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Laryngeal Mask Airway in Ophthalmic Surgery; A Comparison Study

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Objective: This prospective study was performed to compare the effect of the laryngeal mask airway (LMA) with a tracheal tube (TT) on intra-ocular pressure (IOP), heart rate and mean blood pressure during general anaesthesia for cataract surgery.

Methods: We studied 35 patients (ASA I & II according to American society of anaesthesia) who were operated under general anaesthesia for cataract surgery. Patients were divided randomly into 2 groups, the first received standardized general anaesthesia with LMA (19 patients) and the second group with TT (16 patients). The IOP was measured at 30 sec and 3 min post-intubation or LMA application. It was also measured at 1 minute and 5 minutes after extubation or LMA removal. Mean blood pressure and heart rate were continuously recorded.

Results: The intra-ocular pressure remained significantly lower than the baseline value in the LMA group at all time after insertion. In the TT group intra-ocular pressure increased significantly 30 seconds after intubation and 1 minute after extubation. Mean arterial pressure and heart rate after insertion and removal of the airway management devices were significantly higher than baseline value in the TT group, while during the same periods no significant change was observed in LMA group.

Conclusion: General anaesthesia using LMA is an acceptable technique for intra-ocular surgery as it provides cardiovascular and intra-ocular pressure stability.

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For most intraocular surgery, tracheal intubation is performed during general anaesthesia to secure a clear airway and to facilitate ventilation of the lung for control of $PaCO_2$[1]. However, intubation is associated with tachycardia , hypertension[2] and increase in intra-ocular pressure (IOP)[3]. Moreover extubation and early post-extubation period is associated with coughing with the risk of wound dehiscence and iris prolapse[1]. More anaesthetists now use the Brains laryngeal mask airway (LMA) instead of tracheal tube (TT) during general anaesthesia. LMA has been shown to be an effective means of securing a clear airway in appropriate[4,5] patients for elective surgery[6,7].

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The insertion technique of LMA seems to be less stimulating than tracheal intubation[8,9]. Therefore there is less likelihood of a pressor response during LMA insertion than with tracheal intubation and as a consequence the increase in intra-ocular pressure may be diminished. Similarly at the end of anaesthesia, removal of LMA seems to be with fewer sequelae than extubation of tracheal tube[10].

The purpose of the study was to compare the effect of LMA with TT on intra-ocular pressure (IOP) during cataract surgery.

METHODS

Informed consent was obtained from all patients.

We studied thirty five adult patients (ASA (1,II of the American Society of Anaesthesia classification) aged 50-75 years, who were scheduled for cataract extraction and intra-ocular lens implantation. The patients were allocated randomly to receive general anaesthesia using LMA (LMA group), or tracheal tube (TT group). Morbidly obese patient or those with increased risk of regurgitation were excluded from the study.

Before induction of general anaesthesia, a 23 FG canula was inserted under local anaesthesia in one of the 2 radial arteries and intra-ocular pressure was measured in both eyes using Schiotz tonometer after instillation of 0.5% amethocaine drops.

Monitoring consisted of continuous ECG, arterial pressure, pulse oxymetry, end tidal carbon dioxide partial pressure measurement. Nerve stimulator for neuromuscular block monitoring was used.

After determination of baseline data and 3 minutes pre-oxygenation, anaesthesia was induced with propofol 1-3 mg /kg, fentanil 1-2 mcg/kg and atracurium 0.4-0.5 mg/kg. The lung was ventilated using a facemask till intubation or LMA application took place. Anaesthesia was maintained using halothane 0.5%-0.8%, N_2O/O_2, FIO_2 40%.

Mechanical ventilation of the lung was commenced with a tidal volume of 10 ml/kg and respiratory rate sufficient to maintain the end-tidal carbon dioxide partial pressure at 30-35 mmHg.

The LMA was inserted according to the manufacturer's instructions[4]. The correct placement was confirmed by the presence of a clinically clear airway and the ability to inflate the patient's lung manually without any audible gas leak.

All complications concerning LMA application, removal, or interruptions of surgery for compromised ventilation of the patients lung were recorded. Intraoperatively, intra-ocular pressure, heart rate, mean blood pressure of the two groups were recorded at the time intervals of 30 seconds, 3 minutes after intubation or LMA application, 1 minute before global incision, 1 minute before extubation; 1 minute, 5 minute after extubation or LMA removal.

Measurement of intra-ocular pressure after global incision was concluded in the non operated eye. At the end of the surgery neuromuscular block was antagonized using neostigmine 2.5 mg and atropine 1.2 mg. The patients then breathed 100% oxygen and gentle pharyngeal toilet was performed followed by extubation or LMA removal. Data are presented as mean (SEM); the Null hypothesis was rejected at $P>0.05$.

RESULTS

Thirty-five patients were studied: 19 in LMA group, (10 males and 9 females) and 16 in TT group (8 males and 8 females). There were no significant differences between the two groups in age, weight and sex. Patients characteristics and distribution are shown in Table 1.

Table 1. **Patients characteristics and distribution. Mean (SD)**

	T.T	LMA
Age (years)	62.56 (52-73)	64.3 (50-75)
Weight (kg)	67 (15.4)	65
Sex (M:F)	8.8	10:9
Mean blood pressure Hg	96.2 (6.8)	92.3 (8.1)
Heart rate /m	70.6 (15.9)	75.1 (16.3)
Mean intra-ocular pressure Hg	12.2(l.3)	13.1(2.2)

We failed to apply the LMA in one patient in the first attempt; it was successfully applied at second trial. LMA application in the other patients was accomplished without difficulty. It was easy to reach an end-tidal carbon dioxide partial pressure of 30 mmHg in all patients by adjusting the respiratory rate. Pulse oxymeter did not record oxygen saturation of less than 96% in all patients.

Minimal airway leaks were diagnosed in two patients of the LMA group; anaesthesia and surgery were accomplished in these two patients without any interruption. Spasmodic cough and laryngeal spasm in two patients complicated extubation of tracheal tube. Gentle toilet of the pharynx and anterior elevation of the lower mandible resolved these complications. No surgical complications were recorded.

Induction of anaesthesia with propofol produced a small-anticipated decrease in IOP. LMA application did not cause any significant increase in IOP. Mean IOP in the LMA group was significantly less than baseline measurements from 30 seconds after insertion of LMA ($P<0.01$) onwards, as it is shown in Table 2. One minute after removal of the LMA, the IOP started to return to the baseline value. Intra-ocular pressure increased significantly in TT group after intubation ($P<0.001$). IOP reached very high levels in some patients (32 mm Hg) but this rise was transient; 3 minutes after intubation the IOP returned to the baseline value and 1 minute before global incision IOP was significantly less than baseline value. Extubation of tracheal tube was followed by further increase in the IOP ($P<0.001$) which returned to the baseline value later on.

Table 2. **Mean (SD) Intra-ocular pressure (IOP)**

IOP								
					Post-induction	1 min		
		Extubation						
Group	Preoperative			before global incision				
		30sec	3min		1 min before	1 min after	5min after	
LMA	14.6(3.5)	12.3(1.4)	10.2(1.2)	9.3(1.6)	8.7(2.4)	11.2(0.6)	13.8(2.3)	
TT	15.5(2.3)	24.4(5.1)	14.3(3.6)	8.5(5.3)	9.3(3.9)	25.1(3.9)	16.6(2.6)	

The changes in mean blood pressure and mean heart rate recorded during the procedure are shown in Tables 3 and 4. There were significant group differences in both of these variables after induction of anaesthesia, intubation / laryngeal mask application and extubation / LMA removal. The mean blood pressure in the tracheal tube group increased significantly after intubation (P<0.01), then returned to the baseline value in the following measurements. Lightening of the anaesthesia and extubation was followed by a further increase in mean blood pressure (P<0.046). While mean blood pressure in the LMA group showed less variation than in the TT group and did not show significant change from baseline value in almost all measurements. Mean heart rate in the TT group showed significant variations between the different measurements. It increased significantly 30 seconds after intubation (P<0.001) and in 1 minute post-extubation (P<0.001), but in the LMA group slight increase in mean heart rate has been recorded after induction of the anaesthesia and the LMA insertion which returned to the baseline value from 3 minutes post-insertion onwards.

Table 3. **Mean (SD) Blood pressure**

Group	Post-induction Baseline Data	1 min 30sec	3min	before global incision	Extubation 1 min before	1 min after	5min after
LMA	103.1(5.23)	99.4 (5.3)	98.2(3.1)	96.3(6.4)	98.7(5.5)	105.6(8.9)	104.7(5.6)
TT	105.91(4.12)	135.9(9.6)	109(9.4)	101.5(4.3)	100.3(2.4)	129.6(10.4)	121.4(8.4)

Table 4. **Mean (SD) Heart rate**

Group	Post-induction Baseline Data	1 min 30sec	3min	before global incision	Extubation 1 min before	1 min after	5min after
LMA	73.1(6.3)	82 (10.3)	76.6(5.3)	70.2 (3.5)	65.8(5.6)	69.8 (5.6)	70.4(4.8)
TT	70.6(5.9)	97.5(8.75)	90.6(7.33)	85.8(6.5)	75.3(9.6)	98.65(10.3)	95.4(6.9)

DISCUSSION

Most of the cataract patients are elderly. They usually have pathophysiological changes of the cardiovascular system which leaves them with diminished reserve capacity during stress responses. Studies in healthy elderly patients have shown that the cardiovascular pathophysiology as well as circulatory responses to stress is similar to those of coronary patients[11].

Tracheal intubation may be associated with mild sympathoadrenal activity manifested by tachycardia, hypertension and elevation of plasma catecholamines[12,13]. These responses are undesirable in the elderly patients undergoing cataract operation for two reasons: firstly, the sympathoadrenal activity responses may be harmful in the arteriosclerotic patients with hypertension and ischemic heart disease. Secondly, the increase in heart rate and blood pressure may elevate IOP with consequences of expression of globe contents and expulsive haemorrhage after incision of the globe[1].

In this study, the changes in the mean blood pressure were significantly lower in the LMA group, than that in the TT group; the continuous monitoring of the mean blood pressure showed that LMA application and removal did not cause any significant elevation of the mean blood pressure. While in the TT group intubation and extubation did cause significant elevation; the mean blood pressure of some arteriosclerotic patients reached as high as 150 mmHG, and this may be important, as an elevation of this magnitude is associated with myocardial ischemia. The most marked increase in intra-ocular presssure was seen in the TT group at extubation. The magnitude of this increase was such as to cause concern, particularly in patients with closed angle glaucoma, in whom this increase in IOL may cause disc ischemia with possible resultant blindness.

In two patients cough and spasm complicated significantly the extubation; the IOP in these two patients was so elevated. Although complications were not recorded in these two patients, steps should be taken to control this postoperative IOP elevation to reduce the possibility of wound dehiscence or other complications.

The results of the comparison between LMA and TT for intraocular surgery are in agreement with previous studies[8-10,13,14].

CONCLUSION

Anaesthesia using LMA is an acceptable technique for intra-ocular surgery. It provides cardiovascular and intra-ocular stability in comparison with anaesthesia using tracheal tube.

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