Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 9749 - 9757
Received 05 March 2021; Accepted 01 April 2021.

Effectiveness of EMLA Cream Local Application vs Placebo in Increasing Efficiency of ESWL - A Prospective Study

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ABSTRACT

ESWL is a procedure commonly used for the treatment of urolithiasis. Usage of appropriate agents for increasing effectiveness of ESWL is still not standardised and a number of studies have been conducted for this purpose. We attempted to determine whether usage of EMLA cream is effective in ESWL for increasing efficacy. Our study investigated the effectiveness of EMLA cream alleviates pain in a population of 170 patients divided into two comparable populations, one in which EMLA was used and another with placebo over 18 months. We inferred that usage of EMLA is very effective for increasing the rate of stone fragmentation during ESWL with additional benefits of decreasing number of sittings, being cost effective, easy application and better patient acceptability.

Keywords: ESWL, stone fragmentation, EMLA cream, double J stenting

Introduction

Extracorporeal shock wave lithotripsy (ESWL) is one of the most common methods used for the treatment of urolithiasis (1). Patient collaboration during the procedure is essential for the correct application and eventual success. Adequate analgesia enables this.

Pain from ESWL is multifactorial in nature. It consists of parietal and visceral pain. Parietal pain is derived from continuous impact of shock waves on cutaneous nociceptors while visceral pain results from increase in intrapelvic pressure and renal capsule distension (2). Visceral pain is caused by the stimulation of periosteal, pleural, peritoneal and musculoskeletal nociceptors. Other factors involved are operator differences, the type of lithotripter, site and size of the stones, and pressure of shock waves.

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During ESWL, general anaesthesia, regional anaesthesia, intravenous anaesthesia and sedation can be administered. Opioids, sedatives, nonsteroidal anti-inflammatory drugs (NSAIDS) and anesthetic topical creams maybe used to provide analgesia(13).

Opioids provide adequate analgesic control but cause marked side effects. For this purpose, several studies used opioids such as fentanyl, alfentanil, sufentanil and ramifentanil.(12, 13, 14) Since 1986, various studies have been reported on the use of infiltrative or topical local anaesthetics for analgesic purposes.(2, 3, 4) The use of local anaesthetics during ESWL has been shown to be effective in providing analgesia.

The most appropriate analgesia, which enables pain-free treatment along with minimal side effects and is also cost-effective, needs to be established.

Objectives

"Eutectic mixture of local anesthetic" (EMLA) is a type of topical cream that includes lidocaine (2.5%) and prilocaine (2.5%). This cream has a skin-penetrating depth of 4mm and onset time of 10–20min, and provides pain relief for up to 60 minutes.
In this prospective study, the effectiveness of EMLA cream application in enabling a successful ESWL was studied with respect to effectiveness of stone fragmentation, and need for repeat procedures.This prospective study was conducted on patients reporting to the Department of Urology, Saveetha Medical College from September 2018 to April 2020.

Inclusion Criteria

Patients diagnosed with renal or proximal ureteric calculi that underwent ESWL at Saveetha Medical College from September 2018 to April 2020.

Exclusion Criteria

- Patients with deranged renal function tests
- Patients with coagulopathy
- Patients under 16 years of age
- Pregnant women and nursing mothers
- Patients with local anaesthetic allergies

Materials and Methods

After the approval of the Ethics Committee of Saveetha Medical College and the informed consent of patients, a total of 170 patients with urolithiasis between 17-70 years of age who were scheduled to undergo elective ESWL using the Dornier® lithotripter (Dornier MedTech, Germany) were enrolled in the study.

Both In-situ ESWL and patients on whom Double J stenting was done prior to the procedure were included in the study. Patients included irrespective of whether they were undergoing ESWL for the first time or the second time.

Patients were segregated into two groups by simple random technique. At least 30 minutes before ESWL, a placebo cream was applied to a 100 cm^2 outlined skin area corresponding to the presumed entrance of the shock waves in the first group.

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In the second group, 30 gm. EMLA cream (1 gm. contains 25 mg. lidocaine and 25 mg. prilocaine) were applied to a 100 cm^2 outlined skin area corresponding to the presumed entrance of the shock waves. ESWL was performed using a Dornier Lithotripter SII.

ESWL was allowed to proceed for a maximum of 2500 shocks. The intensity of shocks was also kept standard at a setting of 4. Efficacy of stone fragmentation was monitored at this time. Variables evaluated included the patient's sex, age, body mass index, size of the stones, number of stones, location of stones (renal pelvis, upper, middle or lower calyceal, proximal ureteric), Hounsfield Units of the stones, whether ESWL was done In-situ or post Double J stenting, VAS score before and after application of EMLA cream, degree of lithiasis fragmentation in both groups using pre-treatment and post-treatment radiological findings and the number of sittings required for complete fragmentation.

Results

All 85 patients in both the groups who underwent ESWL procedure were studied by demographic characters, BMI, stone characteristics and stone fragmentation index (partial or completely fragmented). Pain score allotted to each patient was tabulated and studied.

Patients in this study were in the age group of 17 – 70 years. Mean age of patients was 41.59 years in study group and 41.21 years in control group with standard deviation of 11.34 and 12.43 respectively. P value obtained by unpaired t test analysis (0.206) which was not significant with respect to age (p value 0.837).

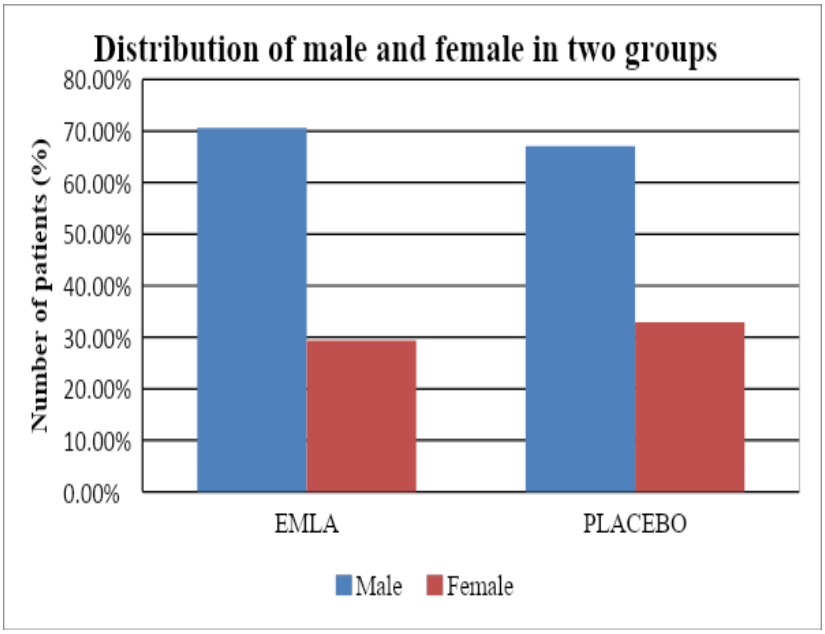

Chart 1. Sex distribution of study population

Majority of the patients were males in both the groups. However, gender distribution between the two groups was not significant (p value 0.619)

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Table 1. Comparison of different parameters in two groups

SEX	**EMLA**	**PLACEBO**	**Pearson Chi-Square(d.f.)**	**p value**
Male	60(70.6%)	57(67.1%)	.247(1)	.619^{NS}
Female	25(29.4%)	28(32.9%)		
LOCATION				
Renal Pelvis	4(4.7%)	5(5.9%)	7.729(7)	.357^{NS}
Upper pole	27(31.8%)	25(29.4%)		
Middle pole	13(15.3%)	19(22.4%)		
Lower pole	23(27.1%)	18(21.2%)		
Proximal ureter	18(21.2%)	13(15.3%)		
Upper, Lower pole	0(.0%)	3(3.5%)		
Middle, Lower pole	0(.0%)	1(1.2%)		
Renal Pelvis Middle ,Upper, lower pole	0(.0%)	1(1.2%)		
LATERALITY				
Right	45(52.9%)	42(49.4%)	.212(1)	.645^{NS}
Left	40(47.1%)	43(50.6%)		
STENTING				
In situ	21(24.7%)	46(54.1%)	15.396(1)	0.0001*
Post DJ stenting	64(75.3%)	39(45.9%)		
FRAGMENTATION				
Fully fragmented	68(80.0%)	44(51.8%)	15.074(1)	0.0001*
Partially fragmented	17(20.0%)	41(48.2%)		
NO. OF SITTINGS				
Single sitting	66(77.6%)	44(51.8%)	12.447(1)	0.0001*
Repeat sitting	19(22.4%)	41(48.2%)		
No. of stones				
1	83(97.6%)	75(88.2%)	8.8059(3)	.032*
2	1(1.2%)	9(10.6%)		
3	1(1.2%)	0(.0%)		
4	0(.0%)	1(1.2%)		

^{NS} Not significant p>0.05, Significant p<0.05, ** highly significant p<0.01

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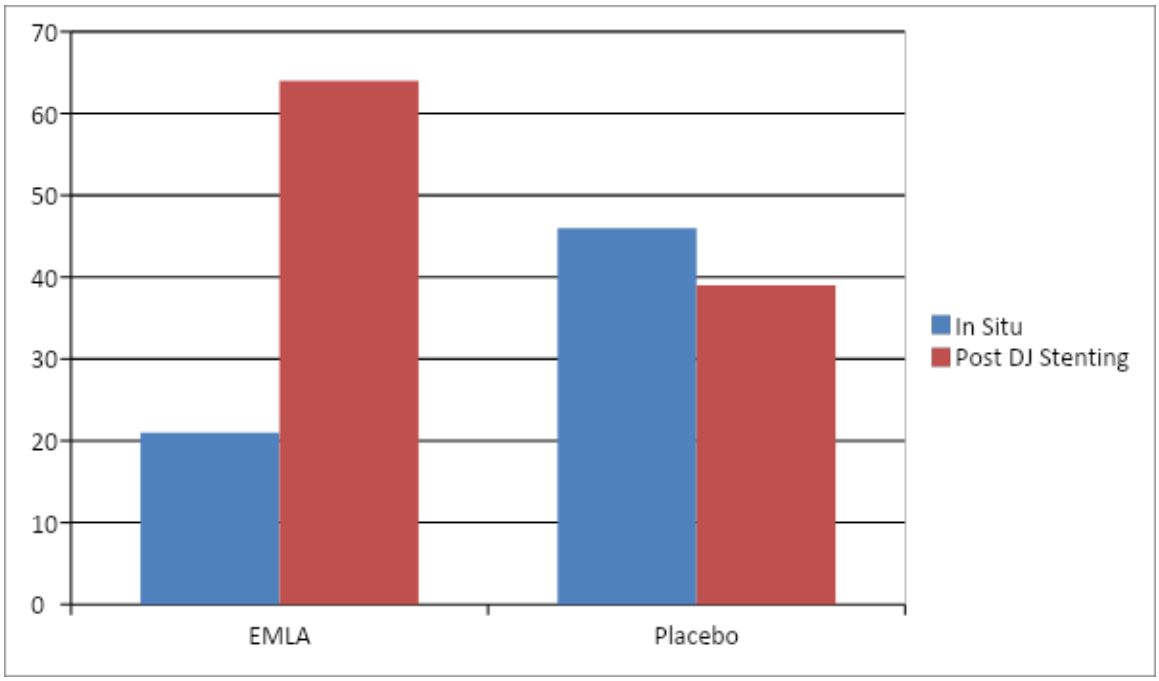

Chart 2. In situ ESWL vs Post DJ Stenting in study population

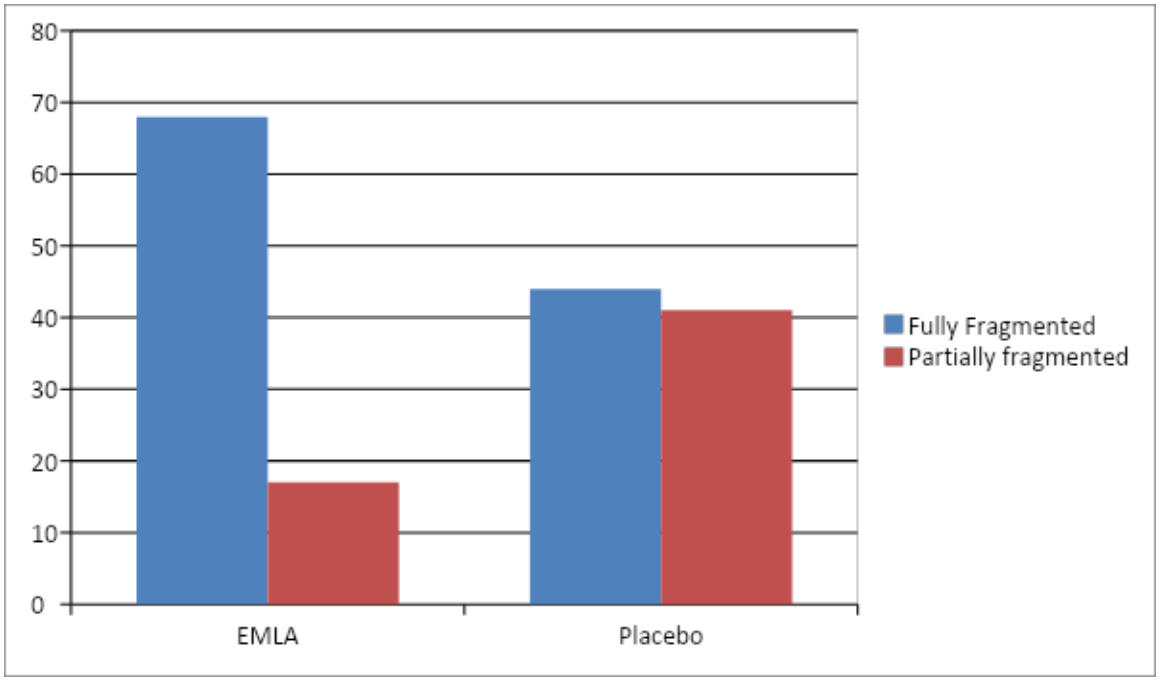

Chart 3. Efficiency of stone fragmentation

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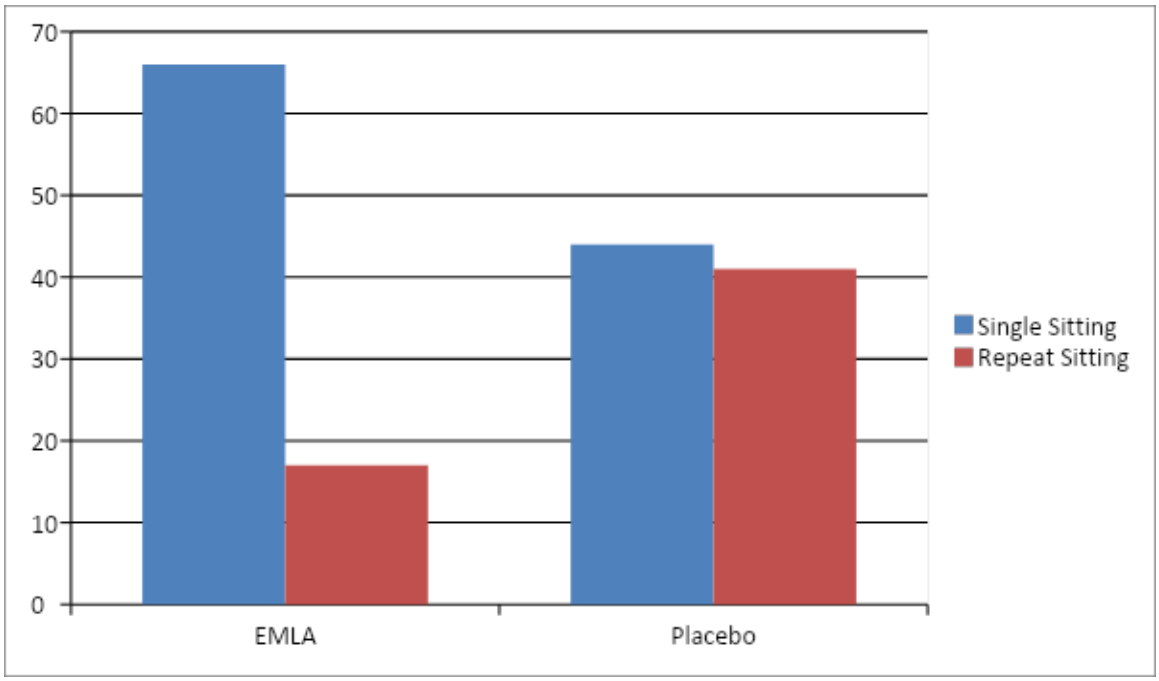

Chart 4. Number of sittings required

From the data obtained, it was observed that complete stone fragmentation in the study group (68/85) was significantly higher than the control group (44/85).The number of sittings required in the study group was also significantly reduced in the study group.

Table 3. Comparison of Age, BMI, Size of stone, HU between two groups by t- test for two independent groups

	Group	N	Mean ± Std. Deviation	Mean Difference ±S.E.M.	t(d.f.)	p value
AGE	**EMLA**	85	41.59±11.336	.376±1.825	.206(168)	.837^{NS}
	PLACEBO	85	41.21±12.436			
BMI	**EMLA**	85	22.86±2.615	.318±.448	.708(168)	.480^{NS}
	PLACEBO	85	22.54±3.202			
SIZE OF STONE	**EMLA**	85	16.54±75.155	7.162±8.157	.878(168)	.381^{NS}
	PLACEBO	85	9.38±2.633			
HU	**EMLA**	85	891.91±249.273	47.553±33.545	1.418(168)	.158^{NS}
	PLACEBO	85	939.46±183.058			

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Discussion

ESWL is used for treatment of patients with renal and ureteric stones. It is an effective procedure with minimal complication rate. It is usually performed as an outpatient procedure in most centres.

ESWL uses acoustic shock waves to break up the renal stones. Pain during ESWL is experienced at the entry site of shock waves and as deep visceral discomfort.

Numerous studies using opioids were conducted to negate these issues(1, 2, 3, 4). Opioids are used extensively because of their high efficiency. But associated side effects of opioids such as bradycardia, hypotension, respiratory depression, sedation, nausea-vomiting, and itching are a deterrent to their use(6). They can also lend to possible prolonged hospital stay (10).This has caused many to search for alternative methods of achieving adequate analgesia.

Since 1986, many studies were conducted using local anesthetics to provide analgesia during ESWL(2, 3, 4, 5).

Local anesthetics were shown to be effective in this regard with only 5% of these patients requiring general anesthesia(11).

A number of studies attempted the use of topical EMLA cream as a means of ensuring adequate analgesia (7, 8). Although EMLA cream was effective in relieving pain at the skin due the shock waves used during the procedure, patients generally required additional analgesia as the pain related to ESWL had both cutaneous and visceral components(9, 10).

Barcena et al. conducted a study on 20 patients who had been unable to tolerate pain without IV analgesia during ESWL (12). In this study, 10 gm. of EMLA cream was applied on the skin over the area of 64-100 cm^2, 60 minutes before the second session. Despite higher voltages, lower pain scores were found in patients for whom EMLA cream was used and only two patients required further analgesia. In addition, all patients required additional fentanyl in the first session without EMLA.

In a study by Ganapathy et al(15), one group received 30 gram EMLA cream and the other group received a placebo 60-90 minutes before the procedure. All patients received 5 mcg/kg of alfentanil via a PCA machine with a lockout time of 3 minutes and no significant differences were noted in pain scores, side effects and duration of stay in the post anesthesia care unit between EMLA cream and placebo.

In the present study, similar to those of Ganapathy and Terri(15), 10 gram of EMLA cream was applied to a 10x15 cm area of skin 30 minutes before the procedure.

We attempted to assess the effectiveness of EMLA cream. All of the patients were able to tolerate the procedure and did not require administration of any other analgesics or the termination of the procedure.

Even though it has been suggested that topical anesthetics used for the elimination of cutaneous component of pain only provide a more desirable analgesia by reducing the use of opioids and

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their side effects, we demonstrated in this study that the use of EMLA cream alone was sufficient for a successful ESWL.

We accept that further investigation of the use of EMLA cream alone or combined with other IV analgesia regimens is needed to prove the efficacy of EMLA cream.

Conclusion

EMLA is an effective means of pain management leading to a successful ESWL with additional benefits of being cost effective, easy application and better patient acceptability. EMLA can be used as topical application 30 minutes before the procedure to decrease the pain and increase effectiveness of ESWL.

Source of Support: Nil.

Conflict of Interest: None.

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