THE EFFECT OF LOW DOSE ROCURONIUM ON INTRAOCULAR PRESSURE IN LARYNGEAL MASK AIRWAY USAGE

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Abstract

Background: We have compared the effect of low dose rocuronium on intraocular pressure (IOP) in larygeal mask airway usage during induction of anesthesia using propofol and fentanyl, in a randomized, double-blind study.

Method: We studied 30 patients randomly allocated to one of two groups. Anesthesia was induced with fentanyl 1 mg kg^{-1} and propofol 2 mg kg^{-1} until loss of eyelash reflex. This was followed by rocuronium 0,3 mg kg^{-1} (group R, n=15) and normal saline (group S, n=15). IOP was measured with Schiotz tonometry device preoperatively (IOP_{pre}) and after propofol infection (IOP_0) and immediately after LMA insertion (IOP_1), 1. (IOP_2), 2. (IOP_3), 3. (IOP_4), 4. (IOP_5) and 15. (IOP_{15}) minutes after laryngeal mask airway (LMA) insertion and after extubation (IOP_{ext}). The collected data were heart rate (HR), oxygen saturation (SpO_2), end-tidal carbon-dioxide pressure ($ETCO_2$) and mean arterial pressure (MAP).

Results: After LMA insertion significant decrease was found in IOP in both groups. No significant difference was found between groups.

Conclucion: Although there have been reports that LMA insertion minimally increases IOP, in our study, by using low dose rocuronium and LMA there was a decrease in IOP.

Introduction

The laryngeal mask airway (LMA) was designed as an airway management device and had some physiological effects on intraocular pressure (IOP). Endotracheal intubation (ETT) is associated with an increase in IOP but LMA has been reported to have minimal influence on the IOP measurement compared with the ETT[1].

Rocuronium is a nondepolarising muscle relaxant which provides a rapid onset with an intermediate duration of action and no obvious side-effects[2,3]. Rocuronium has been shown not to cause an increase and to cause a decrease in IOP during steady state anaesthesia[4,5].

In daily anesthesia practise, when inserting LMA, usually no neuromuscular relaxant are required, but some practitioners use different doses of depolarising or nondepolarising muscle relaxants for facilitating LMA insertion[6,7]. From time to time, we use a low dose rocuronium in anaesthesia procedures in which we use LMA[8]. This study was designed to compare the IOP effects

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of low dose rocuronium with that of LMA in patients undergoing non-ophtalmic surgery.

Methods

After obtaining Local Hospital Ethics Committe approval and informed written consent from patients, we studied 30 ASA status I and II patients, aged 18-70 years, without any known ophthalmic disease who required LMA as part of the anesthetic technique for elective non-ophtalmic surgery. The patients were randomly allocated to one of two groups (n=15 each) to receive either rocuronium (Group R) or normal saline (Group S). All patients were not premedicated. Patients' vital signs (HR, MAP, $ETCO_2$, SpO_2) and IOPs were measured preoperatively (IOP_{pre}), perioperative period (IOP_0, IOP_1, IOP_2, IOP_3, IOP_4, IOP_5, IOP_{15}) and after extubation of LMA (IOP_{ext}). All drugs were administered into a rapidly running i.v infusion by one anesthetist (first anesthetist) who was unaware of the drug administered. After the patients were preoxygenated for 3 minutes, anesthesia was induced using fentanyl 1 µg kg^{1} and propofol 2 mg kg^{-1}. Patients were ventilated via face mask with oxygen following the induction of anesthesia to maintain the $ETCO_2$ in the range 34-36 mmHg. Immediately, this was followed by either rocuronium 0,3 mg kg^{-1} (diluted to 5 ml with 0.9% saline) (Group R) or 5 ml 0.9% saline (Group S). The LMA was inserted in all patients by the same experienced anesthetist the first attempt without any difficulty in the third minute after administration of rocuronium or saline. Experienced eye surgeon measured the IOP. The IOP were measured with Schiotz tonometry after fentanyl, propofol and rocuronium or saline administration. [IOP_0: at induction (immediately after fentanyl, propofol and rocuronium or saline administration), IOP_1: after intravenous induction of fentanyl, propofol and rocuronium or saline administration, immediately after LMA insertion), IOP_2: 4 minutes after fentanyl, propofol and rocuronium or saline administration (1 minute after LMA insertion) IOP_3: 5 minutes after fentanyl, propofol rocuronium or saline administration (2 minute after LMA insertion), IOP_4: 6 minutes after fentanyl, propofol and rocuronium or saline administration, 3 minutes after LMA insertion), IOP_5: 7 minutes after fentanyl, propofol and rocuronium or saline administration, 4 minutes after LMA insertion, IOP_{15}: 15 minute after LMA insertion, and IOP_{ext}: after LMA extubation].

The results were analysed statistically. Results are expressed as the mean and standard deviation (±SD). Fisher's Exact test and Pearson Chi-square test were used in comparing the groups relation to qualitative parameters as sex and difficulty in LMA insertion. Two way analysis of varience for repeated measurements (ANOVA) were performed to analyse the change IOP, HR, MAP, SpO_2, $ETCO_2$ using Statistical Package for Social Sciences (SPSS)/Version 15.0 for Windows computer software. For comparing IOP values at different times, Student's paired t test was used with Bonferroni correction. Less than 0.05 was the criterion for statistical significance.

Results

There was no significant difference between groups in age (year), sex (male/female), BMI (kg/m2), operation time (minute), preoperative IOP (mmHg), preoperative MAP (mmHg), preoperative HR (beat/minute) and preoperative oxygen saturation (%). ($p>0.05$) (Table 1). When comparing groups relation to hemodynamic parameters (HR, MAP, SpO_2, $ETCO_2$) no statistical difference was found in group measurements and among the groups ($p>0.05$).

Table 1
There was no significant difference between groups in age (year), sex (male/female), BMI (kg/m2), operation time (minute), preoperative IOP (mmHg), preoperative MAP (mmHg), preoperative HR (beat/minute) and preoperative oxygen saturation (%). (p>0.05)

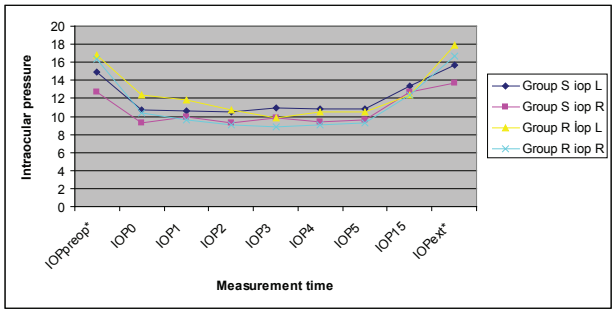
	Group S (n=15)	Group R (n=15)	p
Age (year)	39,61±11,77	42,14±12,73	0,57
Sex (Male/Female)	23/2	22/3	0,59
BMI (kg/m2)	26,35±4,38	27,92±5,82	0,54
Operation time (minute)	48,84±22,56	53,35±20,43	0,49
Initial MAP (mmHg)	105,69±17,59	108,14±14,57	0,90
Initial HR (beat/minute)	78,23±9,79	85,14±13,11	0,15
Initial SpO_2 (%)	99,53±0,77	99,21±0,97	0,33
Initial IOP (Left)	14,92±3,96	16,78±4,27	0,42
Initial IOP (Right)	12,76±3,69	16,36±5,14	0,07

Table 2
Intraocular pressure measurements at selected times

		IOPpreop	IOP0	IOP1	IOP2	IOP3	IOP4	IOP5	IOP15	IOPext
Group S	İop L	14,92	10,77	10,6	10,53	10,95	10,84	10,85	13,42	15,65
	iop R	12,76	9,3	9,97	9,3	9,87	9,43	9,62	12,74	13,7
Group R	İop L	16,78	12,35	11,77	10,7	9,8	10,53	10,52	12,42	17,91
	iop R	16,36	10,4	9,61	9,09	8,8	9,07	9,3	12,35	16,71
P	İop L	0,42	0,08	0,58	0,89	0,14	0,9	0,86	0,26	0,42
	iop R	0,07	0,16	0,79	0,83	0,34	0,69	0,39	0,47	0,1

Changes in IOP in both groups are presented in Fig. 1. In both groups, no statistical difference was found in the right and left eye IOP values in any measurement ($p>0.05$). When comparing the groups relation to IOP changes, no statistical difference was found between the two groups ($p>0.05$). In analysing the groups, the IOP values in the preoperative (IOPpre) and immediately after postextubation (IOPext) were found significantly higher ($p<0.05$). Significant decrease was found in IOP_4 and IOP_{15} after LMA insertion in both groups. No significant difference in the decrease ratio was found between groups. But when comparing the groups relation to IOP left and right preoperatively and immediately after post extubation no significant difference was found between thr groups ($p>0.05$) (Table 2).

Fig. 1
Intraocular pressure measurements at selected times



Change in IOP in both groups, the IOP values in the preoperative (IOPpre) and immediately after post extubation (IOPext) were found significantly higher. Significant decrease was found in IOP_4 and IOP_{15} after LMA insertion in both groups. (*$p<0.05$).

Discussion

This study demonstrated that the insertion of LMA when done after using a low dose rocuronium (0.3 mg kg^{-1}), did not cause a rise in IOP. Rocuronium reduces the tone of extraocular muscles and produces decrease in arterial and venous pressure due to paralysis[9]. LMA is a known concept in airway management and has gained a firm position in anesthesiology practice[10]. Use of the LMA permits the maintenance of a patent airway without the need for laryngoscopy and tracheal intubation and advantages over the tracheal tube included minimal rise in intraocular pressure following insertion[1,10,11]. The minimal changes in intraocular pressure may be of benefit to patients with glaucoma[12]. The low frequency of coughing during emergence may be beneficial to patients following open eye or ear nose and throat (ENT) surgery where excessive straining is potentially harmful[1].

There have been reports in the literature about LMA which revealed no significant changes in mean IOP[12-15]. In one study, a small but significantly higher IOP was found after LMA insertion than before[16] whereas in another study it was found less[10,11]. During total intravenous anesthesia (TIVA), without the use of muscle relaxants neither LMA insertion nor ETT increased the IOP but extubation increased IOP[17]. The changes in hemodynamic and IOP during emergence from anesthesia are less during placement and removal of the LMA than during tracheal intubation and extubation[10,11].

Neuromuscular block has certain effects on IOP. An increase in IOP after succinylcholine is one of its undesirable effects, especially in patients with an open eye surgery[4]. Rocuronium has been shown to cause a decrease in IOP during steady state anesthesia. The results of Robertson EN study confirmed that

rocuronium did not cause an increase in IOP and provided good to excellent intubating conditions at 60 seconds after administration. Rocuronium, with its rapid onset time and lack of IOP effects, would appear to be the relaxant of choice in patients with penetrating eye injuries requiring emergency tracheal intubation when a longer-acting neuromuscular blocking agent is not contraindicated[5]. Rocuronium reduces the tone of extraocular muscles and produces decrease in arterial and venous pressures due to paralysis[6].

One limitation to our study is the sample size, involving 30 subjects. In our study we found that low dose rocuronium bromide has no effect on vital signs and IOP after LMA insertion. In conclusion, rocuronium 0.3 mg kg^{-1} when used with LMA does not cause a rise in IOP. But future studies involving wide series are required to investigate the alternativity of our method.

Acknowledgements

We would thank Dr. Sedat Ziyade for statistical analysis in this study.

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