

## Haemodynamic stability during general anaesthesia for intra-ocular surgery: the effect of topical oxybuprocaine

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### Summary

Local anaesthesia is frequently used in combination with light general anaesthesia to reduce the reflex responses to surgical stimulation. This combination has not previously been evaluated for intra-ocular surgery. During cataract extraction under general anaesthesia, the effect of topical anaesthesia with oxybuprocaine 0.4% on the pressor response was compared with normal saline in a control group. The simple technique of instilling local anaesthetic drops into the conjunctival sac blocked the pain pathway sufficiently to prevent the pressor response to surgical stimulation ( $p < 0.001$ ). Higher inspired concentrations of enflurane were required in the control group to achieve and maintain haemodynamic stability ( $p < 0.001$ ).

### Key words

Anaesthetics, local; oxybuprocaine.  
Surgery; ophthalmological.

Although the use of local anaesthesia for cataract surgery is increasing [1, 2] there are many patients for whom general anaesthesia will be preferred. Surgeons require both an immobile, uncongested operative field and a constant low intra-ocular pressure. Increases in systolic arterial pressure in response to surgical stimulation may increase bleeding [3] and intra-ocular pressure [4–6]. Under general anaesthesia this pressor response is normally controlled by the use of volatile anaesthetic agents and opioid analgesics. This study investigates whether topical anaesthesia of the eye combined with light general anaesthesia blocks the pain pathway sufficiently to prevent an increase in arterial pressure when the surgical stimulus is applied.

### Methods

Thirty-seven patients of ASA grade 1 or 2 scheduled for cataract extraction and intra-ocular lens implantation were randomly allocated to one of two groups. All patients gave informed consent and the study was approved by the local ethics committee.

The patients were premedicated with temazepam 10 mg given 1 h before operation. Anaesthesia was induced with fentanyl  $1 \mu\text{g}\cdot\text{kg}^{-1}$  and thiopentone in a dose sufficient to abolish the eyelash reflex. Vecuronium  $0.1 \text{ mg}\cdot\text{kg}^{-1}$  was given to facilitate orotracheal intubation and maintain neuromuscular blockade. Anaesthesia was maintained with enflurane in 70% nitrous oxide in oxygen. Ventilation was controlled to maintain normocarbia ( $P_{\text{E}}\text{CO}_2$  4.8–5.4 kPa) as indicated by a Datex Capnograph.

During induction, patients in group 1 were given three drops of oxybuprocaine 0.4% and those in group 2 three drops of sodium chloride solution 0.9% into the conjunctival sac of the eye for operation. The identity of the drops was concealed from the investigators.

Following induction of anaesthesia, serial systolic arterial blood pressure measurements were taken using an oscillotonometer [7]: before surgery (t1), during insertion of the eyelid retractor (t2), during insertion of the superior rectus muscle stay suture (t3), during corneal incision (t4) and at 2, 3, 4, 5 and 10 min thereafter (t5–9). Enflurane was administered from a calibrated mark 3 enflurane vaporizer (Ohmeda), at a concentration setting required to achieve a systolic arterial pressure as close as possible to the pressure at t1 (before surgery).

The mean and standard error of the systolic arterial blood pressure and enflurane concentrations of all the patients in each group at each of the times t1–9 were calculated. Student's unpaired *t*-test was used to assess the difference in systolic arterial pressure and enflurane concentration between the two groups at each time point. Statistical significance was defined as  $p < 0.001$ .

### Results

Twenty patients received oxybuprocaine drops and 17 patients 0.9% sodium chloride solution. The groups were similar in respect of age, weight and sex (Table 1). There was no significant difference in the mean systolic arterial blood pressure of the two groups at t1.

In the oxybuprocaine group there was no significant change in the mean systolic arterial pressure during surgery (t2–t9) compared with the pressure before surgery (t1). In the saline group, however, the mean systolic arterial pressure increased when surgery commenced and did not return to the presurgery level until 10 min had elapsed. These differences were highly significant from t4–t6 ( $p < 0.001$ ) (Fig. 1).

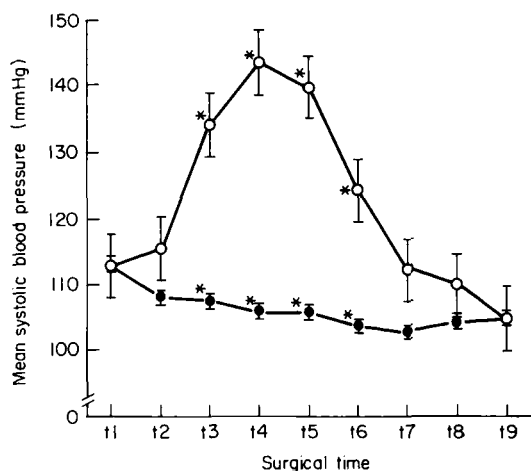
The saline group required higher settings of the enflurane vaporizer to control the increase in systolic arterial pressure and this was significant from t4 when the corneal incision was made until t6 3 min after surgery commenced (Fig. 2).

### Discussion

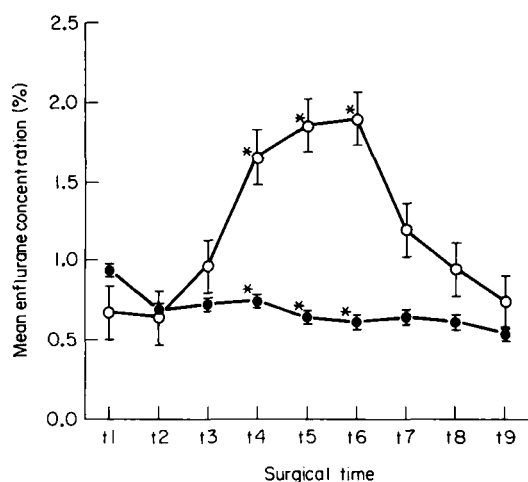
This study demonstrates that the application of local anaesthetic eye drops to the conjunctival sac blocks the pain pathway sufficiently to prevent an increase in arterial pressure during cataract surgery under light general anaesthesia without the need to increase inspired enflurane concentration. Increasing the depth of anaesthesia in

Table 1. Patient characteristics, mean (SEM or range).

	Oxybuprocaine	Saline
Age; years	71.8 (85–51)	74.4 (85–55)
Weight; kg	70.0 (2.57)	74.2 (3.15)
Males/females	7/13	5/12



**Fig. 1.** Systolic arterial pressure, mean (SEM) during initial 10 min of surgery. ● = group 1 oxybuprocaine, ○ = group 2 saline. \*significant difference between groups ( $p < 0.001$ ).



**Fig. 2.** % enflurane concentration, mean (SEM) during initial 10 min of surgery. ● = group 1 oxybuprocaine, ○ = group 2 saline. \*significant difference between groups ( $p < 0.001$ ).

anticipation of a painful stimulus is likely to cause unwanted hypotension during the period before surgery commences, particularly in the elderly [8]. Ageing increases the haemodynamic response of incision [8] therefore the elderly population requiring cataract extraction are likely to obtain increased benefit from a technique which minimises afferent neuronal impulses from the operation site.

Local anaesthetic techniques are commonly used either alone [9], or with general anaesthesia in many branches of surgery to obtund reflex responses to surgical stimulation, particularly in the high risk patient [10]. The use of local anaesthetic techniques to supplement general anaesthesia has not previously been described for intra-ocular surgery. Retrobulbar [11] and peri-orbital block [2] are invasive procedures, requiring expertise and practice and are not without risk. They normally would not be contemplated without the added benefits of avoiding a general anaesthetic. Topical anaesthesia is simple and noninvasive and blocks the rich supply of sensory nerve endings in the cornea and conjunctiva. It is normally used for surface procedures such as tonometry, removal of sutures and superficial foreign bodies and on its own is not adequate for intra-ocular surgery. The addition of light general anaesthesia and neuromuscular blockade renders the eye

immobile and provides suitable conditions for cataract surgery. Oxybuprocaine is a benzoic acid ester related to procaine and is in common use in ophthalmology [12]. Anaesthesia of the cornea develops within 5 min and sensitivity returns to normal after approximately 1 h.

In this study we wanted to show that haemodynamic stability was achieved without the need for continual adjustment of the inspired concentration of enflurane. We therefore chose to record the vaporizer setting as an indicator of the action that the anaesthetist was taking to achieve haemodynamic stability.

Although low concentrations of enflurane were used in this study, particularly in group 1, there was no incidence of awareness. Isoflurane in air produces loss of recall of neutral words at levels as low as 0.2 MAC in volunteers although 'shock' words required up to 0.4 MAC [13]. The MAC of inhalational agents decreases with age [14, 15] and is further reduced in combination with opioids, nitrous oxide and hypnotics [15]. We studied the first 10 min of surgery because the intensity of the stimulus changes rapidly from zero before surgery starts to a maximum when the superior rectus stay suture is inserted and to a reduced level during intra-ocular manipulation. This change in the intensity of the painful stimulus over a short time interval provides an ideal opportunity to test the efficacy of the local anaesthetic.

In conclusion, topical anaesthesia with oxybuprocaine is a safe and simple method of improving haemodynamic stability during cataract surgery under light general anaesthesia.

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