A STUDY ON PAIN ANALYSIS IN ARTERIOVENOUS FISTULA CANNULATION IN CHRONIC HAEMODIALYSIS PATIENTS

Sarathy Shanmugam[1], Dr. A.N. Uma[2*], Abhishek B V[3], Sourav Das[4], Karthick A[5], Lavanya B[6]

1 Intern student, Department of Dialysis Technology, School of Allied Health Sciences, Sri Balaji Vidyapeeth (Deemed to be University), Puducherry, India

2 Professor of Medical Genetics & Principal, School of Allied Health Sciences, Sri Balaji Vidyapeeth (Deemed to be University), Puducherry, India

3 Tutor, Department of Urology, School of Allied Health Sciences, Sri Balaji Vidyapeeth (Deemed to be University), Puducherry, India

4 Assistant Professor, Department of Microbiology, School of Allied Health Sciences, Sri Balaji Vidyapeeth (Deemed to be University), Puducherry, India

5 Tutor, Department of Dialysis Technology, School of Allied Health Sciences, Sri Balaji Vidyapeeth (Deemed to be University), Puducherry, India

6 Assistant Professor, Department of Community Medicine, Shri Sathya Sai Medical College and Research Institute, Sri Balaji Vidyapeeth, (Deemed to be University), Chengalpattu District, Tamil Nadu, India.

*Corresponding Author: Dr. A. N. Uma

A STUDY ON PAIN ANALYSIS IN ARTERIOVENOUS FISTULA CANNULATION IN CHRONIC HAEMODIALYSIS PATIENTS

ABSTRACT

Background:

Arteriovenous fistula (AVF) cannulation, the standard vascular access for haemodialysis in chronic kidney disease (CKD) patients, remains a significant and under-addressed source of pain and psychological distress. Unmanaged cannulation pain can contribute to anxiety, lower treatment adherence, and deteriorating patient quality of life.

Methods:

A descriptive, observational study was conducted over six months (December 2024–May 2025) involving 70 patients with end-stage renal disease (ESRD) undergoing regular haemodialysis at a tertiary care centre. Data were collected using structured questionnaires, the Visual Analogue Scale (VAS), and the Numerical Rating Scale (NRS) to assess pain during AVF cannulation. Sociodemographic, clinical, and procedural variables were analysed using descriptive statistics.

Results:

Of the 70 participants, 83% were male and 17% female, predominantly aged 40–50 years. The prevalence of pain during AVF cannulation was high; 80% reported pain (50% moderate, 30% severe), while 20% experienced no pain. Major factors influencing pain included needle size, insertion technique, and staff proficiency. Anxiety was also common, with 34 patients experiencing moderate and 12 experiencing severe anxiety. The study found a consistent burden of moderate to severe pain and anxiety, comparable with earlier studies.

Conclusion:

AVF cannulation pain in haemodialysis patients is frequent and substantial. Addressing this issue requires comprehensive pain management strategies, including the use of local anaesthetics, improved staff training, structured patient education, distraction techniques, and regular pain assessment to enhance patient comfort and compliance.

Keywords: Arteriovenous fistula, cannulation, haemodialysis, chronic kidney disease, pain, anxiety, pain assessment, patient comfort, pain management, end-stage renal disease.

INTRODUCTION

Chronic kidney disease (CKD) is a growing global health problem, with many patients requiring haemodialysis (HD) as a life-sustaining treatment. The arteriovenous fistula (AVF) is the preferred vascular access method for HD due to its lower complication rates and better clinical outcomes. However, AVF cannulation, which involves repeated needle insertions into the fistula, is associated with significant pain for many patients. Studies suggest that pain during HD is highly prevalent, with up to 89% of patients reporting some form of pain from various causes, including cannulation-related pain. Approximately 60.5% of HD patients experience chronic pain, with nearly 43.6% reporting moderate to severe intensity pain during dialysis sessions(1)(2) (Dos Santos et al., 2021; Davison, 2021). Unaddressed pain during AVF cannulation can lead to increased anxiety, stress, and decreased treatment adherence, ultimately affecting patient outcomes and quality of life.

Effective management of AVF cannulation pain is essential to improve patient comfort, reduce procedure-related anxiety, and encourage compliance with dialysis schedules. This requires evaluation of the pain's prevalence, severity, risk factors, and exploration of both pharmacological and non-pharmacological pain relief strategies to enhance the overall dialysis experience for patients with CKD on haemodialysis (1,2).

METHODS AND METHODOLOGY

This study utilized a descriptive, observational methodology to evaluate the pain associated with arteriovenous fistula (AVF) cannulation in chronic haemodialysis patients. Conducted over six months from December 2024 to May 2025, the research took place in the dialysis unit of the Department of Nephrology at Mahatma Gandhi Medical College and Research Institute, Puducherry. The sample included 70 patients diagnosed with end-stage renal disease (ESRD) and undergoing haemodialysis, selected through random sampling to ensure representative data .Data collection involved structured questionnaires and patient interviews, capturing both demographic and clinical variables relevant to pain perception. Pain assessment was rigorously performed using the Visual Analogue Scale (VAS) and Numerical Rating Scale (NRS), enabling a quantitative analysis of pain intensity experienced during AVF cannulation. Primary data consisted of direct patient responses, while secondary data incorporated clinical information about bacteraemia, antibiotic lock solutions, and infection outcomes in the haemodialysis population .The inclusion criteria encompassed all patients above 20 years of age undergoing haemodialysis in the study setting, while those treated by modalities other than haemodialysis, individuals with HIV, HBV, or HCV, and patients with central venous catheters, AV grafts, or significant cognitive impairment were excluded. This methodological approach facilitated a comprehensive and unbiased evaluation of procedural pain and its associated risk factors in the target population, supporting data-driven recommendations for clinical practice improvements.

STATISTICAL ANALYSIS

Statistical analysis for this study was carried out using descriptive statistics to summarize key demographic and clinical characteristics of the 70 patients. Frequencies and percentages were computed for variables including age, gender, dialysis frequency, comorbidities, and pain levels during AVF cannulation. Pain intensity, assessed through Visual Analogue Scale (VAS) and Numerical Rating Scale (NRS), was categorized as no pain, moderate pain, or severe pain. Graphical tools such as pie charts and bar diagrams were utilized to illustrate prevalence and associated factors, ensuring a clear understanding of pain distribution and its influencers.

RESULT

In this study Pain was assessed 70 patients who undergone dialysis (stage 5 kidney disease or ESRD). The data was collected using the patient’s health questionnaires. Their social and clinical characteristics are defined in the following demography.

The table 5.1 shows the social demography category of the patients. Age and gender are collected for fine-tuning the people categories and further, their clinical characteristics such as the family history of ESRD, dialysis duration, session frequency and co-morbidities are stated in table 5.2.

CHARACTERISTICS	NO. OF. PATIENTS
AGE	
20-30	6
30 - 40	18
40 - 50	43
Above 50	3
GENDER	
MALE	58
FEMALE	12

The study included diverse age group of patients. The majority of age between 40 to 50 years are 61% and the minimum age are above 50 are 4% the sample are collected in both Genders , In that male are 83% and remaining 17 % are female

Table 1 – Social Demography of the Patients

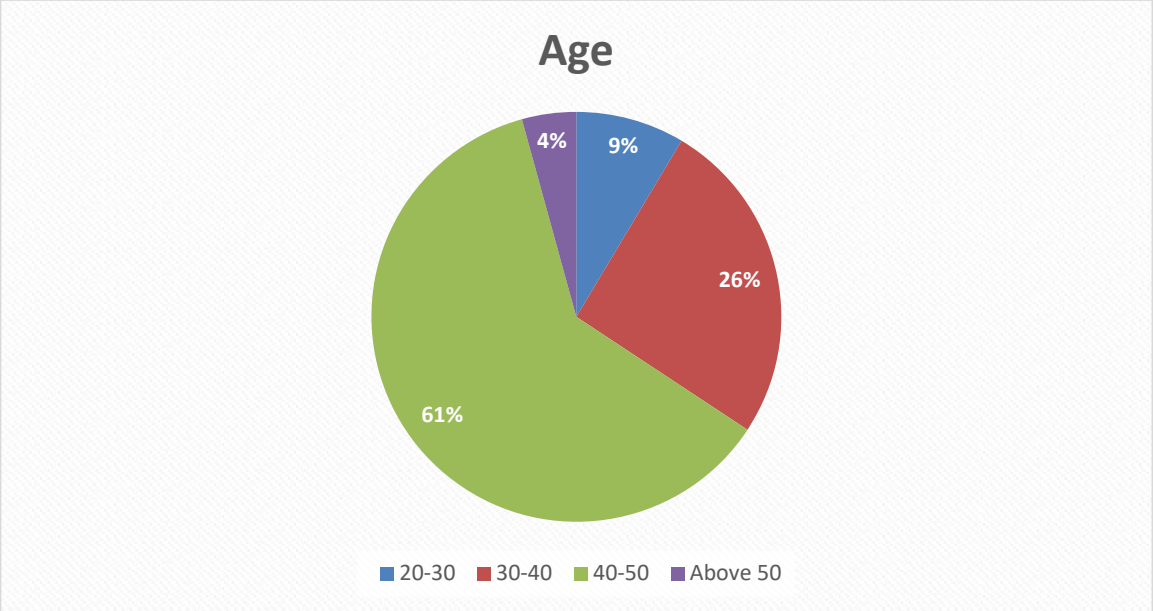

Chart 1 - Count of Age

This chart shows the age range of patients undergoing dialysis. Majority (61%) are

between 40-50 years old. (26 %) are between 30-40 years old. Less than (9%) are below 30 and (4%) are above 50 years old.

Table 2 – Clinical Demographic of the Patients

CHARACTERISTICS	NO OF PATIENTS
FAMILY HISTORY OF ESRD PATIENT	
YES	0
NO	59
UNKNOWN	11
CO-MORBIDITIES OF PATIENTS	
HYPERTENSION	38
DIABETICMELLITUS	14
STROKE	8
IDIOPATHIC ILLNESS	10
PAIN SCALE	
NO PAIN	12
MODERATE PAIN	40
WORST PAIN	18
HDSESSION PERWEEK	
2TIMESPERWEEK	59
3TIMESPERWEEK	11

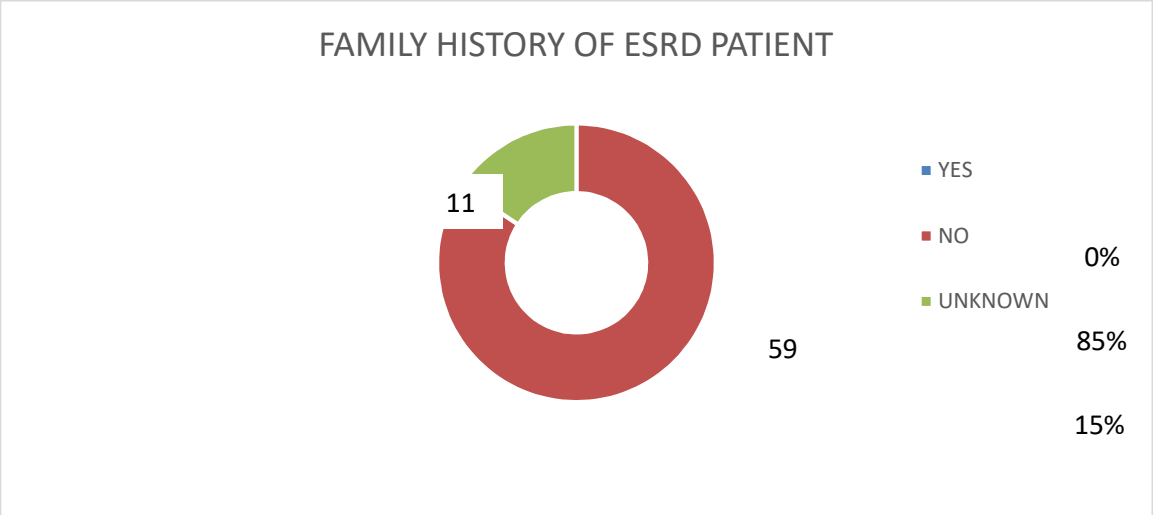

Chart 2 – Family History of ESRD Patient

Among the patients studied, the majority (85%) 59 patients do not have a family history of ESRD, while (15%) 11 patients had an unknown family history status. None of the patients reported a positive family history of ESRD.

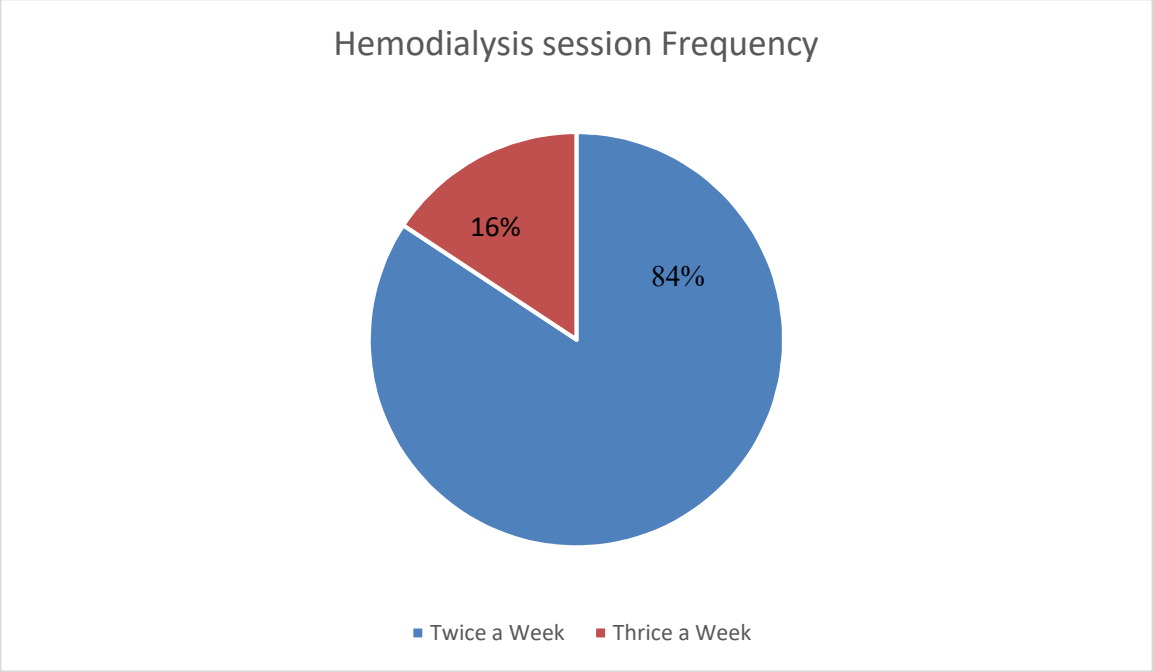

Chart 3 – Hemodialysis Session Frequency

Hemodialysis Session Frequency Twice a week 59 (84%) underwent hemodialysis. Thrice a week 11 (16%) underwent hemodialysis.

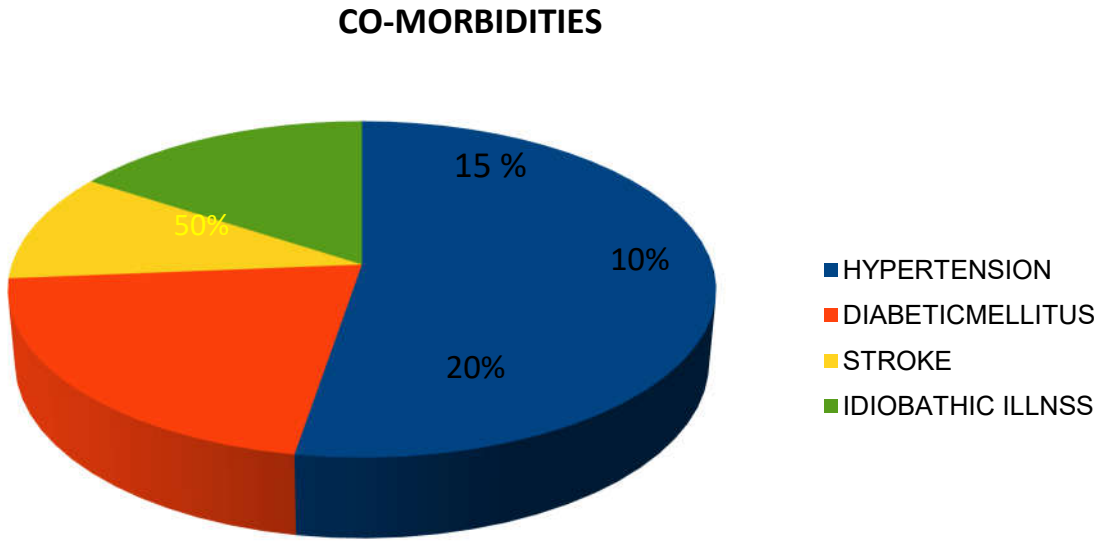

Chart 4 – Co-Morbidities

Among 70 chronic kidney disease (CKD) patients undergoing AVF cannulation, various comorbidities were noted. Hypertension was the most common, affecting 38 (55%) patients. Diabetes mellitus was present in 14(20%) patients while idiopathic causes were found in 10 (15%) patients. Stroke affected 8 patients (10%). These conditions may influence pain perception and management during AVF cannulation.

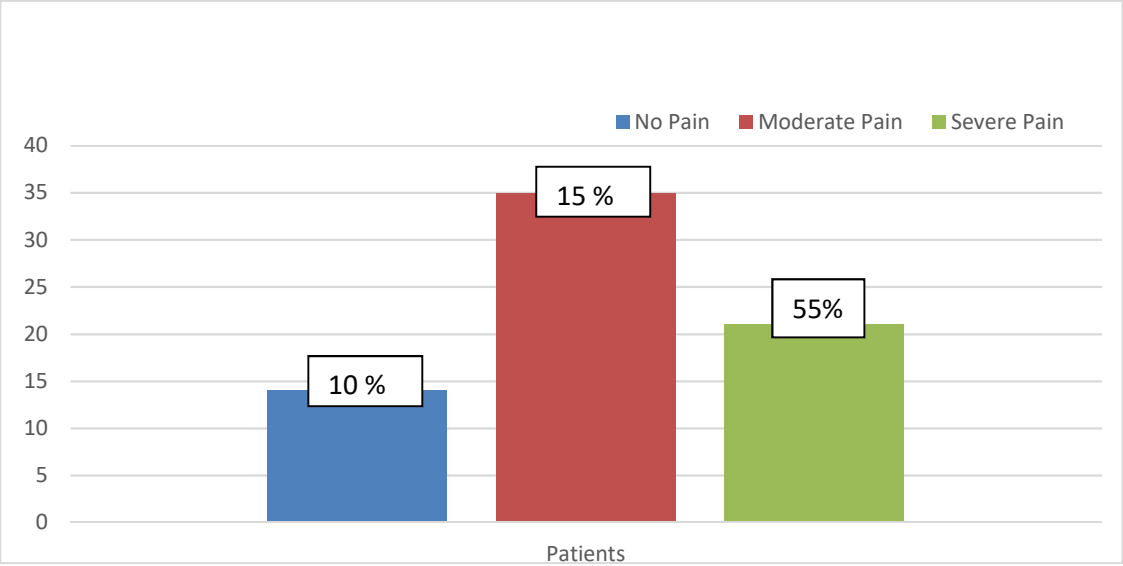

Chart 5 – Prevalence of Pain

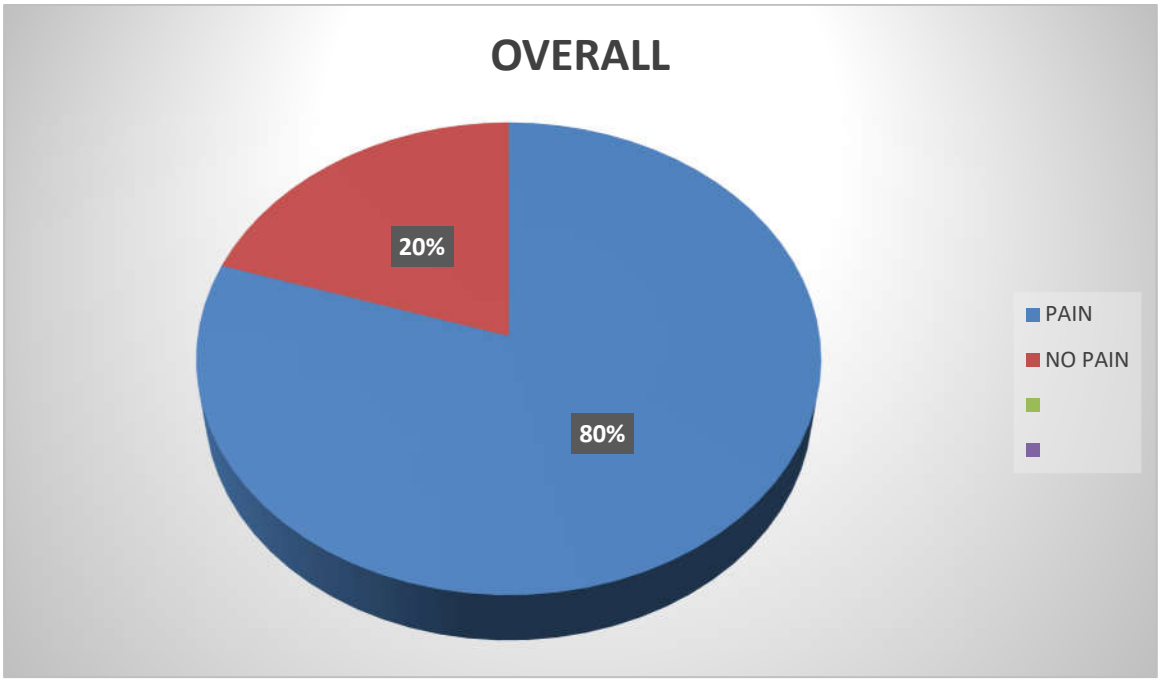

Chart 6 - During the study 70 patients involved on a scale from 0 to 10 Most 35(50%) patients experienced moderate pain which is common due to needle size and repeated vascular access 21(30%) Patients experienced severe pain, highlighting the need for better pain management strategies (e.g., local anesthetics, distraction techniques)14 (20%) Patients reported no pain, possibly due to high pain tolerance or long-term adaptation.

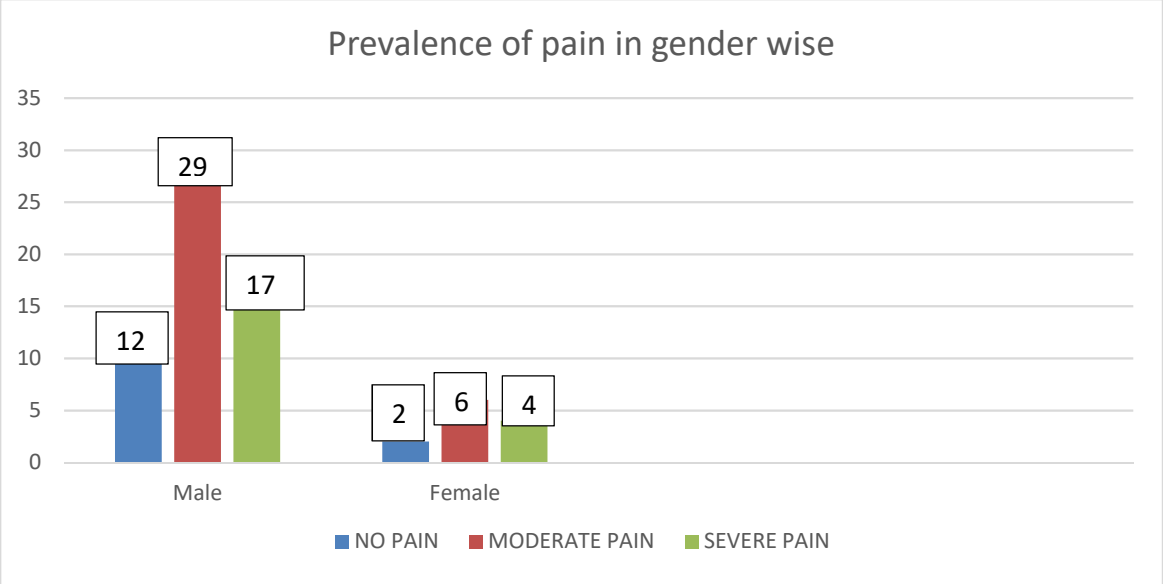

Chart 7 – Among 58 males, 29 (50%) had moderate pain, 17(30%) had severe pain, and 12(20%) had no pain. Among 12 females, 6 (50%) had moderate pain, 4 (30%) had severe pain, and 2 (20%) had no pain.

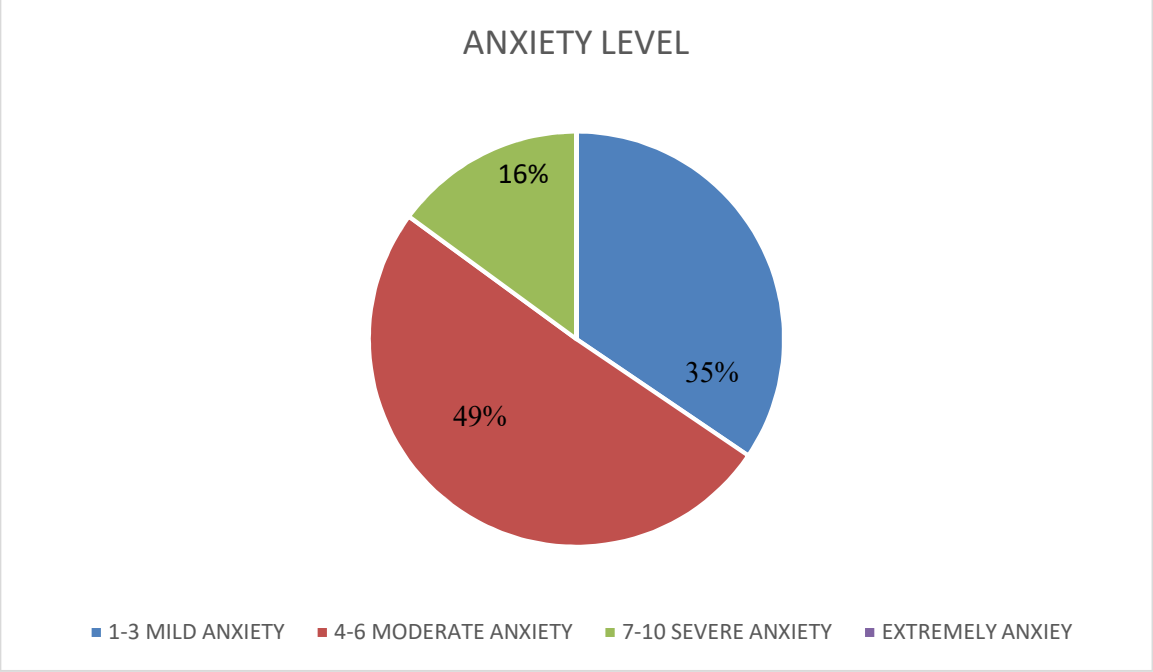

Chart 8 - Prevalence of Anxiety

In this above chart majority of patients experienced varying levels of anxiety. Among them (49%) 34 patients reported moderate anxiety with scores ranging from 4 to 6 representing the largest group. Additionally (35%) 24 patients experienced mild anxiety (scores 1–3) while (16%) 12 patients suffered from extremely high anxiety levels scoring between 7 and 10. These findings psychological evaluation and appropriate intervention strategies to support patients mental well-being during medical treatment.

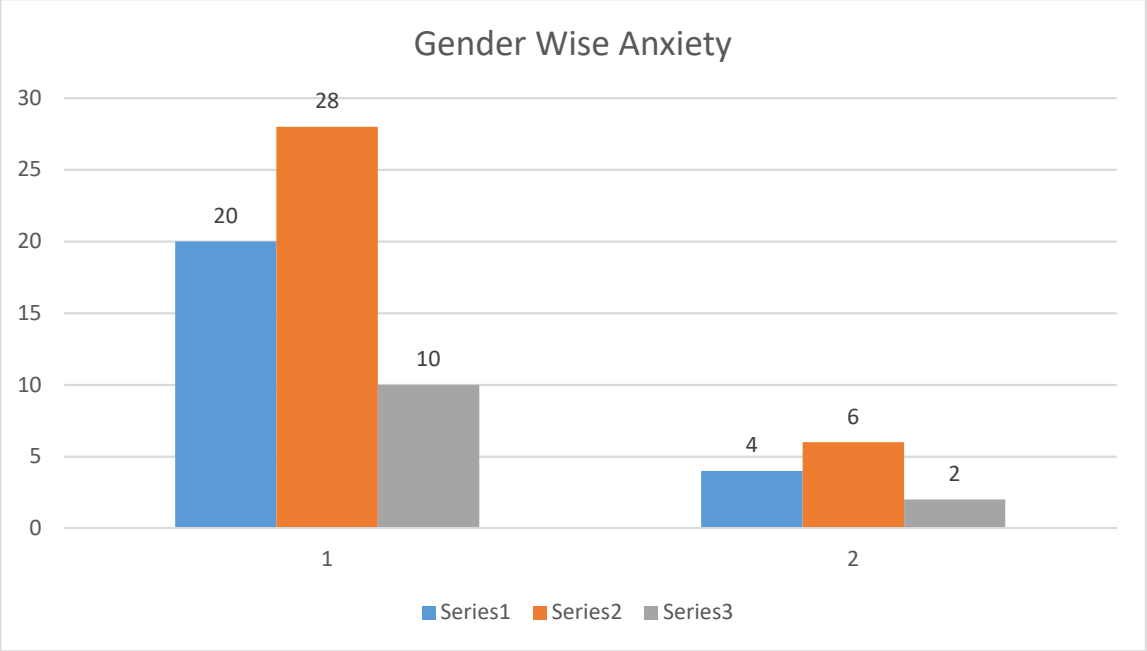

Chart 9 - Among 58 males, 28(49%) had moderate anxiety, 20 (35%) had mild anxiety, and 10 (16%) had high anxiety.Among 12 females, 6 (50%) had moderate anxiety, 5 (42%) had mild anxiety, and 1(8%) had high anxiety.

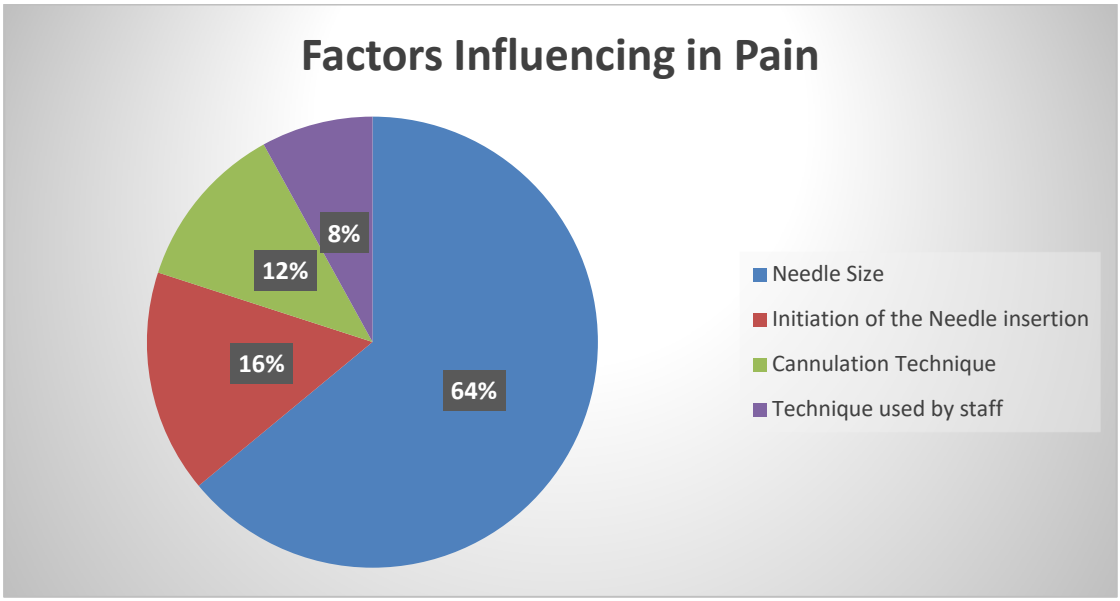

Chart 10 – Among 70 patient the main factors that influencing pain or categories in into 4 groups, majority of 64 % of patients are feeling pain due to needle size, 16% of patient are feeling pain from initiation of the needle insertion 12 % of patients are feeling pain in cannulation technique and only 8% of patients are feeling pain by technique used by staff.

DISCUSSION

Here is a discussion content on pain management in arteriovenous fistula (AVF) cannulation for hemodialysis patients, with references and citations:

Pain during AVF cannulation remains a prevalent and significant issue for patients undergoing maintenance hemodialysis (HD). The pain caused by needle insertion can lead to anxiety, stress, and reduced adherence to treatment protocols, ultimately affecting the quality of life and therapeutic outcomes for chronic kidney disease (CKD) patients. Studies consistently report that patients experience mild to moderate levels of pain and anxiety during AVF cannulation, with some patients reporting severe pain episodes. The intensity of pain is influenced by multiple factors, including the skill and experience of the healthcare provider performing the procedure, the cannulation technique used, and individual patient pain tolerance(3).

Management strategies for AVF cannulation pain focus on three main approaches: specific cannulation techniques, use of local anesthetic agents, and complementary therapies. Cannulation techniques such as the Buttonhole technique have been associated with reduced pain compared to traditional rope-ladder methods because it minimizes repeated trauma at different puncture sites. Local anesthetics, including lidocaine gels and vapocoolant sprays, have demonstrated effectiveness in reducing pain intensity during cannulation without significant adverse effects. Complementary therapies like cryotherapy (application of cold), music therapy, distraction techniques such as virtual reality, and behavioral interventions provide additional pain relief, especially when pharmacological options are limited or contraindicated (4,5).

The role of dialysis nurses is critical in pain management, as their cannulation expertise and empathetic patient care can reduce pain perception and ease anxiety. Training programs for nurses on advanced cannulation techniques and pain assessment tools ensure better patient outcomes. Furthermore, repeated painful experiences without adequate pain control can increase pain sensitivity (hyperalgesia) and lead to needle phobia, complicating long-term vascular access management (3).

Limitations in existing studies include variability in pain assessment methods, limited generalizability due to single-center designs, and a need for longitudinal studies to evaluate pain management effectiveness over time. Nonetheless, current evidence highlights the necessity of routine pain and anxiety assessment during AVF cannulation and adoption of multimodal pain management strategies to improve patient comfort, treatment adherence, and quality of life in HD patients.

CONCLUSION

This study highlights that AVF cannulation continues to be a major source of pain and psychological distress for patients undergoing haemodialysis. Among the 70 patients evaluated, 80% reported experiencing pain 50% moderate and 30% severe during routine cannulation procedures. Additionally, a significant portion experienced anxiety, indicating a strong psychological component linked to the physical discomfort. Factors such as needle size, insertion technique, and staff handling were major contributors to pain. The findings align closely with previous studies, reinforcing that this is a consistent and under-addressed issue in clinical practice. To enhance patient comfort and treatment adherence, it is essential to implement effective pain management strategies, such as local anaesthetics, staff training,

distraction techniques, and regular pain assessments. Further research should also consider patient-specific factors like comorbidities, anxiety levels, and dialysis duration to develop personalized interventions. Addressing this pain proactively will not only improve the quality of care but also support the overall well-being of patients with chronic kidney disease.

REFERENCES

1. dos Santos PR, Mendonça CR, Noll M, Borges CC, Alves PM, Dias NT, et al. Pain in Hemodialysis Patients: Prevalence, Intensity, Location, and Functional Interference in Daily Activities. Healthcare. 2021 Oct 14;9(10):1375.
2. Kitala-Tańska K, Kania-Zimnicka E, Tański D, Kwella N, Stompór T, Stompór M. Prevalence and Management of Chronic Pain, Including Neuropathic Pain, in Dialysis Patients with End-Stage Renal Disease. Medical Science Monitor. 2024 Mar 20;30.
3. Ibrahim MB, Abdelaal Badawi SE, Alameri RA. Assessment of Pain and Anxiety During Arteriovenous Fistula Cannulation Among Hemodialysis Patients: A Cross-Sectional Study in Saudi Arabia. J Multidiscip Healthc. 2022 Apr;Volume 15:705–18.
4. Alzaatreh MY, Abdalrahim MS. Management Strategies for Pain Associated with Arteriovenous Fistula Cannulation: An Integrative Literature Review. Hemodialysis International. 2020 Jan 3;24(1):3–11.
5. Sabitha P, Khakha D, Mahajan S, Gupta S, Agarwal M, Yadav S. Effect of cryotherapy on arteriovenous fistula puncture-related pain in hemodialysis patients. Indian J Nephrol. 2008;18(4):155.