Analgesia for venous cannulation: a comparison of EMLA (5 minutes application), lignocaine, ethyl chloride, and nothing

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SUMMARY

Three commonly available local anaesthetics were compared, in a controlled trial, for use before venous cannulation. The pain of application of the local anaesthetic, the pain of cannulation, and the rate of successful cannulations were compared. The value of EMLA cream applied for 5 min was questioned. Venous cannulation with a 20G venflon was found to be significantly more painful than the application of any of the local anaesthetics ($P<0.01$). Lignocaine 1%, injected subcutaneously, and ethyl chloride spray significantly reduced the pain of venous cannulation ($P<0.01$). The use of lignocaine did not result in significantly more failed cannulations than the control group. It was concluded that local anaesthesia should be used before venous cannulation, even for 20G cannulae.

INTRODUCTION

Patients worry about anaesthetics. One of their major worries is the injection, and injections do hurt[1–3].

The 'eutectic mixture of local anaesthetics' cream (EMLA), a mixture of prilocaine and lignocaine, is commonly used to enable pain-free injections in children[4–6]. However, it is not used routinely in adults, because the pain of venepuncture is not considered sufficient to warrant all the effort, and expense, that would be involved. Arterial lines are a different matter, and it has been shown that EMLA cream is of benefit both for the insertion of the line, and later when the cannula is *in situ*[7].

One study has showed that, in adults, EMLA cream rubbed into the skin, produced a limited amount of analgesia after only 5 min application[8]. The pain of venepuncture was less in the group that had EMLA applied for 5 min than in controls given hand cream, but greater than in those who had the EMLA cream applied for the full hour. Other studies that have looked at the effect of time on the analgesic effects of EMLA cream have either ignored application times of less than 20 min, or have found little difference between control and trial groups at times of less than half an hour[9,10]. However, the cream was not rubbed into the skin in any of these trials. If EMLA cream has some effect after only 5 min, the organization required for its use would be greatly reduced. It could be applied in the reception area of theatre and given time to work prior to venepuncture. The anaesthetist would also have more control over where the cream was applied.

Other agents used to reduce the pain of venepuncture include lignocaine injected either subcutaneously, or intradermally, and ethyl chloride spray. Both these agents hurt on application, and there is much debate as to whether their use reduces the amount of pain experienced by the patient. One study has shown that the application of ethyl chloride is less painful than lignocaine, provides better cannulation conditions, but is not as effective an analgesic[11]. Other studies have shown that lignocaine 1% injected subcutaneously is less painful than cannulation, even for 22G cannulae[12,13].

The purpose of this study was to compare these three analgesics (lignocaine, ethyl chloride spray, and EMLA cream applied for 5 min) for use before venous cannulation.

METHOD

After ethical committee approval, 160 unpremedicated women of ASA grade one or two, requiring the insertion of an intravenous cannula for the administration of a general anaesthetic, were recruited. Exclusion criteria included allergies to local anaesthetics or analgesic medication taken within the previous 4 h. After obtaining informed consent the patients were randomly allocated to one of four groups:

(a) *Control group:* No local anaesthetic prior to venous cannulation

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(b) *EMLA group:* 0.2 ml of EMLA cream was rubbed into the skin over the vein, and covered with a non-absorbent dressing for 5 min before venous cannulation
(c) *Spray group:* Ethyl chloride was sprayed over the vein for ten seconds from a height of 20 cm, and cannulation performed immediately
(d) *Lignocaine group:* 0.2 ml of 1% lignocaine was injected subcutaneously at the site of venepuncture with a 25G needle, and left for 30 s before the cannulation.

Each patient was assessed for their level of anxiety using a visual analogue scale of 100 mm. A vein was then found on the dorsum of a hand, its visibility recorded on a five point scale, where 0=very difficult, and 4=very easy, and the local anaesthetic applied. After the allotted time, a 20G Venflon intravenous cannula was inserted into the vein, and then flushed with heparinised saline.

Using other visual analogue scales of 100 mm the patients were asked to assess the amount of pain they experienced: (a) on application of the local anaesthetic; (b) at insertion of the intravenous cannula; and (c) from the cannula 1 min after its insertion.

The analgesia produced by ethyl chloride spray lasts only for a short period of time, until the tissues have rewarmed, so that by the time the patients would have assessed the amount of pain produced by the cold spray the analgesic effect would have worn off. To avoid this problem, the back of one hand was sprayed with the ethyl chloride spray in the prescribed manner, and the patient was asked to assess the amount of pain experienced. A vein on the back of the other hand was then found, the skin over it sprayed with the ethyl chloride in the same way, and the cannula inserted immediately.

Record was made of the number of cannulations that failed on the first attempt. These patients were then excluded from the assessment of pain produced by the cannula one minute after its insertion.

Statistical analysis of the data was as follows. Demographic data and anxiety were analysed using the analysis of variance, and visibility of veins using the Kruskal-Wallis test. Pain scores were compared using the Kruskal-Wallis test followed by individual comparisons adjusted for the number of groups as described by Siegel and Castellan[14], and the failure rate of cannulations compared using the Fisher's exact test. The correlation coefficient was used to compare the relationship between the total pain experienced at the three stage of the cannulation with the patients own anxiety level.

RESULTS

The groups were similar in terms of age, weight, visibility of veins, and anxiety levels (Table 1).

Table 1 **Table of demographic data, expressed as mean and (standard deviation) except for the grade of vein which is expressed as median and (interquartile range)**

	Control	*EMLA*	*Spray*	*Lignocaine*
Age	31.2	32.8	33.8	31.8
(years)	(9.0)	(8.2)	(9.7)	(7.4)
Weight	62.0	63.5	62.4	62.0
(kg)	(11.6)	(13.7)	(10.3)	(10.5)
Veins	2.0	1.0	3.0	2.0
(grade)	(1.0–3.0)	(1.0–3.0)	(1.25–3.0)	(2.0–3.0)
Anxiety	43.2	33.0	47.7	43.9
(mm)	(28.7)	(27.2)	(26.7)	(27.9)

The pain experienced at the three stages of the cannulation are recorded in Table 2. Considering first the application of local anaesthetic the lignocaine and ethyl chloride caused similar amounts of pain, whereas the application of EMLA cream was pain free (95% confidence intervals for the differences between the EMLA and spray groups being 4.0–15.0 mm, and that for EMLA and lignocaine groups 4.0–12.0 mm).

Lignocaine and ethyl chloride were very effective at removing the pain of venepuncture (95% confidence intervals for the difference between the control and spray groups being 7.0–23.0 mm and between the control and lignocaine groups 10.0–25.0 mm). The EMLA cream had a limited, but insignificant, effect (95% confidence interval for difference between control and EMLA group was −2.0–15.0 mm).

Once the cannula was *in situ*, the pain scores in all the groups were low. The control group having the most pain

Table 2 **Total pain experienced at each of the three stages of cannulation, expressed in millimetres, and recorded as the median and (interquartile range)**

	Application of local anaesthetic	*Insertion of cannula*	*Cannula 1 min after insertion*
Control (n=40)	—	23.5 (12.0–47.75) ** **	6.0 (0.25–21.75) **
EMLA (n=40)	0.0 (0.0–1.0) **	17.0 (6.0–26.0) **	2.0 [n=38] (0.0–11.75)
Spray (n=40)	9.5 (3.0–21.5) **	4.0 (0.0–21.0)	3.0 [n=37] (0.0–11.75)
Lignocaine (n=40)	10.0 (3.5–19.0)	1.0 (0.0–10.5)	0.0 [n=33] (0.0–5.0)

**P=<0.01

Table 3 **The occurrence of failed cannulations in each group, expressed as number and (percentage)**

	Control	*EMLA*	*Spray*	*Lignocaine*
Number of failures	2	3	4	7
	(5)	(7.5)	(10)	(17.5)
Number of successes	38	37	36	33

and the lignocaine group being almost pain free (95% confidence intervals between the lignocaine and control groups 1.0–7.0 mm).

It was found that the insertion of the cannulae in the control group was significantly more painful than the application of any of the local anaesthetics used in this trial ($P<0.01$ for all groups, with 95% confidence intervals for the differences being 16.0–30.0 mm, 3.0–19.0 mm, and 5.0–21.0 mm for the EMLA, spray, and lignocaine groups, respectively).

There was no correlation between the levels of anxiety of the patients and the pain they experienced either on the application of the local anaesthetic, the insertion of the cannula, or by the cannula 1 min after its insertion (correlation values of 0.186, 0.171, 0.015, respectively).

The number of failed cannulations are recorded in Table 3. There were more failures in the lignocaine group than in the control group but this did not reach significance ($P=0.08$, 95% confidence intervals for the difference being −1–26%). The other groups had intermediate frequencies. All the failures were in patients who had veins that had been graded as either grade zero or one.

DISCUSSION

This controlled study has compared the use of three commonly used local anaesthetics for venous cannulation. Lignocaine 1%, injected subcutaneously, and ethyl chloride spray have been shown significantly to reduce the pain of the cannulation, and to hurt less than a 20G Venflon. The value of EMLA cream applied for 5 min, even when rubbed into the skin, has been questioned. Although its onset of action may well be increased by rubbing it into the skin, and there may be a real effect after 5 min, this study was unable to demonstrate it. This could be because of insufficient numbers.

The use of lignocaine produced more failed cannulations than in the other groups, although the difference did not achieve significance at $P<0.05$. This was not a surprise, as the wheal produced, or the occasional haematoma, can obscure the vein. All these failures occurred in patients in whom it could have been predicted that the cannulation would have been difficult. Ethyl chloride and EMLA cream had little effect on the failure rate of cannulations, even though EMLA blanches the skin, and ethyl chloride freezes it, making it feel tough and waxy. It is, therefore, better to use these agents in patients with difficult veins. There is, however, no excuse for not using a local anaesthetic before any cannulation.

Once the cannulae were *in situ* patients complained of only a small amount of pain. This was reduced in the trial groups. This additional benefit of using local anaesthetics even after the cannulae have been inserted would be greater the longer the cannula is left in, especially if sited near a joint. Local anaesthetics, especially EMLA, can also be applied to cannulae already *in situ* to make them more comfortable.

The pain scores recorded in this trial were much lower than those recorded in previous studies. In their two studies, Harrison *et al.*[12,13] recorded median pain scores of 6 and 5, using a discrete pain scale of 1 to 10. Armstrong *et al.*[11] used a 10 cm visual analogue scale and recorded median pain scores of 3.8 cm. This trial recorded median pain scores of 2.3 cm. These differences may be a result of differences in patient selection (Harrison's patients were both male and female, and a mixture of premedicated and unpremedicated, while Armstrong's and this trial's were all unpremedicated female day cases). Alternatively, they could be a result of the circumstances used for the trial. Although not recorded in detail, it would appear that in the other studies the cannulae were inserted while the patients were in theatre, just before being anaesthetized. At this time the patients may have been very anxious. In our study the cannulae were inserted while the patients were on the ward, before being taken down to theatre, and therefore at a time when they may have been less anxious. This alone may account for the differences in the pain scores, but cannot be tested because anxiety levels were not recorded in the other trials. It may be possible to reduce both the patients anxiety as they come to theatre, and the time it takes to induce anaesthesia, by inserting the cannula on the ward, perhaps while making the pre-operative visits. This would also give the patients more time to ask questions. None of the cannulae in this study needed resiting when the patients reached theatre.

CONCLUSION

This study confirms previously published work. The insertion of relatively small 20G cannulae can cause pain. This pain can be reduced using commonly available local anaesthetics, e.g. lignocaine, ethyl chloride spray, and EMLA cream. With a little extra effort, we, as doctors, could make our patients more comfortable by using these agents before venous cannulation, or other venepuncture. This would then reduce the fear that many patients have at

the thought of an injection, whether before an operation or not.

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