

Comparison of Intravenous Lidocaine versus Hyoscine on Prevention of Oculocardiac Reflex in Strabismus Surgery

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Abstract

Purpose: Oculocardiac reflex (OCR) is a frequent event during strabismus surgery. The aim of this study is to compare the preventive effect of intravenous lidocaine and hyoscine on OCR.

Methods: This prospective, randomized clinical trial was performed on 75 patients (5-63 years old) underwent strabismus surgery. Patients divided randomly into three groups. Intravenous hyoscine (0.2 mg/kg), lidocaine (1.5 mg/kg) and distilled water were injected before induction with propofol for each group respectively under standard monitoring. Heart rate, blood pressure and/or cardiac dysrhythmia were recorded immediately before/after injection and muscle hooking. Decrease of heart rate more than 20%, hypotension (decrease more than 20% in systolic or diastolic pressure) or any cardiac dysrhythmia were defined as OCR.

Results: One hundred and thirty-six muscles were hooked during strabismus surgery. OCR was observed in 44 hooked muscles (32.3%). Reflex was observed in hyoscine (34.2%), lidocaine (24.9%) and control (40.9%) groups ($p=0.12$). The most stretched muscles which caused OCR were medial rectus (56.8%) and lateral rectus (36.3%) muscles. OCR was greater in patients with age between 5-10 years (56%).

Conclusion: Intravenous lidocaine and N-buthylbromide hyoscine both could reduce OCR occurrence but the difference was not statistically significant compared to the control group. OCR was seen greater in young patients (5-10 years old). Some patients (specially children) need intervention to restore normal condition.

Keywords: Hyoscine, Lidocaine, Oculocardiac Reflex, Strabismus

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Introduction

Oculocardiac reflex (OCR) occurs due to extraocular muscle traction or any globe stimulation. This reflex is one of the important events that can occur in ophthalmic anesthesia and causes bradycardia, premature ventricular contraction, atrioventricular block, asystole or myocardial infarction due to coronary spasm and death.^{1,2} The incidence of OCR is 32-90%^{3,4} strongly depends on observation and definition of OCR (e. g 10-20% decreases in heart rate). The afferent pathway is started from ciliary ganglion, and then goes to ophthalmic branch of trigeminal nerves and brain stem nucleus. The efferent pathway is vague nerve which ends in the sinoatrial node of the heart.⁵⁻⁷ OCR is mostly temporary and fatigable reflex; and also heart rate response to the surgical manipulation is gradually decreased.⁸⁻¹⁰ On the other hand, this reflex is intensified in hypoxemia, hypercarbia, and insufficient anesthesia depth.^{1,11} Various preventive methods have been used for OCR. A more common compound is anticholinergics.^{12,13} Intravenous atropine leads to muscarinic blockage of the sinoatrial node and can cause OCR blockage lidocaine is antiarrhythmic drug that can blunt the neural reflexes and anesthetize mucosal surfaces. Lidocaine is used before induction to decrease pain of injection and lowered cardiovascular stimulation during laryngoscopy and intubation.⁵⁻⁷ Hyoscine is anticholinergic drug that increase heart rate but has anticholinergic side effects such as cardiac arrhythmia and dry mucosal surface.^{8,9} The aim of this study was to assess incidence of OCR and compare effect of intravenous lidocaine versus hyoscine for prevention of OCR in strabismus surgery.

Methods

With approval of the local ethical committee of medical university, this prospective, randomized and double blinded study was conducted on 75 patients who were admitted for strabismus surgery. Inclusion criteria were age 5-63 years old and any horizontal or vertical strabismus greater than 20 prism diopters in primary deviation which need surgical correction. Exclusion criteria were history of cardiorespiratory disease and

previous strabismus surgery. After explaining to patient or parents and get consent form, a catheter was placed into the midcubital veins. Standard monitoring with electrocardiography, pulse oximetry, end-tidal CO₂, heart rate, and noninvasive arterial blood pressure were applied and vital signs recorded. The patients randomly divided into three groups. Before induction with propofol, for first group distilled water, for second group lidocaine 1.5 mg/kg (20 mg/ml), and for third group (0.2 mg/kg) N-buthylbromide hyocine (4 mg/ml) were injected. Then anesthesia was induced with propofol (2 mg/kg), fentanyl (1 µg/kg), atracurium (0.3 mg/kg). After two minutes, appropriate laryngeal mask was inserted and set mechanical ventilation to keep end-tidal CO₂ between 35-45 mmHg. The anesthesia was maintained by propofol (100-150 µg/kg/min) and N₂O-O₂ (50%). For prevention of postoperative nausea and vomiting, intravenous ondansetron (0.2 mg/kg, maximum 4 mg), was injected 5-10 minutes before termination of surgery. Type of surgeries (unilateral or bilateral) was chosen according to presence of amblyopia and/or ocular dominance. If patients did not have ocular dominance, patients randomly divided for unilateral or bilateral strabismus surgery. All surgeries were done by one surgeon.

The proposed drugs (5 ml syringe numbered) were injected by anesthesiologist. The surgeon and anesthesia technician (data collector) were blinded for type of drugs. Heart rate and blood pressure were recorded immediately before, after injection and muscle traction with hook. Decrease of heart rate more than 20%, decrease of more than 20% in systolic or diastolic pressure and/or dysrhythmias during extra ocular muscle manipulations were defined as activation of OCR. When severe bradycardia (pulse rate below 40/minute), hypotension (less than 80/60 mmHg) or dysrhythmias occurs, intravenous atropine (20 µg/kg) was administered.

Data were analyzed with SPSS software version 11. χ^2 test, Fisher exact test (for qualitative variables), student T test and Anova test (for quantitative variables) were used for statistical analysis. P-value<0.05 was considered statistically significant.

Results

In this study, 75 patients were divided into three equal groups: hyoscine (A), lidocaine (B) and control (C) groups. Average ages were 15 ± 3 years, range (5-43 years), 20 ± 4 years range (5-63 years), 18 ± 3 years range (5-32 years) for A, B and C groups, respectively ($p=0.58$). Male to female ratio were 13/12, 14/11, 12/13 in A, B and C groups, respectively ($p=0.66$). Type of strabismus was congenital esotropia (five cases), acquired esotropia (four cases), duane syndrome (one case), alternate exotropia (13 cases) and superior oblique palsy (two cases) in group A. Congenital esotropia (three cases), acquired esotropia (three cases), alternate exotropia (15 cases), duane syndrome (two cases) and superior oblique palsy (two cases) were in group B. Group C consist of congenital esotropia (four cases), acquired esotropia (four cases), alternate exotropia (15 cases), duane syndrome (one case) and superior oblique palsy (one case). Unilateral surgeries (recess and/or resect) were performed in 68%, 64%, and 64% in group A, B, and C respectively ($p=0.5$). Bilateral surgery (recession) was done in 32%, 36%, and 36% in group A, B, and C respectively ($p=0.5$). Mean heart rates and blood pressure before and during muscle traction were shown for each group in table 1 which showed no significant statistical difference.

One hundred thirty-six muscles were hooked and stretched in this study. OCR was observed in 44 stretched muscles (32.3%) (34.2%, 24.9%, and, 40.9% in hyoscine, lidocaine and control groups, respectively); this difference was not statistically significant ($p=0.12$). Group A consist of 49 hooked muscles, OCR was observed in 17 (34.2%) stretched muscles. They included medial rectus (13) and lateral rectus muscle (4). Group B consist of 45 hooked muscles, OCR was observed in 11 hooked muscles (24.9%) which included medial rectus (5), lateral rectus (4), and inferior oblique muscle (2). Group C consisted of 42 stretched muscles, OCR was

observed in 17 (40.9%) hooked muscles. They consisted of medial rectus (7), lateral rectus (8), inferior rectus (1) and inferior oblique muscle (1). Table 2 shows characteristic of OCR activation during muscle hooking in study groups. Among the 136 muscles which underwent surgery, the most stretched muscles which caused OCR were medial rectus muscle (56.8%) and then lateral rectus muscle (36.3%). Other muscles which stimulated OCR reflex included inferior oblique (0.6%) and inferior rectus muscle (0.2%). Among stretched muscles which activated reflex, 47% were seen in first hooked muscle and 53% in second hooked muscle in group A ($p=0.5$). These were 54% for first hooked muscles, 46% for second hooked muscles ($p=0.5$), 64% for first hooked muscles, 36% for second hooked muscle ($p=0.03$) in group B and C, respectively. No obvious statistical difference was observed between OCR activation and type of the stimulated muscle in this study ($p=0.13$). Difference between first hooked muscle and second hooked muscle in OCR activation was not significant statistically in this study ($p=0.1$).

OCR activation was seen in six male and seven female patients in group A ($p=0.5$), six males and five females in group B ($p=0.4$), nine males and five females in group C ($p=0.02$). No statistical significant difference in activation was seen between male and female in this study ($p=0.01$).

There was a significant difference between age and prevalence of OCR activation ($p=0.002$). OCR activation was observed mostly in patients with age between 5-10 years (56%). The incidence of this reflex between age 5-10 years were 58%, 63% and 47% for group A, B, and C, respectively ($p=0.1$). Figure 1 shows OCR activation in different age groups. Intravenous atropine was injected in 2, 5, and 5 patients in hyoscine, lidocaine and control groups, respectively. There was no significant statistical difference ($p=0.41$).

Table 1. Demographic and hemodynamic parameters in each study group

| | Group A | Group B | Group C | p-value |
|---|------------|------------|------------|---------|
| Age (year) | 15±3 | 20±3 | 18±4 | 0.58 |
| Sex (M/F) | 13/12 | 14/11 | 12/13 | 0.66 |
| Mean pre hooking heart rate (per minute) | 105±18 | 89±15 | 87±19 | 0.07 |
| Mean heart rate during hooking (per minute) | 86.2±15.1 | 82.1±16.2 | 84.3±16.8 | 0.52 |
| Mean pre hooking blood pressure (mmHg) | 115.9±13.3 | 119.1±18.6 | 115.1±12.9 | 0.61 |
| Mean blood pressure during (mmHg) hooking | 100±11 | 112±13 | 110±8 | 0.31 |
| Unilateral/bilateral surgery (%) | 68/32 | 64/36 | 64/36 | |

Table 2. Oculocardiac reflex activation in hooked muscles in each study groups

| | Group A | Group B | Group C | p-value |
|-----------------------------------|-------------------------------------|-----------------------------|---|---------|
| Hooked muscles | 49 | 45 | 42 | 0.5 |
| OCR activation (muscle) | 17 (34%) | 11 (24%) | 17 (40%) | 0.12 |
| OCR activation (patient) | 13 (52%) | 11 (44%) | 14 (56%) | 0.7 |
| OCR in first/second hooked muscle | 8/9 | 6/5 | 11/6 | |
| Type of hooked muscles | MR (23), LR (20), SR (2), IR (2) | MR (16), LR (26), IO (2) | MR (14), LR (23), IR (2), IO (2), SO (1) | |
| OCR activation (type of muscle) | MR (13), LR (4) | MR (5), LR (4), IO (2) | MR (7), LR (8), IR (1), IO (1) | |

OCR: Oculocardiac reflex, MR: Medial rectus, LR: Lateral rectus, SR: Superior rectus, IR: Inferior rectus, IO: Inferior oblique, SO: Superior oblique

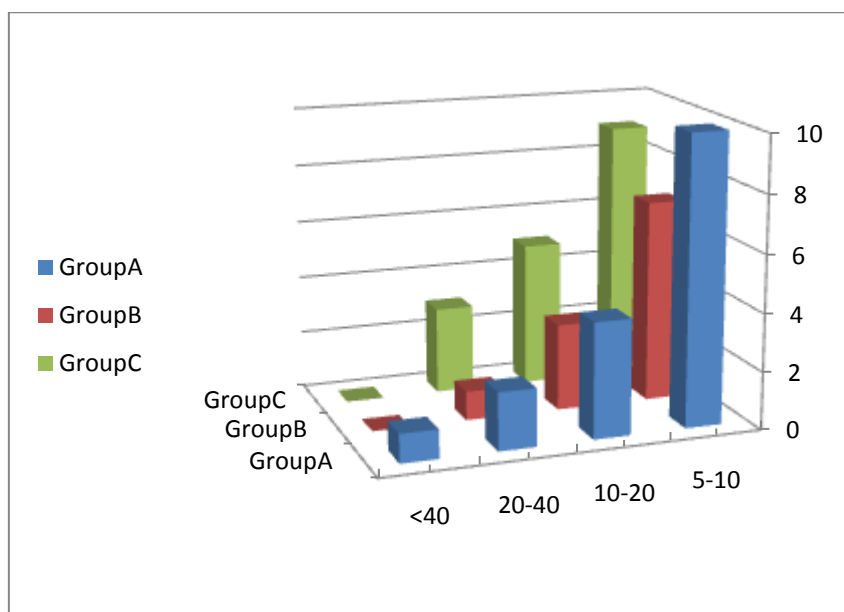


Figure 1. Oculocardiac reflex activation in different age groups

Discussion

Strabismus is the most common eye surgery in children which is accompanied by intraoperative and postoperative side effects such as OCR activation, nausea and vomiting. Prevalence of OCR in strabismus has been reported to be 32-90%.^{3,4} In this investigation, overall OCR prevalence (20% reduction in

heart rate) was 32.3%. Maximum and minimum rates of OCR in this work were among 5-10 years-old children (56%) and adults aged 40-65 years old (4%).

Hyoscine and atropine lead to decreased OCR and, since atropine causes more increase in heart rate, it has been said to be

more effective than hyoscine.³ In some studies, nerve block by lidocaine and bupivacaine has been applied at the site of surgery irritation in order to inhibit OCR.^{14,15} In a study, lidocaine gel was compared with 0.5% proparacaine eye drop; none of them showed a significant difference in controlling OCR; but lidocaine gel was more effective in controlling postoperative pain than the eye drop.¹⁶ On the other hand in some studies, topical lidocaine didn't have effect on preventing OCR.¹⁷

Numerous efforts have been made to control OCR using anesthesia method. In one investigation, sevoflurane instead of remifentanil infusion was found to be more effective in controlling OCR.¹⁸ In another study, sevoflurane was reported to be more effective than halothane inhalation for controlling OCR.¹⁹ In some studies, using ketamine during anesthesia was more effective than propofol, inhalation gases such as halothane and sevoflurane, or remifentanil.²⁰⁻²² We used the same regimen (propofol) in our study groups and did not compare it with another anesthetic drug for OCR control.

In the present study, effects of intravenous lidocaine and hyoscine were compared with the control group. There was a relative decrease of OCR in the lidocaine and hyoscine groups in comparison to the control group; this difference was not statistically significant. Contradictory results have been obtained in numerous studies which have compared atropine and topical lidocaine in OCR.¹⁷ Atropine has been reported to be effective in controlling OCR in some reports, even more effective than topical lidocaine^{4,17} but Snir et al showed that intravenous atropine and topical lidocaine did not have a statistically significant difference in controlling OCR.^{23,24}

Occurrence of OCR in children, specially infants, has been more evident than adults and they have also had more need for treatment. Some studies have necessitated the routine use of intravenous atropine before strabismus surgery in children.^{13,25} Correlation between age and OCR activity in our study showed that OCR had a significant positive occurrence in children of 5-10 years which is in concordance with other studies.

In spite of decrease in rate of OCR in intravenous lidocaine and hyoscine groups compared to the control group, this difference was not statistically significant.

Limitations of this study were small sample size, different instrument for anesthesia, and different technicians who collected data. OCR activation may relate to depths of anesthesia. In this study we did not use bispectral index for measurement of maintenance and depths of anesthesia which could affect the incidence of this reflex.

Conclusion

Hyoscine as much as lidocaine decrease OCR but did not inhibit it. OCR was seen more after in young patients (5-10 years old). It is advised to use an anticholinergic in children under 10 years to reduce or inhibit the OCR reflex.

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