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Effect of lidocaine Instillation into Endotracheal Tube on Intraocular Pressure during Extubation

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Abstract

Objectives: To study the effect of lidocaine instillation into endotracheal tube before extubation on intraocular pressure (IOP) and hemodynamics.

Patients and methods: 60 patients, (ASA) I-II, ages between 18 to 40 years were scheduled for elective unilateral ocular surgery (cataract, squint and ptosis). Patients were randomly classified into two groups of 30 patients each: lidocaine group; received 1 mg/kg lidocaine into the endotracheal tube before extubation, and control group; received saline into the endotracheal tube. IOP, systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were all measured before and after extubation.

Results: a significant increase of IOP in control group at 2, 5 and 10 minutes after extubation (P<0.01) when compared to baseline value (2 min. before extubation). The elevation in IOP in lidocaine group at 2 min was significantly less than that in control group (P<0.05), the readings of IOP at 5 and 10 min. was lower in lignocaine group compared to control group. Both groups showed significant increase in SBP and DBP after extubation compared to baseline (2 min. before extubation), and elevation in lignocaine group was significantly lower than that of control group (p=0.0001).

Conclusion: Instillation of lidocaine into endotracheal tube before extubation attenuates IOP after extubation

Keywords: Lidocaine; Endotracheal tube; Intraocular pressure; Extubation

Introduction

Increase in intraocular pressure (IOP) may have little adverse effects in patients with healthy eyes but has dangerous effects on a diseased or an injured eye. Efforts must be made to maintain intraocular tension at or below normal levels [1]. The stress response to tracheal intubation and extubation is associated with elevation in IOP mainly due to increased sympathetic stimulation [2,3]. Lower pharynx, epiglottis and larynx contain numerous sensory receptors which respond to chemical, thermal and mechanica1 stimuli. The mechanoreceptors are abundant especially in the lower pharyngeal wall, epiglottis and vocal cords. Stimulation of these mechanoreceptors during intubation or extubation can produce reflex motor responses like cough, hiccup and also reflex sympathetic stimulation and cardiovascular pressor response [4] and release of catecholamines from the adrenal medulla into the circulation [5]. The result of all these adrenergic outflow may cause vasoconstriction, tachycardia and an increase in central venous pressure which has a closer relationship to IOP than systemic pressure [6], this can produce an acute increase in IOP by increasing the resistance to the outflow of aqueous humor in the trabecular meshwork between the anterior chamber and the Schlemm's canal [7].

Although intubation has been regarded very much especially when there is a problem in airways, but extubation of patients has not been considered a lot. Anesthesia specialists know that the short time period after extubation is very harmful and causes several events such as laryngospasm, aspiration, lack of perfect opening of airways, lack of enough pulmonary rehabilitation, may result in marked increase IOP, and can develop myocardial ischemia especially in patients suffering from coronary artery disease [8]. Four urgent drugs including epinephrine, lidocaine, naloxan and atropine are injected into tracheal tube and are absorbed from endotracheal membrane because of its abundant vessels [9-12]. For avoidance of these complications, it is important to maintain IOP and cardiovascular condition at the end of general anesthesia, therefore, the aim of this study was to determine the effect of lidocaine instillstion into endotracheal tube before extubation on IOP and hemodynamics.

Patient and Methods

The study was conducted in Al-Minia university Hospital from April 2014 to February 2015. After approval by ethical committee and obtaining informed consents from patients, the study was carried out on sixty ASA grade I and II, patients of either sex , aged from 18 to 40 years, taken up for elective ophthalmic surgeries (unilateral cataract, squint, ptosis). Patients were divided into 2 equal groups (n=30 each group) by simple random sampling. Patients with history of glaucoma, suspected difficult airway, uncontrolled hypertension, diabetes mellitus and obesity were excluded. Monitoring included electrocardiography, heart rate (HR), pulse oximetry, end tidal carbon-dioxide measurement, and noninvasive blood pressure using the monitor (Spacelabs; model 90364, USA). An intravenous (IV) access was secured in operation room and all patients received fentanyl 1.0 μg/kg IV followed by induction of anesthesia with thiopentone sodium (5-7 mg/kg) to loss of eyelash reflex, atracurium bromide 0.5 mg/kg was given for neuromuscular (NM) blockade. Lungs were mask ventilated for 3 min with 100% oxygen with isoflurane, then endotracheal tube inserted with Macintosh laryngoscope and was fixed using adhesive tapes to the skin over maxilla and mandible, the patients were then connected to mechanical ventilation using positive intermittent mandatory ventilation (PIMV). Patients in whom more than one attempt was required for correct placement of the tube were excluded from the study. Anesthesia was maintained using isoflurane and atracurium top ups for NM blockade. Near the end of surgery, we asked the surgeon to till us when there is 10 min remaining before finishing the surgery to instill 1.0 mg/kg lidocaine (2%) inside the endotracheal tube in lidocaine group patients. At the end of the surgery, isoflurane was stopped and the residual NM blockade was antagonized with neostigmine and atropine in appropriate dosages. Lidocaine spray (10%, 10 mg/dose) was sprayed 2 sprayes (20 mg) inside the pharyngeal cavity one minute before extubation in patients of the 2 groups. Extubation was performed when the patient was able to open his healthy eye in reply to verbal orders. IOP was measured in the non-operated eye (previously prepared with lubricant eye drops) 2 min before extubation and subsequently three times at 2, 5, 10 minutes after extubation using Schiotz tonometer (The Diagnostic Company: Riester, Germany). Hemodynamic parameters which included heart rate, systolic and diastolic blood pressure were recorded simultaneously at the time of measuring IOP. These measurements were recorded by assistant anesthetist he was blinded to the study groups.

Statistical Analysis

Based on our pilot study of 5 patients in each group, a sample size of 30 patients per group was required to achieve a power of 80% with an alpha error of 5%, to detect a change in intraocular pressure of 35% from baseline value after extubation in control group versus 6% in lidocaine group.

For statistical analysis, Statistical Package for the Social Sciences (SPSS), version 16.0 (SPSS Inc., Chicago III) software was used. Continuous quantitative data were expressed as mean, standard deviation, median and range were calculated. Qualitative data were presented as number and proportion, and analyzed using Chi-square test or Fischer's exact test as appropriate. Normality test was used to identify a distribution as not normal when the distribution is skewed. Non-parameteric data were compared with Mann-Whitney test to compare independent groups and Wilcoxon test to compare related groups. $P<0.05$ was considered to be significant and $P<0.01$ was considered highly significant.

Results

In our study, 60 young adult patients, ASA class I and II were divided into 2 equal groups (30 patients each), selected to study the effects of lignocaine instillation into the endotracheal tube before extubation on IOP and hemodynamics. The two study groups were comparable with respect to weight, age, sex and surgical procedures (Table 1). Regarding hemodynamic changes (Table 2) both groups showed significant increase in SBP at 2 and 5 minutes after extubation when compared to baseline (2 min. before extubation), and the elevation in lidocaine group at 2 min was significantly lower than that of control group ($p=0.0001$). Both groups showed significant increase in DBP at 2 minutes after extubation when compared to base line (2 min. before extubation), and the elevation in lidocaine group at 2 and 5 min. was significantly lower than that of control group ($p=0.002$) and ($p=0.003$) respectively. HR showed non-significant differences neither within each group nor between the two groups.

Regarding IOP changes (Table 3), there was a significant increase in readings of IOP in control group at 2, 5 and 10 minutes after extubation ($P<0.01$) when compared to baseline value (2 min. before extubation). IOP showed a significant increase in lidocaine group at 2 min after extubation ($P<0.05$). The elevation in IOP in lidocaine group at 2 min was significantly less than that in control group ($P<0.05$), the readings of IOP at 5 and 10 min. was lower in lidocaine group compared to control group.

Discussion

We must avoid the increase in ocular congestion or increase of IOP during intraocular surgery because of undesirable and possibly dangerous effects, as expulsion of vitreous humor from the open eye. So, ideal anesthetic technique for intraocular surgery should produce a moderate reduction in IOP at near normal values and avoid marked fluctuations during surgery.

Variables	Control (n=30)	Lidocaine (n=30)	P-value
Age (years)	30.3 ± 6.2	31 ± 5.7	0.65
Sex (M/F)	19/11	16/14	0.43
Weight (kg)	69.6 ± 8.9	70 ± 12.3	0.88
ASA (I/II)	22/8	20/10	0.57
Operative time (min)	47.7 ± 14.6	51.5 ± 13.9	0.30
Operative type (Cataract/Ptosis/Squint)	16/8/6	18/7/5	0.87
Data are expressed as mean ± standard deviation for quantitative data or number for qualitative data. T-student test was used to compare quantitative data and Chi-square test was used to compare qualitative data.			

Table 1: Demographic data in the studied groups.

Parameters	Control (n=30)	Lidocaine (n=30)	P-value
SBP 2 min before extubation	113 ± 7.67 114 (95-126)	111 ± 6.73 110 (101-130)	0.14
SBP 2 min after extubation	130 ± 4.87° 130 (119-139)	120.96 ± 1.56° 121 (117-124)	0.0001*
SBP 5 min after extubation	114.96 ± 5.22 116 (103-125)	113.96 ± 6.59 113 (100-127)	0.50
SBP 10 min after extubation	112 ± 6.54 112 (102-126)	112.03 ± 3.25 112 (103-118)	0.85
DBP 2 min before extubation	69.03 ± 5.11 69 (61-80)	66.93 ± 4.07 67 (56-75)	0.16
DBP 2 min after extubation	75.10 ± 5.19° 74 (68-86)	71 ± 3.18° 71 (65-76)	0.002*
DBP 5 min after extubation	70.03 ± 4.29 70.5 (60-81)	67.83 ± 1.01 68 (66-70)	0.003*
DBP 10 min after extubation	67.96 ± 5.24 67.5 (54-81)	66.03 ± 2.55 66 (61-72)	0.09
HR 2 min before extubation	80.03 ± 10.78 80.5 (62-104)	78.03 ± 14.29 79 (45-107)	0.56
HR 2 min after extubation	85.96 ± 12.74 86 (62-104)	82.06 ± 12.10 79.5 (64-115)	0.15
HR 5 min after extubation	81.10 ± 9.88 79.5 (53-102)	78.96 ± 2.04 79 (74-83)	0.49
HR 10 min after extubation	81.93 ± 10.20 82 (62-108)	78 ± 3.22 77 (73-84)	0.12
Data are expressed as mean ± standard deviation and median (range); °Significant difference with baseline (within group); *Significant difference between groups; Mann-Whitney test was used for intergroups comparisons and Wilcoxon test was for within group comparison. SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; HR: Heart Rate.			

Table 2: Comparison of hemodynamic changes before and after tracheal extubation in the studied groups.

Parameters	Lidocaine (n=30)	Control (n=30)	P-value
IOP 2 min before extubation	11.10 ± 1.76 11 (8-15)	11.56 ± 1.40 12 (9-14)	0.24
IOP 2 min after extubation	13.53 ± 1.07° 14 (11-15)	16.76 ± 1.10° 17(14-20)	0.0001*
IOP 5 min after extubation	11.53 ± 0.57 11.5 (11-13)	14.23 ± 0.56° 14 (13-15)	0.0001*
IOP 10 min after extubation	10.50 ± 0.50 11 (9-11)	12.40 ± 0.67° 12 (11-14)	0.0001*
Data are expressed as mean ± standard deviation and median (range); °Significant difference with baseline (inside group); *Significant difference between groups; Mann-Whitney test was used for intergroups comparisons and Wilcoxon test was for within group comparison; IOP: Intraocular Pressure.			

Table 3: Comparison of intraocular pressure changes before and after tracheal extubation in the studied groups

In our study we selected the young adult age (18-40 years) as airway reflexes are attenuated by age and these reflexes are prominent in these middle ages than more old ages [13], intratracheal injection of lidocaine markedly attenuated the rise in IOP during the short period after extubation, and all IOP measurments (2, 5 and 10 min) after extubation were significantly lower in ledocaine than placebo. The hemodynamic responses in these times showed attenuation in lidocaine group when compared to placebo, SBP was significantly lower at (2 min), and DBP was significantly lower at (2 and 5 min) after extubation. HR readings were lower in lidocaine than placebo group.

In the study of Ebrahim N; the IOP readings were elevated after intubation and extubation, the highest level of IOP was at first minute after intubation and extubation. The increase of IOP was more after extubation than after intubation. The time passed after extubation till return the IOP to near base line was 10 minutes [14]. Also, similar observation by Pandya; who compared the effect of endotracheal tube versus laryngeal mask on IOP, they showed that IOP increased after extubation [15]. The previous studies coincide with our finding that extubation stress elevates IOP. We tried to avoid or attenuate this rise in IOP after extubation by instilling lidocaine inside the endotracheal tube before extubation; we found reduction and attenuation in this rise in lidocaine group.

Bidway and Stanly examined effects of lidocaine on blood pressure and HR in response to extubation. They injected 1.5 cc of lidocaine into tracheal tube 3 to 5 minutes before extubation and then they instilled 1cc (4%) lidocaine just before extubation. They showed no increase in blood pressure and HR during 1 to 5 minutes after extubation [16]. Tavakkol and his colleagues [17] studded the effect of lidocaine injection into endotracheal tube on incidence of cough and laryngospasm. In test group 100 mg (5 ml) of lidocaine 2% and in control group the same volume of placebo (normal saline) was injected into endotracheal tube. Using anesthesia drugs stopped 5 to 10minutes before end of the surgery and after ending the operation extubation took place. The number of coughs and laryngospasm assessed, recorded and compared. Numbers of coughs were higher in control group and the difference between 2 groups was significant. We decide to test this abolishing effect of lidocaine on IOP as it increased during intubation and extubation pharyngeal use of lidocaine to suppress the supraglottic origin of stress reflexes, but endotracheal lidocaine instillation attenuates manly infraglottic reflexes during extubation

We can conclude that lidocaine instillation into endotracheal tube before extubation can attenuate and prevent marked rise in IOP. It can be beneficial especially in open eye surgery.

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