

A Study To Determine The Effectiveness Of Cryotherapy On Pain Management During Arterio Venous Fistula (AVF) Puncturing Among Patients Undergoing Hemodialysis In P.E.S Hospital, Kuppam, Chittoor District, A.P

Daniel Arun Kumar. K^{1*}, Dr. (Prof) Vishnu Dev Mishra²

1. Research Scholar, Rourkela Senior Nursing College, Sundargarh
2. Principal, Rourkela Senior Nursing College, Sundargarh

*Corresponding Author: Daniel Arun Kumar. K

ABSTRACT

Vascular access is required for hemodialysis. There are three different types of vascular access for hemodialysis i.e., Arteriovenous fistula (AVF), Arteriovenous graft (AVG), and Central venous catheter (CVC). In comparison with arteriovenous graft and central venous catheters, the use of arteriovenous fistula are consistently associate with low rates of morbidity and mortality. AV fistula are formed by connecting (anastomosis) an artery to vein. The most commonly used vessels are the radial or brachial artery and the cephalic vein of the non-dominant arm. Patient with end stage renal disease undergoing hemodialysis is repeatedly experiencing pain, because approximately 300 punctures per year to their arteriovenous fistula. Pain is a complex multidimensional experience that causes suffering and reduces quality of life. Pain as “Unpleasant sensory and emotional experience associated with potential or actual tissue damage or described in terms of such damage.” The degree of pain tolerance differs from one person to another. The main aim of present study was to determine the effectiveness of cryotherapy on pain management during arterio venous fistula (avf) puncturing among patients undergoing hemodialysis. **Methodology:** Evaluative approach with Pre-experimental One group pretest-posttest design was used to determine the effectiveness of cryotherapy on pain management during arteriovenous fistula (AVF) puncturing among patients undergoing hemodialysis. The Independent variable in the present study is Cryotherapy. Dependent variable in the present study is Pain related to arteriovenous fistula (AVF) puncture. 50 patients were selected through convenience sampling technique. To collect the data from patients 0-10 numeric pain intensity scale was used. Results: the results show that Pretest median was 6 and Post- test median was 3 and p value found to be .001 at $p < 0.05$ levels showed that there was significant difference between pre-test and post-test pain level during AV fistula puncturing among hemodialysis patients. Demographic variables like age, sex, religion, educational status, occupation, type of family, duration of hemodialysis, duration of AVF use shows not significance and others like place of residence, no. of hemodialysis per week shows significance. **Conclusion:** It is concluded that, when compared to the pre test scores there was a significant decrease in post-test pain scores during AV fistula puncturing after cryotherapy among patients undergoing hemodialysis. The researcher concluded that the nursing intervention i.e cryotherapy was effective.

Keywords: Cryotherapy, Pain Management, Arterio Venous Fistula (Avf), Hemodialysis

How to cite this article: Daniel Arun Kumar K, Mishra VD. A Study To Determine The Effectiveness Of Cryotherapy On Pain Management During Arterio Venous Fistula (AVF) Puncturing Among Patients Undergoing Hemodialysis In P.E.S Hospital, Kuppam, Chittoor District, A.P. Int J Drug Deliv Technol. 2026;16(62s): 479-484. DOI: 10.25258/ijddt.16.62s.55

Source of support: Nil.

Conflict of interest: None.

INTRODUCTION

Chronic kidney disease (CKD) is a progressive, irreversible disorder characterized by gradual loss of renal function and accumulation of metabolic waste, fluid, and electrolyte imbalance. Globally, CKD has emerged as an important non-communicable disease, with an estimated 674 million people affected worldwide, and kidney failure represents the most severe stage requiring dialysis or kidney transplantation for survival [1]. Recent global burden estimates indicate that CKD is increasingly contributing to mortality and disability, making renal replacement therapy an

essential component of long-term care [2]. In India, the burden is also substantial; a Government of India report citing ICMR data noted CKD prevalence of 9.4% in an urban multicentric study, and lakhs of patients avail dialysis services under the Pradhan Mantri National Dialysis Programme every year [3].

Hemodialysis is one of the most commonly used renal replacement therapies for patients with end-stage kidney disease. For successful hemodialysis, reliable vascular access is essential. An arteriovenous fistula (AVF), created by surgically joining an artery and vein, is widely considered the

preferred vascular access because it provides better long-term patency and fewer complications than grafts or catheters [4,5]. However, AVF use requires repeated insertion of two large-bore needles at every dialysis session, commonly three times per week. This repeated cannulation produces acute procedural pain, anxiety, anticipatory fear, and dissatisfaction among patients [6].

Pain is a subjective experience; therefore, standardized assessment using a valid self-report measure is necessary. The 0–10 Numerical Pain Rating Scale is a simple, widely used and validated tool for quantifying pain intensity, where 0 indicates no pain and 10 indicates worst possible pain [7]. Cryotherapy is a non-pharmacological technique that reduces pain through local cooling, vasoconstriction, decreased nerve conduction velocity, and stimulation of inhibitory pain pathways. Previous studies and systematic reviews have shown that cryotherapy may significantly reduce AVF puncture-related pain among hemodialysis patients [8,9]. Hence, evaluating cryotherapy in routine dialysis settings is clinically relevant.

NEED OF THE STUDY

Patients undergoing maintenance hemodialysis experience repeated invasive procedures throughout life. AVF cannulation is not a single painful event but a recurrent procedure, usually performed several times every week. Literature reports that pain during AVF cannulation is common, with prevalence varying widely from 12% to 80% depending on assessment methods and patient characteristics [10]. Repeated puncture pain may lead to fear of needles, anxiety before dialysis, reduced cooperation during cannulation, sleep disturbance, poor treatment satisfaction and, in some cases, decreased adherence to dialysis schedules [6]. Therefore, pain control during AVF puncturing is not only a comfort measure but also an important component of quality dialysis nursing care.

Pharmacological approaches such as topical anaesthetic creams or sprays may reduce puncture pain, but they can be costly, time-consuming, unavailable in resource-limited settings, and may require waiting time before cannulation. In contrast, cryotherapy is inexpensive, simple, safe, easily taught to nurses, and suitable for repeated use in a dialysis unit. Evidence supports its usefulness: Sabitha et al. demonstrated reduction in AVF puncture-related pain after cryotherapy among hemodialysis patients [8]; Aghajanloo et al. reported that cryotherapy significantly reduced mean pain scores from 5.9 ± 0.96 to 3.2 ± 1.71 compared with placebo [11]; and a meta-analysis found that cryotherapy using ice packs reduced AVF cannulation pain by approximately 1.92 points [9]. A recent randomized controlled trial also concluded that cold packs were safe and more

effective than lidocaine spray or flashlight distraction in reducing cannulation pain [10].

Despite this evidence, pain perception is influenced by age, gender, culture, previous dialysis experience, duration of AVF use, and individual coping ability. Hence, local evidence is necessary before routine implementation. In P.E.S. Hospital, Kuppam, Chittoor District, patients undergoing hemodialysis with AVF are repeatedly exposed to puncture-related pain. Assessing pre-test and post-test pain using the Numerical Pain Rating Scale will help determine whether cryotherapy is an effective, feasible and nurse-led intervention for pain management in this clinical setting.

OBJECTIVES OF THE STUDY:

1. To assess the pre-test level of pain during arteriovenous fistula puncturing among patients undergoing hemodialysis by using numerical pain scale.
2. To assess the post-test level of pain during arteriovenous fistula puncturing after cryotherapy among patients undergoing hemodialysis by using numerical pain scale.
3. To compare the pre-test and post-test level of pain among patients undergoing hemodialysis.
4. To associate the pre-test level of pain with their selected demographic variables.

HYPOTHESES:

1. H_{01} : There will be no significant difference in pre and post-test pain scores among hemodialysis patients.
2. H_{02} : There will be no significant association between pain scores with their selected demographic variables.

METHODOLOGY

Evaluative approach was used to assess the effectiveness of cryotherapy on pain management during arteriovenous fistula (AVF) puncturing among patients undergoing hemodialysis in P.E.S hospital, Kuppam, Chittoor district, A.P. Pre-experimental One group pretest-posttest design was used to determine the effectiveness of cryotherapy on pain management during arteriovenous fistula (AVF) puncturing among patients undergoing hemodialysis. The Independent variable in the present study is Cryotherapy. Dependent variable in the present study is Pain related to arteriovenous fistula (AVF) puncture. Age, Sex, Religion, Educational status, Occupation, Place of residence, Type of family, Duration of Hemodialysis, Duration of AV Fistula and No. of Hemodialysis per week are the demographic variables. 50 patients who are undergoing hemodialysis with AV fistula in P.E.S hospital, Kuppam, Chittoor district were selected through non-probability convenience sampling technique. To collect the data from patients 0-10 numeric pain intensity scale was used. The reliability of tool is statistically significant with

RESEARCH PAPER

'p' value of (0.011) and the 'r' value of (0.95).

RESULTS

Table No. 1: Frequency And Percentage Distribution Of Socio – Demographic Variables

S.N O	DEMOGRAPHIC VARIABLES	EXPERIMENTAL GROUP (n = 50)	
		FREQUENCY (F)	PERCENT AGE (%)
1.	AGE		
	a. 21 – 30 years	8	16%
	b. 31 – 40 years	8	16%
	c. 41 – 50 years	6	12%
	d. More than 50 years	28	56%
2.	SEX		
	a. Male	38	76%
	b. Female	12	24%
3.	RELIGION		
	a. Hindu	37	74%
	b. Muslim	8	16%
	c. Christian	5	10%
	d. Others (specify.....)	-	-
4.	EDUCATIONAL STATUS		
	a. Illiterate	18	36%
	b. Primary	5	10%
	c. Secondary	15	30%
	d. Higher secondary	5	10%
	e. Graduate	4	8%
	f. Post graduate	3	6%
5.	OCCUPATION		
	a. Employee	3	6%
	b. Self-employee	5	10%
	c. Unemployed	42	84%
6.	PLACE OF RESIDENCE		
	a. Rural	36	72%
	b. Urban	14	28%
7.	TYPE OF FAMILY		

	a. Nuclear family	38	76%
	b. Joint family	12	24%
8.	DURATION OF HAEMODIALYSIS		
	a. 0 – 1 year	26	52%
	b. 1.1 – 2 years	6	12%
	c. 2.1 – 3 years	4	8%
	d. More than three years	14	28%
9.	DURATION OF AVF USE		
	a. 0 – 1 year	26	52%
	b. 1.1 – 2 years	6	12%
	c. 2.1 – 3 years	4	8%
	d. More than three years	14	28%
10.	NO. OF HAEMODIALYSIS PER WEEK		
	a. 1 dialysis	4	8%
	b. 2 dialysis	42	84%
	c. 3 dialysis	4	8%
	d. 4 dialysis	-	-

The table no 1 revealed that out of 50 samples 28 (56%) samples were more than 50 years, 38 (76%) belongs to Male, 37 (74%) belonged to Hindu, 18 (36%) samples were Illiterate, 42 (84%) were un employees, 36 (72%) were from rural area, 38 (76%) belonged to Nuclear family, 26 (52%) were in duration of haemodialysis 0-1 year, 26 (52%) were in duration of AVF 0-1 year, and 42 (84%) were undergoing 2 dialysis.

Table No.: 2: Frequency And Percentage Distribution Of Pre Test Pain Level During Av Fistula Puncturing Among Experimental Group

Observation	Level of pain											
	No pain		Mild pain		Moderate pain		Severe pain		Worst pain			
	F	%	F	%	F	%	F	%	F	%		
O1- pretest	-	-	10	20%	21	42%	14	28%	6	12%	-	-

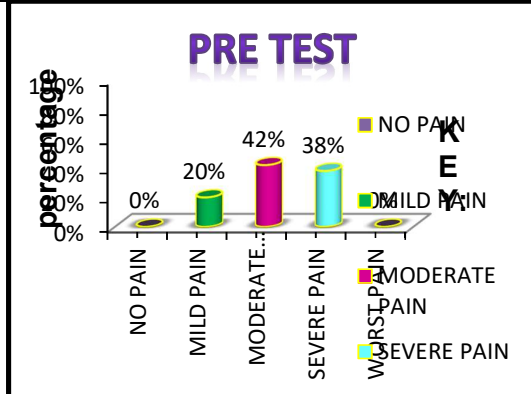


Figure 1: Frequency and percentage distribution of pre-test pain level during AV fistula puncturing among experimental group

Table no. 2 and fig. no. 1 shows pre-test pain scores of hemodialysis patients during AV fistula puncturing in experimental group. Out of 50 samples in experimental group 10 (20%) had mild pain, 21 (42%) had moderate pain, and 19 (38%) had severe pain.

Table no. 3: Frequency And Percentage Distribution Of Post Test Pain Level During Av Fistula Puncturing After Cryotherapy Among Experimental Group

Observation	Level of pain									
	No pain		Mild pain		Moderate pain		Severe pain		Worst pain	
	F	%	F	%	F	%	F	%	F	%
O2- post test	9	18%	21	42%	14	28%	6	12%	-	-

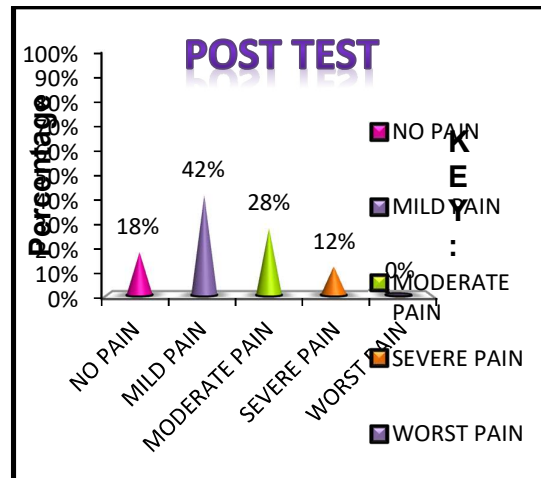


Figure 2: Frequency and percentage distribution of post-test pain level during AV fistula puncturing after cryotherapy among experimental group

Table no. 3 and Figure 2 shows post-test pain scores of hemodialysis patients during AV fistula puncturing after cryotherapy in experimental group. Out of 50 samples 9 (18%) had no pain, 21 (42%) had mild pain, 14 (28%) had moderate pain, and 6 (12%) had severe pain.

Table No. 4: Comparison Of Pre Test And Post Test Pain Level During Av Fistula Puncturing Among Experimental Group

GROUP	EXPERIMENTAL GROUP		P-VALUE
	PRE TEST	POST TEST	
MEDIAN	6	3	.001
IQR	(4,8)	(1,5)	

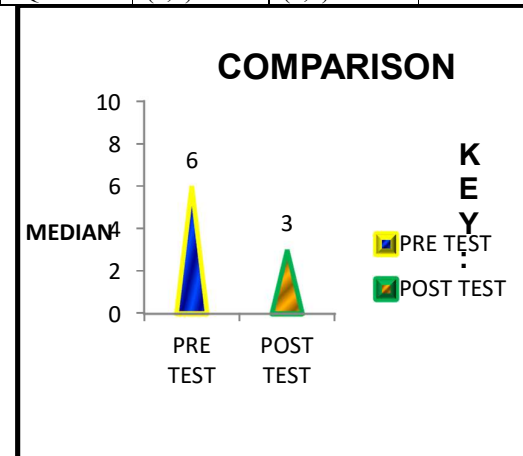


Figure 3: Comparison of pre-test and post-test pain level during AV fistula puncturing among experimental group

Table no. 4 and Figure 3 represents the median of pre and post-test pain level in experimental group.

RESEARCH PAPER

Pretest median was 6 and Post- test median was 3 and p value found to be .001 at $p < 0.05$ levels showed that there was significant difference between pre-test and post-test pain level during AV fistula puncturing among hemodialysis patients.

Table 5: Association Between Chi-Square Values Of Pre Test Scores With Their Demographic Variables

S.NO	VARIABLES	CHI – SQUARE VALUE	SIGNIFICANCE
1.	AGE IN YEARS	.455	Not significant
2.	SEX	.688	Not significant
3.	RELIGION	.881	Not significant
4.	EDUCATION	.915	Not significant
5.	OCCUPATION	.112	Not significant
6.	PLACE OF RESIDENCE	.035	Significant
7.	TYPE OF FAMILY	.912	Not significant
8.	DURATION OF HEMODIALYSIS	.556	Not significant
9.	DURATION OF AVF USE	.735	Not significant
10.	NO. OF HEMODIALYSIS PER WEEK	.012	Significant

Table 5 Shows that the association of 50 samples with their demographic variables. Chi-square analysis was used to determine the significance of association between pre test scores.

It refers to those variables which are highly influenced the dependent variables such as age (.455), sex (.688), religion (.881), educational status (.915), occupation (.112), type of family (.912), duration of hemodialysis (.556), duration of AVF use (.735) shows not significance. Place of residence (.035), no. of hemodialysis per week shows significance.

DISCUSSION

The present study assessed the effectiveness of cryotherapy on pain management during arteriovenous fistula puncturing among patients undergoing hemodialysis. In the pre-test, most patients experienced moderate pain 21 (42%) and severe pain 19 (38%), while only 10 (20%) had mild pain. After cryotherapy, pain intensity was reduced, as 9 (18%) patients reported no pain, 21 (42%) had mild pain, 14 (28%) had moderate pain and only 6 (12%) had severe pain. The median pain

score decreased from 6 in the pre-test to 3 in the post-test, with a statistically significant difference at $p = 0.001$. This finding indicates that cryotherapy was effective in reducing AVF puncture-related pain.

The findings are consistent with the study conducted by Sabitha et al., who reported that cryotherapy significantly reduced arteriovenous fistula puncture-related pain among hemodialysis patients and concluded that cryotherapy is an effective non-pharmacological pain-relieving measure [8]. Similarly, Aghajanloo et al. conducted a randomized controlled trial and found that cryotherapy significantly reduced the mean pain score during AVF cannulation compared with placebo, supporting the effectiveness of cold application in reducing procedural pain [11]. A systematic review and meta-analysis by Jafari-Koulaee et al. also confirmed that cryotherapy had a positive effect on reducing AVF puncture-related pain among hemodialysis patients, thereby strengthening the evidence for its clinical use [13]. Gouda et al. further reported that cold packs were effective and safe in reducing cannulation pain when compared with lidocaine spray and flashlight distraction [10]. Attia et al. also observed that cryotherapy reduced venipuncture pain among children with AVF undergoing maintenance hemodialysis [14].

In the present study, place of residence and number of hemodialysis sessions per week were significantly associated with pre-test pain level, whereas other demographic variables were not significant. Overall, the present findings are supported by previous studies and suggest that cryotherapy is a simple, economical, safe and nurse-led intervention for reducing AVF puncture pain.

CONCLUSION

The present study was conducted to determine the effectiveness of cryotherapy on pain management during arteriovenous fistula puncturing among patients undergoing hemodialysis in P.E.S. Hospital, Kuppam, Chittoor District, Andhra Pradesh. The study findings revealed that before cryotherapy, most of the patients experienced moderate to severe pain during AVF puncturing. In the pre-test, 42% of patients had moderate pain and 38% had severe pain, indicating that AVF puncturing is a painful and distressing procedure for hemodialysis patients.

After the application of cryotherapy, there was a marked reduction in pain intensity. In the post-test, 18% of patients reported no pain, 42% had mild pain, 28% had moderate pain and only 12% had severe pain. The median pain score decreased from 6 in the pre-test to 3 in the post-test, and the difference was statistically significant at $p = 0.001$. This shows that cryotherapy was effective in reducing pain during AVF puncturing.

The study also found significant association of pre-test pain level with place of residence and number of hemodialysis sessions per week. Hence, cryotherapy can be concluded as a simple, safe, cost-effective and nurse-led intervention for pain management during AVF puncturing among hemodialysis patients.

RECOMMENDATIONS

- A similar study can be conducted with large sample size for better utilization.
- A similar study can be conducted with control group to correlate the findings
- A similar study can be conducted by using either true or quasi experimental design.
- A comparative study can be conducted with other non-pharmacological interventions to determine their effectiveness in pain management during AV fistula puncturing among hemodialysis patients.
- A survey can be done to assess the present interventions used by nurses to minimize level of pain during AV fistula puncturing.

Conflict of Interest: The authors certify that they have no involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this paper.

Funding Source: There is no funding Source for this study

BIBLIOGRAPHY

1. World Health Organization. Kidney disease. Geneva: World Health Organization; 2026.
2. Mark PB, et al. Global, regional, and national burden of chronic kidney disease, 1990–2023: a systematic analysis. *Lancet*. 2025.
3. Government of India, Ministry of Health and Family Welfare. Prevalence of chronic kidney disease: Lok Sabha unstarred question no. 4649. New Delhi: Department of Health and Family Welfare; 2025.
4. Marsh AM, Genova R, Buicko Lopez JL. Dialysis fistula. In: StatPearls. Treasure Island: StatPearls Publishing; 2023.
5. National Kidney Foundation. Hemodialysis access: fistula, graft and catheter. New York: National Kidney Foundation; 2026.
6. Arshad AR, Ijaz U, Rafique B. Pharmacological interventions for pain management during arteriovenous fistula puncture in adults and adolescents undergoing maintenance haemodialysis: a systematic review. *Ren Replace Ther*. 2024;10:46. doi:10.1186/s41100-024-00562-y.
7. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain, Numeric Rating Scale for Pain, McGill Pain Questionnaire, Short-Form McGill Pain Questionnaire, Chronic Pain Grade Scale, Short Form-36 Bodily Pain Scale, and Measure of Intermittent and Constant Osteoarthritis Pain. *Arthritis Care Res*. 2011;63 Suppl 11. doi:10.1002/acr.20543.
8. Sabitha PB, Khakha DC, Mahajan S, Gupta S, Agarwal M, Yadav SL. Effect of cryotherapy on arteriovenous fistula puncture-related pain in hemodialysis patients. *Indian J Nephrol*. 2008;18(4):155-8. doi:10.4103/0971-4065.45290.
9. Jafari-Koulaee A, Moosazadeh M, Bagheri Nesami M, Goudarzian AH. Effect of cryotherapy on arteriovenous fistula puncture-related pain in hemodialysis patients: a systematic review and meta-analysis. *Complement Ther Med*. 2020;49:102326. doi:10.1016/j.ctim.2020.102326.
10. Gouda K, El Said T, Fahmy SF. The effect of cold packs, lidocaine spray, and flashlights on cannulation pain in patients undergoing hemodialysis: a randomized controlled trial. *Future J Pharm Sci*. 2023;9:100. doi:10.1186/s43094-023-00539-4.
11. Aghajanloo A, Ghafourifard M, Haririan H, Shiri Gheydari P. Comparison of the effects of cryotherapy and placebo on reducing the pain of arteriovenous fistula cannulation among hemodialysis patients: a randomized control trial. *J Nurs Midwifery Sci*. 2016;3(1):59-65. doi:10.18869/acadpub.jnms.3.1.59.
12. Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, et al. KDOQI clinical practice guideline for vascular access: 2019 update. *Am J Kidney Dis*. 2020;75(4 Suppl 2). doi:10.1053/j.ajkd.2019.12.001.
13. Jafari-Koulaee A, Moosazadeh M, Bagheri Nesami M, Goudarzian AH. Effect of cryotherapy on arteriovenous fistula puncture-related pain in hemodialysis patients: a systematic review and meta-analysis. *Complement Ther Med*. 2020;49:102326.
14. Attia AAM, Hassan AM, El-Sayed A. Effect of cryotherapy on pain management at the puncture site of arteriovenous fistula among children undergoing hemodialysis. *Int J Nurs Sci*. 2016;3(1):46-51.