

Use of EMLA Cream or Alfentanil for Analgesia during Ophthalmic Nerve Blocks

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Abstract

This prospective double-blind study compared the effectiveness of EMLA with alfentanil and placebo in reducing the overall pain during ophthalmic nerve blocks. Seventy-five patients scheduled for cataract surgery were divided into three groups. Patients in the EMLA group had EMLA cream applied over skin areas corresponding to injection sites for retrobulbar and facial nerve blocks one hour before the nerve blocks, and placebo intravenous normal-saline injection 2 minutes before the first nerve block. The alfentanil group had placebo cream applied and intravenous alfentanil 10 µg.kg⁻¹ while patients in the placebo group received placebo cream and intravenous normal-saline at similar time intervals prior to the nerve blocks. Patients then received facial nerve blocks and retrobulbar block by the same surgeon. Pain scores by patients and independent observers were significantly lower in the EMLA and alfentanil groups compared to placebo (P < 0.005) with no significant difference between the EMLA and alfentanil groups.

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Introduction

Cataract surgery is performed mainly as day-case surgery, with the majority performed under regional anaesthesia. Retrobulbar block, combined with facial nerve block, provides good operating conditions, with the facial nerve block preventing blepharospasm and providing lid akinesia. Such ophthalmic regional blocks are painful procedures, especially facial nerve blocks.^{1,2} Pain arising from these procedures can increase the anxiety of patients undergoing cataract surgery and may potentially make the procedure more difficult for the surgeon. Patients' inadvertent movements because of pain during placement of these ophthalmic blocks may lead to an increased risk of complications from these procedures.

Although cataract surgery can be performed under peribulbar eye block or large volume retrobulbar block, both without painful supplementary facial nerve blocks, or even with topical amethocaine eyedrops,⁴ ophthalmic surgeons in Singapore still favour the traditional retrobulbar and facial nerve block combination. In fact, it is standard practice in our institution that every patient undergoing cataract surgery with regional anaesthesia receives three ophthalmic blocks in sequence—O'Brien's and Van Lint's techniques for fa-

cial nerve block and finally, the retrobulbar block.

Several techniques have been used to minimise the pain and discomfort associated with the administration of such nerve blocks. EMLA (eutectic mixture of lignocaine base 2.5% and prilocaine base 2.5%) (Astra) and amethocaine cream have been used and found to be effective in alleviating the pain of retrobulbar injections.^{5,6} Use of intravenous opioids such as alfentanil and remifentanil just prior to retrobulbar and peribulbar blocks have also been described to reduce the pain of these injections.^{7,8} However, these studies did not include the component of facial nerve blocks. As facial nerve block remains an important and integral component of ophthalmic regional anaesthesia, this study aims to compare the use of EMLA cream and alfentanil with placebo to reduce the overall pain during ophthalmic regional blocks consisting of both retrobulbar and facial nerve blocks (O'Brien's and Van Lint's techniques).

Materials and Methods

Following approval by the institutional ethics committee, 75 patients scheduled for cataract surgery under ophthalmic regional anaesthesia were included in this study. Informed, written consent was obtained from all patients. Patients were excluded if they were allergic to

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the above test materials, unable to follow instructions or unable to provide a subjective assessment of the intensity of pain.

This study was a double blind, prospective study comparing EMLA cream with intravenous alfentanil and placebo. The patients were randomly divided into three groups: EMLA group, alfentanil group and placebo group.

Patients were not premedicated and on arrival at the operating theatre, intravenous access was established on the dorsum of the hand of each patient.

In the EMLA group, patients had EMLA cream 5 g applied evenly to the three regions of the face corresponding to the injection sites of the ophthalmic nerve blocks, one hour before the nerve blocks. These areas included the skin over the condyle of the mandible for the placement of the O'Brien's facial nerve block; the skin over the temple, lateral to the orbit, for placement of the Van Lint's facial nerve block and the outer half of the inferior orbital margin for the retrobulbar block. The cream was not covered with any occlusive dressing. Two minutes prior to the nerve blocks, a placebo injection of 2 ml of normal saline was injected intravenously.

In the alfentanil group, a placebo cream containing a mixture of white soft paraffin and wool fat, which was visually identical to the EMLA cream, was applied onto the face of patients in similar fashion as in the EMLA group one hour before the nerve blocks. $10 \mu\text{g.kg}^{-1}$ of alfentanil was then given intravenously, 2 minutes before the placement of the blocks. This intravenous bolus of alfentanil ($10 \mu\text{g.kg}^{-1}$) was diluted to a total of 2 ml with normal saline before the injection was given.

Patients in the placebo group had skin application of the same placebo cream in the same facial regions one hour before the nerve blocks. This was followed by the placebo intravenous normal saline injection two minutes before the nerve blocks.

All patients received supplemental oxygen 3 L.min^{-1} via a nasal cannula prior to the intravenous injections of the test drugs as described above until the end of surgery.

After the intravenous injection, the same ophthalmic surgeon performed the ophthalmic nerve blocks using standard techniques. The first nerve block administered was the O'Brien's technique for facial nerve block. This injection was made about 2 cm anterior and 1 cm inferior to the external auditory canal. The mandibular condyle was identified and a 23-gauge needle (25 mm in length) inserted until it struck the periosteum of the mandibular condyle. 5 ml of 2% lignocaine with adrenaline 1:200,000 was given just above the periosteum at a rate of 1 ml per second. The surgeon then continued with the Van Lint's method for facial nerve block. An identical 23-gauge needle was inserted 1 cm lateral to and below the outer

canthus. 5 ml of 2% lignocaine with adrenaline 1:200,000 at a rate of 1 ml per second was then infiltrated in an upward, downward and medial direction. Immediately after performing the Van Lint's facial nerve block, a standard retrobulbar injection was performed. This injection was performed with a 25-gauge, 50-mm long, short-bevelled needle. The needle was introduced at the junction of the lateral one-third and the medial two thirds of the inferior orbital rim. 2.5 ml of 2% lignocaine with adrenaline 1:200,000 was injected at a rate of 1 ml per second after aspiration to avoid intravascular and subarachnoid injection.

The following recordings and assessment were made. Firstly, an independent "blinded" observer would grade the overall reaction of the patient during the ophthalmic injections. These were graded on a pain reaction rating scale of 0-2 (0 = no pain; 1 = mild or moderate pain as evidenced by transient grimace, slight groan or minor reflex movements; 2 = severe pain with loud or continuous verbal complaint, intensive or continuous reflex movement).

Patients were also requested to give a single score based on a verbal pain scale between 0 (no pain) and 10 (worst pain imagined) that best describes the intensity of pain felt during the three injections. This score was obtained 5 minutes after the final nerve block.

Sedation was assessed on a scale of 0-3 (0 = patient awake and alert; 1 = drowsy but able to follow surgeons instructions; 2 = drowsy and unable to follow instructions; 3 = unarousable).

Local side-effects like skin reactions, in the region where the EMLA/placebo creams was applied, and ocular changes were noted. Incidence of nausea or vomiting during the surgery and in the recovery room was also recorded. Blood pressure was recorded every 3 minutes until the end of the operation. Pulse oximetry was monitored continuously throughout the entire operation.

Results were analysed using Student's t-test for parametric data and the Mann-Whitney test with rank sums for non-parametric data. *P* value of less than or equal to 0.05 was considered significant.

Results

The three groups were comparable for age, gender and weight (Table I).

The patients' overall reaction to the three ophthalmic injections as assessed by the "blinded" independent observer is shown in Table II. This shows that the treatment with either alfentanil or EMLA cream resulted in significantly less overall pain reaction when compared with placebo. There was no statistically significant difference between the use of EMLA cream and alfentanil.

Table II also shows pain scores during the injections

TABLE I: PATIENT DATA

	Placebo group	EMLA group	Alfentanil group
Number (n)	25	25	25
Age (years); mean (SD)	67.5; 10.9	65.6; 11.4	66.4; 9.9
Sex (female:male)	15:10	15:10	16:9
Weight (kg); mean (SD)	60.9; 11.1	59.3; 11.1	60.8; 12.4

TABLE II: PAIN SCORES

	Placebo group	EMLA group	Alfentanil group
a) Pain reaction as assessed by "blinded" observer	1.40 ± (0.76)	0.44 ± (0.51)*	0.36 ± (0.76)†
b) Patients' verbal pain scores	6.92 ± (2.18)	2.48 ± (1.69)*	1.80 ± (1.41)†

Results are expressed as mean score ± (SD)

* EMLA vs placebo group ($P < 0.005$)

† Alfentanil vs placebo group ($P < 0.005$)

according to patients' subjective verbal pain scores. Patients who received EMLA cream or alfentanil experienced significantly less pain than the placebo group. However, there was no significant difference in the pain scores between the EMLA group and the alfentanil group.

The alfentanil group recorded significantly higher sedation scores than the other groups (Fig. 1). However, none of the patients in the alfentanil group had a sedation score greater than one. These patients were able to follow instructions during the ophthalmic nerve blocks.

There were no significant local or systemic adverse effects noted in any of the three groups. No significant skin or ocular changes were detected in any of the patients. There was no incidence of oxygen desaturation ($\text{SpO}_2 < 95\%$) in any patient and non-invasive blood pressure monitoring did not reveal any patient having a

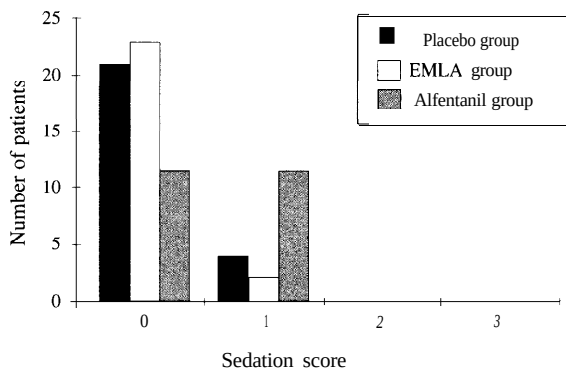


Fig. 1. Sedation scores.

Sedation scores. Patients in the alfentanil group were significantly more sedated than in the placebo and EMLA groups. However, all patients in the alfentanil group were still arousable and able to follow orders.

greater than 20% drop in baseline systolic blood pressure. One patient in the alfentanil group developed bradycardia (pulse rate $45 \cdot \text{min}^{-1}$) 3 minutes after the intravenous alfentanil injection. This was not associated with hypotension, and recovered spontaneously 6 minutes later. There were no incidences of nausea or vomiting in any patient during the period of observation.

Discussion

Avenues to reduce the pain and discomfort of retrobulbar and peribulbar blocks include use of topical anaesthetic creams (EMLA and amethocaine)^{5,6} and intravenous sedatives/analgesics.^{7,8} The advantages of using topical anaesthetic creams like EMLA and amethocaine cream include ease of application and patients' acceptance. The lack of sedative effect may prove beneficial, as most of the patients undergoing cataract surgery are elderly. Just as EMLA cream has been used successfully in reducing pain of superficial procedures like venepuncture in both children and adults, it is also been found to be effective in alleviating pain of deeper injections like retrobulbar and facial nerve blocks, as shown in our study.

Various studies have demonstrated that application of EMLA cream is able to provide anaesthesia and analgesia to variable depth. Bjerring et al⁹ showed that EMLA cream was able to produce a mean depth of analgesia of 3.11 mm after 60 minutes of application, as determined with an 18-gauge needle. After 120 minutes of application, this depth increased to 5 mm. Taddio et al,¹⁰ on the other hand, showed that analgesic depth with EMLA can extend to 16 mm when determined with a 25-gauge needle into the upper arm. Application of EMLA has been shown to reduce pain during "deeper" injections like retrobulbar block, where the block needle often needs to be inserted to a depth of 25 to 35 mm,¹¹ and spinal anaesthesia,¹² although this is possibly due to superficial structures being the source of most of the pain in these nerve blocks.

In our study, EMLA cream was effective in reducing the pain from ophthalmic nerve blocks including facial nerve block without clinically significant local side effects related to its use, though local skin reactions, such as pallor, erythema, alterations in temperature sensation, oedema, itching, and rash have been reported.¹³ There were no ocular injuries observed in any of our patients. Nevertheless, care has to be taken to avoid contact of EMLA cream with the eyes, as there have been reports of accidental application of EMLA cream into the eyes of patients causing conjunctival injection and corneal abrasion but with no long-term damage. These injuries had features of alkaline eye injury and EMLA cream is an alkaline formulation (pH 8-9).¹⁴

Our study also showed that alfentanil is effective in reducing the pain of ophthalmologic nerve blocks. Pre-

vious studies on alfentanil showed conflicting results. At $20\text{ }\mu\text{g.kg}^{-1}$, alfentanil was able to reduce movements and pain during the placement of a retrobulbar block.⁷ However, one elderly patient in that study became apnoeic for approximately 30 seconds and required airway support and supplemental oxygen. This has led to concerns that intravenous injection of $20\text{ }\mu\text{g.kg}^{-1}$ of alfentanil for sedation prior to ophthalmic blocks can lead to potentially fatal complications like respiratory depression.¹⁵ As a result it has been recommended that lower doses of alfentanil ($5\text{ to }10\text{ }\mu\text{g.kg}^{-1}$) should be used for reducing the pain of retrobulbar blocks. However, Ahmad et al⁸ showed that alfentanil $7\text{ }\mu\text{g.kg}^{-1}$ did not provide adequate pain relief for retrobulbar and peribulbar blocks.

Our study demonstrated that at a dose of $10\text{ }\mu\text{g.kg}^{-1}$ alfentanil was significantly better than placebo when administering both retrobulbar and facial nerve blocks. None of the patients in the alfentanil group was excessively sedated and all the patients could follow the surgeon's instructions during the procedure itself. This is important, as ophthalmic surgeons have to communicate with the patients frequently to provide instructions during the administration of the nerve blocks. None of the patients developed any drop in oxygen saturation below 95% after intravenous alfentanil, when supplementary oxygen was given prior to intravenous injection of alfentanil. There were also no significant haemodynamic changes in any patient.

In conclusion, both EMLA cream and intravenous alfentanil $10\text{ }\mu\text{g.kg}^{-1}$ were effective in reducing the pain and discomfort of ophthalmic nerve blocks consisting of retrobulbar block and 2 facial nerve blocks when compared to placebo. We found no significant difference in the efficacy of pain relief between the use of EMLA cream and intravenous $10\text{ }\mu\text{g.kg}^{-1}$ of alfentanil. This study also revealed no significant local, respiratory or haemodynamic side-effects in the study groups. This

provides two alternative methods, each with their own advantages and disadvantages, to alleviate the pain of ophthalmologic nerve blocks.

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