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A Study to Assess the Effect of Cryotherapy to Reduce Puncture Pain on Arteriovenous Fistula (AVF) among Patients on Haemodialysis in Gauhati Medical College and Hospital, Kamrup, Assam

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Abstract: ***Introduction: Pain is a complex and subjective experience. Pain response is seen during puncturing of Arteriovenous fistula among patients receiving hemodialysis. Cryotherapy in the form of cold application acts as a cutaneous stimulation technique to reduce puncture pain. The aim of the study is to assess effect of cryotherapy to reduce puncture pain on Arteriovenous fistula. Methods: A quantitative evaluative approach and non- randomized pre-test and post-test control group design was adopted for the study. Structured interview schedule consisting of two parts-demographic data and numerical pain scale was administered among 40 subjects. Results: There was significant mean difference between pre test and post test level of puncture pain on AVF in experimental group, while there was no such difference in the control group. The null hypothesis is rejected based on P <0.001.There was no significant association between pre test level of puncture pain on AVF and selected variables such as age, gender, period of AVF use, number of haemodialysis per week and duration of haemodialyis. Conclusion: Cryotherapy was found to be very effective in reducing the puncture pain on AVF among patients undergoing haemodialysis.***

Keywords: Cryotherapy, Arteriovenous fistula (AVF), Haemodialysis

1. Introduction

Pain is a complex, multi-dimensional phenomenon. It is mainly subjective in nature.[1]The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage".[2]CKD affects about 10-15% of the population worldwide, and is due to numerous causes.[3]

CKD is 12th leading cause of death and 17th cause of disability and its approximate total burden is 800 per million.[4] A vascular access is the lifeline of hemodialysis patients as it makes treatment possible.[5] A heightened pain response is seen during puncturing of Arteriovenous fistula among patients receiving hemodialysis. Nonpharmacologic nursing activities can assist in pain relief, usually lowering the risk to the patient. The various non pharmacological nursing interventions include massage, thermal therapies, transcutaneous electrical nerve stimulation, distraction, relaxation techniques, distraction, guided imagery, music therapy, hypnosis and alternative therapies.[6]

Cryotherapy in the form of cold therapy acts as a cutaneous stimulation technique to reduce pain.[7]The effect of cutaneous stimulation is best explained by the Gate Control Theory proposed by Ronald Melzack and Patrick Wall in 1965.According to Gate Control Theory, the pain signals carried by the small fibers (A-delta and C fibers) are less intense compared to the other non-pain sensory signals like touch, pressure and temperature, the inhibitory neurons prevent the transmission of the pain signals through the T cells. The non-pain signals override the pain signals and thus the pain is not perceived by the brain; and this is achieved by closing a gate consisting of specific nerve cells in dorsal horn of the spinal cord.[8]Research evidences revealed that cryotherapy in the form of ice massage when applied on LI4 meridian point of the contralateral hand (not having AVF) reduces the puncture pain.For effective pain management cutaneous stimulation technique is combined with accupressure.[9]There are 20 large intestine meridian points, LI4 is the point present on the medial midpoint of the first metacarpal between 3 to 4 mm of the web.[4]Recent researches throw light to the fact that cryotherapy is effective in reducing puncture pain on Arteriovenous fistula among patients on hemodialysis. So, the investigator felt the need to conduct a study, which will help to manage puncture pain among patients undergoing hemodialysis.

1.1. Objectives of the study:

- To assess puncture pain on Arteriovenous fistula among patients undergoing haemo dialysis before and after application of Cryotherapy.
- To determine the effect of Cryotherapy to reduce puncture pain on Arteriovenous fistula.
- To determine the association between pre-assessment level of puncture pain on Arteriovenous fistula and selected variables.

2. Review of Literature

In this study, review of literature is divided under three headings:

a) Review of literature related to puncture pain on Arteriovenous fistula among patients undergoing haemodialysis
b) Review of literature related to effect of cryotherapy on pain.
c) Review of literature related to effect of cryotherapy to reduce puncture pain on Arteriovenous fistula among patients on Haemodialysis.

3. Methodology

A Quantitative evaluative research approach and a Quasi experimental nonrandomized control group design was used to assess the effect of cryotherapy to reduce puncture pain on Arteriovenous Fistula among patients on Haemodialysis. Non-probability purposive sampling technique was used to select the sample. The data was collected from 40 patients (20 in experimental and 20 in control group) with Arteriovenous fistula undergoing two cycles of Haemodialysis in a week in Haemodialysis unit of Gauhati Medical College and Hospital, Kamrup, Assam by using structured interview schedule consisting of demographic data and Numerical pain scale.In first visit data regarding selected variables were collected by using structured interview schedule which patient need to respond and recorded by the investigator, then pre test assessment of puncture pain was done immediately after the puncturing procedure by using numerical pain scale on both experimental and control group. On next visit experimental group only received the intervention i.e Cryotherapy and post test assessment of puncture pain was done for both the groups. Cryotherapy i.e, ice massage was given with 3 ice cubes each made of 10 ml of water wrapped in a glove, for 10 minutes prior to the puncturing procedure and continued for approximately 2 minutes till the puncturing procedure continues. It was given on LI4 meridian point i.e, in the web between the thumb and the index finger on the contralateral hand (hand not having AV fistula).Ethical considerations were taken from Institutional Ethical committee of Regional College of Nursing, Guwahati, permission taken from Medical Suprintendent of GMCH and Head of Department of Nephrology Ward, written consent were taken from the participants and the subjects were ensured of the confidentiality of the data obtained.

4. Variables

- Independent variable: In this study the independent variables is cryotherapy that has been administered among the patients with Arteriovenous fistula undergoing Haemodialysis.
- Dependent Variable: In this study the dependent variable is the puncture pain on Arteriovenous fistula.
- Selected Variables: In this study the selected variables are age, gender, period of Arteriovenous fistula use,numbers of Haemodialysis per week, duration of Haemodialysis.

5. Criteria for sample collection:

Inclusion Criteria

1) Patient above 18 years of age.
2) Patients who are receiving two cycles of Hemodialysis through AVF in a week.
3) And the patients who are willing to give the consent for participation

Exclusion Criteria

1) Patients with neurological disorders who is not able to perceive pain, such as congenital analgesia.
2) Patients who were receiving analgesics.
3) Patients who are allergic to cold, such as in Raynaud's disease.
4) Patients who are having any kind of wound in the web between thumb and index finger of the contralateral hand (hand not having AVF)

6. Analysis and Interpretation

The data are analyzed and interpreted under 4 sections.

Section I: Distribution of subjects according to selected variables

- It was observed that in control group, majority of patients i.e., 7(35%) were in the age group of 48-57, and in experimental group majority of patients i.e,7 (35%)were in the age group of 38-47 years.
- Majority i.e., 15 (75%) are male and 5 (25%) are female in the control group, whereas 14 (70%) are male and 6 (30%) are female in the experimental group.
- In control group, majority patients 14(70%) are using AVF for a period of 1-6 months, whereas in experimental group, 10 (50%) are using AVF for 1-6 months.
- In both control and experimental group, 20(100%) undergoes haemodialysis twice a week.
- Majority i.e., 19(95%) undergone haemodialysis for 0-2 years in control group, whereas 16(80%) undergoes haemodialysis for 0-2 years in experimental group.

Section II: Level of puncture pain in patients with Arteriovenous fistula

Table 1.1: Pre test level of pain in Control and Experimental group

Group	Frequency (n)	Percentage (%)	Mean	SD
Control Group				
None (0)	0	0	0	0
Mild (1-3)	2	10	25	0.71
Moderate (4-6)	18	90	5.28	0.67
Severe (7-10)	0	0	0	0
Total	20	100	5	1.08
Experimental Group				
None (0)	0	0	0	0
Mild (1-3)	2	10	3	0
Moderate (4-6)	17	85	5.06	0.75
Severe (7-10)	1	5	7	0
Total	20	1000	4.95	1.05

Data presented in table1.1 shows that in control group 18(90%) having moderate pain and 2(10%) having mild pain and the total mean score is 5.00 and SD is 1.08.On the other

hand in experimental group,17(85%) is having moderate pain, 2(10%) having mild pain and 1(5%) having severe pain and the total mean score is 4.95 and SD is 1.05.Thus it infers that both the group are homogenous in term of puncture pain.

Table 1.2: Post test level of pain in Control and Experimental group

Group	Frequency (n)	Percentage (%)	Mean	SD
Control Group				
None (0)	0	0	0	0
Mild (1-3)	2	10	25	0.71
Moderate (4-6)	17	85	5.28	0.77
Severe (7-10)	1	5	7	0
Total	20	100	5.1	1.21
Experimental Group				
None (0)	0	0	0	0
Mild (1-3)	12	60	2.83	0.39
Moderate (4-6)	8	40	5.28	0.52
Severe (7-10)	0	0	0	0
Total	20	1000	3.45	0.89

Data presented on table 1.2infers that post test mean is found to be lower(M=3.45,±SD=0.89) in experimental group than the post test mean (M=5.10,±SD=1.21) of control group.

Section III: Effect of cryotherapy in reducing puncture pain on Arteriovenous fistula.

Table 1.3: Comparison of Pre-test Mean pain score in Control and Experimental group

Group	Intervention	Mean	±SD	Mean Diff.	S. Diff.	t	df	P Value
Control Group	Pre test	5	1.1	-0.1	0.641	-0.7	19	0.494^{NS}
	Post test	51	1.2					
Exp Group	Pre test	4.95	1.1	1.5	0.83	8.11	19	$<001^{**}$
	Post test	3.45	0.9					

*= Significant at p(0.05), ** = Significant at p (<0.001), NS= Not Significant

Data presented in table1.3 shows that there was no significant mean difference between pre test and post test level of puncture pain on AVF in control group,whereas there is significant mean difference between pre test and post test level of puncture pain on AVF in experimental group.

Table 1.4: Comparison of post test level of pain between Control group and Experimental group

	Group	Mean	SD	Mean Diff.	ANOVA F	df	P Value
Post test	Control Group	5.1	1.21	1.65	24.2	1, 38	$<001^{**}$
	Exp Group	3.45	0.89				

*= Significant at p(0.05), ** = Significant at p (<0.001), NS= Not Significant

Data presented on table 1.4 shows that there was significant mean difference between control group amd experimental group in post test level of puncture pain on AVF.

Section IV: Association between pre test level of puncture pain on Arteriovenous fistula and selected variables.

There was no significant association between pre assessment level of puncture pain on AVF among patients on haemodialysis and selected variables such as age, gender, period of AVF use, number of haemodialysis per week and duration of haemodialyis.

7. Conclusion

The study findings concludes that cryotherapy is effective in reducing puncture pain on AVF which is established by significant mean difference in post test pain score among control and experimental group. No significant association was found between pre-test level of puncture pain on AVF and selected variables. So it can be inferred that the pre assessment level of puncture pain is independent of age, gender, period of AVF use, number of haemodialysis per week and duration of haemodialysis.

8. Recommendation

- The study can be replicated to larger samples to increase the validity and generalization of the findings.
- The study can be conducted on patients experiencing pain in other type of cannulation.
- A comparative study can be conduted between the pharmacological (use of lignocaine spray and gel) and non-pharmacological intervention (cryotherapy) to reduce puncture pain.
- Similar study can be conducted by assessing the subjective and objective pain from the patient.

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