



## A study to assess the efficacy of eutectic mixture of local anaesthetics cream vs lidocaine spray on pain during arteriovenous fistula (AVF) cannulation among patients visiting dialysis unit in a Tertiary Care Hospital, Ludhiana, Punjab

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### Abstract

Arteriovenous fistula cannulation is one of the painful procedures in Hemodialysis patients. Reducing this pain improves their dialysis acceptance and life quality. The aim of the study was to assess the efficacy of eutectic mixture of local anesthetics vs Lidocaine spray on pain during arteriovenous fistula (AVF) cannulation among patients visiting dialysis unit. Quantitative approach & quasi experimental (post-test only) research design was used for the study. Purposive sampling technique was used to draw the sample from the target population. The study was conducted on 30 patients in dialysis unit of DMC& Hospital, Ludhiana, Punjab. Pain Assessment Sheet as per Numerical Pain Rating scale will be used for data collection. The data analyzed by using descriptive & inferential statistics. The conclusion and discussion made according to the findings of the study and comparing the results of the present study with the previous literature.

**Keywords:** hemodialysis, arteriovenous fistula, EMLA cream, lidocaine spray

### Introduction

Kidneys are the most indispensable organ of the human body. Impairment of the kidneys can lead to serious illness or even death. Each kidney has a very multiplex structure and function. They have two important functions namely (a) To flush out harmful & toxic waste products and (b) To maintain balance of water, fluids, minerals & chemicals i.e. electrolytes such as sodium, potassium etc.

CKD is a chronic kidney disease i.e. slow and gradual loss of kidney function over a period of many years. It is also known as chronic renal failure, chronic renal disease and chronic kidney failure. According to the guideline KDIGO, 2020 "CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health," and requires one of two criteria recorded or inferred for > 3 months: either GFR <60 ml/min/ 1.73 m<sup>2</sup> or markers of kidney damage, including albuminuria. CKD is classified into 5 stages according to severity depending upon GFR rate, stage 1 is the mildest and usually causing few symptoms and stage 5 being a severe illness with poor life expectancy if untreated. Stage 5 CKD is often called End Stage Renal Disease (ESRD).

End stage renal disease is a major problem for public health and it causes complex implications to social and economic structures of every nation in the world. Approximately, 220000 patients are diagnosed with end stage renal disease (ESRD) every year, which includes additional demand of 34 million dialysis sessions in India. According to kidney Wales's foundation in UK, shows that more than 500 million people in worldwide- approximately one in ten adults have some form of kidney damage. Many people ignores the close inter-relationship between kidney diseases and diabetes or hypertension Worldwide, 246 million people suffer from diabetes and expected that it will we 38 million

2025. Diabetic nephropathy affects one third of people suffering from diabetes and approximately 1.5 million people are kept alive by renal dialysis. The number of patients with chronic kidney disease (CKD), and the subsequent need for renal replacement therapy has reached epidemic proportion and is anticipated to rise further affects approximately 10 % of the population worldwide and it is estimated that over 1.1 million patients with end stage renal disease (ESRD) currently require maintenance dialysis and the number is increasing at a rate of 7% per

The end -stage renal disease (ESRD) is the progressive irreversible degeneration of kidney functioning leading to pain and suffering for many people around the world. The growth rate of this disorder is greater than the average global growth reaching about 12 % per year. Hemodialysis as the most common treatment line for ESRD is a stressful process which may cause various psychosocial disturbances. These patients are usually affected with severe complications some of which are related to ESRD and some other pertains to the type of its treatment. Among the complaints expressed by 50 % of these patients is some sort of pain experience. Pain may induce disability, fear and anxiety in most patients more than other disease and it is one of the most common reasons for seeking healthcare and treatment by client

Chronic renal failure is a devastating medical, social and economic problem for both patient and their families. Patients with chronic renal failure need treatments such as kidney transplantation, Hemodialysis or peritoneal dialysis. The most common treatment for the disease is Hemodialysis. Hemodialysis is the most frequently used renal replacement therapy with the arteriovenous fistula (AVF) being the gold standard for the vascular access in Hemodialysis patient.

Functional vascular access is needed for Hemodialysis (HD). Vascular access remains as the lifeline for patients with end stage renal disease who need chronic intermittent Hemodialysis (HD) therapy. The ideal HD access should have long length of a suitable superficial vein for cannulation in two places more than 5 cm apart with a sufficient blood flow for effective dialysis, usually in excess of 400 ml/min. A vascular access should have good primary patency, have a low risk of complications and side effects, and leave opportunities for further procedures in the event of failure. Ideally, a first access should be an arteriovenous (AV) fistula placed peripherally at the wrist.<sup>9</sup>

A prerequisite to regular long-term Hemodialysis is permanent vascular access, which can be established through central venous catheter, arteriovenous graft or arteriovenous fistula. The most preferred access route is arteriovenous fistula. Hemodialysis through arteriovenous fistula necessitates one arterial and one venous puncture using two large-diameter needles. These punctures usually cause severe pain and discomfort for patients.<sup>10</sup> Pain is a subjective feeling, which has a greater influence on the emotional aspect of a person. Pain is initiated by stimulation of nociceptors in the peripheral nervous system<sup>4</sup>. AVF cannulation is the procedure associated with pain. There have been considerable amount of efforts over the past several years to identify the method of decreasing pain.<sup>10</sup>

Everyone has experienced some type or degree of pain, yet the concept of pain is difficult to communicate. The experience of pain is complex, involving emotional, and cognitive components. Pain control is important because pain can affect appetite, sleep, energy and ability to do things. Pain is considered as the 5<sup>th</sup> vital sign. The recommended hierarchy of management should consist of pharmacological & non pharmacological method to control pain.

In Hemodialysis patients, the most common cause of pain is the arteriovenous fistula (AVF) cannulation due to the diameter and length of these catheters. On average, the Hemodialysis patients undergo the procedure three times a week, each time lasting 3-4 hrs. Moreover, the Hemodialysis patients on an average experience the cannulation pain and skin puncture 10 times per month and this pain continues during the lifespan of the patient or until kidney transplant is performed. Among the effective pharmaceutical methods of pain relief are the administration of topical anesthesia techniques such as topical gel, anesthesia patch, and topical analgesic spray. This can reduce the pain induced by medical interventions.

Topical anesthetics were found to have equivalent efficacy compared to lidocaine infiltration but were less painful for closure of skin wounds in children. Eutectic mixture of local anesthetics (EMLA) has been found significantly reduced pain associated with radial artery cannulation compared to lidocaine infiltration and also improves the successful rate of cannulation. Eutectic mixture consists of liquids that melt at temperature lower than the individual components, thus allowing greater concentration. EMLA is combination of lidocaine 25 mg/g and prilocaine 25 mg/g; which is effective in producing dermal analgesia.<sup>12</sup> EMLA cream (2.5% lignocaine, 2.5% prilocaine) cream is an effective and well tolerated topical anesthetic agent for needle insertion and minor dermatological procedures including laser therapy of birthmarks. The efficacy of EMLA is dependent primarily on the dose, application time and area of

application. EMLA cream should be applied at least 60 minutes before procedures involving intact skin, and covered with an occlusive dressing. EMLA cream remains effective for upto 1 hour after removal.

Lidocaine is one of the important common agents used as local anaesthesia. Lidocaine spray is one of the common formulations used clinically with moderate term effect to induce local anesthesia in mucous membranes and skin. Depending upon the site of application, anesthesia is usually induced during 1-5 min lasting for 10-15 min. The pain relief theory behind lidocaine application is the blocking of active and inactive sodium channel followed by blocking of conduction and lack of stimulations reducing in reduced or impaired pain transmission.

### Material and Methods

With quantitative approach, quasi experimental (posttest only) design was used for this study conducted on 30 patients in dialysis unit of DMC & H, Ludhiana, Punjab. Purposive sampling technique was used to draw the sample from the target population based on inclusion and exclusion criteria. Pain assessment sheet as per Numerical Pain Rating Scale was used for data collection. Pain severity was assessed at AVF cannulation in one group with three methods: conventional method without pain management in control arm, application of EMLA cream in experimental arm I & use of Lidocaine Spray in experimental arm II. Each patient was observed for three times for each method, i.e, a total of 9 assessments for each patient, while the order of the methods was determined alternatively for each patient.

### Inclusion criteria

Patients who were

- between the age group 18-65 years
- willing to participate in the study
- visiting twice or thrice a week for hemodialysis
- capable to provide adequate response to pain intensity experienced

### Ethical consideration

Following things were considered to ensure ethical consideration of study

- Written permission for conducting study was undertaken from Institutional ethical committee of DMC & Hospital, Ludhiana.
- Written permission was taken from the Principal, College of Nursing and from the HOD of Dialysis unit.
- The study was approved by Baba Farid University of Health Sciences, Faridkot.
- The patients /attendants were explained about the study and its objectives in their language and written consent was taken from them.
- Anonymity and confidentiality of subjects was maintained.
- It was ensured that intervention was cost effective and patient did not have to pay any charges.
- It was ensured that study did not affect the participants in any way.

### Results

Majority of patients i.e. 17 (56.7%) were falling in age group 46-60 years. 16 (53.3%) were female & 25 (83.3%) were married. Most of the subjects 16(53.3%) living in

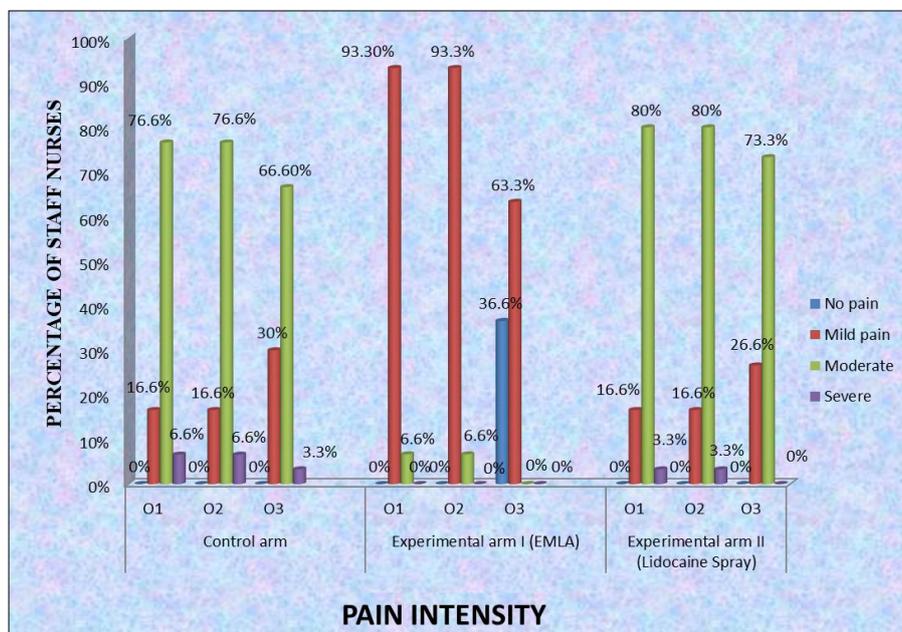
urban areas & 14 (46.7%) were Hindu and Sikh. Only 10(33%) were educated upto primary and secondary level. As per dietary pattern were 16(53.3%) were non-vegetarian. As per occupational status, majority of the patients 24(80 %) were not working. As per socio-economic status (Kuppuswami's Socioeconomic Status Scale 2019) half of the patients i.e. 15 (50%) belonged to upper middle class (II) . As per clinical profile of the patients, majority of the patients diagnosed with CKD 21(70%). Majority of the subjects based on mode of admission were OPD 30(100%).

Majority of the patients were having the co morbidity disease and most of them were with diabetes mellitus and hypertension. 46.7% had dialysis vintage. The findings of the present study reveals that statistically significant results were found in pain intensity within the groups as well as between the groups of experimental arm I (EMLA) (p=0.001) and in experimental arm II (Lidocaine Spray) (p= 0.004) . However, nothing significant results were found in control arm i.e. (p=0.273).

**Table 1:** Frequency and percentage distribution of post interventional pain during AVF cannulation in control arm, experimental arm I (EMLA), experimental arm II (Lidocaine Spray) according to pain intensity in O1, O2, O3.

Pain intensity	Control arm			Experimental arm I (EMLA)			Experimental arm II (Lidocaine Spray)		
	O1 (f %)	O2 (f %)	O3 (f %)	O1 (f %)	O2 (f %)	O3 (f %)	O1 (f %)	O2 (f %)	O3 (f %)
No pain	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	11 (36.6)	0 (0)	0 (0)	0 (0)
Mild pain	5 (16.6)	5 (16.6)	9 (30)	28 (93.3)	28 (93.3)	19 (63.3)	5 (16.6)	5 (16.6)	8 (26.6)
Moderate	23 (76.6)	23 (76.6)	20 (66.6)	2 (6.66)	2 (6.66)	0 (0)	24 (80)	24 (80)	22 (73.3)
Severe	2 (6.6)	2 (6.6)	1 (3.3)	0 (0)	0 (0)	0 (0)	1 (3.3)	1 (3.3)	0 (0)

Maximum score=10  
Minimum score =0



**Fig 1:** Percentage distribution of post interventional pain during AVF cannulation in control arm, experimental arm I (EMLA) , experimental arm II (Lidocaine Spray ) according to pain intensity in O1 , O2 , O3.

**Table 2:** Comparison of mean scores of post interventional pain during AVF cannulation in the same group of patients by using three methods i.e. control arm (no intervention), experimental arm I (EMLA), experimental arm II (Lidocaine Spray) among patients visiting dialysis unit in O1, O2 & O3..

Pain Intensity	Control arm (No intervention)		Experimental Arm I (EMLA)		Experimental Arm II (Lidocaine Spray)		ANOVA f/p value between the groups
	Mean ± SD	Mean %	Mean± SD	Mean%	Mean ± SD	Mean%	
O1	4.90 ± 1.322	49%	2.13 ± 1.105	21.3%	4.83 ± 1.205	48.3%	F=50.6709 df=89 p=0.001*
O2	4.83±1.769	48.3%	2.16±0.912	21.6%	4.53±1.074	45.3%	F=56.9424 df=89 p=0.001*
O3	4.13±1.059	41.3%	0.76±0.67	7.6%	3.93±0.827	39.3%	F=135.516 df=89 p=0.001*
ANOVA f/p value Within the group	F=3.7264 df=89 p=0.0273 <sup>NS</sup>		F=22.8160 df=89 p=0.001*		F=5.7393 df=89 p=0.004*		

Table 2 illustrates the comparison of pain intensity of patients on maintenance hemodialysis among control arm (no intervention), experimental arm I (EMLA) and experimental arm II (Lidocaine Spray) in O<sub>1</sub>, O<sub>2</sub> & O<sub>3</sub> within the groups and between the groups. In control arm (no intervention) on O<sub>1</sub>, O<sub>2</sub>, O<sub>3</sub> mean±SD was 4.90±1.322, 4.83±1.769, 4.13±1.059 respectively with mean% 49%, 48% & 41.3% of respective observations. In experimental arm I (EMLA) on O<sub>1</sub>, O<sub>2</sub>, O<sub>3</sub> mean±SD was 2.13±1.105, 2.16±0.912, 0.76±0.067 respectively with mean% 21.3%, 21.6% & 7.6% of respective observations. In experimental arm II (Lidocaine Spray) on O<sub>1</sub>, O<sub>2</sub>, O<sub>3</sub> mean±SD was 4.83±1.205, 4.53±1.0743, 3.93±0.827 respectively with mean% 48.3%, 45.3% & 39.3% of respective observations. Hence, H<sub>0</sub> null hypothesis is rejected as statistically significant results were found in pain intensity within the groups as well as between the groups of experimental arm I (EMLA) (p=0.001) and in experimental arm II (Lidocaine Spray) (p= 0.004). However, nothing significant results were found in control arm i.e. (p=0.273).

### Discussion

The findings of the study had been discussed in accordance with the objectives of the study and previously reviewed studies. Review of literature enlighten that there are vast number of studies conducted on patients undergoing dialysis and various pain minimizing strategies used to reduce the pain experienced by the patients during arteriovenous fistula puncture. Evidence based practice is the integration of best research evidence with clinical expertise and patient values which when applied by practitioners will lead to improve outcome. It is an ongoing and continuous process. In nursing care services also, we continuously strive for improving standards of care. With the help of comparison by using two pain reducing measures, we will able to find the better one for reducing pain during AVF cannulation. By using pain relieving measures during AVF cannulation, there will be increased compliance in patients with arteriovenous fistula undergoing Hemodialysis. This chapter deals with the discussion for the findings of study titled "A study to assess the efficacy of eutectic mixture of local anesthetics cream vs Lidocaine spray on pain during Arteriovenous fistula (AVF) cannulation among patients visiting dialysis unit in a tertiary care hospital, Ludhiana, Punjab." The research was conducted on one group by using the three methods: conventional method without pain management, Lidocaine Spray & EMLA analgesic cream. This study concluded that application of both EMLA and Lidocaine Spray were effective in pain reduction during AVF cannulation. The findings of the present study showed that the mean pain scores of the three method. In control arm (no intervention) on O<sub>1</sub>, O<sub>2</sub>, O<sub>3</sub> mean±SD was 4.90±1.322, 4.83±1.769, 4.13±1.059 respectively with mean% 49%, 48% & 41.3% of respective observations. In experimental arm I (EMLA) on O<sub>1</sub>, O<sub>2</sub>, O<sub>3</sub> mean±SD was 2.13±1.105, 2.16±0.912, 0.76±0.067 respectively with mean% 21.3%, 21.6% & 7.6% of respective observations. In experimental arm II (Lidocaine Spray) on O<sub>1</sub>, O<sub>2</sub>, O<sub>3</sub> mean±SD was 4.83±1.205, 4.53±1.0743, 3.93±0.827 respectively with mean% 48.3%, 45.3% & 39.3% of respective observations. But, eutectic mixture of local anaesthetics cream showed better outcome compared to lidocaine spray in reducing the pain during AVF cannulation among patients visiting dialysis unit. The

findings of the present study reveals that statistically significant results were found in pain intensity within the groups as well as between the groups of experimental arm I (EMLA) (p=0.001) and in experimental arm II (Lidocaine Spray) (p= 0.004). However, nothing significant results were found in control arm i.e. (p=0.273).

### Conclusion

This study concluded that application of both EMLA and Lidocaine Spray were effective in pain reduction during AVF cannulation. But, eutectic mixture of local anaesthetics cream showed better outcome compared to lidocaine spray in reducing the pain during AVF cannulation among patients visiting dialysis unit

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