

# Effect of Cryotherapy during Arteriovenous Fistula Puncture-related Pain among Haemodialysis Patients in SGPGIMS Hospital, Lucknow

Alwin Issac<sup>1</sup>, Praveen Namboothiri G<sup>2</sup>

## Abstract

*Pain during arteriovenous fistula (AVF) cannulation remains a common problem in haemodialysis (HD) patients. This study was undertaken to assess the effect of cryotherapy on pain due to arteriovenous fistula puncture in haemodialysis patients, a convenience sample of 30 patients (15 each in experimental and control groups) undergoing haemodialysis by using AVF, was assessed in a randomised control trial. Haemodialysis patients who met the inclusion criteria were randomly assigned to experimental and control groups using flip of coin method. Objective and subjective pain scoring was done on two consecutive days of HD treatment (with cryotherapy for the experimental and without cryotherapy for the control group). The tools used were a questionnaire examining demographic and clinical characteristics, an adult non-verbal pain scale for assessing objective pain, and a numerical rating scale for subjective pain assessment. Descriptive statistics were used as deemed appropriate. Mann Whitney U test, Wilcoxon's signed rank test and Shapiro Wilk test were used for inferential statistics. We found that the objective and subjective pain scores were found to be significantly reduced within the experimental group with the application of cryotherapy ( $p=0.001$ ). This study highlights the need for adopting alternative therapies such as cryotherapy for effective pain management in hospital settings.*

Pain during arteriovenous fistula (AVF) cannulation remains a common problem in haemodialysis (HD) patients. Although AVF puncturing causes pain, local anaesthesia is not frequently used due to concerns of vasoconstriction, burning sensation, scarring, and infection (Crespo et al, 2004; Balli, 2005). Research evidence shows that cutaneous stimulation is an independent nursing intervention that is advocated to reduce pain in patients. Cold application as a cutaneous stimulation technique is an inexpensive nursing intervention that is advocated to minimise the pain in patients (Kubsch et al, 2000; Park, 1994).

The effect of cutaneous stimulation is best explained by the gate control theory. According to this theory touch impulse by the A-fibres is the impulse transmission in thick fibres (touch) can be increased, this selectively blocks conduction in the thin fibres (pain) by closing a gate consisting of specific nerve cells in dorsal horn of spinal cord. The large intestine meridian is an acupressure point located on the back side of the hand between the thumb and the first finger. Its dominant uses are to relieve pain in the shoulder and arm, rigidity of the neck, scapula,

and eye diseases, and to treat constipation or other bowel disorders.

## Objectives

The objectives of the study were to:

- assess the objective and subjective pain during arteriovenous fistula puncture in haemodialysis patients, and
- evaluate the effectiveness of cryotherapy on pain during arteriovenous fistula puncture in haemodialysis patients.

## Review of Literature

A study conducted to assess the effectiveness of cryotherapy on AVF puncture-related pain on haemodialysis patients found that the objective and subjective pain scores were found to be significantly reduced ( $p=0.001$ ) within the experimental group with the application of cryotherapy. This study highlighted the need for adopting alternative therapies such as cryotherapy for effective pain management in hospital settings (Mahajan et al, 2008).

In 1980, Melzack *et al* conducted a study in which patients suffering from acute dental pain were treated with ice massage of the web between the thumb and index finger of the hand on the same side as the pain-

*The authors are: 1. Sister Grade-II Nephrology B, and 2. Sister Grade-II, Cath Lab, both at SGPGIMS Hospital, Lucknow (UP).*

ful region. Ice massage decreased the intensity of dental pain in the majority of patients.

Park *et al* (1980) found that cutaneous stimulation decreased intravenous injection pain in chemotherapy patients with a reduction in both the objective and subjective pain scores. However, they found that in patients on HD, cutaneous stimulation only partly reduced the subjective pain scores and had no effect on the objective pain scores during AVF puncture.

## Methodology

The research design of this study was pre-test – post-test experimental type and a tertiary care hospital in Lucknow was selected on the basis of convenience and approachability.

*Selection of sample:* Patients who were capable of giving subjective response to pain to enable AVF puncture by a staff who has two or more years of experience in dialysis unit, patients not having any other problem that would result in pain and patients undergoing haemodialysis through AVF puncture, were enrolled in for the study.

Patients requiring more than one attempt for fistula puncturing and patients who were given a local anaesthesia before procedure were excluded. Samples were randomly assigned to experimental and control group using flip of coin method with 15 samples in each group.

Cryotherapy (i.e. application of cold therapy i.e. ice cubes on the contra lateral arm, in between the web of thumb and index finger with ice cubes wrapped in

gloves) was started 3 minutes before fistula puncture and continued throughout the puncturing procedure (approximately 2 minutes). The researcher himself performed the ice massage, while another staff member did the AVF cannulation.

*Demographic proforma:* The tool consisted of 5 items. The subjects were asked to answer using tick mark (✓) in the appropriate space provided on the right side of each item. The items in the tool did not have scoring as it reflected factual information.

*Numeric pain rating scale:* The numeric pain rating scale asks a patient to rate their pain by assigning a numerical value with zero indicating no pain and 10 representing the worst pain imaginable. The numeric rating scale, a standardised pain scale, has a well-established reliability of  $r = 0.78 - 0.93$ .

*Adult non-verbal pain scale:* The NVPS is a standardised scale which is based on the behavioural dimensions – Face, Guarding, Activity (movement), Physiology (vital signs), and Respiration that are graded in severity. Samples were observed during AVF puncture and were graded accordingly. Each of the 5 categories is scored from 0-2, which results in a total score between 0 and 10. Document total score was arrived at by adding numbers from each of the 5 categories. Scores of 0-2 indicate no pain, 3-6 moderate pain, and 7-10 severe pain.

*Data collection technique:* Demographic data were collected by interviews using the questionnaire. Objective and subjective pain scoring was done on both control group and in the experimental group on the first day. On the day 2 of visit, in experimental group during AVF puncture cold application was done with ice cubes wrapped in gloves on the web between the thumb and index finger of the hand not having the AV fistula (contralateral arm). The procedure was started 5 minutes before venipuncture and continued throughout the puncturing procedure (approximately two minutes). Objective and subjective pain scoring was again done on both the experimental and control group. The same group of staff members performed the punctures for both experimental and control group patients as per the unit schedule.

## Results and Discussion

*Description of sample characteristics:* Majority of the samples belonged to the age category of 30-40 years (4 samples) in experimental group whereas it remained equally distributed in the control group (Table 1). Majority of the patients were males in both experimental (13 samples) and in control group (12 samples). Most of the patients were having plus two education in control group (5 samples) whereas it

**Table 1: Frequency and percentage distribution of samples (experimental, control) according to demographic characteristics**

| Items               | Frequency          |               | Percentage         |               |
|---------------------|--------------------|---------------|--------------------|---------------|
|                     | Experimental group | Control group | Experimental group | Control group |
| Age (years)         |                    |               |                    |               |
| 20-30               | 2                  | 3             | 13.33              | 20            |
| 30-40               | 4                  | 3             | 26.66              | 20            |
| 40-50               | 3                  | 3             | 20                 | 20            |
| 50-60               | 3                  | 3             | 20                 | 20            |
| 60-70               | 3                  | 3             | 20                 | 20            |
| Gender              |                    |               |                    |               |
| Male                | 13                 | 12            | 86.66              | 80            |
| Female              | 2                  | 3             | 13.33              | 20            |
| Education           |                    |               |                    |               |
| Tenth               | 3                  | 4             | 20                 | 26.66         |
| Plus 2              | 4                  | 5             | 26.66              | 33.33         |
| Degree              | 4                  | 3             | 26.66              | 20            |
| Post graduation     | 4                  | 3             | 26.66              | 20            |
| AV fistula (yrs)    |                    |               |                    |               |
| 0-2                 | 3                  | 5             | 20                 | 33.33         |
| 3-5                 | 7                  | 4             | 46.66              | 26.66         |
| Above 5             | 5                  | 6             | 33.33              | 40            |
| Haemodialysis (yrs) |                    |               |                    |               |
| 0-2                 | 3                  | 5             | 20                 | 33.33         |
| 3-5                 | 7                  | 4             | 46.66              | 26.66         |
| Above 5             | 5                  | 6             | 33.33              | 40            |

**Table 2: Effectiveness of cryotherapy on subjective pain score**

| Group        | Z value | t value | p value |
|--------------|---------|---------|---------|
| Experimental | 3.236   | 36.00   | 0.001   |
| Control      |         |         |         |

**Table 3: Effectiveness of cryotherapy on objective pain**

| Group        | Z value | t value | p value |
|--------------|---------|---------|---------|
| Experimental | 3.330   | 6.500   | 0.001   |
| Control      |         |         |         |

remained uniform in the experimental group. In most of the patients (n=7) AV fistula has been in use for 3-5 years (7 samples) in experimental group whereas in control group 6 samples have been using it above 5 years. Majority of the patients (7 samples) were undergoing haemodialysis for 3-5 years and in control 6 samples were undergoing haemodialysis for above 5 years.

#### **Effect of cryotherapy on subjective pain**

Data was assessed for its normal distribution through Shapiro Wilk test and since it was not found following normal distribution, Mann Whitney u test was used (Table 2).

It was found that cryotherapy is significantly effective ( $p=0.001$ ) in reducing subjective pain score at  $p<0.05$  level of significance. Hence the null hypothesis is rejected and it is interpreted that cryotherapy is significantly effective in reducing subjective pain during AVF puncture.

#### **Effect of cryotherapy on objective pain scores**

Data was assessed for its normal distribution through Shapiro Wilk test and since it was not found following normal distribution, Mann Whitney u test was used (Table 3).

It was found that cryotherapy was significantly effective ( $p=0.001$ ) in reducing objective pain score at  $p\leq 0.05$  level of significance. Hence the null hypothesis is rejected and it is interpreted that cryotherapy is significantly effective in reducing objective pain during AVF puncture.

Haemodialysis patients frequently report pain during AVF puncture and alleviation of this pain might improve their acceptance of the procedure and thus, their quality of life. In the present study, the objective and subjective pain scores were found to be significantly reduced ( $p=0.001$ ) within the experimental group with the application of cryotherapy. Thus,

cryotherapy was found to be an effective pain management technique in these patients. Studies using cutaneous stimulation to decrease acute pain have shown the benefit of these procedures. In 1980, Melzack *et al* (1980) found that patients suffering from acute dental pain were treated with ice massage of the web between the thumb and index finger of the hand on the same side as the painful region. Ice massage decreased the intensity of dental pain in the majority of patients.

The findings of the study are supported by those of Sabitha PB, Khakha DC, Mahajan S, where a convenience sample of 60 patients (30 each in experimental and control groups) underwent haemodialysis by using AVF, was assessed in a randomised control trial. Objective and subjective pain scoring was done on two consecutive days of HD treatment (with cryotherapy for the experimental and without cryotherapy for the control group). They found that the objective and subjective pain scores were significantly reduced ( $p=0.001$ ) within the experimental group with cryotherapy. In the present study it was found that cryotherapy is significantly effective in reducing subjective pain and objective pain at  $p\leq 0.05$  level of significance.

#### **Conclusion**

Pain is a common and distressing symptom in critically ill patients. Uncontrolled pain places patients at risk for numerous adverse psychological and physiological consequences, some of which may be life-threatening.

Among the physical treatments to reduce pain, ice has had its place for many years. Experience tells us that ice has a strong short-term analgesic effect in painful conditions. Cryotherapy treatment appears to be quite safe and nurses are ideally placed to implement cryotherapy during arterio venous fistula puncture in haemodialysis patients.

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