

# Effect of Cold Application on Arteriovenous Fistula Puncture Pain among Hemodialysis Patients in Selected Hospitals of Kamrup Metro, Guwahati

Chandrama Borgohain<sup>1</sup>, Nabajani Dutta<sup>2</sup>

<sup>1</sup>Msc Nursing, Student of Army Institute of Nursing, Guwahati, India  
Email: [chandramaborgohain0\[at\]gmail.com](mailto:chandramaborgohain0[at]gmail.com)

<sup>2</sup>Msc Nursing, Assistant Professor, Army Institute of Nursing, Guwahati, India  
Email: [duttanabajani\[at\]gmail.com](mailto:duttanabajani[at]gmail.com)

**Abstract:** Background: Chronic kidney disease (CKD) is one of the most devastating medical, social and economic problems for patients and their families in our country. Patients undergoing hemodialysis are repeatedly exposed to pain from approximately 300 punctures per year. Therefore, pain assessment and management are considered as the nursing priority and one of the important aspects of clinical nursing and one of the therapies to reduce pain is Cold Application. Aim: To determine the effectiveness of cold application on ArterioVenous Fistula Puncture Pain among hemodialysis patients. Material and Methodology: The research approach adopted was quantitative research Approach using pre-experimental (one group pretest posttest) research design. The study was conducted in the Nephrology Department of Guwahati Medical College and Hospital, Guwahati, Assam. The sample for the study consists of hemodialysis patients with ArterioVenous Fistula Puncture pain. 60 samples were selected for the study. The selection of the sample was done by non-probability convenience sampling technique. Two tools which include tool 1-Semi structured questionnaire (demographic and health related variables) and tool 2-Numerical Pain Rating Scale were utilized to collect the data. Results: Results revealed that before intervention mean pain score was 6.38 (SD=1.027) and after intervention mean pain score was 3.22 (SD=1.106) with mean difference was 3.16. The effectiveness was tested using paired t test with obtained ( $t=36.71$ ,  $df=59$ ,  $p=0.001$ ) was statistically significant at  $p<0.05$  level. Findings revealed that cold application was effective on reduction of ArterioVenous Fistula Puncture Pain among Hemodialysis patients. Conclusion: Hence, findings concluded that cold application was effective on reduction of ArterioVenous Fistula Puncture Pain among Hemodialysis patients.

**Keywords:** Effect, ArterioVenous Fistula Puncture pain, Cold Application, Hemodialysis

## 1. Introduction

“The human body has been designed to resist an infinite number of changes and attacks brought about by its environment. The secret of good health lies in successful adjustment to changing stresses on the body.”

– Harry J. Johnson

Chronic kidney disease (CKD) is an important and common noncommunicable condition globally. In national and international guidelines, CKD is defined and staged according to measures of kidney function that allows for a degree of risk stratification using commonly available markers Chronic kidney disease is emerging and most devastating medical, social and economic problem for both patients and their families of our country<sup>1</sup>. Most CKD patients reporting to tertiary care centers in India are in the final stage where Renal Replacement Therapy (RRT) is the only option at that stage.<sup>2</sup> Hemodialysis (HD) is the most frequently used RRT with the ArterioVenous Fistula (AVF) being the gold standard for vascular access in Hemodialysis patients<sup>3</sup>.

According to National Kidney Foundation Dialysis Outcome Quality Initiative [DOQI] (2005) report, ArterioVenous Fistula remains as a Gold standard for vascular access in hemodialysis patients. Once mature, the ArterioVenous Fistula has excellent long term patency rate and rarely become infected. ArterioVenous Fistula can provide adequate vascular access for over 20 years<sup>1</sup>.

Pain during ArterioVenous Fistula cannulation remains a common problem in hemodialysis patients. Pain inflicted by the insertion of large cannula into the ArterioVenous Fistula is a significant cause of concern for both children and adults on regular hemodialysis<sup>4</sup>. Non pharmacological therapies are quiet effective in offering pain relief. Nurses use this therapy to lessen the reception and perception of pain<sup>5</sup>.

## 2. Objectives

- To assess ArterioVenous Fistula Puncture Pain among Hemodialysis patients before and after intervention
- To determine the effectiveness of cold application on ArterioVenous Fistula Puncture Pain among Hemodialysis patients
- To find out the association between ArterioVenous Fistula Puncture Pain among Hemodialysis patients before intervention with selected demographic variables
- To find out the association between ArterioVenous Fistula Puncture Pain among Hemodialysis patients before intervention with selected health related variables

## 3. Literature Survey

Shehab M (2019) conducted a quasi-experimental research design on to evaluate the effect of Cryotherapy Related Pain Management among Patients Undergoing Hemodialysis at the Site of Arteriovenous Fistula Puncture in Alazhar

University Hospital at new Damietta city. 60 samples who were undergoing hemodialysis therapy through their arteriovenous fistula (AVF) over 6 months' period were taken for the study. Tools of data collection included a structured interviewing questionnaire, numerical pain rating scale, behaviour pain scale and physiological parameters measurement. Results showed highly statistically significant differences between mean score in all vital signs during AVF puncture pre and post cryotherapy.<sup>6</sup>

Suresh H et. al, (2018) conducted a prospective observational study on a new and pernicious complication of pulmonary hypertension (PH) in patients with chronic kidney disease, treated at Karnataka Institute of Medical Sciences, Hubli Karnataka. The aim of this study is to analyze the prevalence of PH in patients with CKD, its severity in different stages of CKD, and risk factors for it. The sample size of the study was 108 patients. The finding showed that the mortality rate among those with PH was significantly higher, compared to those without PH ( $P = 0.03$ ). Hence this study concludes that substantial number of the patients with CKD develops Pulmonary Hypertension.<sup>7</sup>

A Srivastava (2018) conducted a prospective study on Role of preoperative duplex ultrasonography to predict functional maturation of wrist radio-cephalic arteriovenous fistula among 173 patients of Indian population. The aim of this study was to determine the role of preoperative duplex USG (DUS) for prediction of functional maturity of radiocephalic fistula in the wrist. The study analysed that Mean RAD noted in patients with successful outcome versus maturation failure was  $2.33 \pm 0.28$  and  $1.91 \pm 0.31$  mm also statistically significant when compared using independent t-test ( $P < 0.00$ ). Thus the study concludes that the vascular calcifications were associated with high risk of maturation failure in diabetics. Hence, the proximal fistulas should be considered in diabetic patients with inadequate arterial diameter and calcifications.<sup>8</sup>

Divya Jain Pachori (2017) conducted a quasi-experimental study on Effectiveness of Cryotherapy on Pain during Puncture of Arteriovenous Fistula among the Patients on Haemodialysis in selected hospitals, Gujrat. The sample size was 60 subjects (30 in Experimental and 30 in Control group) were selected by purposive sampling technique. Post-test only control group research design was used. Modified mc caffery's numeric pain rating scale was used for objective pain behaviour which includes facial expression, verbalization, body movement, interpersonal behaviour and physiology (Vital sign). The analysis of the data reveals that, the cryotherapy is highly significant in experimental group for reduction of pain during puncture of arteriovenous fistula among the patients on haemodialysis than control group.<sup>9</sup>

Olvani Martins da Silva et. al, (2016) conducted a cross-sectional study on Pain during Arteriovenous Fistula Cannulation in Chronic Renal Patients on Hemodialysis. 70 individuals participated in the research and were assessed by the visual analogue scale. The study analysis that the use of VAS showed the presence of moderate pain in most patients and no association between pain and gender, treatment period and hemodialysis shifts were found. So, the study

concluded that the need for pre-cannulation analgesia improves comfort during the procedure.<sup>10</sup>

#### 4. Methods/ Approach

**Research Approach:** Quantitative Research Approach was used to assess the effectiveness of Cold Application on Arterio Venous Fistula Puncture Pain among Hemodialysis patients.

**Research Design:** The research design adopted for this study was Pre-experimental, One-group pretest-posttest research design.

**Setting:** The setting for the study was conducted in the Nephrology Department of Guwahati Medical College and Hospital, Guwahati, Assam.

**Population:** Patients undergoing Hemodialysis

**Target population:** Patients undergoing Hemodialysis with ArterioVenous Fistula Puncture Pain.

**Sample:** The sample for the study consists of Hemodialysis Patients with ArterioVenous Fistula Puncture pain.

**Sample Size:** The total sample size was 60. The sample size was determined after extensive literature review.

**Sampling Technique:** Samples were selected with the help of Non-probability Convenience sampling technique.

#### Criteria for sample selection:

##### Inclusion criteria:

- Patients receiving hemodialysis
- Patients having ArterioVenous Fistula Puncture.
- Capable of giving adequate response to pain

##### Exclusion Criteria:

- Patients with neuro vascular disorders

##### Variables:

- **Independent Variable:** The independent variable was cold application
- **Dependent Variable:** The dependent variable refers to the pain score of ArterioVenous Puncture Pain among Hemodialysis Patients.

##### Description of the tool:

Semi structured questionnaire and Numerical Pain Rating Scale was prepared to assess the level of pain of hemodialysis patients having ArterioVenous Fistula Puncture

##### It consists of 2 Tool

**Tool I** – Semi structured questionnaire

Part A-Demographic Variables

It consist of 8 items including-

Age, Gender, Occupational status, Duration of sleep at night time, Personal habits, Duration of illness, History of illness, Family history of illness

Part B-Health related Variables

It consists of 6 items including-

Reason of hemodialysis, Site of arteriovenous fistula, Period of hemodialysis, Frequency of dialysis in a week, Duration of present arteriovenous fistula use, Sign of any complication at the site of puncture

Tool II-Numerical Pain Rating Scale

Numerical pain rating scale which includes 5 items with total score of 10.

The score is divided into following categories-

- 0-no pain
- 1-3-mild pain
- 4-6-moderate pain
- 7-9-severe pain
- 10-worst pain

Data collection procedure:

- Informed consent was obtained from the patients.
- Demographic performa and health related variables data were collected prior to the pretest
- Pretest was performed by using Numerical Pain Rating Scale.
- Cold application was administered, where ice cube was taken within a glove and wrapped with gauze piece was given to patients at LI-4 meridian point on the contra lateral hand of ArterioVenous Fistula i. e the hand that does not having ArterioVenous Fistula for around 10mins was applied for 2 times a day-(1st when hemodialysis starts and 2nd time when hemodialysis procedure ends) for consecutive 3 days.
- Posttest was performed by using the same Numerical Pain Rating Scale to assess the level of pain.

5. Results

Table 1: Frequency and percentage distribution of level of ArterioVenous Fistula Puncture Pain before and after intervention among Hemodialysis patients

Level of pain	Before		After	
	f	%	f	%
No pain	0	0	0	0
Mild pain	0	0	37	61.7
Moderate pain	32	53.3	23	38.3
Severe pain	28	46.7	0	0

In Table1 depicts the frequency and percentage distribution of level of ArterioVenous Fistula Puncture Pain before and after intervention among Hemodialysis patients. Result revealed that before intervention majority 32 (53.3%) of participants had moderate pain and 28 (46.7%) had severe pain whereas after intervention majority 37 (61.7%) of participants had mild pain and 23 (38.3%) had moderate pain among hemodialysis patients.

Table 2: Effectiveness of cold application on ArterioVenous Fistula Puncture Pain among Hemodialysis patients

Comparison of level of pain	Mean	SD	Mean Difference	t test value	df	p value
Before	6.38	1.027	3.16	36.71	59	0.001**
After	3.22	1.106				

\*\*P<0.01 level of significance

In Table2 depicts the effectiveness of cold application on ArterioVenous Fistula Puncture Pain among Hemodialysis patients. Findings showed that before intervention mean pain score was 6.38 (SD=1.027) and after intervention mean pain score was 3.22 (SD=1.106) with mean difference was 3.16. The effectiveness was tested using paired t test which obtained (t=36.71, df=59, p=0.001) was statistically significant at p<0.05 level. Findings revealed that cold application was effective on reduction of ArterioVenous Fistula Puncture Pain among Hemodialysis patients.

Table 3: Association between ArterioVenous Fistula Puncture Pain among Hemodialysis patients before intervention with selected demographic variables

Sl. No	Demographic variables	Pre interventional pain		$\chi^2$ value	df	p value
		Moderate pain	Severe pain			
1	<b>Age in years</b>			0.560	2	0.756 <sup>NS</sup>
	a. 20-40 years	6	6			
	b. 41-60 years	19	14			
	c. 61-80 years	7	8			
2	<b>Gender</b>			0.463	1	0.496 <sup>NS</sup>
	a. Male	19	19			
	b. Female	13	9			
3	<b>Occupational status</b>			1.288	4	0.863 <sup>NS</sup>
	a. Unemployed	15	11			
	b. Daily wages	8	8			
	c. Business	4	6			
	d. Private employee	3	2			
	e. Government employee	2	1			
4	<b>Duration of sleep at night time</b>			7.450	2	0.024*
	a. 0-3 hours	4	11			
	b. 4-6 hours	14	5			
	c. 7-9 hours	14	12			
	d. Above 10 hours	--	--			

<b>5</b>	<b>Personal habits</b>					
	a. Alcohol	4	5	2.331	3	0.507 <sup>NS</sup>
	b. Smoking	1	1			
	c. Chewing tobacco	14	7			
	d. No such habits	13	15			
<b>6</b>	<b>Duration of illness</b>					
	a. Less than 1 year	9	9	0.731	3	0.866 <sup>NS</sup>
	b. 1-3 years	8	7			
	c. 3-5 years	13	9			
	d. More than 5 years	2	3			
<b>7</b>	<b>History of illness</b>					
	a. Diabetes	1	5	10.60	3	0.014*
	b. Hypertension	7	2			
	c. Both A and B	11	3			
	d. No illness	13	18			
<b>8</b>	<b>Family history of illness</b>					
	a. Diabetes	8	4	1.448	2	0.485
	b. Hypertension	7	9			
	c. Kidney disease	--	--			
	d. No illness	17	15			

\*P<0.05 level of significance NS-Non significant

In Table 3 depicts the association between ArterioVenous Fistula Puncture Pain among Hemodialysis patients before intervention with selected demographic variables. The chi-square values showed that duration of sleep at night and history of illness of hemodialysis patients were statistically found significant association at p<0.05 level. The other

demographic variables such as age, gender, occupational status, personal habits, duration of illness and family history of illness were statistically nonsignificant with ArterioVenous Fistula Puncture Pain before intervention among Hemodialysis patients.

**Table 4:** Association between ArterioVenous Fistula Puncture Pain among Hemodialysis patients before intervention with selected Health related variables

S. No	Health related variables	Pre interventional pain		$\chi^2$ value	df	p value
		Moderate pain	Severe pain			
1	<b>Reason of hemodialysis</b>					
	a. CKD	32	28	NA	NA	NA
	b. Others	--	--			
2	<b>Site of arteriovenous fistula</b>					
	a. Right arm	12		0.188	1	0.664 <sup>NS</sup>
b. Left arm	20	9				
			19			
3	<b>Period of hemodialysis</b>			0.762	3	0.858 <sup>NS</sup>
	a. < 1 year	12	12			
	b. 1-2 years	8	5			
	c. 2-3 years	10	10			
	d. > 3 years	2	1			
4	<b>Frequency of attending dialysis in a week</b>			0.155	1	0.694 <sup>NS</sup>
	a. Once	--	--			
	b. Twice	11	11			
	c. Thrice	21	17			
	d. Daily	--	--			
5	<b>Duration of present arteriovenous fistula site use</b>			6.807	2	0.033*
	a. 1-6 months	--	--			
	b. 7-12 months	13	19			
	c. 13-18 months	11	8			
	d. 19-24 months	8	1			
	e. More than 24 months	--	--			
6	<b>Sign of any complication at the site of puncture</b>			2.550	3	0.466 <sup>NS</sup>
	a. Redness	14	8			
	b. Swelling	4	5			
	c. Pain	10	13			
	d. No sign	4	2			

\*P<0.05 level of significance NS-Non significant

Table 4 depicts the association between ArterioVenous Fistula Puncture Pain among Hemodialysis patients before intervention with selected health related variables. The chi-square values showed that duration of present arteriovenous

fistula site use of hemodialysis patients was statistically found significant association at p<0.05 level. The other health related variables such as reason of hemodialysis, site of arteriovenous fistula, period of hemodialysis, frequency

of attending dialysis in a week and sign of any complication at the site of puncture were statistically nonsignificant with ArterioVenous Fistula Puncture Pain before intervention among Hemodialysis patients.

## 6. Discussions

### Objective 1

To assess the ArterioVenous Fistula Puncture Pain among Hemodialysis patients before and after intervention.

This study was supported by the experimental study conducted by Thankam et al 2019 to evaluate the effectiveness of cryotherapy on ArterioVenous fistula puncture site pain among patients on Hemodialysis. A non-probability purposive sampling technique was used to obtain 60 patients. (30 were divided each in the experimental and control group) who are undergoing hemodialysis by using AV fistula. Findings shows that in the pretest, in experimental group 18 (60%) had moderate and 12 (40%) had severe level of pain. In control group 7 (23.3%) had mild pain, 14 (46.7%) had moderate pain, 9 (30%) had severe level of pain. In the post test, in experimental group 20 (66.66%) had mild, 10 (33.3%) had moderate level of pain. In control group 21 (70%) had severe, 9 (30%) had moderate level of pain<sup>11</sup>.

### Objective 2

To determine the effectiveness of Cold Application on ArterioVenous Fistula Puncture Pain among Hemodialysis patients

This study was supported by the quasi-experimental time series study conducted by Josel Lijjiya, Loba Diana (2015) to evaluate the effectiveness of cryotherapy on arteriovenous fistula puncture related pain among hemodialysis patients in selected hospitals, Mangalore. By using purposive sampling technique 50 hemodialysis patients were selected and patients were randomly assigned to the experimental group (n 1 =25) and control group (n 2 =25) and data was collected using the demographic performa, numerical rating scale and observational checklist. There was a significant difference between the pre-test and post-test behavioural response scores and pain scores in the experimental group. The calculated ANOVA value (F=54.7) and (F=30.4) was significantly more than the tabled value =3.15 at 0.05 level. The current study concluded that cryotherapy was effective in reducing subjective pain and objective behavioural response scores of arteriovenous fistula puncture related pain.<sup>12</sup>

### Objective 3

To find out the association between ArterioVenous Puncture Pain among Hemodialysis patients before intervention with selected demographic variables.

This study was supported by the Quasi experimental study conducted by Nazir S et al 2018 to Evaluate the Effectiveness of Cryotherapy on Pain during Arteriovenous Fistula Puncturing among Hemodialysis Patients in Dialysis Unit of Safdarjung Hospital, New Delhi. The selection of the sample was done by non-probability purposive sampling technique followed by random assignment of 60 subjects to

experimental and control groups. Three tools were utilized to collect the data. The study findings revealed that in gender Chi-square is significant at 0.05 level of significance. The computed Chi-square values of other selected variables, i. e., age, duration of hemodialysis, and duration of AV fistula are not significant at 0.05 level of significance<sup>13</sup>.

### Objective 4

To find out the association between ArterioVenous Puncture Pain among Hemodialysis patients before intervention with selected health related variables.

This study was supported by the Prospective, Quasi experimental study conducted by Kaur R, et al 2019 to evaluate the effectiveness of cutaneous stimulation technique on A. V fistula puncture pain among chronic kidney disease patients undergoing hemodialysis in dialysis unit of Gian Sagar medical college and hospital, Ram Nagar, Distt. Patiala, Punjab. Study included 40 samples of chronic kidney disease patients selected by purposive sampling technique. Data were collected using demographic & clinical Performa, Numerical pain rating scale, objective pain behaviour scale (r=0.87). Findings revealed that, there was significant association of subjective pain (artery puncture) with employment status and co morbidity (p<0.05). There was also association of subjective pain (venous puncture) and employment status (p<0.05)<sup>14</sup>.

## 7. Limitations

- 1) Data collection period is 4 weeks only
- 2) Sample size is 60
- 3) The present study is limited to assessment of specific aspect i.e level of pain of the patients suffering from Chronic Kidney Disease undergoing Hemodialysis
- 4) The present study is limited to the patients having ArterioVenous Fistula Puncture Pain

## 8. Recommendations

- 1) A similar study can be conducted to compare different pharmacological and non pharmacological approaches as alternative to minimize pain
- 2) A similar study can be replicated in a different setting to strengthen the findings
- 3) Same study can be replicated on dental pain and for IV Cannulation
- 4) A similar study can be conducted on two different age group.
- 5) Cold application can be used during different painful procedures

## 9. Conclusion

The investigator had conducted the study to assess the effectiveness of Cold Application on ArterioVenous Puncture Pain among Hemodialysis patients. Results revealed that before intervention pain score was 6.38 and after intervention mean pain score was 3.22 so the difference is 3.16. Through results it revealed that cold application was effective on reduction of ArterioVenous Fistula Puncture Pain among Hemodialysis patients. Cold application has no

complication, less cost effective, easily available easy to administer to patients. The investigator found that cold application it can be used as a non – pharmacological intervention and is recommended as a pain relief technique during ArterioVenous Fistula puncture in hemodialysis patients.

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## Author Profile

**Chandrama Borgohain**, Msc Nursing (Medical Surgical Nursing), Student of Army Institute of Nursing, Guwahati.

**Nabajani Dutta**, Msc Nursing (Medical Surgical Nursing), Assistant Professor, Army Institute of Nursing, Guwahati.