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EFFECTIVENESS OF ICE APPLICATION ON PAIN INTENSITY DURING ARTERIOVENOUS FISTULA (AVF) PUNCTURE AMONG PATIENTS UNDERGOING HEMODIALYSIS.

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Abstract

Pain during arteriovenous fistula (AVF) puncture is a common issue affecting the comfort and quality of life of patients undergoing hemodialysis. This quasi-experimental study aimed to assess the effectiveness of ice application in reducing pain intensity during AVF puncture. A total of 60 hemodialysis patients were selected and divided into two groups: 30 patients in the experimental group received ice application before AVF puncture, while 30 patients in the control group received no intervention. Pain intensity was measured using a numerical rating scale, and data were analyzed using descriptive statistics and an independent t-test. The findings revealed that the experimental group experienced significantly lower pain intensity (mean = 1.2, SD = 0.75) compared to the control group (mean = 2.1, SD = 0.85), with a calculated t-value of 4.82, which was statistically significant at p = 0.05. The study concluded that ice application is

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an effective, simple, and cost-efficient non-pharmacological intervention for reducing pain during AVF puncture in hemodialysis patients.

Keywords: Ice Application, Pain Intensity, Arteriovenous Fistula, AVF Puncture, Hemodialysis

INTRODUCTION

Chronic kidney disease (CKD) is a global public health concern, with an increasing number of patients requiring long-term renal replacement therapy such as hemodialysis.[1] For individuals undergoing hemodialysis, arteriovenous fistula (AVF), a regular part of treatment, is often painful and affects patient comfort and quality of life.[2]

Various pharmacological and non-pharmacological methods have been explored to minimize pain during AVF access.[3] While local anesthetics are commonly used to reduce pain during AVF access, concerns about cost, side effects, and frequent use have led to interest in other options, including non-pharmacological methods.[4,5] Using ice application is a safe and low-cost way to reduce pain during AVF needle insertions.[6] It works by cooling the skin, which can block pain signals from reaching the brain. This method is based on the "gate control theory," which means that the cold feeling can help shut the "gate" on pain signals.[7,8]

Previous studies have shown promising results with ice application in various clinical procedures, including venipuncture and intravenous cannulation.[9] However, limited research specifically targets its effectiveness during AVF puncture in hemodialysis patients.[10] Given the repetitive nature of this procedure and the cumulative psychological burden of pain, evaluating the efficacy of ice application could offer valuable insights into improving patient care and comfort.[11]

This study aims to assess the effectiveness of ice application in reducing pain during AVF puncture among patients undergoing hemodialysis. By exploring this simple, low-cost intervention, the study hopes to contribute to the development of better pain management strategies in dialysis settings.[12]

MATERIALS AND METHODS

A quasi-experimental post-test only design was used to assess pain intensity during arteriovenous fistula (AVF) puncture among hemodialysis patients. The study was conducted in the hemodialysis unit of Tracery Care Hospital with 60 adult participants, divided equally into an experimental group (ice application before AVF puncture) and a control group (routine care). Purposive sampling was used to select patients meeting the inclusion criteria.

Inclusion Criteria

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- Adult patients (≥20 years) undergoing hemodialysis via AVF
- Willing to participate and provide informed consent
- Undergoing regular AVF puncture procedures

Exclusion Criteria

- AVF with complications such as infection, thrombosis, or aneurysm
- Patients on analgesics or sedatives before puncture
- Critically ill or uncooperative patients

Data were collected using a structured tool that included demographic and clinical variables, along with pain assessment using the Numerical Pain Rating Scale (NPRS). Pain scores were recorded post-puncture. Data analysis was done using SPSS, with descriptive statistics for demographic variables and an independent t-test for comparing pain scores. A p-value < 0.05 was considered significant.

RESULTS

Table 1: Frequency and Percentage Distribution of Socio-Demographic Variables Among Patients Undergoing Hemodialysis in the Experimental and Control Groups.

n=60

Socio-Demographic Variables		Experimental Group		Control Group	
		Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Age	20-30	2	6.7%	1	3.3%
	31-40	5	16.7%	6	20%
	41-50	10	33.3%	8	26.7%
	51-60	9	30%	10	33.3%
	Above 60 Years	4	13.3%	5	16.7%
Gender	Male	17	56.7%	16	53.3%
	Female	13	43.3%	14	46.7%
Religion	Hindu	20	66.7%	19	63.3%
	Muslim	4	13.3%	5	16.7%
	Christian	3	10%	2	6.7%

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	Sikh	2	6.7%	3	10%
	Other	1	3.3%	1	3.3%
Marital Status	Single	4	13.3%	3	10%
	Married	22	73.3%	23	76.7%
	Widowed	3	10%	3	10%
	Divorced	1	3.3%	1	3.3%
Educational Qualification	No formal education	3	10%	4	13.3%
	Primary	5	16.7%	6	20%
	Secondary	8	26.7%	7	23.3%
	Higher secondary/Diploma	7	23.3%	6	20%
	Graduation	5	16.7%	5	16.7%
	Post Graduation	2	6.7%	2	6.7%
Occupation	Unemployed	6	20%	5	16.7%
	Daily work \ labor work	5	16.7%	6	20%
	Employment	7	23.3%	6	20%
	Self-employed	4	13.3%	3	10%
	Private	5	16.7%	7	23.3%
	Government job	3	10%	3	10%
Monthly Income	Less than ₹10,000	9	30%	10	33.3%
	₹10,001 – ₹25,000	11	36.7%	9	30%
	₹25,001 – ₹50,000	7	23.3%	8	26.7%
	More than ₹50,000	3	10%	3	10%
Place of Residence	Urban	12	40%	10	33.3%
	Semi-Urban	8	26.7%	9	30%
	Rural	10	33.3%	11	36.7%

Table presents the socio-demographic distribution of patients undergoing hemodialysis in experimental and control groups. In the experimental group, most patients were aged 41–50 years

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(33.3%) and 51–60 years (30%), while in the control group, 51–60 years (33.3%) and 41–50 years (26.7%) were predominant. Males constituted 56.7% in the experimental and 53.3% in the control group. Majority were Hindus in both groups (66.7% experimental, 63.3% control), followed by Muslims, Christians, Sikhs, and others. Most participants were married (73.3% experimental, 76.7% control). Educationally, the majority had secondary to higher secondary/diploma qualifications in both groups. Regarding occupation, employed and private job holders were common, while income-wise, most earned between ₹10,001–₹25,000. In terms of residence, both groups had participants from urban, semi-urban, and rural areas, with a slight rural predominance in the control group.

Table 2: Frequency and Percentage Distribution of Clinical Variables Among Patients Undergoing Hemodialysis in the Experimental and Control Groups.

n=60

Clinical Variable		Experimental Group		Control Group	
		Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Duration of hemodialysis treatment	Less than 6 months	5	16.7%	6	20%
	6–12 months	8	26.7%	7	23.3%
	1–2 years	10	33.3%	9	30%
	More than 2 years	7	23.3%	8	26.7%
Frequency of hemodialysis per week	Twice	6	20%	7	23.3%
	Thrice	24	80%	23	76.7%
	Other	0	0%	0	0%
Duration since AVF creation	Less than 6 months	4	13.3%	5	16.7%
	6–12 months	7	23.3%	6	20%
	1–2 years	10	33.3%	9	30%
	More than 2 years	9	30%	10	33.3%

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Site of AVF	Right Arm	14	46.7%	13	43.3%
	Left Arm	16	53.3%	17	56.7%
History of AVF-related complications	Yes	10	33.3%	11	36.7%
	No	20	66.7%	19	63.3%
If Yes, Specify	Swelling	6	60%	7	63.6%
	Blockage	4	40%	4	36.4%
History of AVF puncture pain	Yes	25	83.3%	27	90%
	No	5	16.7%	3	10%
Use of any analgesic before puncture	Yes	7	23.3%	8	26.7%
	No	23	76.7%	22	73.3%
If Yes, Specify,	Inj. Diclofenac	3	42.9%	4	50%
	Inj. Tramadol	2	28.6%	2	25%
	Inj. Paracetamol	2	28.6%	2	25%
Needle size used for puncture	16 G	5	16.7%	6	20%
	17 G	15	50%	13	43.3%
	18 G	8	26.7%	9	30%
	Other	2	6.6%	2	6.7%
Any comorbid Conditions	Diabetes	10	33.3%	11	36.7%
	Stoke	3	10%	2	6.7%
	Cardiovascular Problems	7	23.3%	6	20%
	Autoimmune disorder	2	6.7%	3	10%
	Any Other	8	26.7%	8	26.7%

Table 2 presents the distribution of clinical variables among patients undergoing hemodialysis in

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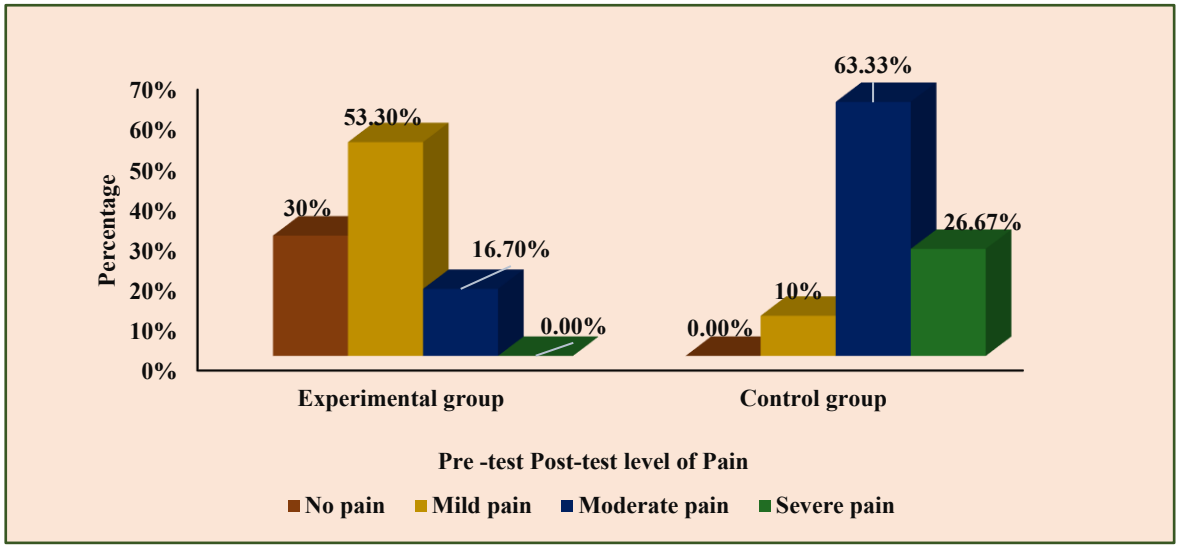
both groups. In the experimental group, 33.3% had been on hemodialysis for 1–2 years, while in the control group, 30% had the same duration. Most patients in both groups underwent hemodialysis thrice weekly (80% experimental, 76.7% control). The majority had AVF created 1–2 years ago (33.3% experimental, 30% control), with AVF commonly placed in the left arm (53.3% experimental, 56.7% control). AVF-related complications were reported by 33.3% (experimental) and 36.7% (control), mainly swelling and blockage. History of AVF puncture pain was present in 83.3% (experimental) and 90% (control). About a quarter of patients used analgesics before puncture, with Diclofenac being the most common. Most used 17G needles, followed by 18G and 16G. Common comorbidities included diabetes, cardiovascular problems, stroke, autoimmune disorders, and others, with similar distributions in both groups.

Figure 1: Percentage Distribution of Level of Pain Intensity During Arteriovenous Fistula (AVF) Puncture Among Patients Undergoing Hemodialysis.

n=60



This graph presents the distribution of Level of Pain Intensity During Arteriovenous Fistula (AVF) Puncture Among Patients Undergoing Hemodialysis. In the experimental group, 9 (30%) patients experienced no pain, 16 (53.3%) reported mild pain, 5 (16.7%) had moderate pain, and none experienced severe pain during AVF puncture. In contrast, in the control group, no patients reported no pain, while 3 (10%) experienced mild pain, 19 (63.33%) had moderate pain, and 8 (26.67%) experienced severe pain during the procedure.

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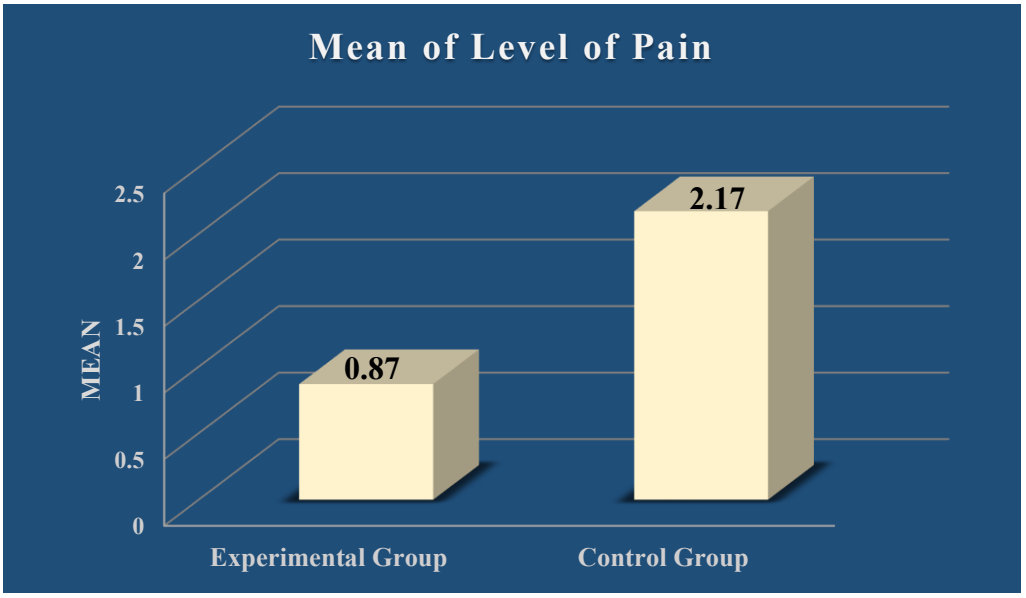
This distribution shows that the majority of patients in the experimental group experienced mild or no pain, whereas the control group had a higher frequency of moderate and severe pain during AVF puncture.

Figure 2: Mean of Experimental Group and Control Group Level of Pain Intensity During Arteriovenous Fistula (AVF) Puncture Among Patients Undergoing Hemodialysis.



The mean pain intensity score in the experimental group was 0.87 with a standard deviation (SD) of 0.67, indicating that most patients experienced low levels of pain with less variation in pain scores. In contrast, the control group had a mean pain intensity score of 2.17 with a standard deviation of 0.58, indicating a higher level of pain experienced by patients with relatively less variability in their responses. This comparison shows that the experimental group experienced significantly lower pain levels during AVF puncture than the control group, suggesting the effectiveness of the intervention applied to the experimental group.

Table 3: Mean, Standard Deviation, and "t" Value of Experimental Group and Control Group Level of Pain Intensity During Arteriovenous Fistula (AVF) Puncture Among Patients Undergoing Hemodialysis.

n=60

	Number of patients	Mean	SD	Calculated "t" value	't' value tabulated	df	p= value

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Experimental group	30	0.87	0.67	9.03	2.00	58	0.0001
Control group	30	2.17	0.58				

Table presents the comparison of the mean level of pain intensity during Arteriovenous Fistula (AVF) puncture among patients undergoing hemodialysis in the experimental and control groups. The experimental group (n = 30) had a mean pain score of 0.87 with a standard deviation (SD) of 0.67, while the control group (n = 30) had a significantly higher mean pain score of 2.17 with an SD of 0.58. The calculated *t*-value was 9.03, which is much higher than the tabulated *t*-value of 2.00 at 58 degrees of freedom (df). The associated p-value was 0.0001, which is highly statistically significant ($p < 0.05$).

This result indicates that there is a significant reduction in pain intensity among patients in the experimental group compared to those in the control group, suggesting the effectiveness of the intervention applied.

DISCUSSION

The findings of the present study showed that in the experimental group, 30% of patients experienced no pain and 53.3% reported mild pain during AVF puncture. In contrast, in the control group, 63.33% experienced moderate pain and 26.67% reported severe pain. These findings are consistent with results from similar studies.

A similar study, Ghodsbin et al. (2015) conducted a quasi-experimental study on the effect of cryotherapy on AVF puncture pain in 60 hemodialysis patients. Their results revealed that 83.3% of patients in the experimental group reported mild or no pain, while 80% in the control group reported moderate to severe pain. This supports the current study's findings that cryotherapy is effective in reducing pain during AVF puncture.[13]

In another quasi-experimental study, Mohammed and Elsayed (2020) evaluated the effect of guided imagery on pain during AVF puncture among 80 patients. They reported that 70% of patients in the intervention group experienced mild or no pain compared to only 20% in the control group. This further confirms the effectiveness of distraction and relaxation methods in reducing procedural pain in hemodialysis patients [14]

Compare the pain-related response among experimental group and control group during

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haemodialysis.

Comparable findings were reported in a study by Ugur et al. (2017), where the mean pain score in the experimental group (vibration + cold application) was 1.01 ± 0.60, while in the control group, it was 2.56 ± 0.84, with a statistically significant p-value of <0.001. Their findings reinforce the effectiveness of combining sensory distraction and cold application in reducing pain during AVF cannulation.[15]

CONCLUSION

According to study findings, the ice application was significantly effective in reducing pain during Arterio-Venous Fistula (AVF) puncture in the experimental group compared to the control group, with a p-value of 0.0001. This indicates that the intervention effectively reduced pain, emphasizing the importance of effective pain management strategies to enhance patient comfort during haemodialysis.

Acknowledgment

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Conflict of Interest

The authors hereby declare that there are no conflicts of interest associated with this research study.

Ethical Consideration

Ethical approval for the study was granted by the Parul Institute Ethics Committee (PIEC), Vadodara, Gujarat. Participants were fully informed about the study objectives, and informed consent was obtained from all before data collection commenced.

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