# A PROSPECTIVE, QUASI EXPERIMENTAL STUDY TO EVALUATE THE EFFECTIVENESS OF CUTANEOUS STIMULATION TECHNIQUE ON A.V. FISTULA PUNCTURE PAIN AMONG CHRONIC KIDNEY DISEASE PATIENTS UNDERGOING HAEMODIALYSIS IN DIALYSIS UNIT OF GIAN SAGAR MEDICAL COLLEGE AND HOSPITAL, RAM NAGAR, DISTT. PATIALA, PUNJAB.

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**ABSTRACT: Background:** Chronic kidney disease (CKD), is a progressive loss in renal function over a period of months or years. Haemodialysis patients frequently report pain during A.V. fistula puncture. Research evidence shows that cutaneous stimulation is an independent nursing intervention that is advocated to minimize pain in patients. Cryotherapy is the application of superficial cold & it is considered as the best cutaneous stimulation technique in terms of pain reduction. **Aim:** The aim of the study is to evaluate the effectiveness of cutaneous stimulation technique on the A.V. fistula puncture pain among chronic kidney disease patients undergoing haemodialysis. **Methods:** This will be a Prospective, Quasi experimental study to evaluate the effectiveness of cutaneous stimulation technique on A.V. fistula puncture pain. Study included 40 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). At 1st and 2nd visit, pain assessment for control period was conducted followed by administration of cryotherapy at 3rd visit before haemodialysis procedure. Post test was conducted after A.V. fistula puncture at 3rd visit. **Result:** Study findings revealed that mean ± SD of subjective pain score of arterial & venous puncture (control period) during visit V1 & V2 was 5.20 ±1.30, 5.63 ± 0.979 & 4.68 ± 1.347, 4.98 ± 1.097 respectively with the mean difference of 0.43 ($p < 0.05$). & 0.30 ($p > 0.05$) respectively. Study finding also shows that mean ± SD of subjective pain score of arterial & venous puncture (experimental period) during visit V2 & V3 was 5.63±0.979, 2.48±1.301 & 4.98± 1.097, 1.75 ± 1.296 respectively with the mean difference of 3.15 & 3.23 respectively ($P<0.05$). Study finding shows that mean ± SD of objective pain score of arterial puncture (experimental period) during visit V1 & V2 was 12.03±2.496, 12.83±1.767 & 11.68 ± 2.129, 12.50 ± 1.881 respectively with the mean difference of 0.8($P>0.05$). & 0.82($P<0.05$) respectively. Study finding shows that mean ± SD of objective pain score of venous puncture (experimental period) during visit V2 & V3 was 12.83 ± 2.496, 2.68 ± 1.385 & 12.50 ± 1.881, 2.43 ± 1.412 respectively with the mean difference of 10.15 & 10.08 respectively ($P<0.05$). Findings also 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 ($p<0.05$). **Conclusion:** It was concludes that cutaneous stimulation technique (cryotherapy) is effective procedure in decreasing A.V. fistula puncture pain. **Recommendations**: Longitudinal experimental study can be conducted to evaluate the effect of cutaneous stimulation technique on A.V. fistula puncture pain.

**Key words:** Cutaneous stimulation technique, cryotherapy, A.V.fistula, haemodialysis

## Introduction

Chronic kidney disease (CKD), is a progressive loss in renal function over a period of months or years. Pain during A.V. fistula cannulation remains a common problem in haemodialysis (HD) patient. Haemodialysis patients frequently report pain during A.V. fistula puncture. Cutaneous stimulation includes cryotherapy thermotherapy, massage, pressure, and vibration, may help patients to relax or distract them from their pain. **(Mayer, 1985).** The term cryotherapy comes from the Greek ward cryo means cold and therapy means cure. Cryotherapy is the application of superficial cold & it is considered as a best cutaneous stimulation technique in terms of pain reduction. Applying cold will numb the area providing pain relief, reduce swelling and decrease metabolic rate reducing the oxygen requirements of the injured cells.[11]This study evaluates the effect of cutaneous stimulation technique i.e. cryotherapy on A.V. fistula puncture pain among chronic kidney disease patient undergoing haemodialysis.

### 1.2 Need of the Study

The investigator felt that cryotherapy is a simple form of cutaneous stimulation techniques & can be effective independent nursing intervention to decrease A.V. fistula puncture pain but unfortunately it is not applied in practice in dialysis units. The intervention of cutaneous stimulation has solid utilization potential and could be easily incorporated into practice in dialysis unit before doing artery & vein puncture for haemodialysis.

Hence investigator felt the need to conduct study to evaluate the effect of cutaneous stimulation technique (cryotherapy) on the A.V. fistula puncture pain among chronic kidney disease patients undergoing haemodialysis.

### 1.1. Research Design:

A Prospective, Quasi-experimental (one- group pre-test post-test design using a double pre test) design is adopted for the present study.

$$O_1 \ O_2 \ X \ O_3$$

**Figure 3: Schematic representation of Research Design**

| | | |
|---|---|---|
| $O_1$ | = | Observation of A.V. fistula puncture pain on 1st visit |
| $O_2$ | = | Observation of A.V. fistula puncture pain on 2nd visit |
| X | = | Administration of cryotherapy on 3rd visit before A.V. fistula puncture. |
| $O_3$ | = | Observation of A.V. fistula puncture pain on 3rd visit after administration of cryotherapy |

The sample at observation $O_1$ & $O_2$ will be considered as a control period and same sample group at observation $O_3$ will be considered as experimental period.

### 1.2. Research Setting:

The present study will be conducted at dialysis unit of Gian Sagar Medical College and Hospital, Ram Nagar, Distt. Patiala, Punjab.

### 1.3. Target Population:

Chronic kidney disease patient undergoing haemodialysis in the dialysis unit of Gian Sagar Medical College and Hospital.

### 1.4. Sampling Technique & Sample:

Purposive Sampling technique will be used. Sample size is of 40.

### 1.5. Inclusion Criteria and exclusion criteria:

**Inclusion criteria**

1. Patients who will be willing to participate in the study.
2. Patients who are diagnosed as chronic kidney disease & undergoing haemodialysis with A.V. fistula of upper extremity currently used for haemodialysis which can be radio cephalic, radio basilic or brachio cephalic.
3. Chronic kidney disease patients who are visiting regularly, minimum 2 times per week for haemodialysis.

**Exclusion Criteria:**

1. Chronic kidney disease patients who are undergoing haemodialysis with other vascular access than A.V. fistula access.
2. Patients who are undergoing haemodialysis for less than 6 month.
3. Patient who are undergoing haemodialysis for other reason than chronic kidney disease.
4. Patients who are allergic to cold therapy.
5. Patients having peripheral vascular diseases, Reynaud's disease, Connective tissue disorders, Diabetic neuropathy, Unconscious, and Disorientation.
6. Patients requiring more than one attempt for fistula puncturing.

### 1.6. Selection & Development of Tools:

The tools will develop by the investigator after the extensive review of literature on relevant topic and after discussion with experts and guides. In this study following tools was uesd:

1. Demographic & Clinical Proforma
2. Numerical Rating Scale
3. Objective Pain Behavior Rating Scale
4. Ice sensitivity & Cryotherapy procedure

## Result

The result of the study revealed that maximum 30 % of chronic kidney disease patients belonged to age group 41-50 and minimum of 5 % of chronic kidney disease patients belonged to age group 61-70. The typical (Modal) participants (57%) were male and 43 % were females. Twenty eight chronic kidney disease patient were having highest qualification as matric and only 5% have done primary and above graduation. Mostly (65 %) chronic kidney disease patients were unemployed, 25% have their own businessmen and only 10% were employed. Majority of participants (88 %) were married and only 13 % were unmarried. Majority (65 %) belonged to Sikh religion and only 5% were Muslim. Major part of study sample (75%); duration of chronic kidney disease & duration of patients undergoing haemodialysis was in between 2 year & above. Majority (40 %) were having

A.V. fistula in use from last 3 year & above. Half of Chronic kidney disease patients undergoing haemodialysis had co morbidities i.e. CAD, hepatitis C, hepatitis B, hypertension, hypertension + hepatitis B.

Study findings revealed that mean ± SD of subjective pain score of arterial & venous puncture (control period) during visit V1 & V2 was 5.20 ±1.30, 5.63 ± 0.979 & 4.68 ± 1.347, 4.98 ± 1.097 respectively with the mean difference of 0.43 & 0.30 respectively($p < 0.05$). Study finding also shows that mean ± SD of subjective pain score of arterial & venous puncture (experimental period) during visit V2 & V3 was 5.63±0.979, 2.48±1.301 & 4.98± 1.097, 1.75 ± 1.296 respectively with the mean difference of 3.15 & 3.23 respectively.($P<0.05$).

Study finding shows that mean ± SD of objective pain score of arterial puncture (experimental period) during visit V1 & V2 was 12.03±2.496, 12.83±1.767 & 11.68 ± 2.129, 12.50 ± 1.881 respectively with the mean difference of 0.8 & 0.82 respectively ($P<0.05$). Study finding shows that mean ± SD of objective pain score of venous puncture (experimental period) during visit V2 & V3 was 12.83 ± 2.496, 2.68 ± 1.385 & 12.50 ± 1.881, 2.43 ± 1.412 respectively with the mean difference of 10.15 & 10.08 respectively ($P<0.05$). Friedmen test was computed to compare the median scores of visit 1, 2, & 3. There were significant difference between double pre test and post test pain scores. Post Hoc analysis of visit V1 & V3 and V2 &V3 shows significant difference whereas post hoc analysis of visit V1 & V2 shows non significant difference between subjective and objective pain score during arterial and venous puncture.

Hence there was reduction in subjective and objective pain score during 3rd visit which showed the effectiveness of cutaneous stimulation technique.

Findings also 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 ($p<0.05$).

**DISCUSSION**

In this study, the investigator found that maximum 30 % of chronic kidney disease patients belonged to age group 41-50 and minimum of 5 % of chronic kidney disease patients belonged to age group 61-70. The typical (model) participants (57 %) were male and 43 % were females. Twenty eight chronic kidney disease patient were having highest qualification as matric and only 5% have done primary and above graduation. Mostly (65 %) chronic kidney disease patients were unemployed, 25% have their own businessmen and only 10% were employed. Majority of participants (88 %) were married and only 13 % were unmarried. Majority (65 %) belonged to Sikh religion and only 5% were Muslim. Major part of study sample (75%); duration of chronic kidney disease & duration of patients undergoing haemodialysis was in between 2 year & above.

This study was in line with Faheem et al., who found that more than half of their sample was male.[37]

As regard duration of the last A. V. Fistula in use, it was noted from the present study that the mean duration was 2.425±1.104 years. In a similar study done by Hassan et al, the mean duration was 3.26±2.34 years.[22] Also Celik et al., found that the mean age of A. V. fistula was 4.0± 3.3 years.[32]

Regarding the presence of co morbidity, 50% was found that less than one fourth of studied sample had hepatitis C. This result is greater than the result of Sabitha et al. who stated that minority of studied subjects had positive hepatitis C.[6] This may be related to difference in setting which may affect the prevalence of any disease. Also less than one fourth of the current sample had hypertension. This is in line with El-Taiar et al., who reported that hypertension is one of the most common complications of haemodialysis.[38]

Hemodialysis patients are repeatedly exposed to stress and pain because these patients undergo an average ten A.V. fistula puncture a month and would continue to do so throughout their life. Repeated A.V. fistula puncture lead to a considerable degree of pain due to caliber and length of the bevel of fistula needle. This was in accordance with the result of the present study which showed that during 1st and 2nd visit of arterial and venous puncture, more than half of studied sample had moderate objective (80 % and 97.5 %, 82.5 % and 92.5 % respectively) and subjective pain score (85 % and 97.5 %, 82.5 % and 90 % respectively) before applying cutaneous stimulation technique. These both scores either subjective or objective were significantly reduced (67.5 %, 65 %), (30 %, 27.5 %) after applying cutaneous stimulation. This was in line with Sabithia et al., who found that the objective and subjective pain scores were significantly reduced within the experimental group with the application of cutaneous stimulation.[6]

Study findings revealed that mean ± SD of subjective pain score of arterial & venous puncture (control period) during visit V1 & V2 was 5.20 ±1.30, 5.63 ± 0.979 & 4.68 ± 1.347, 4.98 ± 1.097 respectively with the mean difference of 0.43 & 0.30 respectively($p < 0.05$). Study finding also shows that mean ± SD of subjective pain score of arterial & venous puncture (experimental period) during visit V2 & V3 was 5.63±0.979, 2.48±1.301 & 4.98± 1.097, 1.75 ± 1.296 respectively with the mean difference of 3.15 & 3.23 respectively ($P<0.05$).

Study finding also shows that mean ± SD of objective pain score of arterial puncture (experimental period) during visit V1 & V2 was 12.03±2.496, 12.83±1.767 & 11.68 ± 2.129, 12.50 ± 1.881 respectively with the mean difference of 0.8 & 0.82 respectively ($P<0.05$). Study finding shows that mean ± SD of objective pain score of venous puncture (experimental period) during visit V2 & V3 was 12.83 ± 2.496, 2.68 ± 1.385 & 12.50 ± 1.881, 2.43 ± 1.412 respectively with the mean difference of 10.15 & 10.08 respectively ($P<0.05$). Friedmen test was computed to compare the median scores of visit 1, 2, & 3. There was significant difference between double pre test and post test pain scores. Post Hoc analysis of visit V1 & V3 and V2 &V3 shows significant difference whereas post hoc analysis of visit V1 & V2 shows non significant difference between subjective and objective pain score during arterial and venous puncture.

This was in line with Hassan et al. who reported that there was a decrease in the mean pain score during either artery or vein needle puncture after applying cryotherapy.[22] Moreover Abu Bakr et al., and Celik et al., stated that pain scoring decreased significantly in cryotherapy study group with using a superficial cooling.[32] In addition Wares B.L. and Raisler investigated the use of ice message to reduce labor pain during contraction and showed successful reduction in intensity of labor pain.[24]

It was noticed from the study that objective and subjective pain score decreased during the third visit than the 1st and 2nd visit after application of cutaneous stimulation technique. This is in agreement with Hassan et al., who revealed that there was decrease in mean of pain score during needle puncture in day 4 than day 3 and he illustrated that they may be related to patients skin adaptation to cold therapy and patients became more interested with the procedure that produce more analgesic effect.[22]

Findings also 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 ($p<0.05$).

**Conclusion**

The current study concludes that cutaneous stimulation technique (cryotherapy) is an effective procedure in decreasing A.V. fistula puncture pain. On the whole carrying out this study was really a good experience for investigator.

**Limitations**

- The main limitation of the study is that the number of subjects is less which limits the generalization ability of the study findings beyond the study population.
- As a result of financial and time constraints, this study was limited to Gian Sagar Medical College & Hospital, Ram Nagar, Distt. Patiala, Punjab.
- This study did not include In- Patient department patients who were admitted in the ward.

**Implications**

The findings of this study will be used in different areas of nursing like areas of practice, education, administration and research.

**Nursing practice**

Using the current research findings nurses can use cutaneous stimulation as an effective intervention in their practice. Cutaneous stimulation is easy to learn, cost effective and has no side effect. It does not require additional equipments, extra preparation for procedure. The findings of this study can be incorporated in the training of other health care personnel and family members in providing health care to relieve pain.

**Nursing education**

The use of non pharmacological measures like cutaneous stimulation technique can be easily incorporated in nursing education along with other complementary therapies. Family educators or nursing personnel's should also be educated on cutaneous stimulation technique which will enable them to help and care for the individual who is in pain and thereby making these measures beneficial to common people.

**Nursing administration**

The findings of this study could be used by nursing and non nursing personnel. In service education for the staff nurses could be provided with special emphasis on the use of cutaneous stimulation to relieve pain in chronic kidney disease patients undergoing haemodialysis.

**Nursing research**

In Indian setting researches related to cutaneous stimulation technique are limited. The findings of the research need to be disseminated through publications so that the utilization of such research findings are encouraged.

**Recommendations**

The study recommended that:

- Similar study can be conducted with large sample to generalize the findings.
- Study can be conducted by taking subjects from different wards.
- Longitudinal study can be conducted to evaluate the effect of cutaneous stimulation technique on A.V. fistula puncture pain.
- The same study can be applied on a larger group of children with different age groups, in different seasons, in different clinical setting and patients with different diagnosis.

- The Study can be conducted to compare the impact of cutaneous stimulation technique with other non pharmacological methods such as relaxation, breathing exercise in managing A.V. fistula puncture pain among chronic kidney disease undergoing haemodialysis.

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**Table -1 Frequency & percentage distribution of demographic & clinical Characteristics**

**N=40**

| Sr. No. | Characteristics | F | Percentage (%) |
|---|---|---|---|
| **1.** | **Age (in years)** | | |
| | a) 20-30yrs | 8 | 20 |
| | b) 31-40yrs | 9 | 23 |
| | c) 41-50yrs | 12 | 30 |
| | d) 51-60yrs | 9 | 22 |
| | e) 61-70yrs | 2 | 5 |
| | **Mean ± SD** | **42 ± 11.66** | |
| **2.** | **Gender** | | |
| | Male | 23 | 57 |
| | Female | 17 | 43 |
| **3.** | **Highest qualification** | | |
| | Don't attend the school/ illiterate | 10 | 25 |
| | Primary | 2 | 5 |
| | Middle | 5 | 12 |
| | Matric | 11 | 28 |
| | Senior Secondary | 10 | 25 |
| | Graduation & above | 2 | 5 |
| **4.** | **Employment status** | | |
| | Employed | 4 | 10 |
| | Unemployed | 26 | 65 |
| | Businessman | 10 | 25 |
| **5.** | **Marital status** | | |
| | Married | 35 | 88 |
| | Unmarried | 5 | 12 |
| | Widowed | 0 | 0 |
| **6.** | **Religion** | | |

| | | | |
|---|---|---|---|
| | Hindu | 12 | 30 |
| | Muslim | 2 | 5 |
| | Sikh | 26 | 65 |
| | Christian | 0 | 0 |
| | Any other (specify) | 0 | 0 |

Table 1 continue on next page.

| | | | |
|---|---|---|---|
| **7.** | **Duration of Chronic kidney disease** | | |
| | < 1 year | 3 | 8 |
| | 1 year to < 2 year | 7 | 17 |
| | 2 year & above | 30 | 75 |
| | **Mean ± SD** | **2.175 ± 0.6077** | |
| **8.** | **Duration of haemodialysis** | | |
| | <1 year | 3 | 8 |
| | 1 year to <2 years | 7 | 17 |
| | 2 years & above | 30 | 75 |
| | **Mean ± SD** | **2.175 ± 0.6077** | |
| **9.** | **Duration of A.V. fistula used for haemodialysis** | | |
| | <1 year | 7 | 18 |
| | 1year to < 2 year | 5 | 13 |
| | 2 year to 3 year | 12 | 30 |
| | 3 year & above | 16 | 40 |
| | **Mean ± SD** | **2.425±1.10413** | |
| **10.** | **Co morbidity** | | |
| | No | 20 | 50 |
| | Yes | 20 | 50 |

**Table 2 Range & Mean ± SD of subjective and objective A.V. fistula puncture pain**

**N=40**

| **Puncture** | **Pain score** | **Range** | | **Mean ± SD** | |
|---|---|---|---|---|---|
| | | **V1** | **V2** | **V1** | **V2** |
| Arterial Puncture | **Subjective** | 2-7 | 3-7 | 5.20±1.305 | 5.63±0.979 |
| | **Objective** | 6-16 | 8-16 | 12.03±2.496 | 12.825±1.767 |
| Venous Puncture | **Subjective** | 1-9 | 2-7 | 4.68±1.347 | 4.98±1.097 |
| | **Objective** | 7-16 | 8-16 | 11.68±2.129 | 12.50±1.881 |

**Table 3 Mean ± SD, Mean difference (MD) & 't' value of double pre-test and post test of subjective and objective pain score during arterial and venous puncture**

**N=40**

| **Pain score** | **Puncture** | **Visit** | **Mean ± SD** | **MD** | **"t" value** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Subjective** | **Arterial puncture** | **V1** | 5.20±1.305 | | |
| | | **V2** | 5.63 ± 0.979 | 0.43 | 2.333* |
| | | **V3** | 2.48 ±1.301 | 3.15 | 16.465* |
| | **Venous puncture** | **V1** | 4.68±1.347 | | |
| | | **V2** | 4.98± 1.097 | 0.30 | 1.455NS |
| | | **V3** | 1.75± 1.296 | 3.23 | 15.120* |
| **Objective** | **Arterial puncture** | **V1** | 12.03±2.496 | | |
| | | **V2** | 12.83± 1.767 | 0.8 | 1.851NS |
| | | **V3** | 2.68± 1.385 | 10.15 | 34.749* |
| | **Venous puncture** | **V1** | 11.68± 2.129 | | |
| | | **V2** | 12.50±1.881 | 0.82 | 2.114* |
| | | **V3** | 2.43±1.412 | 10.08 | 32.625* |

't'$_{(39)}$ = 2.023, p<0.05 * significant , NS= non significant

**Table 4: Median, mean rank & $\chi^2$ value of subjective and objective pain score during arterial and venous puncture at visit V1, V2 & V3**

| Pain score | Puncture | Visit | Median | Mean rank | Friedmen $\chi^2$ |
|---|---|---|---|---|---|
| **Subjective** | **Arterial puncture** | **V1** | **5** | 2.31 | |
| | | **V2** | **6** | 2.66 | 63.879* |
| | | **V3** | **3** | 1.02 | |
| | **Venous puncture** | **V1** | **5** | 2.36 | |
| | | **V2** | **5** | 2.62 | 64.743* |
| | | **V3** | 2 | 1.01 | |
| **Objective** | **Arterial puncture** | **V1** | **12** | 2.39 | |
| | | **V2** | **13** | 2.61 | 62.178* |
| | | **V3** | **2.5** | 1.00 | |
| | **Venous puncture** | **V1** | **12** | 2.39 | |
| | | **V2** | **12** | 2.61 | 62.981* |
| | | **V3** | **2** | 1.00 | |

df=2, p<0.05 *significant

**Table 6: Frequency and percentage distribution of subjective and objective level of pain**

**N=40**

| A.V. Fistula Puncture | | Pain Level | Visit 1 | Visit 2 | Visit 3 |
|---|---|---|---|---|---|
| | | | **f (%)** | **f (%)** | **f (%)** |
| **Arterial puncture** | **Subjective** | No pain | 0(0%) | 0(0%) | 4(10%) |
| | | Mild | 4 (10%) | 1 (2.5%) | 27 (67.5%) |

| | | | | | |
|---|---|---|---|---|---|
| | | Moderate | 34 (85%) | 39 (97.5%) | 9 (22.5%) |
| | | Severe | 2(5%) | 0 (0%) | 0 (0%) |
| | **Objective** | No pain | 0 (0%) | 0 (0%) | 28 (70%) |
| | | Mild | 8(20%) | 1(2.5%) | 12(30%) |
| | | Moderate | 32 (80%) | 39 (97.5%) | 0 (0%) |
| | | Severe | (0%) | (0%) | (0%) |
| **Venous puncture** | **Subjective** | No pain | 0(0%) | 0(0%) | 10(25%) |
| | | Mild | 6(15%) | 4(10%) | 26(65%) |
| | | Moderate | 33(82.5%) | 36(90%) | 4(10%) |
| | | Severe | 1(2.5%) | 0(0%) | 0(0%) |
| | **Objective** | No pain | 0(0%) | 0(0%) | 29(72.5%) |
| | | Mild | 7(17.5%) | 3(7.5%) | 11(27.5%) |
| | | Moderate | 33(82.5%) | 37(92.5%) | 0(0%) |
| | | Severe | (0%) | (0%) | (0%) |

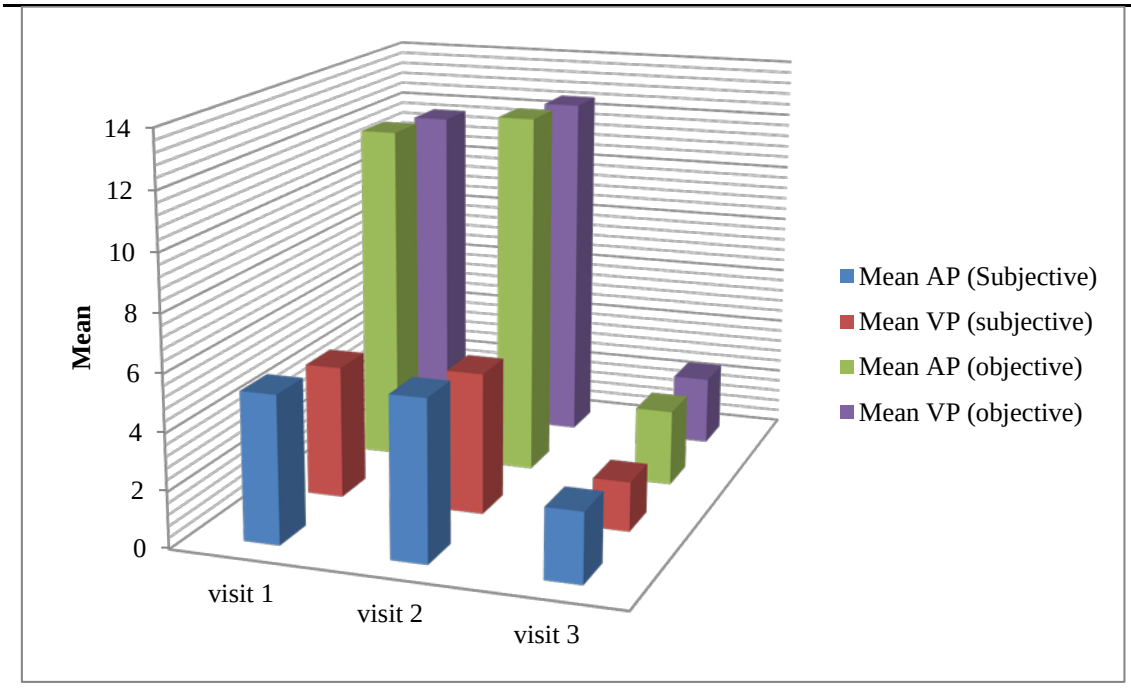


**Fig 6: Column diagram showing mean of objective and subjective A. V. fistula puncture pain score at 1st, 2nd,3rd visit**