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Which Intervention is Most Effective? Rhythmic Breathing, Hugo Point Acupressure, and Vapocoolant Spray for Pain Relief During Needle Insertion in Hemodialysis Patients: A Randomized Controlled Trial

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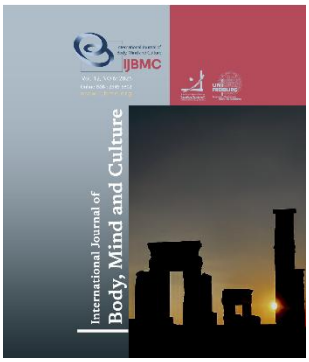

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ABSTRACT

Objective: Pain from needle insertion during hemodialysis is a common challenge that requires effective pain management to ensure patient comfort. This study aimed to compare the efficacy of three pain management techniques (rhythmic breathing, Hugo Point acupressure, and vapocoolant spray) on pain intensity during needle insertion in hemodialysis patients.

Methods and Materials: A randomized controlled trial was conducted from December 4, 2024, to January 16, 2025 in Iraq, involving 120 hemodialysis patients. Participants were randomly assigned to one of four groups: control (n=34), rhythmic breathing (n=24), Hugo Point acupressure (n=35), and vapocoolant spray (n=27). Pain intensity was assessed immediately after needle insertion using the Visual Analog Scale (VAS). The rhythmic breathing group practiced controlled breathing exercises 2 minutes before and during needle insertion, the Hugo Point acupressure group received acupressure 2 minutes before and during needle insertion, and the vapocoolant spray group received a brief application of the spray prior to the procedure. Data were analyzed using SPSS version 27, employing the Mann-Whitney U test, Kruskal-Wallis H test, one-way ANOVA, Pearson correlation, and Spearman correlation.

Findings: The mean pain intensity scores were highest in the control group (64.79 ± 15.8), followed by the rhythmic breathing group (37.79 ± 4.293), the Hugo Point acupressure group (33.14 ± 4.264), and the vapocoolant spray group (25.59 ± 3.6). All three interventions significantly reduced pain intensity compared to the control group ($P < 0.001$). The vapocoolant spray demonstrated the most significant pain reduction, followed by Hugo Point acupressure and rhythmic breathing ($P < 0.001$). Additionally, Hugo Point acupressure was significantly more effective than rhythmic breathing in reducing pain intensity ($P < 0.001$).

Conclusion: The findings indicate that rhythmic breathing, Hugo Point acupressure, and vapocoolant spray are all effective in reducing pain during needle insertion in hemodialysis patients. However, vapocoolant spray emerged as the most effective intervention, followed by Hugo Point acupressure and rhythmic breathing. These results suggest that vapocoolant spray should be considered the preferred pain management option, with Hugo Point acupressure as a secondary alternative and rhythmic breathing as a viable option for patients who may not tolerate or have access to the other interventions.

Keywords: Arteriovenous Fistula, Hemodialysis, Vapocoolant Spray, Cold Spray, Pain, Rhythmic Breathing, Hugo Point Acupressure

Introduction

Chronic renal failure (CRF) is a long-term and irreversible decline in kidney function. It affects the body's ability to maintain metabolic and electrolyte balance, leading to increased levels of urea and nitrogen in the blood, which then accumulate in the body (Hosseinzadeh et al., 2019). According to the National Kidney Federation (NKF), CRF is defined as any kidney damage or a decrease in glomerular filtration rate (GFR) to less than 60 mL/min/1.73 m^2 of body surface area for more than three months (Alipor et al., 2018).

Kidney disease is becoming more common worldwide, and the number of people with end-stage renal disease (ESRD) in the United States is expected to reach 2,240,000 by 2030 (Shabandokht-Zarmi et al., 2017). Hemodialysis is the most commonly used treatment for CRF patients (Abas & Mohammed, 2013; Ghadimi et al., 2019; Shnishil & Mansour, 2013) and requires proper vascular access.

Establishing a suitable vascular access and performing timely dialysis are crucial for saving patients' lives. In long-term hemodialysis, several techniques are used for vascular access, including arteriovenous fistula (AVF), arteriovenous graft (AVG), and catheters such as Shaldon and permcath (Rajabzadeh Malayjerdy et al., 2019). Among these, AVF is considered the best option (Golda et al., 2016; Mirtajadini et al., 2016).

One of the major discomforts for hemodialysis patients is the pain caused by needle insertion into the fistula (Mirtajadini et al., 2016). More than one-fifth of patients report this pain as unbearable (Ghafourifard et al., 2016; Mirtajadini et al., 2016) Since hemodialysis is performed three times a week, patients undergo approximately 300-320 needle insertions per year (Anupreethi, 2018; Arab et al., 2017). Poor pain management can lead to longer hospital stays, higher medical costs for both patients and hospitals, dissatisfaction with treatment, and frequent visits to medical centers for pain control (Shiasi & Yousefi, 2021).

Proper pain relief can help patients better tolerate treatment and improve their quality of life (QOL), making it a key aspect of nursing care (Baloochi Beydokhti, 2021). Nurses, who spend the most time with patients (Jafarimanesh et al., 2017), play a crucial role in predicting, assessing, and reducing pain during cannulation, especially for hemodialysis patients. They should be knowledgeable about various pain management techniques to improve QOL and enhance the patient-caregiver relationship (Alzaatreh & Abdalrahim, 2020).

Several pain relief methods have been suggested and studied, including topical anesthetics like lidocaine (Al-Jubouri et al., 2024; Collado-Mesa et al., 2015), distraction techniques (Al-Shammary & Al-Fayyadh, 2024; Khalel & Shawq, 2024; Tran Thi et al., 2022), vibration at the injection site (24), applying pressure (Al-Shammiry & Al-Fayyadh, 2024; Öztürk et al., 2017), thermotherapy (Abbas Ali Madadi et al., 2017), aromatherapy (Al-Mussawi & Al-Jubouri, 2024) and cooling the injection site (Griffith et al., 2016; Hogan et al., 2014).

Vapocoolant sprays are a type of topical anesthetic that temporarily numb the skin by rapidly lowering its temperature. This cooling effect reduces nerve sensitivity through the use of volatile liquids that evaporate quickly (Griffith et al., 2016; Hogan et al., 2014). These sprays offer several advantages over other anesthetics, including fast action, affordability, and ease of use, making them practical in clinical settings. They have been proven effective in reducing pain during various medical procedures, such as catheter insertions, vaccinations, and venipuncture, which often cause discomfort and anxiety (Barbour et al., 2017; Unal et al., 2021).

Rhythmic breathing techniques constitute a significant subset of distraction methodologies that enable patients to intentionally redirect their attention away from nociceptive stimuli, thus fostering a certain degree of analgesic control during various medical procedures (Borzou et al., 2013; Brown et al., 2019). The fundamental premise that underpins distraction is predicated upon the assertion that when individuals encounter a broad spectrum of substantial sensory input, the reticular formation located within the brainstem possesses the extraordinary capacity to selectively modulate or ignore the propagation of pain signals, thereby augmenting the overall comfort and therapeutic experience for patients undergoing medical treatment (Hosseinzadeh et al., 2019). An extensive body of research has corroborated the efficacy of rhythmic breathing in mitigating pain experiences among patients subjected to painful interventions, thereby reinforcing its position as a valuable adjunct within pain management paradigms (Borzou et al., 2002; Borzou et al., 2013; Bozorg-Nejad et

al., 2018; Farzin Ara et al., 2018; Lalegani et al., 2014; Park et al., 2013).

Acupressure is an ancient healing practice that dates back around 5,000 years. It involves applying pressure to specific points on the body to relax muscles, improve blood flow, and boost energy circulation (Ichihashi et al., 2012). One of the most important acupressure points is the Hugo point, also known as LI-4. This point is located on the back of the hand, between the thumb and index finger. It is widely recognized as one of the most effective points for pain relief in the body (Kim & Kim, 2021). Research has shown that stimulating this point can reduce pain in different parts of the body. This is because the Hugo point is located in an area where energy flows close to the skin, making it easy to access and stimulate through methods like pressing, needling, or applying cold. This stimulation helps block pain signals and creates a feeling of relief and well-being (Hamidzadeh et al., 2012). Additionally, activating the Hugo point can stimulate the brain's hypothalamus and pituitary glands, which release natural pain-relieving chemicals called endorphins, further reducing the sensation of pain (Goddard & Albers, 2009).

This study aimed to compare the effectiveness of three different methods (Hugo point acupressure,Rhythmic breathing and vapocoolant spray) on pain intensity during needle insertion in hemodialysis patients with arteriovenous fistulas. all methods have been shown to be effective and practical, but there is insufficient evidence to determine if one is superior to the other in our target population.

Methods and Materials

Study Design

This study was designed as A Randomized Controlled Trial.

Study Setting

The study was conducted in hemodialysis centers in Iraq from December 4, 2024, to January 16, 2025. The participating centers included Al-Hussein Dialysis Center, Al-Shatra Dialysis Center, Souq Al-Shuyukh Dialysis Center, Al-Rifai Dialysis Center, Habib Ibn Mazahir Dialysis Center, and the Dialysis Unit at Imam Hassan Al-Mujtaba Hospital.

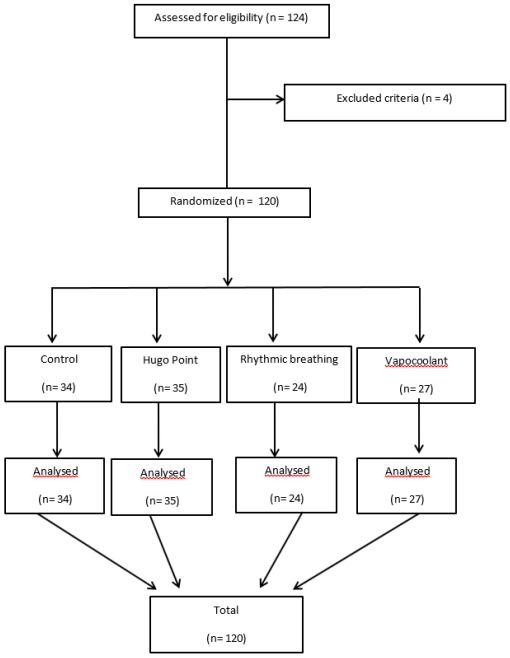

Figure 1

Flow diagram of patients

Sample and Sampling

The study included male hemodialysis patients who needed needle insertion into their arteriovenous fistulas. A simple random sampling method was used to divide participants into four groups: the control group, the rhythmic breathing group, Hugo point acupressure group, and the vapocoolant spray group. Each participant picked a sealed envelope with a color (white, yellow, green, and blue) to determine their group .

Sample Size

The minimum required sample size was calculated using a Sample Size Calculator. It was determined that 96 participants were needed, based on an accessible population of 126 male dialysis patients across six centers in Iraq. The calculation considered a 5% margin of error and a 95% confidence level. Initially, 124 patients agreed to participate. After excluding 4 patients who did not meet the inclusion criteria, the final sample size was 120 participants. These participants were randomly assigned to four groups. The final distribution was 34 participants in the control group (white), 24 participants in the Rhythmic breathing group (yellow),and 35 participants in the Hugo Point Acupressure group (green), and 27 participants in the vapocoolant spray group (blue). Small differences in group sizes occurred due to the randomization process, which is normal in random sampling.

Inclusion Criteria

The participants in this study were male patients who were regularly receiving hemodialysis treatment and were fully alert. To be included, they had to be at least 18 years old, able to communicate verbally, and have a functioning brachio-cephalic arteriovenous fistula (AVF) that was used as the access point for their dialysis sessions.

Exclusion Criteria

The study excluded individuals who experienced significant pain that was not related to the needle insertion process. It also excluded those who had an arteriovenous fistula (AVF) in place for more than 5 years. Additionally, patients with known allergies or hypersensitivity to vapocoolant spray were not included. It also excluded those who had shortness of breath, pulmonary edema, or a chest injury.Those who had recent surgery or trauma near the AVF site, or who had used painkillers (analgesics) before the study, were also excluded. Patients with diabetes for 10 years or more were not eligible to participate. Furthermore, individuals with cognitive impairment or mental health conditions that affected their ability to understand instructions or provide informed consent were excluded. Lastly, patients with active infections, complications at the AVF site, or inflammation or injury at the Hugo point (used for acupressure) were also not included in the study. Flow diagram of patients is shown in Fig. 1

Study Instrument

Data was collected using a questionnaire with two sections: demographic and clinical characteristics, and the Visual Analogue Scale (VAS) for pain assessment. Demographic and clinical characteristics included age, sex, educational level, occupation, marital status, chronic diseases, and duration of hemodialysis treatment. The VAS is a widely used tool for measuring pain intensity. It consists of a 10 cm line ranging from 0 (no pain) to 100 (unbearable pain). Pain levels were categorized as no pain (0–4), mild pain (5–44), moderate pain (45–74), and severe pain (75–100). Participants were asked to mark their pain level on the scale after the needle insertion .

Data Collection

To ensure consistency, all participants were positioned comfortably in a supine position two minutes before needle insertion. The area around the fistula was disinfected with a 70% alcohol solution by trained nursing staff. Two 16G cannulas were inserted into the AV fistula at least 5 cm apart. The needle was inserted at an angle of 30–40 degrees, with the bevel facing upwards, in a fibrosis-free area. Pain was assessed immediately after needle insertion using the VAS scale .

Control Group Process

No intervention was administered for this group. Pain was evaluated immediately after needle insertion by directing participants to indicate their pain level on the VAS scale included in the questionnaire .

Hugo Point Acupressure Group

For the Hugo Point Acupressure group, the researcher received formal training in acupressure pain relief techniques before conducting this study. The Hugo Point, located on the back of the hand between the first and second metacarpal bones, was massaged in circular motions with moderate pressure. This massage was done for two minutes before and during needle insertion, using the opposite hand from the arteriovenous fistula. Pressure was applied for ten seconds, followed by a two-second rest. Pain levels were recorded immediately after the needle was inserted. Pain was then measured using the VAS scale.

Vapocoolant Spray Group

For the vapocoolant spray group, the spray was applied around the fistula area for 3–4 seconds from a distance of 15–20 cm. After waiting ten seconds for the spray to dry, the needle was inserted. Pain was then measured using the VAS scale.

Rhythmic breathing group

participants were instructed to engage in rhythmic breathing for two minutes before needle insertion. They were asked to close their eyes, inhale deeply through their nostrils for three seconds, hold their breath for three seconds, and exhale through their mouth for three seconds. This breathing pattern continued during needle insertion, and pain was assessed immediately after needle stabilization using the VAS scale.

Data Analyses

Data was analyzed using SPSS software version 27 with different statistical tests, including the Mann-Whitney U test, Kruskal-Wallis H test, one-way ANOVA, Pearson correlation, and Spearman correlation .

Limitations of the Study

This study had some limitations. The perception of pain varies from one individual to another. To reduce bias linked to the subjectivity of pain, all experimental methods should be consistently applied to the same participant using a cross-sectional study design. Additionally, the study was limited to male patients, so the results may not apply to female patients.abilized.

Findings and Results

In Table 1 the results showed the distribution of 120 male patients undergoing hemodialysis socio demographic data characteristics according to their groups (Control = 34, Vapocoolant spray = 27, Rhythmic breathing = 24, and Hugo point acupressure = 35), mean age was 54.82 in control group, 55.22 in Vapocoolant spray group, 47.40 in Hugo point acupressure group, and 49.50 in Rhythmic breathing group, all group most were married (76.5% in control group, 74.1% in Vapocoolant spray group, 74.3% in Hugo point acupressure group, and 62.5% in Rhythmic breathing group). According to the educational level, all groups most were between not read and write, read and write, and primary school (in control group 29.4% not read and write, 29.4% read and write, 29.4% primary school ,in Vapocoolant spray group 40.7% not read and write, in Hugo point acupressure group 28.6% primary school and in Rhythmic breathing group 29.2% primary school). Regarding the occupation, all groups most were unemployed (61.8% in control group, 74.1% in Vapocoolant spray group, 77.1% in Hugo point acupressure group and 50% in Rhythmic breathing group), all groups most have Hypertension only (29.4% in control group, 48.1% in Vapocoolant spray group, 62.9% in Hugo point acupressure group and 29.2% in Rhythmic breathing group), all groups have a duration of hemodialysis treatment from one to five years (73.5% in control group, 59.3% in Vapocoolant spray group, 68.6% in Hugo point acupressure group and 54.2%in Rhythmic breathing group).

Table 1

Distribution of the Participants socio demographic data characteristics According to their groups.

Demographic characteristics	Subgroup	Control		Vapocoolant spray		Hugo point acupressure		Rhythmic breathing	
		f.	%	f.	%	f	%	f	%
Age		Mean ± SD 54.82 ± 14.003		Mean ± SD 55.22 ± 14.219		Mean ± SD 47.40 ± 17.112		Mean ± SD 49.50 ± 15.342	

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		Min- Max 24 - 74 years		Min- Max 18 - 80 years		Min- Max 20 - 80 years		Min- Max 24 - 72 years	
Educational level	Not read &write	10	29.4	11	40.7	6	17.1	2	8.3
	Read & write	10	29.4	6	22.2	9	25.7	6	25.0
	Primary school	10	29.4	5	18.5	10	28.6	7	29.2
	Intermediate school	1	2.9	1	3.7	6	17.1	5	20.8
	Secondary school	1	2.9	1	3.7	2	5.7	1	4.2
	Diploma graduate	2	5.9	1	3.7	1	2.9	1	4.2
	Bachelor graduate	0	0	1	3.7	1	2.9	2	8.3
	Higher education	0	0	1	3.7	0	0	0	0
	Total	34	100.0	27	100.0	35	100.0	24	100.0
Occupation	Employee	4	11.8	4	14.8	4	11.4	4	16.7
	Freelance	2	5.9	1	3.7	0	0	0	0
	Unemployed	21	61.8	20	74.1	27	77.1	12	50.0
	Retired	7	20.6	2	7.4	4	11.4	7	29.2
	Student	0	0	0	0	0	0	1	4.2
	Total	34	100.0	27	100.0	35	100.0	24	100.0
Marital Status	Single	2	5.9	1	3.7	3	8.6	3	12.5
	Married	26	76.5	20	74.1	26	74.3	15	62.5
	Divorced	0	0	2	7.4	3	8.6	4	16.7
	Widow	6	17.6	4	14.8	3	8.6	2	8.3
	Total	34	100.0	27	100.0	35	100.0	24	100.0
Chronic diseases	Heart disease (only)	0	0	0	0	0	0	2	8.3
	Diabetes (only)	3	8.8	0	0	1	2.9	2	8.3
	Both (heart disease and diabetes)	1	2.9	0	0	0	0	0	0
	Hypertension (only)	10	29.4	13	48.1	22	62.9	7	29.2
	hypertension and Diabetes	6	17.6	4	14.8	7	20.0	3	12.5
	Hypertension and heart disease	1	2.9	5	18.5	2	5.7	5	20.8
	All three (hypertension, diabetes, and heart disease)	3	8.8	3	11.1	0	0	2	8.3
	None of the above	10	29.4	2	7.4	3	8.6	3	12.5
	Total	34	100.0	27	100.0	35	100.0	24	100.0
Duration of hemodialysis treatment	Less than 1 year	6	17.6	8	29.6	10	28.6	8	33.3
	1-5 years	25	73.5	16	59.3	24	68.6	13	54.2
	>5years	3	8.8	3	11.1	1	2.9	3	12.5
	Total	34	100.0	27	100.0	35	100.0	24	100.0

f= frequencies, %=Percentages, M = Mean of score, S.D = Standard Deviation, Min= minimum and Max= maximum

In Table 2, the results indicated that the mean pain intensity during needle insertion into the arteriovenous fistula in hemodialysis patients was highest in the control group (64.79 ± 15.8), followed by the rhythmic breathing group (37.79 ± 4.293), the Hugo point acupressure group (33.14 ± 4.264), and lowest in the Vapocoolant spray group (25.59 ± 3.6).

Table 2

Evaluation of the Pain Intensity During Needle Insertion into Arteriovenous Fistula in Hemodialysis Patients according to their groups (Control, Vapocoolant spray, Hugo point acupressure).

Group	Min	Max	Mean	SD
Control	22	86	64.79	15.847
Rhythmic breathing	31	47	37.79	4.293
Hugo point acupressure	22	41	33.14	4.264
Vapocoolant spray	20	31	25.59	3.651

Min= minimum, Max= maximum, M = Mean of score, S.D = Standard Deviation

In Table 3, using the Mann-Whitney U test and Kruskal-Wallis test, the results showed that all three interventions (rhythmic breathing, Hugo point acupressure, and Vapocoolant spray) significantly reduced pain intensity compared to the control group ($P < 0.001$). The Vapocoolant spray group demonstrated the most significant pain reduction, followed by the Hugo point acupressure group and the rhythmic breathing

group (P < 0.001). Additionally, the Hugo point acupressure group was significantly more effective than the rhythmic breathing group in reducing pain intensity (P < 0.001).

Table 3

Differences between Pain Intensity Patients Groups During Needle Insertion into Arteriovenous Fistula in Hemodialysis By using the Kruskal-Wallis test and the Mann-Whitney U test

Group	Mann-Whitney U Test				Kruskal-Wallis test	
	N	Mean Rank	Mann-Whitney U	Sig	Kruskal-Wallis H	Sig
Control	34	43.21	44.000	.000	62.755	.000
Vapocoolant spray	27	15.63				
Control	34	49.57	99.500	.000		
Hugo point acupressure	35	20.84				
Control	34	39.38	72.000	.000		
Rhythmic breathing	24	15.50				
Vapocoolant spray	27	17.11	84.000	.000		
Hugo point acupressure	35	42.60				
Vapocoolant spray	27	14.07	2.000	.000		
Rhythmic breathing	24	39.42				
Rhythmic breathing	24	39.69	187.500	.000		
Hugo point acupressure	35	23.36				

P=probability value, NS: Non-Significant at P ≥ 0.05, S: Significant at P < 0.05, HS: Highly Significant at P < 0.001

In Table 4, the results were analyzed using statistical methods. For the Control group and Vapocoolant Spray group, Spearman's correlation coefficient was used to examine the relationship between age and pain intensity, while the Kruskal-Wallis H test was applied for other variables. In the Acupressure group and Rhythmic Breathing group, Pearson's correlation coefficient was used for age, and one-way ANOVA was applied for other variables. The analysis revealed no significant correlation between age and pain intensity in any of the groups (P ≥ 0.05). Additionally, there were no significant differences in pain intensity based on factors such as marital status, education level, occupation, chronic diseases, and duration of hemodialysis treatment in any of the groups (P ≥ 0.05).

Table 4

Association between Pain Intensity During Needle Insertion into Arteriovenous Fistula in Hemodialysis Patients according to their groups with their socio demoghraphic

Demographic characteristics	Subgroup	Control			Vapocoolant spray			Rhythmic breathing			Hugo point acupressure		
		M.	Ana.	Sig.	M.	Ana.	Sig.	M.	Ana.	Sig.	M.	Ana.	Sig.
Age		64.79	Cc = .305	.080*	25.59	Cc = .090	.654*	37.79	Cc =.359	.085**	33.14	Cc = -.147-	.400**
Educational level	Not read &write	60.40		.813***	26.18		.513**	41.50		.542****	31.67		.797****
	Read & write	67.30			25.33			38.67			35.11		
	Primary	63.30	H = 2.253		24.00	H =. 6.235		37.00	F =.861		33.10	F =.508	
	Intermediate	72.00			22.00			38.20			32.00		
	Secondary	81.00			30.00			41.00			33.50		
	Diploma	70.00			23.00			34.00			33.00		
	Bachelor	64.79			25.00			33.50			31.00		
	Higher education	60.40			31.00								
Occupation	Employee	68.25		.885***	27.50		.104***	35.75		.470****	33.75		.957****
	Freelance	53.50			20.00								
	Unemployed	66.62			25.85			37.25			33.07		
	Retired	60.57	H = .651		22.00	H = 6.157		39.43	F =.876		33.00	F =.044	
	Student	68.25						41.00					
Marital Status	Single	74.50	H = [illegible]	.529	26.00	H = [illegible]		36.67	F =1.[illegible]	.255	32.33	F =1.[illegible]	.279

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	Married	65.00		***	25.60		.917*	37.13		****	33.65	****
	Divorced				27.00		**	38.25			28.67	
	Widow	60.67			24.75			43.50			34.00	
Chronic diseases	HD			.289			.254	32.00		.064		.640
	DM	72.00		***			***	37.50		****	35.00	****
	Both (HD and DM)	57.00										
	HT	68.20	H = 6.182		25.46	H = 4.074		37.71	F =2.506		32.41	F =.637
	HT and DM	56.33			28.75			35.33			33.71	
	HT HD	54.00			25.00			41.60			33.50	
	All three	71.33			23.00			41.50				
	None of the above	64.20			25.50			35.67			36.33	
Duration of hemodialysis treatment	Less than 1 year	73.67		.279	24.75		.562	35.63		.086	36.20	.166
	1-5 years	63.76	H = 2.553	***	26.13	H = 1.154	***	38.00	F = 2.758	****	31.88	F =1.902 ****
	>5years	55.67			25.00			42.67			33.00	

Discussion and Conclusion

One of the most significant challenges faced by hemodialysis patients is the intense pain associated with the cannulation of the arteriovenous fistula (AVF). Many consider the needle insertion process before dialysis to be the most daunting and distressing aspect of their entire treatment. The pain experienced during this procedure is not merely a source of discomfort; it is a significant barrier that often leads patients to withdraw from hemodialysis sessions altogether. This withdrawal, in turn, has dire consequences, as it directly contributes to prolonged treatment gaps and exacerbates the risk of mortality among these patients. Therefore, effective pain management during AVF cannulation must be prioritized as a critical component of dialysis care—not only to improve patient comfort and quality of life but also to ensure treatment adherence and reduce the alarming rates of mortality associated with treatment discontinuation. The present study aimed to compare the effectiveness of Rhythmic Breathing, Hugo Point Acupressure, and Vapocoolant Spray in reducing pain intensity during needle insertion in hemodialysis patients with arteriovenous fistulas. The results revealed that the mean pain intensity during needle insertion was highest in the control group (64.79 ± 15.8), followed by the rhythmic breathing group (37.79 ± 4.293), the Hugo point acupressure group (33.14 ± 4.264), and lowest in the Vapocoolant spray group (25.59 ± 3.6). The Vapocoolant spray group demonstrated the most significant pain reduction, followed by the Hugo point acupressure group and the rhythmic breathing group ($P < 0.001$). Additionally, the Hugo point acupressure group was significantly more effective than the rhythmic breathing group in reducing pain intensity ($P < 0.001$). there are no studies that directly compare the effectiveness of Hugo Point Acupressure, rhythmic breathing, and Vapocoolant Spray in reducing pain intensity during needle insertion in hemodialysis patients with Arteriovenous Fistulas (AVF). However, there are studies that have compared Hugo Point Acupressure with other interventions, as well as studies comparing rhythmic breathing with other interventions and studies comparing vapocoolant spray with other interventions. Regarding Hugo Point Acupressure, one study compared the effect of cryotherapy by using ice pack and Hugo Point Acupressure on the pain intensity of needle insertion into arteriovenous fistulas in hemodialysis patients. This single-group, quasi-experimental study found that the mean pain score decreased in both Hugo Point Acupressure (4.19 ± 2.43) and cryotherapy (3.16 ± 2.17) compared to no intervention (6.52 ± 1.82), with cryotherapy being more effective in reducing pain at $P < 0.05$ (Hosseinzadeh et al., 2019). Another study compared the effect of Hugo point cold therapy by using ice pack with the needle insertion site on pain caused by venipuncture in hemodialysis patients. This randomized clinical trial found no significant difference in pain intensity between the two groups at $P > 0.05$ (Sasha, 2024). A third study compared Hegu point ice massage and 2% lidocaine gel on fistula puncture-related pain in hemodialysis patients. This randomized controlled trial found significant differences in pain reduction between the pre- and post-intervention phases for both groups, with Hegu point ice massage showing greater pain reduction compared to lidocaine gel (Arab et al., 2017). Regarding Rhythmic Breathing, A

study compared the effects of Rhythmic Breathing and lidocaine spray on pain during needle insertion for hemodialysis patients. The goal was to see which method worked better at reducing pain. The results showed that both Rhythmic Breathing and lidocaine spray significantly reduced pain, but lidocaine spray was more effective than Rhythmic Breathing (Beydokhti & Sajjadi, 2023). Regarding vapocoolant spray or cold spray, a randomized cross-over clinical trial compared the effects of cooling spray, 10% lidocaine spray, and placebo spray on needle insertion pain in hemodialysis patients. The results showed that patients receiving cooling spray reported an average pain score reduction of 2.29 compared to placebo (B = -2.29, 95% CI: -4.17 to -0.43; P < 0.05). Additionally, cooling spray resulted in a 1.61 lower pain score compared to lidocaine spray, though this difference was not statistically significant (95% CI: -0.26 to 3.48; P > 0.05) (Khosravi Pour et al., 2023). Another study evaluated the effect of cryotherapy versus aromatherapy on pain during arteriovenous fistula puncture. The results showed that pain scores were lower in the cryotherapy group compared to the aromatherapy group (Elhalafawy, 2020). A randomized, placebo-controlled, crossover study compared the effectiveness of ethyl chloride vapocoolant spray, EMLA cream, and placebo in controlling pain during venipuncture. EMLA cream resulted in significantly lower pain scores compared to placebo and vapocoolant spray (P < 0.05) (Çelik et al., 2011). Another study compared the effect of lidocaine spray, cold packs, and flashlights on pain during arteriovenous cannulation. A borderline significant difference was observed between groups (P = 0.054), with cold packs showing a borderline significant difference compared to the control group (P = 0.051) (Gouda et al., 2023). A randomized controlled study compared the efficacy of audiovisual distraction, topical anesthesia, and cold spray application in reducing pain during venipuncture. Participants in the intervention groups reported lower pain scores than the control group, though the differences were not statistically significant (Puangrab et al., 2024). Another study compared the effectiveness of vapocoolant spray and EMLA cream in reducing pain during spinal injections. No significant difference in pain scores was found between the two groups (Firdaus et al., 2018). Finally, a study compared the efficacy of ShotBlocker and cold spray in reducing intramuscular injection-related pain. No significant differences in pain scores were found between the ShotBlocker and cold spray groups (Basal & Okasha, 2013). Regarding the role of demographics in the severity of pain among the study sample, the results showed that there was no relationship between AVF punctures pain and participants' age, marital status, level of education, occupation, chronic diseases, and duration of hemodialysis treatment. This finding is supported by other studies which have stated that the pain resulting from AVF puncture in hemodialysis patients has no relationship with patients' age (Babamohamadi et al., 2022; Namazinia, 2024), marital status (Koushki et al., 2023), level of education (Basal & Okasha, 2013; Sabitha et al., 2008), occupation (Öztürk et al., 2017; Satav & Biradar, 2023), chronic diseases (Al-Jubouri et al., 2024; da Silva et al., 2016), and duration of hemodialysis treatment (Arslan & Akca, 2018; Malayjerdy et al., 2019)

The study has several limitations. First, it did not include female patients, which limits the generalizability of the findings to both male and female populations. Additionally, the study design was not cross-sectional, which may have impacted the accuracy of comparing both interventions on the same patient. Future studies should address these limitations by including female patients and utilizing a cross-sectional design to obtain more precise and reliable results.

The findings indicate that rhythmic breathing, Hugo Point acupressure, and vapocoolant spray are all effective in reducing pain during needle insertion in hemodialysis patients. However, vapocoolant spray emerged as the most effective intervention, followed by Hugo Point acupressure and rhythmic breathing. These results suggest that vapocoolant spray should be considered the preferred pain management option, with Hugo Point acupressure as a secondary alternative and rhythmic breathing as a viable option for patients who may not tolerate or have access to the other interventions.

Future research should focus on cross-sectional studies, applying all interventions to the same patients. This approach would allow for more accurate and direct comparisons, leading to more reliable outcomes. Additionally, it is recommended to include female patients in future studies to ensure that the results can be generalized across both male and female populations, improving pain management strategies for all hemodialysis patients.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional. The study proposal was reviewed and approved by the scientific committee of the Adult Nursing Department, the College of Nursing at the University of Baghdad, and the Institutional Review Board (IRB). It complied with the ethical principles of the Declaration of Helsinki and was registered with the Iranian Registry of Clinical Trials (Trial ID: 80153, IRCT ID: IRCT20241103063578N1). Approval was also obtained from the Iraqi Ministry of Health, the Ministry of Planning, and the health directorates of Dhi Qar and Karbala.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

References

Abas, A., & Mohammed, W. (2013). Effectiveness of Continuing Nursing Education Program on Nursing Staffs, Knowledge at Kidney Transplantation Units in Baghdad Teaching Hospitals. *Iraqi National Journal of Nursing Specialties*, *26*(1), 25-32. https://doi.org/10.58897/injns.v26i1.158

Abbas Ali Madadi, Z., Azimian, J., Falahatpishe, F., & Alipour Heidari, M. (2017). Effect of warm footbath with vibration on arteriovenous fistula puncture-related pain in hemodialysis patients. *Int J Res Med Sci*, *5*(2), 631-635. https://doi.org/10.18203/2320-6012.ijrms20170165

Al-Jubouri, M. B., Jaafar, S. A., Abbas, M. K., Gazi, I. N., Shawwat, M. A., Karmoud, K. F., & Al-Faham, T. M. (2024). Using cryotherapy, EMLA (eutectic lidocaine/prilocaine) cream, or lidocaine spray to reduce pain during arteriovenous fistula puncture: A randomized controlled trial. *Hemodial Int*, 270-277. https://doi.org/10.1111/hdi.13152

Al-Mussawi, G., & Al-Jubouri, M. B. (2024). Effect of Aromatherapy on Pain Intensity for Patients Undergoing Arterial Sheath Removal after Percutaneous Coronary Intervention: A Randomized Controlled Trial. *Pakistan Journal of Life and Social Sciences*, *22*(1), 1427-1436. https://doi.org/10.57239/PJLSS-2024-22.1.0096

Al-Shammary, S. E., & Al-Fayyadh, S. (2024). The effectiveness of non-pharmacological interventions on reducing intramuscular injection-related pain in adult patients: a randomized control trial. *Iraqi National Journal of Nursing Specialties*, *37*(1), 36-49. https://doi.org/10.58897/d17ypv79

Al-Shammiry, S. E., & Al-Fayyadh, S. (2024). Manual Pressure verses Shot Blocker in Reducing Intramuscular InjectionRelated Pain: A Comparative Randomized Controlled Trial. *Bahrain Medical Bulletin*, *46*(1). https://www.bahrainmedicalbulletin.com/March_2024/BMB-23-512.pdf

Alipor, A., Yasari, F., Khodakarim, S., & Shokri, A. (2018). Epidemiologic pattern of patients with chronic renal failure and related factors in hemodialysis patients of Shahid Ayatollah Ashrafi Esfahani Hospital in Tehran in 2017. *J Res Urol*, *2*(3), 13-19. https://doi.org/10.30699/jru.2.3.13

Alzaatreh, M. Y., & Abdalrahim, M. S. (2020). Management strategies for pain associated with arteriovenous fistula cannulation: An integrative literature review. *Hemodial Int*, *24*(1), 3-11. https://doi.org/10.1111/hdi.12803

Anupreethi, S. (2018). *A study to assess the effectiveness of cold application on arteriovenous fistula puncture pain among hemodialysis patients at Erode and Namakkal District* Vivekanandha College of Nursing, Tiruchengode]. https://core.ac.uk/download/pdf/235671175.pdf

Arab, V., Bagheri-Nesami, M., Mousavinasab, S. N., Espahbodi, F., & Pouresmail, Z. (2017). Comparison of the Effects of Hegu Point Ice Massage and 2% Lidocaine Gel on Arteriovenous Fistula Puncture-Related Pain in Hemodialysis Patients: A Randomized Controlled Trial. *Journal of caring sciences*, *6*(2), 141-151. https://doi.org/10.15171/JCS.2017.014

Arslan, D. E., & Akca, N. K. (2018). Pain following needle insertion into a hemodialysis fistula and influencing factors. *Int J Caring Sci*, *11*(3), 1662-1667. https://www.academia.edu/download/100189952/37_kilic_original_113.pdf

Babamohamadi, H., Ameri, Z., Asadi, I., & Asgari, M. (2022). Comparison of the Effect of EMLATM Cream and the Valsalva Maneuver on Pain Severity during Vascular Needle Insertion in Hemodialysis Patients: A Controlled, Randomized, Clinical Trial. *Evidence-Based Complementary and Alternative Medicine*, 1-9. https://doi.org/10.1155/2022/8383021

Baloochi Beydokhti, T. (2021). A comparative study on the effects of acupressure at SP6 and ST36 acupoints on the pain caused by fistula needle placement in hemodialysis patients. *J Complement Med*, *10*(4), 354-367. https://doi.org/10.32598/cmja.10.4.975.1

Barbour, T., O'Keefe, S., & Mace, S. E. (2017). Patient and Health Care Provider Responses from a Prospective, Double-Blind, Randomized Controlled Trial Comparing Vapocoolant Spray versus Placebo Spray in Adults Undergoing Venipuncture in the Emergency Department. *Pain Management Nursing*. https://doi.org/10.1016/j.pmn.2017.09.006

Basal, A. A., & Okasha, K. (2013). Effect of cryotherapy on pain intensity at puncture sites of arteriovenous fistula among adult patients undergoing hemodialysis at Tanta university hospital. *Tanta Sci Nurs J*, *5*, 27-42. https://doi.org/10.21608/tsnj.2013.74467

Beydokhti, T., & Sajjadi, M. (2023). Comparing Effects of Rhythmic Breathing and Lidocaine Spray on Pain Intensity During Needle Insertion into Arteriovenous Fistula in Hemodialysis Patients: A Randomized Controlled Trial. *Anesthesiology and Pain Medicine*, *13*(2). https://doi.org/10.5812/aapm-126384

Borzou, S., Felegari, G., & Turkman, B. (2002). Survey effect of rhythmic breathing on the intensity of pain in post orthopedic surgery patients. *Scientific Journal of Kurdistan University of Medical Sciences*, *6*(23), 6-10. https://www.sid.ir/paper/69134/en

Borzou, S. R., Akbari, S., Falahinia, G. H., & Mahjub, H. (2013). Effect of Rhythmic Breathing on Pain Intensity during Insertion of Vascular Needles in Hemodialysis Patients. *Hayat*, *19*(4). https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=17352215&AN=95690530&h=g784Z5xZGnO1uLDPctpm9XvYy7NSOO7Nu6E8Iu2LN42xfRd%2FyHtnUV4K%2BAO7YIBSOPkda6q1M3SLVuBmLxWpAA%3D%3D&crl=c

Bozorg-Nejad, M., Azizkhani, H., Mohaddes Ardebili, F., Mousavi, F., Manafi, F., & Hosseini, A. F. (2018). The effect of rhythmic breathing on pain of dressing change in patients with burns referred to Ayatollah Mousavi Hospital. *World Journal of Plastic Surgery*, *7*(1), 51-57. https://pmc.ncbi.nlm.nih.gov/articles/PMC5890366/

Brown, R. P., Gerbarg, P. L., Hoseini, T., Golaghaie, F., & Khosravi, S. (2019). Sudarshan kriya yogic breathing in the treatment of stress, anxiety, and depression: Part I-neurophysiologic model Comparison of two distraction methods on venipuncture pain in children. *The Journal of Alternative and Complementary Medicine*, *22*(3), 27-35. https://www.liebertpub.com/doi/abs/10.1089/acm.2005.11.711

Çelik, G., Ozbek, O., Yilmaz, M., Duman, I., Ozbek, S., & Apiliogullari, S. (2011). Vapocoolant Spray vs Lidocaine/Prilocaine Cream for Reducing the Pain of Venipuncture in Hemodialysis Patients: A Randomized, Placebo-Controlled, Crossover Study. *International Journal of Medical Sciences*, *8*(7), 623-627. https://doi.org/10.7150/IJMS.8.623

Collado-Mesa, F., Net, J. M., Arheart, K., Klevos, G., & Yepes, M. (2015). Application of a topical vapocoolant spray decreases pain at the site of initial intradermal anaesthetic injection during ultrasound-guided breast needle biopsy. *Clin Radiol*, *70*(9), 938-942. https://doi.org/10.1016/j.crad.2015.04.013

da Silva, O. M., Rigon, E., Dalazen, J. V. C., Bissoloti, A., & Rabelo-Silva, E. R. (2016). Pain during arteriovenous fistula cannulation in chronic renal patients on hemodialysis. *Open J Nurs*, *6*, 1028-1037. https://doi.org/10.4236/ojn.2016.612098

Elhalafawy, S. (2020). Effect of cryotherapy versus aromatherapy on pain of arteriovenous fistula puncture for children undergoing hemodialysis. *IOSR Journal of Nursing and Health Science*, *9*(1), 9-19. https://doi.org/10.9790/1959-0901100919

Farzin Ara, F., Zare, M., Mousavi Garmaroudi, M., Behnam Vashani, S., & Talebi, S. (2018). Comparative study of the effect of Allah's recitation and rhythmic breathing on postoperative pain in orthopedic patients. *Anesthesiology and Pain (JAP)*, *9*(1), 68-78. https://www.sid.ir/paper/216304/en

Firdaus, R., Sukmono, B., Melati, A. C., & Marzaini, B. D. (2018). Comparison between Vapocoolant Spray and Eutectic Mixture of Local Anesthetics Cream in Reducing Pain during Spinal Injections. *Anesthesiology Research and Practice*, *2018*, 5050273. https://doi.org/10.1155/2018/5050273

Ghadimi, M., Rejeh, N., Heravi-Karimooi, M., & Tadrisi, S. D. (2019). The effect of audio distraction technique on the intensity of pain caused by the insertion of dialysis needles in hemodialysis elderly patients. *Iran J Nurs Res*, *13*(6). http://ijnr.ir/browse.php?a_id=2106&sid=1&slc_lang=en

Ghafourifard, M., Aghajanloo, A., Haririan, H., & Gheydari, P. (2016). Comparison of the effects of cryotherapy and placebo on reducing the pain of arteriovenous fistula cannulation among hemodialysis patients: A randomized control trial. *Journal of Nursing and Midwifery Sciences*, *3*(1). https://doi.org/10.18869/acadpub.jnms.3.1.59

Goddard, G., & Albers, D. (2009). Effects of acupuncture at Large Intestine 4 (LI 4) on electrical tooth pulp stimulation: A randomized controlled pilot study. *Med Acupunct*, *21*(3), 167-171. https://doi.org/10.1089/acu.2009.0691

Golda, M., Revathi, D., Subhashini, N., Mathew, J., & Indira, A. (2016). Assess the effectiveness of cold application on pre procedure (AV fistula puncture) pain among hemodialysis patients in tertiary care hospital, Nellore. *Int J Appli Res*, *2*(6), 660-664. https://www.academia.edu/download/116645026/2_5_100_307.pdf

Gouda, K., El said, T., & Fahmy, S. F. (2023). The effect of cold packs, lidocaine spray, and flashlights on cannulation pain in patients undergoing hemodialysis: a randomized controlled trial. *Future Journal of Pharmaceutical Sciences*, *9*. https://doi.org/10.1186/s43094-023-00539-4

Griffith, R. J., Jordan, V., Herd, D., Reed, P. W., & Dalziel, S. R. (2016). Vapocoolants (cold spray) for pain treatment during intravenous cannulation. *Cochrane Database Syst Rev*, *4*(4), CD009484. https://doi.org/10.1002/14651858.CD009484.pub2

Hamidzadeh, A., Shahpourian, F., Orak, R. J., Montazeri, A. S., & Khosravi, A. (2012). Effects of LI4 acupressure on labor pain in the first stage of labor. *J Midwifery Womens Health*, *57*(2), 133-138. https://doi.org/10.1111/j.1542-2011.2011.00138.x

Hogan, M. E., Smart, S., Shah, V., & Taddio, A. (2014). A systematic review of vapocoolants for reducing pain from venipuncture and venous cannulation in children and adults. *Journal of Emergency Medicine*, *47*(6), 736-749. https://doi.org/10.1016/j.jemermed.2014.06.028

Hosseinzadeh, F., Alaee, N., Rejeh, N., & Alemohammad, S. (2019). Comparing the effect of cryotherapy and acupressure on pain intensity of arteriovenous fistula cannulation in patients hemodialysis. *Iran J Nurs Res*, *14*(3). http://ijnr.ir/browse.php?a_code=A-10-4576-1&sid=1&slc_lang=en&ftxt=1&pure_pdf=1

Ichihashi, S., Higashiura, W., Itoh, H., Sakaguchi, S., & Kichikawa, K. (2012). Fracture and collapse of balloon-expandable stents in the bilateral common iliac arteries due to shiatsu massage. *Cardiovasc Intervent Radiol*, *35*, 1500-1504. https://doi.org/10.1007/s00270-011-0336-2

Jafarimanesh, H., Hajiaghaee, R., Mehrabi, F., Hasanbig, M. M., Alimoradian, A., & Ranjbaran, R. (2017). Comparative effects of quinine plant and lidocaine on pain of venipuncture. *J Complement Med*, *7*(1), 1777-1790.

http://cmja.arakmu.ac.ir/browse.php?a_id=468&sid=1&slc_lang=en

Khalel, M., & Shawq, A. H. (2024). Effect of Music Medicine Intervention on Child's Pain Level During Bone Marrow Aspiration and Lumber Puncture Procedures. *Iraqi National Journal of Nursing Specialties*, *37*(1), 103-111. https://doi.org/10.58897/99mxqa51

Khosravi Pour, A., Hejazi, S. S., Kameli, A., Hoseini Azizi, T., Armat, M. R., & Eshghi, M. (2023). Cooling spray or lidocaine spray and needle insertion pain in hemodialysis patients: an open-label cross-over randomized clinical trial. *BMC Anesthesiology*, *23*(1). https://doi.org/10.1186/s12871-023-02028-w

Kim, M., & Kim, J. (2021). Effects of acupressure on pain, flexibility, and substance P in middle-age women with chronic neck pain. *J Altern Complement Med*, *27*(2), 160-167. https://doi.org/10.1089/acm.2020.0413

Koushki, B., Khajeh, M., Bagheri, H., Talebi, S. S., & Ebrahimi, H. (2023). Comparing the Effect of Local Application of Peppermint and Cold Compresses on the Severity of Pain from Venipuncture in Dialysis Patients: A Parallel Randomized Clinical Trial Study. *Saudi Journal of Kidney Diseases and Transplantation*, *34*(4), 288-296. https://doi.org/10.4103/1319-2442.395444

Lalegani, H., Safar, A., & Safdari, A. (2014). The effect of breathing techniques on pain intensity of burn dressing. *Journal of clinical nursing*, *2*(4), 61-68. https://www.sid.ir/paper/247069/en

Malayjerdy, Z., Mazlom, S. R., & Malekzadeh, J. (2019). Effect of Mirror Therapy on Arteriovenous Fistula Cannulation-Related Pain Severity in Hemodialysis Patients. *Evidence Based Care*, *9*(2), 31-37. https://doi.org/10.22038/EBCJ.2019.35641.1918

Mirtajadini, H., Kalroozi, F., & Pishgooei, A. (2016). Shiatsu massage and the pain intensity of venipuncture in patients undergoing hemodialysis. *Military Caring Sciences*, *3*(1), 27-33. https://doi.org/10.18869/acadpub.mcs.3.1.27

Namazinia, M. (2024). Effects of virtual reality on pain induced by arteriovenous fistula needle insertion in patients undergoing hemodialysis: A randomized clinical trial. *The Journal of Vascular Access*. https://doi.org/10.1177/11297298231225755

Öztürk, D., Baykara, Z. G., Karadag, A., & Eyikara, E. (2017). The effect of the application of manual pressure before the administration of intramuscular injections on students' perceptions of postinjection pain: a semi-experimental study. *J Clin Nurs*, *26*(11-12), 1632-1638. https://doi.org/10.1111/jocn.13530

Park, E., Oh, H., & Kim, T. (2013). The effects of relaxation breathing on procedural pain and anxiety during burn care. *Burns*, *39*(6), 1101-1106. https://doi.org/10.1016/j.burns.2013.01.006

Puangrab, S., Tawanwongsri, W., Mordmuang, A., Khocharoen, W., & Krainukun, P. (2024). Efficacy of topical local anesthetic, topical cooling spray, and audiovisual distraction on relief of needle-related pain during blood collection: A randomized controlled trial. *Advances in Clinical and Experimental Medicine*, *34*(5). https://doi.org/10.17219/acem/188106

Rajabzadeh Malayjerdy, Z., Mazlom, S. R., & Malekzadeh, J. (2019). effect of mirror therapy on arteriovenous fistula cannulation-related pain severity in hemodialysis patients. *Evid Based Care J*, *9*(2), 31-37. https://ebcj.mums.ac.ir/http:/ebcj.mums.ac.ir/article_13274.html

Sabitha, P. B., Khakha, D. C., Mahajan, S., Gupta, S., Agarwal, M., & Yadav, S. L. (2008). Effect of cryotherapy on arteriovenous fistula puncture-related pain in hemodialysis patients. *Indian J Nephrol*, *18*, 155-158. https://doi.org/10.4103/0971-4065.45290

Sasha, I. A. (2024). Comparing the Effect of Cryotherapy on Hugo Point and Needle Insertion Site on the Pain of Arteriovenous Fistula Cannulation in Patient with Hemodialysis. *Journal of Clinical Care and Skills*, *5*(2), 85-91. https://doi.org/10.58209/jccs.5.2.85

Satav, K. A., & Biradar, V. S. (2023). The Effect of Cryotherapy on Arterio-Venous Fistula Puncture Related Pain among Hemodialysis Patients at Selected Hospital in City. https://www.researchgate.net/profile/Vishwanath-Biradar-4/publication/387466796_The_Effect_of_Cryotherapy_on_Arterio_-_Venous_Fistula_Puncture_Related_Pain_among_Hemodialysis_Patients_at_Selected_Hospital_in_City/links/67751959e74ca64e1f401bbd/The-Effect-of-Cryotherapy-on-Arterio-Venous-Fistula-Puncture-Related-Pain-among-Hemodialysis-Patients-at-Selected-Hospital-in-City.pdf

Shabandokht-Zarmi, H., Bagheri-Nesami, M., Shorofi, S. A., & Mousavinasab, S. N. (2017). The effect of self-selected soothing music on fistula puncture-related pain in hemodialysis patients. *Complement Ther Clin Pract*, *29*, 53-57. https://doi.org/10.1016/j.ctcp.2017.08.002

Shiasi, F., & Yousefi, M. R. (2021). The study of pain types, its inhibitory methods and tens effect on pain. *J Intel Procedures Electr Technol*, *12*(45), 17-33. https://research.iaun.ac.ir/pd/mr-yousefi/pdfs/PaperM_4310.pdf

Shnishil, A., & Mansour, K. (2013). Assessment of patients' satisfaction toward nursing care at hemodialysis units. *Iraqi National Journal of Nursing Specialties*, *26*(1), 1-9. https://doi.org/10.58897/injns.v26i1.154

Tran Thi, T. H., Konara Mudiyanselage, S. P., & Huang, M. C. (2022). Effects of Distraction on Reducing Pain During Invasive Procedures in Children with Cancer: A Systematic Review and Meta-Analysis. *Pain Manag Nurs*, *23*(3), 281-292. https://doi.org/10.1016/j.pmn.2021.12.002

Unal, N., Tosun, B., Aslan, O., & Tunay, S. (2021). Effects of Vapocoolant Spray Prior to SC LMWH Injection: An Experimental Study. *Clinical Nursing Research*. https://doi.org/10.1177/1054773818825486