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FORUM

Intra-ocular pressure changes following laryngeal mask airway insertion: a comparative study

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Summary

We compared the effects of the Brain laryngeal mask airway with a tracheal tube on intra-ocular pressure. Propofol was used as induction agent and atracurium as relaxant. Twenty-six patients with normal intra-ocular pressure undergoing cataract surgery were randomly allocated to two groups. Group A ($n = 13$) had a laryngeal mask airway inserted and Group B ($n = 13$) had a tracheal tube inserted. Intra-ocular pressure was measured just before insertion of the airway, 20 s after insertion and at 2 min. In the laryngeal mask airway group there were no significant changes in mean intra-ocular pressure. In the tracheal tube group there was a significant rise in mean intra-ocular pressure at 20 s ($p = 0.0056$) which returned to pre-insertion levels at 2 min. We conclude that the laryngeal mask airway continues to have advantages over the tracheal tube for ophthalmic surgery despite the use of propofol and atracurium as anaesthetic agents.

Keywords *Equipment; laryngeal mask. Eye; intra-ocular pressure. Surgery; ophthalmic.*

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Table 1 Demographic details of patients

	LMA Group	TT Group
Male:female ratio	3:10	4:9
Age (SE)	72.3 (1.83)	69 (3.8)
Weight (SE)	63.42 (2.81)	74.76 (5.99)

Cataract surgery with or without simultaneous intra-ocular implantation is one of the most commonly performed elective operations in the elderly. The procedure is carried out under the microscope and the proximity of the surgical site to the airway is an important consideration for anaesthesia. The surgery, under general anaesthesia, has conventionally required tracheal intubation. This entails laryngoscopy and the use of muscle relaxants, which have been shown to contribute to an increase in intra-ocular pressure (IOP) and intra-ocular blood flow (IOBF) [1–3].

General anaesthesia allows control of IOP using mechanical ventilation. The Brain laryngeal mask airway (LMA) has become an important alternative to the tracheal tube (TT). It has been demonstrated that the rise in IOP that occurs with tracheal intubation and/or laryngoscopy is attenuated using the LMA [4]. Atracurium and propofol have also been shown to attenuate the rise in IOP [1, 5]. Mirakhur *et al.* showed that the use of propofol in intubated patients resulted in only a minimal and insignificant change in IOP, in comparison to values before intubation [5]. We designed a controlled prospective randomised study to investigate whether the benefits of the use of an LMA over a TT on IOP are sustained when propofol and atracurium are used.

Methods

Ethics committee approval and informed written patient consent were obtained. Twenty-six consecutive patients, ASA grade 1 or 2, undergoing elective unilateral cataract surgery were enrolled in this study. There were seven

males and 19 females with a mean age of 71 years. Glaucoma had been ruled out pre-operatively. Patients were randomly allocated to one of two groups using a closed envelope technique. Group A received controlled ventilation via the LMA and Group B via the TT. All patients received premedication with temazepam 10 mg orally 1 h pre-operatively. Anaesthesia was induced using a sleep dose of propofol in both groups. The end point was determined by lack of response to verbal communication. Atracurium ($0.6 \text{ mg} \cdot \text{kg}^{-1}$) was administered to provide muscle relaxation to facilitate the insertion of either the LMA or the TT, 3 min later. Anaesthesia was maintained using enflurane with a 70% nitrous oxide in oxygen mixture. A Siemens 900B ventilator was used for intermittent positive pressure ventilation. Monitoring consisted of continuous three-lead electrocardiography, noninvasive blood pressure, pulse oximetry and end-tidal carbon dioxide was maintained between 4.5 and 5.5 kPa.

Intra-ocular pressure was measured using the electronic pneumatonometer from the Langhams OBF system [6], immediately postinduction (prior to manipulation of the airway), 20 s after securing the airway and 2 min later. Measurements of heart rate, mean arterial blood pressure and oxygen saturation were recorded at the same time. Student's *t*-test was used to compare data from both groups.

Results

There were no significant differences between the two groups in respect of demographics (Table 1). Table 2 outlines changes in mean IOP ($P_{i\text{Max}}$), mean heart rate and mean arterial pressure following airway insertion. In Group A there was a small decrease in the mean IOP ($P_{i\text{Max}}$) at 20 s following insertion of the LMA that was not statistically significant. However, in Group B there was a significant rise in $P_{i\text{Max}}$ at 20 s following insertion of the tracheal tube ($p = 0.0056$). Changes in $P_{i\text{Max}}$ at 2 min from baseline in either group were not significant. Mean arterial blood pressure and heart rate are shown in Table 2. There was a significant rise in mean arterial blood

Table 2 Mean intra-ocular pressure ($P_{i\text{Max}}$) = mmHg, mean arterial pressure (MAP) = mmHg, mean heart rate (HR) = $\text{beat} \cdot \text{min}^{-1}$, mean and (SE).

	$P_{i\text{Max}}$		MAP		HR	
	Grp A (LMA)	Grp B (TT)	Grp A (LMA)	Grp B (TT)	Grp A (LMA)	Grp B (TT)
Pre-insertion	16.06 (3.02)	12.54 (1.73)	80.61 (4.43)	80.30 (4.31)	74.30 (3.18)	78.30 (4.11)
Postinsertion (20 s)	13.40 (2.82) (NS)	20.50 (1.96) $p = 0.0056$	79.50 (3.13) (NS)	105.0 (5.36) $p = 0.0015$	74.40 (3.91) (NS)	87.00 (5.36) (NS)
Postinsertion (2 min)	14.34 (2.85)	13.39 (1.26)	77.92 (3.44)	82.5 (2.31)	71.5 (2.95)	78.2 (3.35)

pressure ($p = 0.0015$) at 20 s which had settled at 2 min in Group B.

Discussion

The laryngeal mask airway was first introduced at the Royal London Hospital, Whitechapel, in 1981 by Dr A. Brain and became commercially available in the United Kingdom in 1988 [7]. It is now used in more than 50% of general anaesthetics administered in some centres in the UK. It has been found to be a safe and effective method of maintaining the airway. Intermittent positive pressure ventilation may be performed safely via the laryngeal mask airway in most patients, the main exception being those with full stomachs and/or significant gastro-oesophageal reflux.

One advantage of the laryngeal mask airway is that patients are more haemodynamically stable than those whose tracheas are intubated [4]. It avoids most of the stress response to intubation reflected by an increase in heart rate, mean arterial blood pressure and increased IOP [4, 8]. This increase in IOP disappears in a few minutes and may not be of any great consequence in the majority of patients undergoing elective cataract surgery but it may be harmful in patients with glaucoma or in those with penetrating eye injuries [8].

It has been shown that the choice of induction agents and relaxants used to facilitate control of the airway may have a significant effect on IOP [1, 5]. Changes in IOP reported in previous studies have varied with the techniques used. Some authors have shown a marked increase in IOP after tracheal intubation, others an insignificant change [1, 2, 5, 8]. This is accounted for by the use of different anaesthetic agents. Propofol may attenuate the increase in IOP following tracheal intubation [5]. Atracurium has been shown to decrease IOP to a statistically greater degree than pancuronium following tracheal intubation [1]. The use of suxamethonium has been shown to cause a significant rise in IOP [9].

This study demonstrated a small decrease in IOP following insertion of the LMA at 20 s which was statistically insignificant. However, there was a marked increase

in intra-ocular pressure at 20 s following tracheal intubation. This occurred despite the use of propofol and atracurium and conflicts with the results of Mirakhur *et al.* who found that propofol was effective in attenuating this increase in IOP [5]. Our study confirms the results of previous studies showing a transient but significant rise in IOP following tracheal intubation. This rise was attenuated by the use of the LMA. We conclude that the LMA continues to have significant advantages over the TT for elective surgery, despite the use of propofol and atracurium.

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