) compared to deep breathing relaxation (Cohen's d = -0.552).

Table 1.
Characteristics

Characteristics		Experiment	Control
		Mean (SD)	Mean (SD)
Age		52.4	52.9
Gender	Man	16	11
Cormobid	DM type 2	12	15
	Hypertension	5	3
	There isn't any	4	3
Long illness		79.5	82.4

Table 2.
Evaluation of the Effectiveness of Combination Pain and Deep Breathing Relaxation Therapy

Outer	Combination		Deep breathing relaxation therapy		Between Test		
	Mean	SD	Mean	SD	MD (SE)	P-value	Cohen's d
Painful							
During	1.52	1.13	1.55	1.09	-0.024	0.922	-0.002
After	2.24	1.14	2.26	1.11	-0.024 (0.25)	0.923	-0.002
MD (SE)	0.714 (0.18)		0.714 (0.20)				
P-value	<0.001		<0.001				
Cohen's d	-0.631		-0.552				

Table 3.
Evaluation of Systolic Blood Pressure Effectiveness of Combination and Deep Breathing Relaxation Therapy

Outer	Combination		Deep breathing relaxation therapy		Between Test		
	Mean	SD	Mean	SD	MD (SE)	P-value	Cohen's d
Systolic BP							
Before	151	24.2	147	22.9	3.93	0.447	0.167
During	136	21.4	137	22.5	- 0.476	0.921	0.021
After	141	23.2	139	22.0	2.33 (4.91)	0.636	0.104
Mean Square	2274		1206				
F	10.9		6.44				
η^2p	0.209		0.136				
P	< 0.001		0.003				

Table 3, shows that Overall, there was no significant difference in systolic blood pressure between groups at each measurement stage ($p > 0.05$), but each group experienced a significant decrease in blood pressure during the intervention. This shows that both therapies are effective in lowering systolic blood pressure, with a greater effect in the combination group of music therapy and stress ball.

Table 4.
Evaluation of Diastolic Blood Pressure Effectiveness of Combination and Deep Breathing Relaxation Therapy

Outer	Combination		Deep breathing relaxation therapy		Between Test		
	Mean	SD	Mean	SD	MD (SE)	P-value	Cohen's d
Diastolic BP							
Before	80.6	14.6	83.0	10.4	-2.71	0.333	-0.2127
During	77.9	10.6	78.7	10.7	-0.833	0.720	-0.0786
After	78.3	9.54	78.9	10.6	-0.881	0.692	-0.0866
Within test,							
Mean Square	112.5		256.7				
F	0.034		0.089				
P	0.237		0.024				
η^2p	0.030		0.007				

Table 5.
Evaluation of the Effectiveness of the Combination of Pulse and Deep Breathing Relaxation Therapy

Outer	Combination		Deep breathing relaxation therapy		Between Test		
	Mean	SD	Mean	SD	MD (SE)	P-value	Cohen's d
Pulse							
Before	81.1	11.9	84.3	13.0	-3.12	0.256	-0.250
During	82.4	15.0	85.0	13.8	-2.55	0.421	-0.177
After	84.3	13.3	83.5	14.9	0.833	0.787	0.0591
Within test,							
Mean Square	106.5		23.6				
F	1.26		0.309				
η^2p	0.030		0.007				
P	0.290		0.735				

Table 4, Changes in diastolic blood pressure at three stages of measurement showed no significant differences between groups ($p > 0.05$). Diastolic blood pressure decreased during the intervention and increased slightly afterward without significant differences. The deep breathing relaxation group experienced statistically significant changes ($p = 0.024$), while the combination group was not significant ($p = 0.237$). However, the partial effect value (η^2p) was higher in the combination group, indicating a relatively greater effect of the intervention although not significant.Table 5, Changes in heart rate were also not significantly different between groups at all stages of measurement ($p>0.05$). Heart rate experienced a slight increase during and after the intervention without significant differences. Variation in heart rate changes was greater in the combination group, reflected by higher Mean Square and η^2p values, although not statistically significant.Overall, the combined intervention of music therapy and stress ball and deep breathing relaxation was effective in reducing pain in hemodialysis patients, but did not show significant differences in the effect on diastolic blood pressure and heart rate between the two groups.

DISCUSSION

This study explores the characteristics of respondents, the effectiveness of combination therapy and deep breathing relaxation, and factors that influence pain in hemodialysis patients during Arteriovenous Fistula (AVF) cannulation. This analysis was conducted based on the formulation of the problem, research objectives, hypotheses proposed, and research results obtained.The majority of respondents in this study were adults to elderly, with an average age of 52.4 years in the experimental group and 52.9 years in the control group. This age range is relevant because kidney function tends to decline with age, as shown by Mahardian et al. (2021) and Sembiring et al. (2020) who noted a progressive decline in Glomerular Filtration Rate (GFR) and Renal Blood Flow (RBF). Although there have been few studies directly linking age to pain during AVF puncture, age-related variables such as decreased nerve sensitivity and common comorbidities in the elderly (diabetes, cardiovascular disease) can affect pain perception (Anastasia A. Basir, Herlina, & Andi Nailah Amirullah, 2023; Yanti, Apriyeni, Frdalni, & Yunita, 2022).

In terms of gender, the study involved 42 respondents with the majority being male, although no proportion criteria were set. This finding is in line with Anita & Novitasari (2022) who noted that 65% of respondents were male. However, this data is in contrast to Kesehatan (2020) who reported more female patients (53.2%) in the hemodialysis room. This difference may be related to hormonal factors such as estrogen levels in women (Anita & Novitasari, 2022). Gender is also a factor that affects the patient's quality of life.Comorbidity of Type 2 Diabetes Mellitus (DM) was found in 27 of 42 respondents. Chronic hyperglycemia in DM can cause diabetic nephropathy and Chronic Kidney Failure (CKF) due to protein glycation, oxidative stress, and systemic inflammation (Suherman et al., 2023). This finding is supported

by Wijayanti et al. (2024), which states that Type 2 DM patients have a high risk of developing CKF.The duration of hemodialysis also affects the patient's response to pain. Respondents who underwent hemodialysis longer reported decreased pain sensitivity, which may be due to psychological adaptation and education received during therapy (Widyawati, Yartin, & Mulki, 2023). Suciana and Hidayati (2020) found that patients who underwent hemodialysis for 1-2 years had the best quality of life. However, pain during AVF puncture remains a significant problem influenced by anxiety and AVF conditions (Sugion, 2020).

This study proves that the combination of music and stress ball therapy is effective in reducing pain during hemodialysis cannulation. Both methods distract patients from the sensation of pain, reduce anxiety, and increase relaxation. Within-group analysis (within-test) showed a significant decrease in pain ($p < 0.001$) with Cohen's d values (-0.631 and -0.552) indicating a moderate effect. These results are in line with Inayama et al. (2022) who found that music can reduce cannulation pain, and Dinis & Sousa (2023) who reported that stress balls reduce pain perception.During the cannulation process, changes were found in systolic, diastolic blood pressure, and pulse rate. In general, blood pressure and pulse rate tend to increase before cannulation due to anxiety, decrease during the procedure due to activation of the parasympathetic nervous system, and increase again after the procedure is completed.

These changes are in line with the body's physiological response to pain and anxiety, as explained by Tadesse, et al (2022) who showed that pre-procedure anxiety can increase arterial pressure. Although there were significant changes in each group, the comparison between the combination therapy and deep breathing relaxation therapy groups did not show significant differences in effectiveness on blood pressure and pulse rate. Factors that influence pain during AVF puncture include age, gender, anxiety level, attention, and individual pain tolerance threshold. Holistic pain management with a non-pharmacological approach is essential to improve patient comfort during the procedure. Overall, this study confirms the effectiveness of combined music and stress ball therapy and deep breathing relaxation therapy in reducing pain and affecting physiological parameters in hemodialysis patients. The results of this study indicate that the effectiveness of pain therapy does not only depend on medical aspects, but also involves psychological factors and subjective experiences of patients.

CONCLUSION

The combination of music therapy and stress ball has an effect on reducing pain during the cannulation process. There was a significant change in the level of pain after insertion ($p < 0.001$). The effect size indicated by Cohen's -0.632 showed that the combination therapy had a stronger effect on reducing pain compared to deep breathing relaxation therapy.There were significant changes in systolic, diastolic blood pressure, and pulse rate during the hemodialysis cannulation process, both in the group receiving a combination of music and stress ball therapy and the deep breathing relaxation therapy group.Pain during AV fistula puncture is influenced by various individual factors , such as age, gender, anxiety level, attention, and pain tolerance threshold . So these factors influence pain perception and how patients respond to interventions.

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