

# EMLA CREAM FOR VENOUS CANNULATION : AN EVALUATION OF THE EFFICACY AND TIMING OF APPLICATION

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## Summary :

Eutectic mixture of local anaesthetics (EMLA) cream is useful in providing analgesia for short local procedures, including cannulations and certain short surgical procedures. The purpose of this study was to evaluate the efficacy and effective timing of application of EMLA 5% cream in obtunding the pain produced by intravenous cannulation. Sixty patients were randomly allocated into three groups of 20 each; group A patients were cannulated after 30 minutes of EMLA cream application, group B patients were cannulated after 60 minutes of EMLA cream application and group C patients were cannulated with placebo. Both the study groups A and B had significantly lower pain scores when compared to the control group. The control group had a significant rise in heart rate and blood pressure during cannulation. We conclude that, application of EMLA cream for venous cannulation alleviated pain, prevented haemodynamic stress response to cannulation and the maximum effect was seen after an application time of 60 minutes.

## Keywords:

EMLA, Prilocaine, lignocaine, dermal analgesia

## Introduction:

One of the most important pre requisites of delivering anaesthesia to any patient is securing a safe and patent intravenous access for drug and fluid administration. Intravenous cannulation is now performed almost universally before induction of anaesthesia<sup>1</sup>. Superficial venous puncture in adults is currently performed without anaesthesia, as it is considered to be less traumatic experience for them when compared to children. However this procedure has been reported to produce significant pain<sup>2</sup> and therefore the use of percutaneous anaesthetic agents may be appropriate. The needle prick can also make the patient uncooperative and the anxiety caused can result in a haemodynamic stress response leading to increase in heart rate and blood pressure of the patient<sup>3</sup>. Many attempts have been made to produce local analgesia and to allow painless venepuncture by the topical application of

various drugs. Topical application of 40% lignocaine or 20% benzocaine<sup>4</sup>, ethyl chloride spray<sup>5</sup>, lignocaine iontophoresis<sup>6</sup>, and topical application of Ibuprofen<sup>7</sup> have been described but each one has certain drawbacks.

With the advent of eutectic mixture of local anaesthetic (EMLA) cream, effective topical analgesia of intact skin is now claimed to be feasible without the need for subcutaneous injections or exposure to high concentration of local anaesthetics<sup>8</sup>. EMLA cream is 1:1% oil in water emulsion of 2.5% lignocaine and 2.5% prilocaine bases. This mixture is termed eutectic as it has a melting point lower than its individual components. The mixture is liquid at room temperature while individual components are crystalline substances<sup>9</sup>. Different studies done to prove the efficacy showed various effective timing of application of EMLA cream<sup>10,11,12</sup>. We undertook this study to assess the most effective timing of application along with attenuation of stress response to cannulation after application of EMLA cream.

## Methods :

After obtaining institutional ethical committee clearance, and informed consent, this

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study was undertaken on 60 ASA I and II patients, between 18 to 60 years, of either sex, scheduled for elective surgeries. A routine pre operative evaluation was done for all patients and the following patients were excluded from the study: patients with known hypersensitivity to EMLA cream or any other local anaesthetic, patients with methemoglobinemia or on drugs that may cause it and pregnant and lactating patients. All patients were premedicated with 1mg/kg. body weight of pethidine and 0.5 mg/kg. body weight of promethazine via the intra muscular route. The patients were randomly allocated by envelope method into three groups (A, B, C) of 20 each. After explaining the procedure, non-dominant hand (unless otherwise specified) was chosen and a suitable vein on the dorsum of the hand was selected. In group C patients, intravenous cannulation was performed with 18G I.V. cannula. In group A and B patients, EMLA cream 1.5 to 2 gm/10 cm<sup>2</sup> area was applied over the site of cannulation in a thick layer. This layer was then covered with an occlusive dressing. The surrounding area was cleaned with dry gauze. EMLA cream was applied for 30 minutes in group A patients and 60 minutes in group B patients, followed by removal of the occlusive dressing. The area was then wiped dry with gauze and observed for signs of any local reaction like blanching, rashes, pruritis etc. After disinfecting with spirit, I.V. cannulation was performed with 18G cannula. Heart rate and blood pressure were recorded in all groups before and during cannulation. Pain score was noted by an independent observer using the 4-point scale (BJA 1994)<sup>1</sup> as shown below :

- 0 – no pain
- 1 – mild facial grimace
- 2 – verbal response
- 3 – withdrawal of hand

#### **Statistical Analysis :**

A sample size of roughly 20 for each group was obtained using the numerical testing method (NNT). All data were reported as mean values  $\pm$  2SD. Statistical analysis of the demographic data was done using the chi square test. Comparison of the groups for pain score and haemodynamic parameters was done using

paired 't' test. A 'p' value < 0.05 was considered statistically significant.

#### **Results :**

The demographic data were comparable regarding age, weight and gender as shown in table 1.

The mean pain score was found to be 2.5 in the control group C as compared to significantly lower values in the study group A with 1.35 and an even lower value of 0.15 in the study group B; as shown in table 2.

The haemodynamic parameters were compared before and during cannulation. It was observed that even though there was no significant change in heart rate, overall the patients in the control group had a higher increase in heart rate during cannulation compared to the study groups; as shown in graph 1.

There was a significant rise in mean systolic and diastolic blood pressure during cannulation in the group C as shown in graph 2 and 3.

Only one patient in the study group B had blanching as a side effect. No serious adverse reactions were seen in any of the patients.

#### **Discussion :**

Venepuncture is commonly observed as one of the most painful and frequently performed invasive procedures<sup>13</sup>. EMLA (eutectic mixture of local anaesthetic) cream is a 5% mixture of two local anaesthetic; lignocaine and prilocaine. This combination has unique physical properties of high concentration gradient, small micro droplet size, satisfactory release rate and decreased chances of toxicity due to a low overall concentration; this makes EMLA cream an ideal agent for dermal analgesia. Though various studies have proved the efficacy of EMLA cream for venous cannulation<sup>1,14</sup>, the effective timing of application assessed in some studies varied from minimum 5 minutes<sup>12</sup> to 60 minutes<sup>11</sup>. Only very few studies have assessed the attenuation of haemodynamic stress response associated with venous cannulation<sup>15</sup>. In our study we evaluated the efficacy of EMLA cream in producing pain free venous cannulation and

thus abolish the rise in haemodynamic parameters associated with the pain and anxiety of venepuncture. We also made an attempt to assess the most effective timing of application of the cream prior to cannulation.

Out of the 40 patients in our study groups, 32 had lower pain score values of 0 and 1 based on the 4-point rank score considered to assess pain. This was the same pain score, which Molodecka J and Stenhouse C<sup>1</sup> used to compare efficacy of topical amethocaine and EMLA cream in alleviating pain of venous cannulation. They found good analgesia in both the groups. 80% of our subjects with EMLA cream prior to cannulation had reduced pain scores compared to only 10% of our patients in the control group. These values are comparable to the results obtained by Wig J, Johl K S<sup>14</sup> whose study revealed low pain scores in 84% of their patients with EMLA cream before cannulation as compared to 16% of the placebo group.

Another finding we obtained was that though both our study groups had low mean pain score when compared to the control group, the patients with EMLA cream application for 60 minutes had the least pain score of 0.15 when

compared to the group with EMLA application time of 30 minutes in whom the pain score was 1.35. These values showed that EMLA cream application is probably effective after half hour but for maximum analgesic effect, it has to be applied an hour before. Hallen B, Olsson G C, et al<sup>11</sup> claimed that in their study the effect of the cream became evident at about 60 minutes; whereas Ehrenstrom, Reiz G, Reiz S et al<sup>10</sup> revealed a minimum effective application time of 45 minutes. This is totally different from the 5-minute application time claimed by M R Nott & J L Peacock<sup>12</sup>. A study conducted in children by Hopkins C S & Buckley C J<sup>16</sup> did not reveal any variation in analgesia for application times between 30 minutes and 90 minutes.

The rise in heart rate and blood pressure seen in our control group of patients when compared to our study group clearly indicates that EMLA cream is effective in decreasing the stress response to cannulation. The same finding was appreciated by Lindh et al<sup>15</sup> in his study that EMLA cream application decreased the stress response to venepuncture in newborn infants. Norbert Griessinger<sup>3</sup> suggested the use of EMLA cream for venepuncture in patients with sympathetic dystrophy as it avoids any haemodynamic alterations.

**Table - 1 : Demographic data.**

Parameter	Groups			P-Value
	A	B	C	
Age	40.5 ± 13.71	34.15 ± 10.22	36.50 ± 12.62	0.214*
Weight	55.30 ± 14.38	51.25 ± 7.53	56.41 ± 10.52	0.315*
Gender (M/F)	50/50	45/55	55/45	0.819*

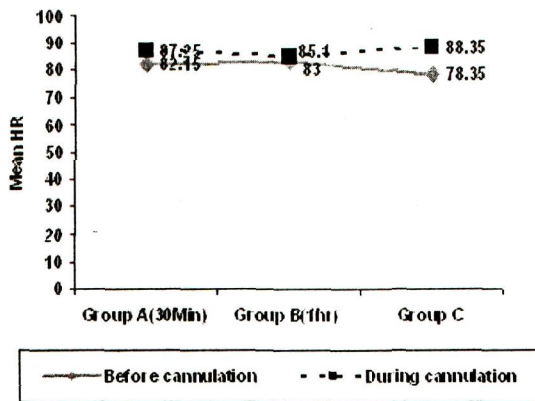
\*p = not significant between groups

**Table - 2 : Mean Pain Score**

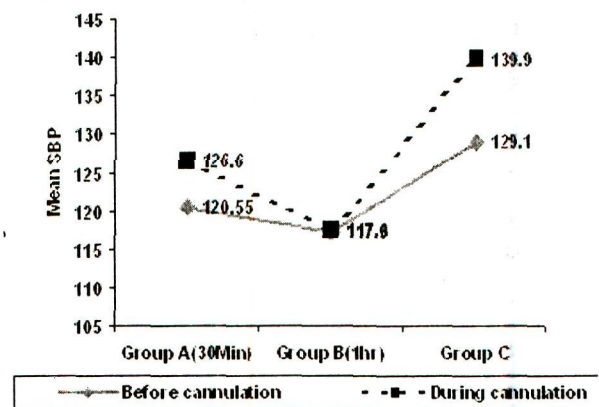
Groups	Mean Pain Score	P-Value
	0 - No pain ; 1- Mild facial grimace ; 2 - Verbal response ; 3 - Withdrawal of hand	
A	1.35 ± 0.58	0.001*
B	0.15 ± 0.63	
C	2.5 ± 0.6	

\*p = highly significant

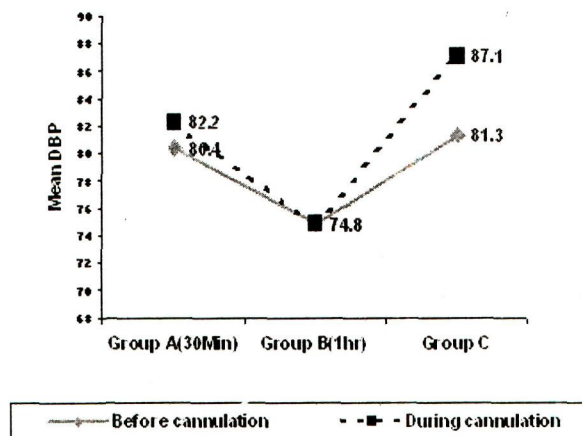
GRAPH-1 HEART RATE



GRAPH-2 SYSTOLIC BLOOD PRESSURE



GRAPH-3 DIASTOLIC BLOOD PRESSURE



### Conclusion :

Based on our results we conclude that EMLA cream has been found to be efficacious as a topical analgesic prior to venous cannulation. The effective time of application was found to be 60 minutes prior to venepuncture. EMLA cream also prevented the rise in heart rate and blood pressure associated with venous cannulation.

The main advantage of this cream is its single dosage and easy application without distorting anatomical landmarks and without serious adverse effects. The main disadvantage lies in its effective time of application of 60 minutes, which prevents its use in emergency venepuncture. The other drawback is its cost but this can be overlooked at times considering the efficacy of EMLA cream in producing dermal analgesia especially in children, anxious adults and in patients exposed to repeated venepuncture.

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