

Comparing the Effect of LMA Insertion and ETT Intubation to Induce General Anaesthesia on IOP

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ABSTRACT

Aim: To evaluate the intraocular pressure and haemodynamic changes subsequent to insertion of laryngeal mask airway and endotracheal tube.

Methods:- After obtaining formal approval of the ethics committee of the institution and informed consent from the patients, the study was conducted on 60 adult ASA grade I and II patients aged between 50 to 65 years, taken up for elective intraocular lens implantation surgery.

Results: We used Isoflorane-Nitrous Oxide for general anesthesia in patients under going posterior chamber lens implantation and studied the effects of Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) on intraocular pressure (IOP) and hemodynamic changes (heart rate, mean arterial blood pressure). Sixty patients were studied and divided into two groups of thirty and intraocular pressures (mmHg), heart rates, mean arterial blood pressure were measured before and after ETT intubation and LMA insertion while intraocular pressure, mean arterial blood pressure and heart rate were not significantly increased in the LMA inserted group, these measurements were increased significantly in the ETT inserted group ($p < 0.05$ - $p < 0.0001$).

Conclusion: According to these results, we noticed that the use of LMA is a preferable and safe technique for the patients when high intraocular pressure is not desired.

Keywords: Laryngeal mask airway, endotracheal tube, intraocular pressure.

INTRODUCTION

Intra ocular pressure is the pressure of aqueous humor which it exerts outward, normally it is 10-20mmHg. Aqueous humor is clear fluid of anterior and posterior chamber. It helps to maintain shape of eye ball and to provide metabolic needs of posterior cornea, lens and trabecular meshwork. It is formed by inner non pigmented ciliary epithelium of ciliary body by active secretion, ultrafiltration and osmosis. Intraocular pressure is increased with age, coughing, straining, valsalva's maneuver and suxamethonium. It is decreased by all Intravenous anaesthetics except ketamine. Clinically ocular tension is measured by determining the resistance of eye to an applied force. There are two main types of tonometers used.

1. Applanation instrument (Goldman tonometer, Perkin tonometer) that determines the force required to flatten a standard area of cornea.
2. Indentation instruments (Schiotz tonometer) that measure the indentation of cornea in response to weight applied to it.

Our utmost aim is to avoid any drug, maneuver and precipitating factor which can increase intraocular pressure. Ideally the eye should be soft before the anterior chamber is opened, as a sudden decompression may produce stresses which can in

turn result in choroidal haemorrhage and risk of iris or vitreous prolapse during operation.

To establish a safe airway is one of the main principles of general anesthesia. Endotracheal tube (ETT) and laryngeal mask airway (LMA) are both current devices for this purpose. ETT insertion in general anesthesia has been used approximately for 100 years¹. One of the problems of ETT use is transient increase of intraocular pressure. Recently, LMA which was reported to cause less complications in general anesthesia. LMA was first used by Archie Brain in London Royal Hospital in 1981^{2,3,4}. In this study we compared the effects of ETT and LMA on IOP and of hemodynamic under Isoflorane -Nitrous oxide anesthesia.

MATERIAL AND METHODS

After obtaining formal approval of the ethics committee of the institution and informed consent from the patients, the study was conducted on 60 adult ASA grade I and II patients aged between 50 to 65 years, taken up for elective intraocular lens implantation surgery. The patients with cardiovascular or pulmonary disease, those with diabetes mellitus and obstetric patients were excluded from the study. All the patients were premedicated with oral midazolam 7.5 mg at night and one hour before operation; and inj. Nalbuphine 4 mg 10 to 15 minutes prior to induction. Monitoring consisted of electrocardiogram, non-invasive blood pressure, end

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tidal CO₂, oxygen saturation and airway pressure. After preoxygenation, all patients were induced with thiopentone 4mg/kg. Neuromuscular blockade was achieved with Rocuronium 1 mg/kg and anaesthesia was maintained at normocapnia with 0.5%–2% isoflurane and 60% nitrous oxide in oxygen with controlled ventilation.

RESULTS

A statistically significant rise in heart rate, systolic blood pressure, diastolic blood pressure and intraocular pressure was seen in both the groups subsequent to insertion of laryngeal mask airway or endotracheal tube. Mean maximum increase was statistically more after endotracheal intubation than after laryngeal mask airway insertion. The duration of statistically significant pressure responses was also longer after endotracheal intubation.

Laryngoscopy and tracheal intubation is a time-tested method to achieve the airway control in anesthesia practice and resuscitation. However, it is associated with significant cardiovascular response in the form of hypertension and tachycardia because of sympathetic discharge following laryngotracheal stimulation. Laryngoscopy and tracheal intubation is also known to be associated with increase in intraocular pressure. Attempts have been made by many workers in the past to mitigate or prevent cardiovascular and ocular reactions especially the acute increase in intraocular pressure (IOP) associated with laryngoscopy and endotracheal intubation. Use of Brain laryngeal mask airway (LMA) as an alternative to endotracheal tube has attracted the attention of several workers with regard to haemodynamic and IOP changes, as it obviates the need for laryngoscopy and endotracheal intubation. Previous workers, who compared IOP response to LMA and endotracheal tube insertion, have reported different results.

Table 1: Effect of LMA insertion on intraocular pressure (n=30)

Pre-induction	Post-Induction
12-16 mm Hg	18-22 mm Hg

Table-2: Effect of endotracheal intubation on intraocular pressure

Pre-induction	Post-Induction
12-16 mm Hg	22-26 mm Hg

Table 3: Effect of LMA vs endotracheal intubation on mean arterial BP (n=60)

Anesthetic Conduct	LMA (n=30)	Endotracheal Tube (n=30)
Preinduction	100-05mm Hg	100-105mm Hg
PostInduction	110-115mmHg	118-133mmHg

Table4:Effect of LMA vs endotracheal intubation on heart rate

Anesthetic Conduct	LMA (n=30)	Endotracheal Tube (n=30)
Pre-induction	80–90beats/min	80–90 beats/min
Postinduction	95-105beats/min	112–128 beats/min

DISCUSSION

Laryngoscopy and tracheal intubation, to achieve airway control in anaesthesia practice, have been consistently bothering anaesthesiologists with regard to regular occurrence of the pressor responses associated with it. The haemodynamic responses, manifesting as increase in heart rate and blood pressure, are due to reflex sympatho-adrenal discharge provoked by epilaryngeal and laryngotracheal stimulation subsequent to laryngoscopy and tracheal intubation^{6,7}. The stress response to tracheal intubation and extubation is also associated with increase in IOP^{7,8,9,10}. The mechanism of IOP rise is secondary to increased sympathetic activity. Adrenergic stimulation causes vaso and venoconstriction, and an increase in central venous pressure, which has a close relationship with IOP¹¹. In addition adrenergic stimulation can also produce an acute increase in IOP, by increasing the resistance to the outflow of aqueous humour in trabecular meshwork between anterior chamber and Schlemm's canal¹². This explains the close relationship between haemodynamic and IOP response as also seen in our study.

The acute increase in IOP may be dangerous for patients with impending perforation of eye, perforating eye injuries, glaucoma etc. This problem has drawn the attention of many workers to study the attenuation of these responses with some pre-treatment or by some alternative to laryngoscopy and tracheal intubation viz. LMA. Lignocaine pre-treatment either intravenous or nebulised, has been used to attenuate ocular and systemic responses to laryngoscopy and tracheal intubation¹³. Intranasal nitroglycerine has also been evaluated to prevent increase in IOP associated with tracheal intubation¹¹. LMA, as an alternative to endotracheal tube has attracted the attention of many workers with regards to IOP changes, as it obviates the need for laryngoscopy and tracheal intubation. Holden et al were the first one to compare the IOP changes using LMA¹⁴ and endotracheal tube and their observations as well as those of Lamb et al¹³ revealed a significantly smaller increase in IOP using LMA both on placement and removal as compared to endotracheal intubation. Similar results were reported in other studies¹⁵.

In our study we found that both groups were associated with significant haemodynamic and intraocular pressor responses after airway instrumentation, in the form of increase in heart rate, blood pressure and IOP, however the mean maximum increase was significantly higher in the tracheal tube group compared to LMA group. The duration of these responses was significantly longer in tracheal tube group. Our results are in accordance

with Holden et al¹⁴. Using intravenous propofol anaesthesia noticed no significant changes in intraocular pressure subsequent to LMA insertion or tracheal intubation¹⁶. However, they noticed fewer complications immediately following surgery in LMA group. The attenuated increase in IOP in their study was possibly due to the use of propofol. Intravenous propofol anaesthesia has been shown to cause a 30% decrease in IOP from baseline and while the stimulus of tracheal intubation increased IOP, this remained below baseline level¹⁷. Kilickan et al using alfentanil and propofol for total intravenous anaesthesia reported neither tracheal tube or LMA insertion being associated with increase in IOP¹¹. However endotracheal extubation was associated with significant increase in IOP compared to LMA removal. Haemodynamic parameters subsequently decreased below baseline values in both the groups and IOP decreased subsequently below baseline values only in LMA group. This was possibly due to the use of halothane and vecuronium both of which are known to cause fall in heart rate, BP and IOP¹⁸.

The technique of insertion of LMA is absolutely different from that of inserting an endotracheal tube. It involves no use of laryngoscopy as vocal cords do not need to be visualized and LMA does not enter trachea but instead sits on the hypo pharynx when positioned correctly. So, considering these, the pressor responses to LMA insertion were expected to be different from that of laryngoscopy and tracheal intubation. We believe that not performing laryngoscopy during insertion of LMA is one major reason for the observed attenuated pressor responses to LMA, apart from other reason like no direct laryngeal stimulation. The mechanical stimulation by pressure of laryngoscope on the soft tissue is the major factor in producing stress response to laryngoscopy and tracheal intubation¹⁹. Laryngoscopy produces the major contribution to the sympathoadrenal response and tracheal intubation per re-contributed little additional effect⁶.

The LMA offers additional advantages during emergence from anaesthesia; removal does not increase IOP and it is not accompanied by complication like coughing^{11,13}. Tracheal extubation, however, causes a marked increase in IOP, coughing and breath holding²⁰.

CONCLUSION

Laryngeal mask airway is an acceptable alternative technique for ocular surgeries, offering advantages in terms of intraocular pressure and cardiovascular stability compared to tracheal intubation.

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