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**Original Research Article**

# Efficacy of EMLA cream in attenuating pain and haemodynamic response to venous cannulation

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**Abstract:**

**Background & Method:** The aim of this study is to observe the effect of EMLA cream on producing dermal analgesia and attenuating hemodynamic response to venous cannulation. The patients were selected randomly, from those who were posted for surgery next day. Patients were selected for study using chit/slip pick up randomization. Each day only 3 patients were selected for the study. Three chits were made one for control/placebo, one for 60 minutes, one for 90 minutes. All chits were folded and kept in blank opaque envelope. Selected three patients were asked to pick up one slip each and EMLA cream or plain patch were applied for selected duration. Cannulation was done after observing patch site and cleansing and sterilising.

**Result:** Group A and B patients had good analgesia whereas group C patients experienced more pain. Pain on VAS was significantly higher in group C and accordingly pain relief was best seen in group A and B at the time of cannulation. It can be observed that intravenous cannulation pain was much less in group A and B. 39.1% patients of group A and 79.3% in group B experienced very less pain. Group C patients experienced mild to severe pain. 13% patients from group C had severe pain on intravenous cannulation whereas remaining 87% had mild to moderate pain. Less pain on cannulation observed in group A and group B patients in whom EMLA cream was applied is statistically significant and hemodynamic response was less in Group A and B.

**Conclusion:** This study was carried out in 69 patients, which were divided in three groups. EMLA cream was applied in two groups, group B (23) patients for 90 minutes before cannulation and group A (23) patients 60 minutes before cannulations whereas group A (23) patients only patch was applied.

Patients were assessed one day prior to surgery pre-anaesthetic check up and ASA grading was done. VAS scale was explained to the patient and best sites were selected for intravenous cannulation. On the day of surgery after applying cream, patients were closely monitored by various parameters like any change in like SBP, DBP and pulse on intravenous cannulation and after cannulation at pre-decided intervals of 5 min, 10 minutes and as pre-scheduled.

**Keywords:** EMLA, dermal, analgesia, hemodynamic & cannulation.

**Study Designed:** Observational Study.

## 1. INTRODUCTION

Surgery is a necessity but is painful, with advances in anesthesiology this pain can be alleviated. It is anesthesiologist's and operation theatre staff's duty to block or reduce this pain so that the patient has better and amicable experience with less anxiety and discomfort.
Peripheral venous cannulation is a routine procedure preceding induction of anaesthesia, which is painful and may result in increase in heart rate and blood pressure and may cause vaso-vagal reactions. Since most adults require venous cannulations before surgeries to reduce the intravenous cannulation pain, it is logical to use topical local anaesthetic to reduce pain and adverse effects of cannulation pain. EMLA emulsion cream is a eutectic mixture of equal (by weight) of lidocaine and prilocaine. It is a 5% emulsion preparation containing 2.5% each of lidocaine/ prilocaine and comes with name EMLA (Eutectic mixture of local anaesthetic). When applied topically it provides effective dermal analgesia for venepuncture and its use in paediatric patient is now almost routine. Increase in heart rate and blood pressure leads to increase in incidence of myocardial oxygen consumption and may increase myocardial ischemia in patients at risk, especially those with hypertension and coronary artery disease. We will try to observe the efficacy of topical EMLA (Eutectic mixture of local anaesthetic) in attenuating pain associated with peripheral venous cannulation in adults, and other benefits and side effects. EMLA cream has also been used for additional clinical applications which includes donor site analgesia for split skin grafting, removal of molluscum contagiosum, tattoos and warts.
Fear of pain and anxiety associated with venous cannulation may contribute to overall stress experienced by patients in the perioperative setting. In addition, the reported incidence of intravenous device related thrombophlebitis in a large series of over 10,000 surgical patients has been reported to be 10.3%, with a lower incidence of bacteremia for peripheral, compared to central venous devices.1 Thrombophlebitis may cause to postoperative patient discomfort, and clinically recognized by the presence of erythema, induration, and edema.2 A number of strategies to minimize the pain of venous cannulation for surgical patients are available, including local skin infiltration, topical application of eutectic mixture of local anaesthetics (EMLA) or nonsteroidal anti-inflammatory drugs (NSAIDs), ethyl chloride spray, inhalation of nitrous oxide, ibuprofen and others.3,4 Each technique has advantages as well as limitations, but none has been shown to be effective in completely blocking venous cannulation pain and reducing peripheral venous thrombophlebitis (PVT). Recently, a transdermal diclofenac patch (TDP) has been reported to be effective in attenuating venous cannulation pain.
As venous cannulation is often a painful procedure with the potential to cause significant anxiety, distress discomfort. Pain relief prior to venous cannulation using topical analgesics is a growing practice as healthcare providers strive for a pain free and pleasant hospital stay for patients. Topical application of drugs and transdermal approach has always been popular as it is painless, easy to perform and does not require any special equipment. Compared to oral administration of drugs, dermally absorbed medicines do not undergo first pass effect7. Enterally administered drugs after absorption go through hepatic circulation there by reducing the effect. Transdermal drug delivery results in slow and steady absorption which in case of local irritation or side-effects can be easily washed off with soap and water. For topical effect small calculated amount of drugs can be applied reducing systemic absorption and toxicity.

Different skin layers give protection to body from outside chemicals and infection. Skin has epidermis dermis and hypodermis. Stratum corneum a part of epidermis which is 10-20 μm thick, gives waterproof protection and is most serious barrier for transdermal passage of hydrophilic drugs. Stratum corneum is composed of 79-90% protein and 5-15% of lipids. Stratum corneum also prevents larger than 500 Da (Dalton) molecular size particles.7 Stratum corneum also regulates water loss from body surface and hence helps in regulating body temperature.7 Commercially available transdermal drug delivery system use lipophilic compounds of molecular weights less than 500 Da (Dalton).7 Solubility and passage of drugs is also dependent on partition coefficient which indicates solubility of lipophilic drugs. Oil water compatibility of cell membrane which is made of phospholipid double layer (lipid bilayer). The cell membrane passes the lipophilic rather than hydrophilic drugs because of lipophilicity of cell. Over past few years different method have been used to increase the permeability of the barrier. such methods include the use of chemical penetration enhances ionophoresis, sonophoresis and others. Recently micron sized needles (microneedles mn) have been developed which penetrate the upper layer of skin without reaching the nerves thereby delivering the drugs transdermally in a painless manner.

## 2. MATERIAL & METHOD

The present study was carried out in Department of Anaesthesia R.D. Gardi Medical College and CRGH hospital Ujjain after approval of hospital ethics committee on 69 patients admitted in surgical, gynaecological and orthopaedics ward undergoing surgery. Duration of this study was from December 2020 to December 2021. It's an observational study conducted in 69 patients.

**Inclusion criteria:**
1) Patients belonging to ASA 1-2
2) Age – 20 to 70 years of age
3) Both genders
4) All patients scheduled for any kind of surgery, whether procedure is done under local anaesthesia.

**Exclusion criteria:**
1) Previous use of EMLA for iv cannulation
2) Patient refusal to participate in study.
3) Use of sedatives or analgesic drug 12 hour before venous cannulation
4) Participation in clinical trial in previous 2 weeks
5) Active dermatitis or open wound at cream application site
6) Not fulfilling inclusion criteria
7) Past history of hypertension, arrhythmias, chronic pain and local skin infections
8) Those on anti-arrhythmic agents such as calcium channel blockers and beta blockers
9) Allergy or sensitivity to amide local anaesthetic
10) More than two attempts at cannulation
11) Patients unable to understand Visual Analogue Scale.

**Methods**
To conduct this study, we selected the patients, from those who were posted for surgery next day. Patients were selected for study using chit/slip pick up randomization. Each day only 3

patients were selected for the study. Three chits were made one for control/placebo, one for 60 minutes, one for 90 minutes. All chits were folded and kept in blank opaque envelope and patients were asked to pick one envelope. EMLA cream or plain patch were applied for selected duration. Cannulation was done after observing patch site for any local reaction and cleaning the site with spirit swab for sterilization. Only 20 gauge cannula was used in all the patients. This study was conducted by randomly selecting patients, posted for surgery next day. Total 69 patients were selected and divided randomly in three groups, 23 patients in each. Group C (control group) was applied plain patch, Group B was applied 7cm wide and 7 cm long plastic patch. EMLA cream was spread over approx. 4*4 $cm^2$ (16 sq.cm.)(approx. 1.5-2 mg of EMLA cream) for 90 minutes, and in Group A for 60 minutes. A day before surgery, during pre-operative evaluation the patients were taught how to express pain on VAS and best proposed sites for venous cannulation were marked. Prior to EMLA cream application and intravenous cannulation standard monitors were connected systolic blood pressure, DBP, RR, PR, $SpO_2$ were recorded. Patients understanding of visual analogue scale was reconfirmed by pinching and patient's feedback.

On the day of surgery EMLA cream was applied and after appropriate interval intravenous cannulation was done using 20 gauge cannula (pink) at selected site after wiping cream and the patients expressions and intensity of pain was recorded on VAS. Patient was also asked to give feedback on pain experienced. After cannulation intravenous Ringer lactate 500 ml bottle was started at very low drop rate of 2-5 drops per minute.

## Observations

Following charts show age wise and ASA grade wise distribution of the selected patients, Table no 2 shows no. of attendents taken for cannula table 4 show incidence of pain.

**Table No.1: Age-wise distribution of patients in all three groups**

| | | Group | | | | | | Chi-square | p |
|---|---|---|---|---|---|---|---|---|---|
| | | Group A (60 min) | | Group B (90 min) | | Group C (Control) | | | |
| | | N | % | N | % | N | % | | |
| Age Groups | <= 30 Years | 7 | 30.40% | 5 | 21.70% | 6 | 26.10% | 6.787 | 0.341 |
| | 31-40 Years | 5 | 21.70% | 9 | 39.10% | 7 | 30.40% | | |
| | 41-50 Years | 9 | 39.10% | 3 | 13.00% | 7 | 30.40% | | |
| | > 50 Years | 2 | 8.70% | 6 | 26.10% | 3 | 13.00% | | |

Bar diagram showing age-wise distribution in groups.

**Table no. 2: shows distribution according to ASA grading in three groups**

| | | Group | | | | | | Chi-square | p |
|---|---|---|---|---|---|---|---|---|---|
| | | Group A (60 min) | | Group B (90 min) | | Group C (control) | | | |
| | | N | % | N | % | N | % | | |
| ASA grade | 1 | 8 | 34.8% | 4 | 17.4% | 9 | 39.1% | 2.875 | 0.238 |
| | 2 | 15 | 65.2% | 19 | 82.6% | 14 | 60.9% | | |

**Patient distribution according to ASA grading and distribution is comparable.**

**Table No.3: Number of intravenous cannulation attempts in various groups**

| | Group | | | | | | Chi-square | p |
|---|---|---|---|---|---|---|---|---|
| | Group A (60 min) | | Group B (90 min) | | Group C (Control) | | | |
| | N | % | N | % | N | % | | |
| Cannula in 1st attempt | 17 | 73.90% | 19 | 82.60% | 13 | 56.50% | 3.943 | 0.139 |
| Cannula in 2nd attempt | 6 | 26.10% | 4 | 17.40% | 10 | 43.50% | 2.875 | 0.238 |
| Cannula in 3rd attempt | 0 | 13.00% | 0 | 0.00% | 0 | 0.00% | 6.273 | 0.043 |

Group A majority of patients (73.9%) were cannulated in first attempt while 26.1% in second attempt. In Group B, majority (82.6%) cannulated in first attempt whereas 17.4% were cannulated in second attempt. In control group majority (56.5%) were cannulated in first attempt whereas 43.5% patients required second attempt.

## 3. RESULTS

Patients response to intravenous cannulation was observed and pain recorded on VAS.

**Table No. 4: Pain on visual analogue scale in study groups**

| | | Group | | | | | | Chi-square | p |
|---|---|---|---|---|---|---|---|---|---|
| | | Group A (60 min) | | Group B (90 min) | | Group C (Control) | | | |
| | | N | % | N | % | N | % | | |
| Visual Analogue Scale | No pain | 9 | 39.1% | 17 | 73.9% | 0 | 0.0% | 32.176 | 0.000 |
| | Mild pain | 8 | 34.8% | 6 | 26.1% | 9 | 39.1% | | |
| | Moderate pain | 5 | 21.7% | 0 | 0.0% | 11 | 47.8% | | |
| | Severe pain | 1 | 4.3% | 0 | 0.0% | 3 | 13.0% | | |

Accompanying bar diagram shows pain assessment of patients observed on visual analogue scale during and after intravenous cannulation. Highly significant analgesia was observed in groups A and B whereas group C patients experienced more pain. Pain on VAS was significantly higher in group C and accordingly pain relief was best seen in group A and B at the time of cannulation. It can be observed that in intravenous cannulation pain was much less in group A and B. 39.1% patients of group A and 79.3% in group B experienced very less pain. Group C patients experienced mild to severe pain. 13% patients from group C had severe pain on intravenous cannulation whereas remaining 87% had mild to moderate pain. Less pain on cannulation observed in group A and group B patients in whom EMLA cream was applied is statistically significant.

## 4. DISCUSSION

The patients were observed for hemodynamic changes of intravenous cannulation, incidence of pain and local reaction if any. Incidence of pain in our study was recorded using VAS and description of pain by patients. Patients experienced was noted and periodic record was kept till 30 minutes. EMLA cream applied for 60 minutes and 90 minutes before cannulation was sufficient to produce dermal analgesia and lowering of pain.

Any local reaction after EMLA cream application was recorded. Earlier studies have observed that EMLA Cream or patch application causes itching, blanching, erythema, redness, induration and edema. Because EMLA cream causes local vasoconstriction followed by vasodilatation. Due to vasoconstriction blanching is seen initially but 1 hour after application of cream, vasodilation may cause redness and edema. In present study, blanching was seen after application for an hour in one patient only. Immediately post cannulation there was no reaction. Although total of fourteen patients presented with mild to moderate itch. Blanching post application of cream in some patients similar to our studies. Shrinivas T.R. et al observed negligible side-effects of EMLA cream which is comparable with present study. Oluwayemisi Bamidele et al8 in their study got only one patient who had burning sensation with EMLA cream and blanching was also seen, this was comparable to present study. We did not get complaints of burning sensation in any of our patients but blanching was observed in only 1 patient. Agarwal A et al (2007)9 observed local reactions (blanching, erythema, induration) at cannulation site for 24 hours and found that blanching was present in EMLA group compared to diclofenac patch ($p=0.001$ at 6 hours). This is similar to present study, although diclofenac patch was not used in present study. Matsumoto T et al10 (2018) also used EMLA cream for reducing pain during cannulation in whom local reactions were observed in 5 patients. This is comparable to present study.

## 5. CONCLUSION

We found group A and B had good analgesia and lesser hemodynamic changes compared to group C. No serious side effects were observed in any of the groups.

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