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The Laryngeal Mask Airway Versus Endotracheal Tube for Intraocular Surgery

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Abstract

The use of the laryngeal mask was compared with tracheal intubation in 20 patients who underwent intraocular ophthalmic surgery and received standardized anaesthesia. The changes in intraocular pressure was significantly less in the LMA group at all time points after airway instrumentation. The change in mean arterial pressure was significant between the two groups but the heart rate changes were insignificant. The mean rate pressure product was significantly smaller in LMA group compared with ETT group after both insertion and removal. At the end of the procedure, a significantly higher percentage of patients tracheal tube coughed, reacted to head movement and suffered breath holding ($p < 0.05$), as they also complained of postoperative sore throat ($p < 0.01$) more than patients with LMA.

Introduction

TRACHEAL intubation is performed routinely during general anaesthesia in patients undergoing intraocular surgery to secure a clear airway, to facilitate ventilation of the lungs and to allow good surgical access.

However, intubation is associated with tachycardia, hypertension [1] and an increase in intraocular pressure [2]. Many techniques have been tried to attenuate this response but to date none has been successful [1].

The Brain laryngeal mask (LMA) has been shown to be an effective means of securing a clear airway in fasted patients for elective surgery [3]. Its insertion needs neither visualization of the cords nor penetration of the larynx, making placement less stimulating than tracheal intubation. Therefore, during insertion of the LMA there is less likelihood of a pressor response or coughing than with conventional tracheal intubation and as a consequence the increase in intraocular pressure may be diminished. Similarly, at any depth of anaesthesia, removal of LMA would be expected to be less stimulating than removal of tracheal tube.

The aim of the present study was to assess the use of the Brain LMA and compare it with tracheal intubation in patients who underwent intraocular ophthalmic surgery.

Patients and Methods

Twenty patients ASA grade I, II, or III scheduled to undergo intraocular ophthalmic surgery under general anaesthesia, were studied after institutional approval and after obtaining informed consent.

The patients were allocated randomly to one of two groups with equal numbers in each group; the laryngeal mask airway was used in group (1) while tracheal intubation was used in group (2). Patients with raised intraocular pressure were not studied. All patients were premedicated with diazepam 0.2 mg/kg given orally 90 minutes before surgery. Intraocular pressure was measured in nonoperated eye using a Perking hand held applanation tonometer after instillation of 5% amethocaine drops and fluorescein dye to the cornea from an impregnated strip.

On arrival to the operating room, monitoring was instituted. The ECG was monitored continuously and arterial pressure was measured at 1 minute intervals using a non-invasive arterial pressure monitor. Baseline measurement of intraocular pressure was made when the patient arrived in the anaesthetic room.

After determination of baseline data, the lungs were pre-oxygenated. Fentanyl 2-3 μg/kg was given and 1 minute later, anaesthesia was induced with slow i.v. injection of thiopentone (sufficient to abolish the lash reflex). Intraocular pressure was measured immediately after induction of anaesthesia and alloferin 0.2-0.3 mg/kg was administrated. Intraocular pressure was measured again immediately after insertion of a laryngeal mask or tracheal intubation. Controlled ventilation (mechanical) was carried out. Anaesthesia was maintained with 1% end-tidal halothane and 60% nitrous oxide in oxygen. At the end of surgery neuromuscular block was antagonized with neostigmine 0.35 mg/kg and atropine 0.01 mg/kg. The patients then breathed 100% oxygen. Pre-extubation data were obtained. An eye bandage was applied by the surgeon and extubation or removal of the laryngeal mask was carried out after satisfactory establishment of spontaneous breathing. Post extubation reading of the intraocular pressure was taken and the development of coughing, straining or breath holding at termination of anaesthesia was recorded.

Student's *t*-test and chi-squared test were used for the statistical analysis of the data.

Results

Patients characteristics are summarized in table 1. There were no significant differences in demographic data, ASA class, or duration of anaesthesia between the groups.

Tracheal intubation and placement of laryngeal masks were accomplished without difficulty in all patients. It was easy to ventilate the lungs of all patients, both techniques provided excellent surgical conditions. There were no complications in extubation in all patients.

The absolute values for intraocular pressure were not significantly different at any stage between the two groups because of the large scatter in baseline intraocular pressure (Fig. 1) except immediately after insertion of the laryngeal mask and endotracheal tube where the difference in intraocular pressure was significant.

However, when the change from baseline considered in each patient, significant differences were seen. Intraocular pressure increased in group (2) after intubation, whilst there was a small decrease in intraocular pressure in group (1); the difference between groups was significant (Fig. 2).

At the end of surgery, intraocular pressure was significantly greater in group (2) than in group (1) before extubation and extubation was followed by a further increase in intraocular pressure in group (2), at which point intraocular pressure was significantly different from baseline ($p < 0.05$). In group (1), the intraocular pressure was significantly less than post induction immediately after insertion. A slight increase occurs in the pre and post extubation but the difference between the two groups was still significant ($p < 0.05$).

Intraocular pressure in groups (1) and (2) were 12.49 (1.79) mmhg and 11.99 (0.97) mmhg before induction anaesthesia, 12.05 (1.90) mmhg and 11.74 (0.99) mmhg immediately after induction of anaesthesia and 11.82 (1.78) mmhg and 13.08 (1.22) mmhg after insertion of LMA or ETT respectively (Fig. 1).

There were no significant differences between the groups in respect of intraocular pressure measured before and immediately after induction. The difference between groups immediately after insertion was significant (Fig. 1).

The mean arterial pressure changed from 95.6 (8.62) mmhg to 96.9 (10.20) mmhg on the placement of LMA and from 98.9 (9.79) mmhg to 112.2 (9.19) mmhg after insertion of ETT (Fig. 3). Heart rate increased from 76.9 (11.96) beat/min. to 93.1 (11.94) beat/min. after tracheal intubation; there was a slight increase from 83.3 (12.94) beat/min. to 88.5 (10.180 beat/min. after insertion of LMA (Fig. 4). The changes in mean arterial pressure between the two groups were statistically significant after insertion of LMA and ETT. The changes in heart rate on induction of anaesthesia or insertion of the LMA or ETT were not statistically significant. Rate-pressure product (RPP) increased significantly after intubation in group (2), but showed a small, non-significant increase in group (1). The difference between groups was significant ($p < 0.05$).

No patient in the LMA group reacted to movement when the head was lifted for bandaging the eye at end of operation while 80% of patients in group (2) strained or coughed ($p < 0.05$) (table 2). 90% of intubated patients coughed, 50% held their breath at extubation while no patient in group (1) coughed or held his breath ($p < 0.05$). Post operative sore throat was reported by 30% of the patients in group (2), while no patient in group (1) complained of sore throat ($p < 0.01$).

Table (1): Patients Characteristics Presented as Mean (Standard Deviation).

	Laryngeal mask (n = 10)	Tracheal tube (n = 10)
Males /females	4 /6	3 / 7
Age (years)	46 (19.1)	53.1 (10.8)
Weight (kgms)	70.5 (11.4)	78.7 (11.9)
Duration of anaesth. (mins)	92 (18)	98 (21)

Table (2): Frequency of Post-operative Complications.

	Laryngeal mask (n = 10)	Tracheal tube (n = 10)
Reaction to head movement	0	8 *
Cough	0	9 *
Breath holding	0	5 *
Sore throat	0	3 **

* $p < 0.05$ ** $p < 0.01$

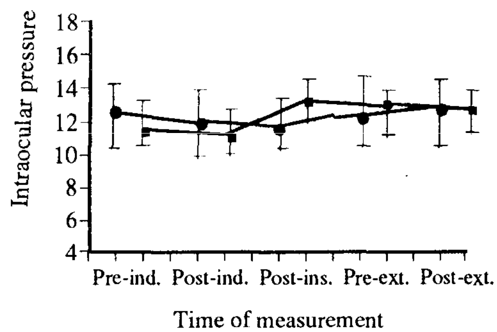

Fig. (1): Intraocular pressure before induction of anaesthesia (pre-ind), after induction of anaesthesia (post-ind), after insertion (post-ins) of either a LMA●---●or ETT■----■, before extubation (pre-ext) and after extubation (post-ext). Bars represent SD

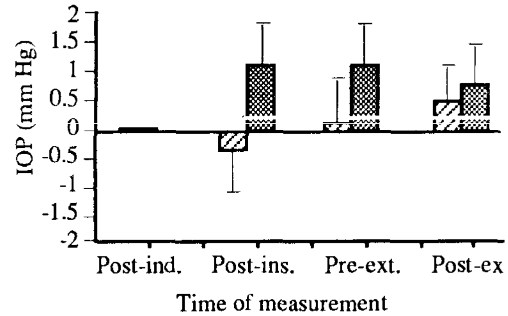

Fig. (2): Mean (SEM) changes in intraocular pressure from post-induction (baseline) values in the LMA (▨) and ETT (▩) groups. (post-ins) after insertion, (pre-ext) pre-extubation and (post-ext) post extubation.

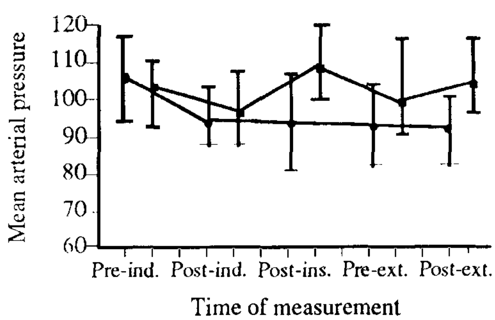

Fig. (3): Mean arterial pressure before induction of anaesthesia (pre-ind), after induction of anaesthesia (post-ind) after insertion (post-ins) of either a LMA●----●or ETT ■----■, before extubation (pre-ext) and after extubation (post-ext). Bars represent standard deviation.

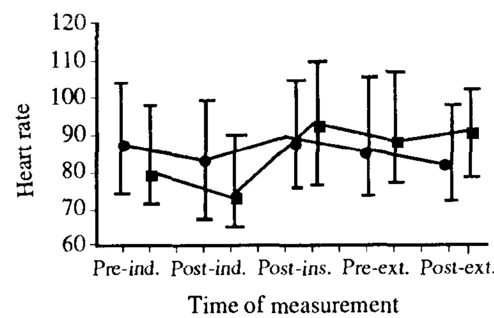

Fig. (4): Heart rate before induction of anaesthesia (pre-ind), after induction of anaesthesia (post-ind), after insertion (post-ins) of either a LMA ●------● or ETT ■------■ before extubation (pre-ext) and after extubation (post-ext). Bars represent standard deviation.

Discussion

An excessive increase in intraocular pressure during intraocular ophthalmic surgery should be avoided; various factors which affect intraocular pressure have been discussed by Holloway [4]. Tracheal intubation is associated with a marked pressor response and increases in intraocular pressure [5]. The insertion of a laryngeal mask causes an attenuated pressor response [3] and less of an increase in intraocular pressure.

In our study, although the absolute values of intraocular pressure were not significantly different after intubation, the changes in intraocular pressure from baseline were highly significant. The values before extubation were surprising, as it is not clear why the intraocular pressure should be increased in the ETT group, but less in the LMA group at this time. This may be the result of the residual effect of tracheal intubation throughout the operation. It is also possible that lightening of anaesthesia in both groups resulted in stimulation of sympathetic pathway by the presence of ETT in group (2), but not in group (1) because of the better tolerance of the airway in group (1).

The differences in systolic arterial pressure after intubation are in agreement with previous comparisons between the LMA and ETT, as are the minor differences in heart rate [1]. Rate pressure product was significantly lower ($p < 0.01$) in the LMA group than the ETT group both after intubation and after extubation. The mean RPP exceeded 12000 in group (2) patients and this may be important, as a RPP of this magnitude is associated with myocardial ischaemia [6]. This is particularly relevant to ophthalmic surgery as many patients presenting for intraocular surgery are at risk of hypertension and ischaemic heart disease.

Coughing may increase intraocular pressure to more than 50 mmHg [7] and should be avoided, particularly in patients with a perforating eye injury and immediately after intraocular ophthalmic surgery. The frequency of coughing at extubation in group (2) was high (90%), while no patient coughed at any time under anaesthesia or at the removal of a laryngeal mask. Holden, et al. [7] also reported an increased frequency of coughing during extubation compared with the removal of laryngeal mask, inspite of the use of topical lignocaine. Deeper anaesthesia at the time of extubation could have prevented coughing, but it would have resulted in delayed recovery and compromised airway. Postoperative sore throat has been reported in up to 30% patients of after tracheal intubation while no patient in the laryngeal mask group complained of sore throat.

In conclusion, in appropriate patients the LMA is an acceptable technique for intraocular surgery offering advantages in terms of intraocular pressure and cardiovascular stability compared with tracheal intubation. The laryngeal mask is not recommended in patients with full stomach, a history of hiatus hernia or reflux, or bronchitis as aspiration of gastric content remains a hazard [8].

The principal theoretical disadvantage of the laryngeal mask airway is that airway may be compromised unexpectedly during the procedure whilst the eye is open. This has not been reported, and the potential risk of loss of airway control during anaesthesia with the LMA requires further evaluation.

References

1- BRAUDE N., CLEMENTS E.A.T., HODGES V.M. and REWSB.P.: The pressure response and LMA insertion. A comparison with tracheal intubation. Anaesthesia, 44: 5510554, 1989.

2- ABBOTT M.A. and SAMUEL J.R.: The control of intraocular pressure during induction of anaesthesia for emergency eye surgery. Anaesthesia, 42: 1008-1012, 1987.

3- BRAIN A.I.J.: The laryngeal mask. A new concept in airway management. Br. J. Anaesthesia, 55: 801-805, 1983.

4- HOLLOWAY K.B.: Control of the eye during general anaesthesia for intraocular surgery. Br. J. Anaesthesia, 52: 671-679, 1980.

5- BRODRICK P.M., WEBSTER N.R. and

NUNN J.F.: The laryngeal mask airway: a study of 100 patients during a spontaneous ventilation. Anaesthesia, 44: 228-241, 1989.

6- GRIFFIN R.M.: Myocardial ischaemia during anaesthesia. Current status of monitoring techniques. In: Kaufman L., ed. Anaesthesia Review 6, London: Churchill Livingstone, 77-78, 1989.

7- HOLDEN R., MORSMAN C.D.G., BUTLER J., CLARK G.S., HUGHES D.S. and BACON P.J.: Intraocular pressure changes using the laryngeal mask airway and tracheal tube. Anaesthesia, 46: 922-924, 1991.

8- GRIGGIN R.M. and HATCHER I.S.: Aspiration pneumonia and the laryngeal mask airway. Anaesthesia, 45: 1039-1040, 1990.

9- REBECCA G. and CLINTON M.: Clinical epidemiology and biostatistics. Williams & Wilkins, ed. 275-292, 1992.