Original Article

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Study on Effectiveness of EMLA Cream in Attenuation of the Hemodynamic Response to Venepuncture

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Abstract

Context: The anxiety related to venepuncture can result in a hemodynamic stress response leading to increase in heart rate and blood pressure of the patient.
Aims: To evaluate the efficacy of eutectic mixture of local anesthetic (EMLA) cream in attenuating the hemodynamic response to venous cannulation.

Settings and Design: 200 patients undergoing elective operative procedures belonging to ASA grade I and II aged 18-60 years were selected and were divided into two groups.

Methods and Material: EMLA cream was applied for 60 minutes in 100 group I patients with an occlusive dressing and in remaining 100 group II patients, normal saline was applied before cannulation. Heart rate and blood pressure was recorded prior and during cannulation.

Statistical Analysis Used: Data analysis was done by Z-test.

Results: There was no significant difference in heart rate, systolic blood pressure, diastolic blood pressure among group-I and group-II before cannulation. There was statistically significant difference in heart rate among group-I and group-II during cannulation ($z=5.05$, $p<0.01$). There is significant difference in systolic blood pressure among group-I and group-II during cannulation ($z=5.28$, $p<0.01$). Significant difference of diastolic blood pressure among group-I and group-II patients was noticed during cannulation ($z=2.65$, $p<0.01$).

Conclusions: The hemodynamic stress response to venous cannulation was significantly low in patients with EMLA cream when compared to the control group. The effective time of application of EMLA cream in producing adequate analgesia to venous cannulation was found to be 60 minutes. No significant local side effects of EMLA cream were seen.

Keywords: Eutectic Mixture of Local Anaesthetic Cream; Hemodynamic Response; Venepuncture.

Introduction

Venous cannulation is the most commonly performed invasive procedure in hospital patients [1]. It is painful and associated with a high incidence of vasovagal reactions and pressor responses in patients [2]. The nociceptive apparatus associated with skin can often produce fear of medical procedures, causing discomfort, pain and anxiety, which sometimes lead to vasovagal attacks [3]. The needle prick can also make a patient uncooperative and the anxiety caused can result in a hemodynamic stress response leading to increase in heart rate and blood pressure of the patient [4]. Different pharmacological agents have been used to obtund this response. The major step in pharmaceutical research on topical drugs came with a discovery that a specific mixture of crystalline bases of lidocaine and prilocaine had a lower melting point than the melting point of the individual drugs. This combination is termed a eutectic mixture and such a combination of local anesthetics is a liquid at room temperature and the individual components are crystalline solids [5].

The eutectic mixture of local anesthetics (EMLA) cream consists of an oil in water emulsion of a eutectic mixture of lignocaine base 2.5% and prilocaine base 2.5% with a thickener (carbopol) added to obtain suitable consistency [6].

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With the advent of EMLA cream, effective topical anesthesia of intact skin is now claimed to be feasible without the need for subcutaneous injections or exposure to high concentrations of local anesthetics [5]. Hence a study was conducted to evaluate the efficacy of eutectic mixture of local anesthetic (EMLA) cream in attenuating hemodynamic response to venous cannulation.

Subjects and Methods

Ethical Committee approval was obtained before starting the study. A total of 200 patients undergoing elective operative procedures belonging to American society of Anesthesiologist (ASA) grade I and II were selected. The patients belonged to either sex and were of the age group between 18 and 60 years. The purpose and procedure of the study was explained to all the patients and informed and written consent was taken.

A routine pre-operative evaluation was done for all patients and the following patients were excluded:

- Patients with known hypersensitivity to EMLA cream or any other local anesthetics.
- Patients with methemoglobinemia or on drugs that may cause methemoglobinemia.
- Patients with mental illness.
- Patients with open wounds on dorsum of hand.

Investigations included routine haemogram, urine analysis, blood sugar and other specific tests like ECG, chest X-ray, blood urea, serum creatinine etc. as required for respective patients and surgeries.

Procedures

The patients were selected randomly and were divided into two groups.

Group-I: Patients applied with EMLA cream before intravenous cannulation.

Group-II: Patients applied with placebo (normal saline) before intravenous cannulation.

After explaining the procedure, a suitable vein on the dorsum of the hand was selected. In group-I patients, EMLA cream 1.5 to 2 gm/ 10 cm^2 area was applied over the site of cannulation in a thick layer. This layer was then covered with an occlusive dressing. EMLA cream was applied for a minimum period of 1 hour. The occlusive dressing was removed just before the intravenous cannulation. The area was then wiped dry with gauze. Heart rate and blood pressure was recorded prior to cannulation. After disinfecting with spirit, intravenous cannulation was performed with 18 gauge IV cannula. Heart rate and blood pressure was recorded during cannulation.

In group-II, normal saline was applied over the site of cannulation and was covered with an occlusive dressing for a minimum period of 1 hour. The occlusive dressing was removed just before the intravenous cannulation. Heart rate and blood pressure were recorded prior to cannulation. After disinfecting with spirit, intravenous cannulation was performed with 18 gauge IV cannula. Heart rate and blood pressure were recorded during cannulation.

Results

The two groups were compared with respect to age, sex, heart rate, systolic and diastolic blood pressure. Data analysis was done by Z-test.

Age difference among male and female was statistically insignificant in group-I ($z=1.22$, $p>0.05$) (Table 1) and group-II ($z=1.93$, $p>0.05$) (Table 2).

There was no significant difference in heart rate among group-I and group-II before cannulation ($z=1.49$, $p>0.05$) (Table 3). There was statistically significant difference in heart rate among group-I and group-II during cannulation ($z=5.05$, $p<0.01$) (Table 3). The mean heart rate before and during cannulation in group-I showed no significant change whereas significant change was noted in group-II.

There was no significant difference in systolic blood pressure among group-I and group-II before cannulation ($z=0.89$, $p>0.05$) (Table 4). There is

Table 1: Age and sex wise distribution of cases in group-I

Age	Sex		Total
	Male	Female	
18 – 27	15	19	34
28 – 37	13	14	27
38 – 47	13	06	19
48 – 57	10	08	18
58 – 67	01	01	02
Total	52	48	100.00
Mean	36.54	33.75	35.20
SD	10.43	12.25	11.84

Table 2: Age and sex wise distribution of cases in group-II

Age	Sex		Total
	Male	Female	
18 – 27	13	13	26
28 – 37	17	17	34
38 – 47	17	09	26
48 – 57	07	03	10
58 – 67	04	00	04
Total	58	42	100
Mean	37.37	33.28	35.30
SD	11.23	9.84	10.68

Table 3: Comparison of heart rate variation before and during cannulation in group-i and group-II

	Group	No. of cases	Mean±SD	Test value 'z'	'p'	Remarks
Before cannulation	Group-I	100	79.36±7.88	1.49	>0.05	Insignificant
	Group-II	100	77.76±7.25			
During cannulation	Group-I	100	79.86±8.11	5.05	<0.01	Highly significant
	Group-II	100	85.46±7.62			

Table 4: Comparison of systolic blood pressure before and during cannulation in group-i and group-II

	Group	No. of cases	Mean±SD	Test value 'z'	'p'	Remarks
Before cannulation	Group-I	100	117.78±7.63	0.89	>0.05	Insignificant
	Group-II	100	118.66±6.15			
During cannulation	Group-I	100	117.92±7.60	5.28	<0.01	Highly significant
	Group-II	100	123.20±6.58			

Table 5: Comparison of diastolic blood pressure before and during cannulation in group-I and group-II

	Group	No. of cases	Mean±SD	Test value 'z'	'p'	Remarks
Before cannulation	Group-I	100	76.40±6.70	0.098	>0.05	Insignificant
	Group-II	100	76.32±5.32			
During cannulation	Group-I	100	76.42±6.10	2.65	<0.01	Highly significant
	Group-II	100	78.57±5.42			

significant difference in systolic blood pressure among group-I and group-II during cannulation ($z=5.28$, $p<0.01$) (Table 4).

Significant difference of diastolic blood pressure among group-I and group-II patients was noticed during cannulation ($z=2.65$, $p<0.01$) (Table 5).

Discussion

EMLA (Eutectic Mixture of Local Anesthetic) cream is a 5% mixture of two local anesthetics, lignocaine and prilocaine. Using a eutectic mixture, Frederick Broberg discovered that equal parts of lignocaine and prilocaine produced adequate analgesia after topical application to the skin [7].

A total of 200 patients of either sex belonging to the age group 18-60 years posted for elective surgeries were selected. They were divided into two groups i.e., group-I and group-II with 100 patients in each group. The efficacy of eutectic mixture of local anaesthetic cream in attenuating the hemodynamic response to venous cannulation was evaluated. Before intravenous cannulation, EMLA cream was applied in group-I patients and placebo (normal saline) was applied in group-II patients. Both the groups were compared regarding age and sex and there was no statistical difference with respect to these variables. The venous cannulation causes increase in heart rate and blood pressure due to anxiety and pain. The hemodynamic response to venous cannulation such as the heart rate, systolic and diastolic blood pressure was recorded before and during cannulation. We observed that the mean heart rate in group-I patients before and during cannulation showed no significant change whereas in group-II patients, the mean heart rate before and during the cannulation showed significant change. The difference in heart rate among group-I and II patients during cannulation ($z=5.05$, $p<0.01$) was statistically significant.

The systolic blood pressure and diastolic blood pressure did not show any significant change in group-I patients before and during cannulation, whereas in group-II patients, there was significant change in systolic blood pressure and diastolic blood pressure.

There was statistically significant difference in systolic blood pressure ($z=5.28$, $p<0.01$) and diastolic blood pressure ($z=2.65$, $p<0.01$) among group-I and group-II patients during cannulation. The above observations in our study reveal that the EMLA cream is efficient in attenuating the haemodynamic response to venous cannulation. Similar finding was appreciated by Lindh V et al [8] (2000) in newborn infants on application of EMLA cream during venepuncture. Tak JH, Van Bon WHJ [9] (2006) compared the effect of EMLA cream and a placebo cream on reported pain and observed distress associated with venepuncture. They concluded that EMLA cream reduces pain and distress from venepuncture. Study by Norbert Griessinger [10] (1995) showed that the application of EMLA cream can be a very useful measure to facilitate venepuncture in patients with reflex sympathetic dystrophy as it avoids any haemodynamic alterations. In this study, we applied the EMLA cream for a minimum period of 60 minutes as per the recommendations made in various studies. Significantly lower pain scores for EMLA cream at 60 minutes was also demonstrated in a study by Smith AJ and Stacey MR [11] (1996).

Another study by Vaghadia H, Al-Ahlan OA, Nevein K [12] (1997) showed that EMLA patch when applied to the skin for 60-90 minutes before venous cannulation reduced the pain of venepuncture and also reduced vasovagal side effects. Hallen B, Olsson G et al [6] (1984) conducted a study to assess the effect of application of EMLA cream and their study also revealed that the effect of cream became evident at about 60 minutes for venepuncture. A study by Noor M Gajraj and John H Penant [5] (1994) on various uses of EMLA cream in adults and children concluded that EMLA cream is a safe, effective, topical anesthetic for use in a variety of clinical settings. It is particularly helpful in venepuncture and intravenous cannulation. In our study, only 2% of patients had blanching at the site of EMLA cream application. There were no other side effects.

Conclusion

In our study, we have proved that the application of EMLA cream for venous cannulation prevented a significant rise in blood pressure and heart rate. The effective time of application was found to be 60 minutes. EMLA cream has been found to be efficacious as a topical analgesic prior to venepuncture. The main advantage being in its single dosage and easy application. The minor disadvantages include cost of EMLA cream and requirement of a rather long application time up to one hour. The cost factor could be overlooked considering the efficacy of EMLA cream in producing dermal analgesia especially in children and anxious adults.

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