J Nur Today

RESEARCH ARTICLE

www.jolnt.com

e-ISSN 2456-1630

Effectiveness of Cryotherapy on Pain during Puncture of Arteriovenous Fistula among the Patients on Haemodialysis

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Received: 29.03.2017

Edited : 20.04.2017

Accepted: 06.05.2017

Published: 15.05.2017

ABSTRACT

CKD is the most devastating medical, social and economic problem for patients and their family of our country. With an estimated new cases of end stage renal disease of 100 per million people in a year globally, there could be 1 lakh patients from India. Most CKD patients reporting to tertiary care centres in India are in the final stage where Renal Replacement Therapy (RRT) is the only opinion at this stage. The availability of various renal replacement therapies helps in reducing severity of symptoms and results in longer survival of ESRD patients. These patients largely depend on haemodialysis and renal replacement therapy. They receive chronic or maintenance dialysis therapy for the control of uremic and azotemic manifestations.4 Pain is an individual's unique experience that may be difficult for the clients to explain or describe and is often difficult for others to recognize, understand and assess. There are different nursing interventional modalities that can be applied to reduce the pain according to the condition of the patient. Cold application as a cutaneous stimulation technique is an effective non-pharmacological intervention for pain management. Pain during arteriovenous fistula cannulation remains a common problem in hemodialysis patients. Thus, studies have shown that Cryotherapy given on the contralateral arm not having the AV fistula reduces the puncture pain in hemodialysis patients.7

A study was undertaken with the objective to assess the effectiveness of selected intervention on pain during puncture of arteriovenous fistula among patients on haemodialysis, the study was performed with evaluative research approach and post-test only control group research design was used. All the subjects were assessed for pain and effectiveness of cryotherapy during puncture of arteriovenousfistula in experimental and without crytherapy in control group. Following which the data was complied, tabulated, analyzed and interpreted with the descriptive and inferential statistics. The study concluded that the cryotherapy is an effective intervention to reduce pain during puncture of arteriovenous fistula among patients of haemodialysis.

KEYWORDS

Effectiveness, Cryotherapy, Pain, Arteriovenous fistula, Puncture, Haemodilysis

INTRODUCTION

"That's the thing ***about pain***.... It demands to be felt" JOHN GREEN

Chronic Kidney Disease (CKD) is a progressive irreversible detoriation in renal function in which body's ability to maintain metabolic, fluid and electrolyte balance fails. Most patients are in the final stage of CKD where the glomerular filtration rate is less than 15 ml/hr. It is now emerging as a public health problem globally.[2] World Health Organization (WHO) estimates that the diseases of the kidney and urinary tract contribute to over 8,50,000 deaths, over 30 million people have been diagnosed to have CKD and it is estimated that over 6, 00,000 will need renal replacement therapy by 2010, costing US dollar 28 billion.11 It is estimated that approximately one lakh new patients develop ESRD in India annually. This suggests the possibility that the burden of CKD could be significant in India.[3] the availability of various renal replacement therapies helps in reducing severity of symptoms and results in longer survival of

ESRD patients. These patients largely depend on haemodialysis and renal replacement therapy. They receive chronic or maintenance dialysis therapy for the control of uremic and azotemic manifestations.[4] AV fistula remains as a gold standard for vascular access in haemodialysis patients. Once mature, the AV fistula has excellent long term patency rates and rarely become infected. AV fistula can provide adequate vascular access for over 20 years. Pain during arteriovenous fistula cannulation remains a common problem in hemodialysis patients. Thus, studies have shown that Cryotherapy given on the contralateral arm not having the AV fistula reduces the puncture pain in hemodialysis patients. Therefore, the need for adopting alternative therapies such as Cryotherapy for effective pain management in hospital settings is becoming an essential factor.

MATERIALS AND METHODS

The research approach adopted for this study was quasi-experimental approach and post-test only control group research design. The sample composed of 60 subjects (30 in Experimental and 30 in Control group) undergoing haemodialysis having arteriovenous fistula. The sampling technique used in the study was Purposive sampling technique.

The researcher used 7 items for demographic data which include age, gender, duration of dieases, Haemodialysis started since, Number of haemodialysis carried per week, What make your pain better, What make your pain worse? Modified mccaffery'snumericpain rating scale.Modified scale for objective pain behaviour which includeS 5 items like facial expression, verbalization, body movement, interpersonal behaviourand physiology (Vital sign).

In this study Inter rater method was used to find out the reliability of the tool. The reliability of the tool was calculated 0.89 for pain and 0.84 for pain behaviour. This correlation coefficient is very high and it is good tool for assessing effectiveness of Cryotherapy.

MAJOR FINDINGS OF THE STUDY:

I. Findings related to demographic data of the participation:

Distribution of subjects characteristics (personal characteristics) in relation to demographic data.

Demographic variables	group		Chi square test
	Control (30)	Experiment (30)	

		n	%	n	%	
Age	18 -28 yrs	5	16.7%	6	20.0%	$\chi 2$=0.85
	29 -38 yrs	6	20.0%	8	26.7%	P=0.84
	39 -48 yrs	8	26.7%	8	26.7%	
	> 48 yrs	11	36.7%	8	26.7%	
Gender	Male	17	56.7%	21	70.0%	$\chi 2$=1.15
	Female	13	43.3%	9	30.0%	P=0.28
Duration of disease	1 - 3 yrs	8	26.7%	7	23.3%	$\chi 2$=0.44
	4 - 6 yrs	10	33.3%	10	33.3%	P=0.93
	7 - 9 yrs	6	20.0%	5	16.7%	
	> 10 yrs	6	20.0%	8	26.7%	
Haemodialysis started since	Below 2 years	8	26.7%	5	16.7%	$\chi 2$=2.87
	2 - 4 yrs	6	20.0%	3	10.0%	P=0.41
	4 - 6 yrs	6	20.0%	10	33.3%	
	Above 6 yrs	10	33.3%	12	40.0%	
Number of haemodialysis per week	1 time	12	40.0%	7	23.3%	$\chi 2$=3.16 P=0.21
	2 times	7	23.3%	13	43.3%	
	3 times	11	36.7%	10	33.3%	
Alleviating factor	Elevation of hand	14	46.7%	21	70.0%	$\chi 2$=4.47
	Cold application	7	23.3%	6	20.0%	P=0.11
	Medicines	9	30.0%	3	10.0%	
Aggravating factor	Uncomfortable position	10	33.3%	11	36.7%	$\chi 2$=0.12 P=0.94
	Injury at site	7	23.3%	6	20.0%	
	Hand movement	13	43.3%	13	43.3%	

II. Analysis of data related to assess AV fistula puncture related pain among patients undergoing haemodialysis.

Comparison of the pain score between experiment and control group indicates that in Control group patients are having 6.47 pain score and experiment group are having 4.83 pain score, so the difference is 1.63, this difference is large and it is statistically significant difference. Statistical significance was calculated using student's independent t-test.

	Control		Experiment		Student's Independent t-test
	Mean	SD	Mean	SD	
Pain score	6.47	2.37	4.83	2.33	t=2.69 P=0.01** significant

Comparison the level of pain score between experiment and control group indicates that in control group, 13.3% of the patients are having mild pain, 36.7% are having moderate pain and 50% of the patients are having severe pain. Considering experiment group 33.3%% of the patients are having mild pain, 46.7% are having moderate pain and 20.0% of the patients are having severe pain. This difference is statistically significant

.Level of pain	Control		Experiment		Chi square test
	n	%	n	%	
Mild	4	13.3%	10	33.3%	$\chi 2=6.78$
Moderate	11	36.7%	14	46.7%	P=0.03*
Severe	15	50.0%	6	20.0%	Significant

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

Section III

Analysis of data related to assess AV fistula puncture related pain during giving Cryotherapy among patients undergoing haemodialysis.

Comparison of the pain behavior score between experiment and control group indicates that in Control group patients are having 4.57 pain behavior score and experiment group are having 3.23 pain

behavior score, so the difference is 1.33, this difference is large and it is statistically significant difference. Statistical significance was calculated using student's independent t-test.

	Control		Experiment		Student's Independent t-test
	Mean	SD	Mean	SD	
Pain behavior score	4.57	2.12	3.23	2.09	t=2.44 P=0.02* significant

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

Comparison of thelevel of pain behavior score between experiment and control group indicates that incontrol group, 13.3% of the patients are having mild pain behavior , 46.7% are having moderate pain behavior and 40% of the patients are having severe pain behavior. Considering experiment group 36.7%% of the patients are having mild pain behavior, 46.7% are having moderate pain behavior and 16.7% of the patients are having severe pain behavior. This difference is statistically significant.

Level of Pain behavior	Control		Experiment		Chi square test
	n	%	N	%	
No pain	4	13.3%	11	36.7%	χ2=6.15
Moderate	14	46.7%	14	46.7%	P=0.05*
Severe	12	40.0%	5	16.7%	significant

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

Domain wise level of pain behaviour score. Except physiology pain behaviour all other scores are statistically significant.

		group				Chi square test
		Control		Experiment		
		n	%	n	%	
facial expression	0	9	30.0%	12	40.0%	χ2=6.70 P=0.04*
	1	15	50.0%	18	60.0%	

	2	6	20.0%	0	0.0%	
body movement	0	4	13.3%	10	33.3%	$\chi 2=6.37$ P=0.04*
	1	16	53.3%	17	56.7%	
	2	10	33.3%	3	10.0%	
verbalization	0	5	16.7%	15	50.0%	$\chi 2=7.72$ P=0.02*
	1	20	66.7%	11	36.7%	
	2	5	16.7%	4	13.3%	
physiology	0	13	43.3%	21	70.0%	$\chi 2=4.40$ P=0.11
	1	14	46.7%	7	23.3%	
	2	3	10.0%	2	6.7%	
interpersonal behaviour	0	10	33.3%	21	70.0%	$\chi 2=9.07$ P=0.01**
	1	9	30.0%	6	20.0%	
	2	11	36.7%	3	10.0%	

* Significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

Section IV

Analysis of data related to assess the effectiveness of Cryotherapy in experimental group

Effectiveness of Cryotherapy On an average, experimental group patients are having 16.4% reduced pain than control group patients.On an average, experimental group patients are having 13.4% reduced pain behaviour score than control group patientsDifference in scores was analysed using proportion with 95% CI and mean difference with 95% CI.

	Max score	Mean score	Mean difference with 95% Confidence interval	Percentage difference with 95% Confidence interval

Pain score	**Experiment**	10	4.83		
	Control	10	6.47	1.64(0.42 - 2.85)	**16.4%(4.2%-28.5%)**
Pain behavior score	**Experiment**	10	3.23	1.34(0.24 - 2.43)	
	Control	10	4.57		**13.4%(2. 4%-24.3%)**

Section V

Analysis of data related to correlation between pain and pain behavior score.

Correlation between pain and pain behavior score

	Pain vs pain behaviour	**Karl pearson Correlation coefficient**	**interpretation**
Experiment	4.83±3.23	r=0.63 p=0.001***	Good, positive correlation
Control	6.47±4.57	r=0.45p=0.001***	Moderate, positive correlation

Section VI

Analysis of data related to association between level of pain and pain behavior score with selected demographic variables.

Table 11 Association between level of pain score and demographic variables (experiment group)

Demographic variables		**Level of pain score**						**Total**	**Chi square test**
		Mild pain		**Moderate pain**		**Severe pain**			
		n	**%**	**n**	**%**	**n**	**%**		
Age	18 -28 yrs	2	33.3%	2	33.3%	2	33.3%	6	$\chi 2=2.15$ P=0.91
	29 -38 yrs	3	37.5%	4	50.0%	1	12.5%	8	
	39 -48 yrs	3	37.5%	3	37.5%	2	25.0%	8	
	> 48 yrs	2	25.0%	5	62.5%	1	12.5%	8	
gender	Male	8	38.1%	12	57.1%	1	4.8%	21	**$\chi 2=10.25$ P=0.01****
	Female	2	22.2%	2	22.2%	5	55.6%	9	

duration of disease	1 - 3 yrs	3	42.9%	3	42.9%	1	14.3%	7	$\chi 2=1.98$ P=0.92
	4 - 6 yrs	3	30.0%	5	50.0%	2	20.0%	10	
	7 - 9 yrs	1	20.0%	2	40.0%	2	40.0%	5	
	> 10 yrs	3	37.5%	4	50.0%	1	12.5%	8	
haemodialysis started since	Below 2 years	3	60.0%	2	40.0%			5	$\chi 2=6.64$
	2 - 4 yrs			1	33.3%	2	66.7%	3	P=0.35
	4 - 6 yrs	3	30.0%	5	50.0%	2	20.0%	10	
	Above 6 yrs	4	33.3%	6	50.0%	2	16.7%	12	
number of haemodialysis per week	1	1	14.3%	5	71.4%	1	14.3%	7	$\chi 2=2.37$ P=0.66
	2	5	38.5%	5	38.5%	3	23.1%	13	
	3	4	40.0%	4	40.0%	2	20.0%	10	
alleviating factor	Elevation of hand	10	47.6%	9	42.9%	2	9.5%	21	$\chi 2=9.79$
	Cold application	0	0.0%	3	50.0%	3	50.0%	6	P=0.05*
	Medicines	0	0.0%	2	66.7%	1	33.3%	3	
aggravating factor	Uncomfortable position	1	9.1%	5	45.5%	5	45.4%	11	$\chi 2=9.65$ P=0.05*
	Injury at site	3	50.0%	2	33.3%	1	16.7%	6	
	Hand movement	6	46.1%	7	53.8%	0	0.0%	13	

Association between level of pain score and demographic variables (control group)

Demographic variables		**Level of pain score**						**Total**	**Chi square test**
		Mild pain		**Moderate pain**		**Severe pain**			
		n	**%**	**n**	**%**	**n**	**%**		
Age	18 -28 yrs	1	20.0%	2	40.0%	2	40.0%	5	$\chi 2=4.56$ P=0.60
	29 -38 yrs			1	16.7%	5	83.3%	6	
	39 -48 yrs	2	25.0%	3	37.5%	3	37.5%	8	
	> 48 yrs	1	9.1%	5	45.5%	5	45.5%	11	
gender	Male	3	17.6%	9	52.9%	5	29.4%	17	**$\chi 2=6.70$**

	Female	1	7.7%	2	15.4%	10	76.9%	13	**P=0.03***
duration of disease	1 - 3 yrs			2	25.0%	6	75.0%	8	$\chi 2=7.10$ P=0.32
	4 - 6 yrs	3	30.0%	4	40.0%	3	30.0%	10	
	7 - 9 yrs			2	33.3%	4	66.7%	6	
	> 10 yrs	1	16.7%	3	50.0%	2	33.3%	6	
haemodialysis started since	Below 2 years			2	25.0%	6	75.0%	8	$\chi 2=11.26$
	2 - 4 yrs	3	50.0%	1	16.7%	2	33.3%	6	P=0.08
	4 - 6 yrs			3	50.0%	3	50.0%	6	
	Above 6 yrs	1	10.0%	5	50.0%	4	40.0%	10	
number of haemodialysis per week	1 time	1	8.3%	5	41.7%	6	50.0%	12	$\chi 2=4.02$ P=0.40
	2 times			2	28.6%	5	71.4%	7	
	3 times	3	27.3%	4	36.4%	4	36.4%	11	
alleviating factor	Elevation of hand	2	14.3%	6	42.9%	6	42.9%	14	$\chi 2=3.94$ P=0.41
	Cold application	2	28.6%	1	14.3%	4	57.1%	7	
	Medicines			4	44.4%	5	55.6%	9	
aggravating factor	Uncomfortable position	3	30.0%	4	40.0%	3	30.0%	10	$\chi 2=4.77$ P=0.31
	Injury at site			3	42.9%	4	57.1%	7	
	Hand movement	1	7.7%	4	30.8%	8	61.5%	13	

II. Findings related to effectiveness of cryotherapy through the pain scoring by using modified objective behaviour assessment tool.

The pain assessment score by modified objective behaviour assessment tool where in experimental group 24(80%) subjects were having mild pain, followed by 5 (16.6%) subjects were having moderate pain and remaining 1(3.3%) subjects were having severe pain. In control group 14(46.6%) subjects were having moderate pain, followed by 12(40%) subjects were having severe pain and remaining 4 (13.3%) subjects were having mild pain.

Comparison of Pain assessment score by modified objective behavior assessment tool in experiment and control group

Behavior	Experiment (n=30)	Control (n=30)	MW test Z	P Value

assessment tool	Mean	SD	Mean	SD	Value	
Pain score	2.30	1.78	5.60	1.92	5.19	<0.0001

DISCUSSION

The findings of present study have been discussed with reference to the objectives and assumptions. The finding of the study shows that the level of pain in experimental group is less compare to control group in subjective pain score and objective pain score. Majority of the patients were males in the study.

The objective and subjective pain scores were found to be significantly (P = 0.001) reduced within the experimental group with the application of Cryotherapy with the sample of 60 patients (30 each in experimental and control groups) who were undergoing hemodialysis by using AV fistula. These findings are in line with the study conducted by Sabitha.P.B. to assess the effect of Cryotherapy on pain due to arteriovenous fistula puncture in hemodialysis patients. Pain during arteriovenous fistula (AVF) cannulation remains a common problem in hemodialysis (HD) patients. A convenience sample of 60 patients (30 each in experimental and control groups) who were undergoing hemodialysis by using AV fistula was assessed in a randomized control trial. The objective and subjective pain scores were found to be significantly (P = 0.001) reduced within the experimental group with the application of Cryotherapy. This study highlights the need for adopting alternative therapies such as Cryotherapy for effective pain management in hospital settings.

The results are also in line with a study conducted by Manal E. Fareed to examine the effect of cutaneous stimulation on pain relieving at arteriovenous fistula puncture site among hemodialysis patients. After giving Cryotherapy in experimental group pain ratings were mild to moderate and in control group pain ratings were moderate to severe. So Cutaneous stimulation is effective in reducing arteriovenous fistula puncture objective and subjective pain scores among hemodialysis patients.

CONCLUSION

The purpose of the present study was to study to "To assess the effectiveness of Cryotherapy on AV fistula punctures related pain among patients undergoing haemodialysis in selected hospitals." Results revealed that Control group patients are having 6.47 pain score and experiment group are having 4.83 pain score, so the difference is 1.63. Control group patients are having 4.57 pain

behavior score and experiment group are having 3.23 pain behavior score, so the difference is 1.33.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

ACKNOWLEDGEMENT

I thank the scholars whose articles are cited and included inreferences of this manuscript. I am grateful to authors/editors/publishers of all those articles, journals, books fromwhere the literature for this article has been viewed and discussed.

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