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Comparative Efficacy of EMLA Cream and Ethyl Chloride Spray for Reducing the Venipuncture Pain During Intravenous Cannulation

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Abstract

Background and Objectives: Intravenous Cannulation is a pain full procedure. Pain associated with intravenous cannulation can be decreased by using local anaesthetics. This study was conducted to evaluate the efficacy of EMLA cream against the reduction of the venipuncture pain during IV cannulationin comparison with Ethyl chloride spray.

Methods: This single center, prospective randomized study with two parallel groups was conducted at Department of Anaesthesiology, Critical Care and Pain Management, S.S Institute of Medical Sciences, Davanagere. A total of 100 subjects admitted due to various illnesses were enrolled into the study. Study subjects were randomly divided into two groups viz. G1 and G2 with 50 subjects in each group. Subjects in G1 were anesthetized with topical application of EMLA cream, and in G2 with Ethyl Chloride spray.

Results: The results of VAS score depicted that following application of EMLA cream causes mild venepuncture pain during intravenous cannulation, whereas Ethyl chloride spray causes moderate venepuncture pain during intravenous cannulation. Furthermore, our study findings delineated that EMLA cream was safe to use without any side effects when compared to Ethyl chloride spray wherein burning sensation, itching and redness like side effects were experienced by study subjects.

Conclusion: EMLA cream is safe and effective in reduction of venipuncture pain during IV cannulation.

Keywords: EMLA cream; Ethyl chloride spray; Pain; IV cannulation; VAS; Efficacy; Safe.

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Introduction

Approximately one-half of patients undergoing intravenous (IV) cannulation report moderate pain and anxiety before the procedure.1 Furthermore, venipuncture is a routine nursing procedure which is often performed in children and has the potential to produce pain, anxiety, fear, and distress, if preventive measures are not taken.[2-4] Literature reports revealed that that local anesthesia is applied to the venipuncture sites on a regular basis in children, but this is handled rather inconsistently in adults.[5-9] In a survey among anaesthetists' in the UK, the doctors reported that they administered a local anesthetic for venipuncture in cases where the cannulasize exceeded 18 G. However, fewer than half of surgeons or specialists in internal medicine

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followed this practice.[8] According to a survey of 71 hospital doctors, 35% occasionally administered a local anesthetic—mostly lidocaine—before venous cannulation.[9] Doctors'reasons for not doing so included the amount of time it takes (45%), a lacking need/indication (35%), and the worry that venous cannulation might be more difficult as a result of this practice (21%).

In eutectic mixture of lidocaine & prilocaine (EMLA) cream, 2.5% lidocaine & 2.5% prilocaine are mixed in equalproportion at 25 oc. This leads to lowering of melting pointof both solids.[10] After removal, its effect lasts for 30-60minutes. After 60 minutes of cutaneous application underocclusion, the local effect of EMLA is sufficient for needleinsertion and minor superficial skin surgery. Pain threshold depth is about 3 mm after 60 minutes of application, about 4mm after 90 minutes of application, and about 5 mm after 120 minutes of application.[11]

Ethyl chloride spray is a refrigerant spray. It causes atransient hypoesthesia of the skin. It works by freezing and numbing the skin. The ethyl chloride spray cools the skin by rapid evaporation of the volatile liquid itself. The cooling effect decreases nerve conduction velocity of A-delta and C-fibres which decreases transmission of pain.[12] The duration of decreased sensation lasts between 30 and 60 seconds; hence, procedure should be done immediately after evaporation of the liquid from the skin surface. Furthermore, it can cause significant "frost" of the skin as a permanent skin changes , if sprayed for longer than10seconds.[13]

With this scenario, the present study was designed to evaluate the comparative efficacy of topical application of ethyl chloride spray and EMLA cream against the reduction of the venipuncture pain during IV cannulation.

Materials and Methods

Study design

It is single center, prospective randomized study with two parallel groups conducted at Department of Anaesthesiology, Critical Care and Pain Management, S.S Institute of Medical Sciences, Davanagere. The study is approved by institutional ethical committee.

Study subjects

A total of 100 subjects admitted at S. S. Institute of Medical Sciences & Research Centre, due to various illnesses were enrolled into the study. A written informed consent was obtained from the all the study subjects. Study subjects were randomly divided into two groups, viz. G1 and G2 with 50 subjects in each group by chit pull out technique. Subjects in G1 were anesthetized with topical application of EMLA cream and in G2 with Ethyl Chloride spray.

Inclusion Criteria

- Patients willing to give informed consent form
- Patients aged between 18 and above
- Exclusion criteria
- Patients with history of hypersensitivity to either ethyl chloride spray or EMLA cream and/or other local anesthesia
- Patients with damaged, denuded, or broken skin at the designated site.

All the patients were informed about the procedure and their written consent were recorded. Complete history, clinical examination and routine investigations were also done to all the patients.

Methodology

To subjects in Group G1EMLA cream was applied at the dose level of 1 gm/10 cm^2 skin surface area under occlusive dressing. After 60 minutes, we removed the cream and cleaned the area. IV cannulation was done 60 minutes after the application of EMLA cream.

Ethyl chloride spray was applied to subjects in Group G2 in a well-ventilatedroom. Area of Injections which was scalped, was prepared with alcohol swab. Ethyl chloride spray was then sprayed at a distance of 3-5 inches away from the skin. To spray Ethyl Chloride, we held the bottle upright over the treatment area and valve was pressed completely allowing spray from the bottle. Duration of application of spray was 4-6 seconds or until overlying skin turned white. Then we inserted 18 Gauge IV cannula immediately after evaporation of liquid from skin within 30-60 seconds.

Any local skin changes such as erythema, pallor or oedema were noted.

Assessment Parameters

ASA grade (ASA Physical Status Classification System) of subjects in both G1 and G2 groups were recorded. Pain intensity was assessed immediately after IV cannulation on a 10 cm horizontal Visual Analogue scale (VAS).[14] We used a chart card with a 10-cmhorizontal line with word anchors at each

end, ranging from 0 = ''no pain'' to 10 = ''worst pain.'' If the patients had difficulty communicating with us directly, we used the same chart card with pain scaled facial pictures to evaluate the pain severity (Figure 1). Pain score was recorded in proforma.

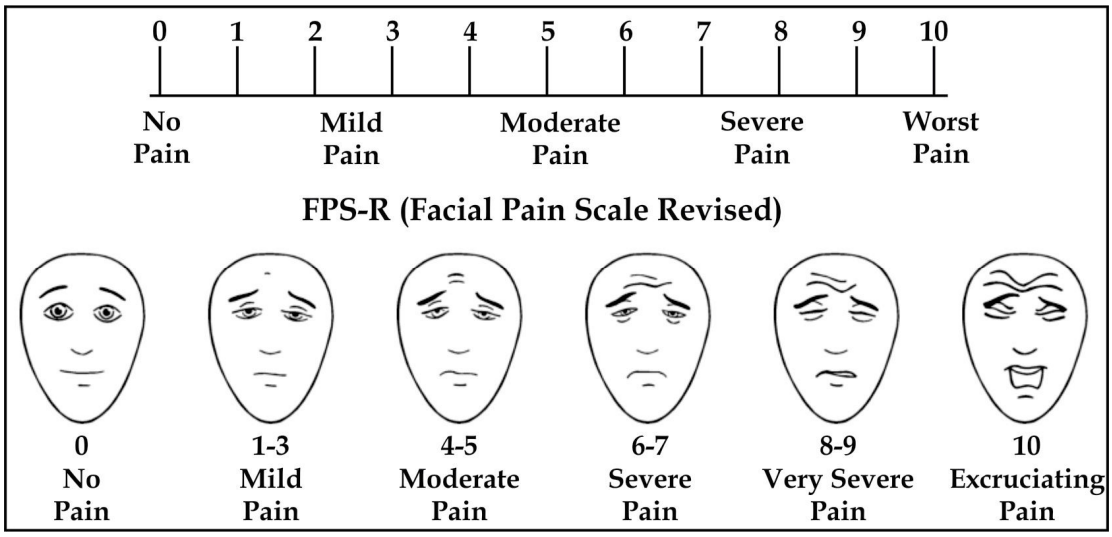

Fig. 1: Visual analog scale (VAS) score chart card.[14]

Side effects

The side effects evaluation parameters viz. burning sensation, Itching, Swelling, and Redness was assessed by visual observation and scored as 1 for Yes and 0 for No. The side effects scoring was recording in the proforma.

Statistical analysis

Categorical data were presented as frequency distributions, and numeric data were represented as mean and standard error of mean. Statistical comparison between treatment groups was done by using students t-test. P<0.05 was considered statistically significant. Statistical analysis was performed with the SPSS (Statistical Package for Social Sciences) version 16. [IBM SPASS statistics (IBM corp. Armonk, NY, USA released 2011)].

Results

Table 1: Age wise distribution of study subjects.

	G1-EMLA Cream		G2-Ethyl Chloride Spray	
Age (Years)	**Frequency**	**Percent**	**Frequency**	**Percent**
10 - 20	6	12.00	6	12.00
21 - 30	21	42.00	13	26.00
31 - 40	9	18.00	15	30.00
41 - 50	10	20.00	9	18.00
51 - 60	4	8.00	7	14.00
Total	50	100.00	50	100.00

In Group I (EMLA treatment group), majority of the study subjects i.e. 42 % belonged to age group between 21-30 yrs followed by 20% belonged between 41-50 yrs, 18% belonged 31-40 yrs, 12% belonged to 10-20 yrs, and only 8% of study subjects belonged to age group of 51-60 yrs. In Group II (Ethyl chloride spray treatment group) majority of the study subjects i.e. 30% belonged to age group between 31-40 yrs. followed by 26% belonged between 21-30 yrs., 18% belonged between 41-50 yrs., 14% belonged to 51-60 yrs., and another 12% of study subjects belonged to age group of 10-20 yrs age group (Table 1).

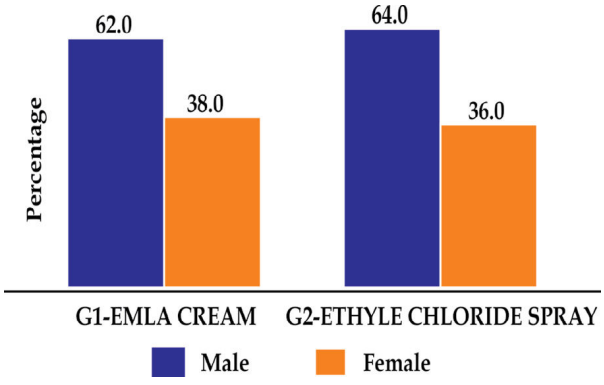

Fig. 2: Gender Wise Distribution of Study Subjects.

The majority of the study subjects i.e. 62% and 64% of study subjects in both EMLA treatment and Ethyl chloride spray treatment group were found to be males, respectively. Whereas, 38% and 36% of subjects were found to be females (Figure 2).

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Table 2: Distribution of Study Subjects Based on Body Weight.

	G1-EMLA Cream		G2-Ethyl Chloride Spray	
Weight (Kg)	**Frequency**	**Percent**	**Frequency**	**Percent**
10 - 20	0	0.00	0	0.00
21 - 30	0	0.00	0	0.00
31 - 40	0	0.00	0	0.00
41 - 50	9	18.00	9	18.00
51 - 60	17	34.00	14	28.0
61 - 70	15	30.00	20	40.0
71 - 80	9	18.00	7	14.0
Total	50	100.00	50	100.0

34% of the study subjects body weight in EMLA cream (G1) treatment group was found to be in 51-60 Kg, Where as in Ethyl chloride (G2) treatment groups majority of the study subjects i.e. 40%body weight was found to be in 61-70 Kg. (Table 2).

Table 3: Comparision of Study Parameters Between Groups By Students T-Test.

Parameters	G1-EMLA Cream	G2-Ethyl Chloride Spray	p-value
Physical Status			
ASA Grade	1.28 ± 0.06	1.30 ± 0.06	0.821
Pain Assessment			
VAS Score	2.98 ± 0.09	4.18 ± 0.09	0.000
Side Effects			
Burning Sensation	0.00 ± 0.00	0.48 ± 0.07	0.000
Itching	0.00 ± 0.00	0.12 ± 0.05	0.013
Swelling	0.00 ± 0.00	0.00 ± 0.00	-
Redness	0.00 ± 0.00	0.14 ± 0.05	0.007

There was no statistically significant difference between ASA grade between the treatment groups. While VAS score was significantly lower (p-0.000) in EMLA cream treatment (G1) group as compared to Ethyl chloride spray treatment (G2) group. The findings of VAS score depicted that following application of EMLA cream causes mild venepuncture pain during intravenous cannulation. Whereas Ethyl chloride spray causes moderate venepuncture pain during intravenous cannulation. The mean scores of side effects viz. Burning sensation, Itching and Redness of skin during intravenous cannulation were significantly higher in G2 (Ethyl chloride spray treatment) when compared to G1 (EMLA cream treatment). These finding delineated that EMLA cream was safe to use without any side effects (Table 3).

Discussion

Local anesthetic pre-treatment of the venipuncture site on the dorsum of the hand is indicated when using venous cannulas from a size of 18G, and without such preparations patients experience pain during IV cannulation.8Hence, in present comparative efficacy of topical application of ethyl chloride spray and EMLA cream against the reduction of the venipuncture pain during IV cannulation was evaluated.

Ethyl chloride is a fast acting and non-invasive agent. It is ask in refrigerant, abstracts heat when it evaporates from the skin after application which blocks sensory nerve conduction & produce anaesthesia.[15] There are several studies of ethyl chloride which yield conflicting results. On eunblinded randomised study demonstrated no significant pain relief with ethyl chloride versusno intervention in patients undergoing intravenous catheterization.[1] Conversely, three unblinded randomised studies demonstrated superioranesthetic efficacy of ethyl chloride versus no intervention in-patients undergoing venepuncture.[16-18]

In our study pain assessment score (VAS) depicted that there was only mild pain observed in study subjects during IV cannulation after application of EMLA cream; Whereas, among subjects sprayed with Ethyl chloride spray there was moderate amount of pain experience by the study subjects. Furthermore, our study findings delineated that EMLA cream was safe to use without any side effects as compared to Ethyl chloride spray wherein burning sensation, itching and redness like side effects were experience by study subjects. These findings were in accordance with the previous reports published by other research investigators.[19] EMLA cream is an oil in water emulsion of 2.5% lignocaine and 2.5% prilocaine. The pH level of eutectic mixture is 9.4.[20] Effectiveness of cream may be influenced by skin integrity, race, skin thickness, location and depth of lesion, and the localvascularity.[21] Goodacre et.al demonstrated that EMLA has comparable efficacy as conventional infiltration in split skin grafting with less discomfort.[22] Thune et. al also found that EMLA cream provided adequate anaesthesia for excisional biopsies after application for 60 to 190 minutes.[23]

Conclusion

In conclusion, results of this study demonstrated the efficacy of ethyl chloride and EMLA cream

as topical anesthesia. While comparision of effectiveness between Ethyl chloride and EMLA delineated that EMLA cream was safe and effective in reduction of venipuncture pain during IV cannulation.

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