

Brief report

Comparison of the Effect of Atracurium and Cisatracurium on Intraocular Pressure and Pupillary Diameter

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Abstract

Purpose: Although there are ample evidences for the effects (mostly decrease) of intraocular pressure (IOP) after the administration of atracurium and cisatracurium during general anesthesia in ophthalmic operations, no study has yet been done to compare their effects on both IOP and pupillary diameter (PD) simultaneously. The aim of this study was to determine whether there is any difference between the effects of atracurium and cisatracurium on IOP and PD.

Methods: Sixty patients with American Society of Anesthesiologists class I-II without history of previous eye surgery were studied in two randomly divided, double-blind groups. Following induction of anesthesia, atracurium (0.6 mg/kg) and cisatracurium (0.15 mg/kg) were administered to each group. IOP was measured by applanation tonometry (TONO – PEN ® XL) and PD (COLVARD pupillometer) at six sequential occasions, before induction of anesthesia, 2 and 5 minutes after induction and 2, 5 and 10 minutes after intubation prior to initiation of operation. Then they were compared to each other.

Results: Trend of recorded IOP and PD values showed that there were no statistically significant differences between atracurium and cisatracurium according to their effect on IOP ($p=0.125$) and PD ($p>0.137$) during the course of study.

Conclusion: It seems that both atracurium and cisatracurium have similar effects on IOP and PD before and up to ten minutes after tracheal intubation prior to surgical intervention.

Keywords: Atracurium, Cisatracurium, Intraocular Pressure, Pupillary Diameter, Endotracheal Intubation, General Anesthesia

Introduction

During ophthalmic operations, under general anesthesia, accurate control of intraocular pressure (IOP) is very necessary. Relationship between the use of muscle relaxant and IOP has been attractive for anesthesiologists due to academic and clinical reasons.¹ Reduction of IOP induced by non-depolarizing muscle relaxants is associated with less intraoperative and postoperative complications. Conducting a research to compare the effects of atracurium and cisatracurium, as too widely used muscle relaxants on both IOP and PD seems to be necessary. The aim of this study is to determine the preferred muscle relaxant between cisatracurium or atracurium in ophthalmic operations. It is noticeable that comparison of the effect of these relaxants on both IOP and PD has not been studied yet.

Methods

Sixty patients were included in our study. They were numbered from one to sixty. Even and odd numbers were allocated to groups A and B, respectively.

Premedication drugs were midazolam 0.03 mg/kg and sufentanil 0.2 µg/kg followed by thiopental 2-4 mg/kg and muscle relaxant (for group A atracurium 0.6 mg/kg and for group B cisatracurium 0.15 mg/kg). Then ventilation was maintained by face mask in normocapnic condition. Five minutes later, patients were intubated and mechanical ventilation was started. Anesthesia was maintained by Oxygen, Nitrous Oxide (50%-50%) and Isoflurane.

IOP and PD were measured before, 2 and 5 minutes after induction of anesthesia and 2, 5 and 10 minutes after tracheal intubation. No surgical stimuli were applied during this period.

Results

Data analysis was done with paired *t*-test and SPSS software (version 15).

Thirty patients were included in each group. Demographic data revealed no significant difference.

Mean values for IOP and PD in both groups are shown in figure 1 and 2.

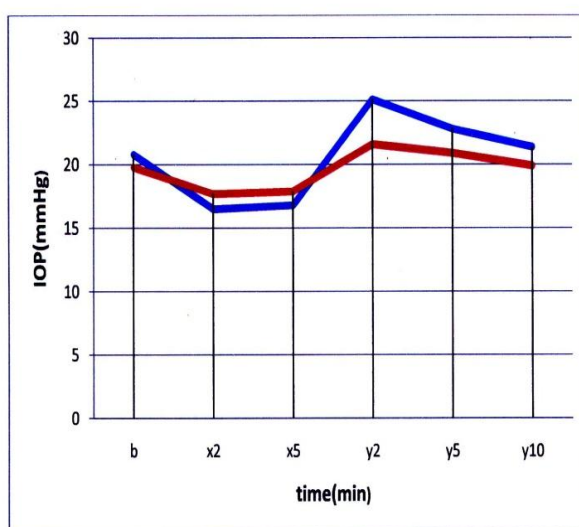


Figure 1. Changes of intraocular pressure in atracurium and cisatracurium groups

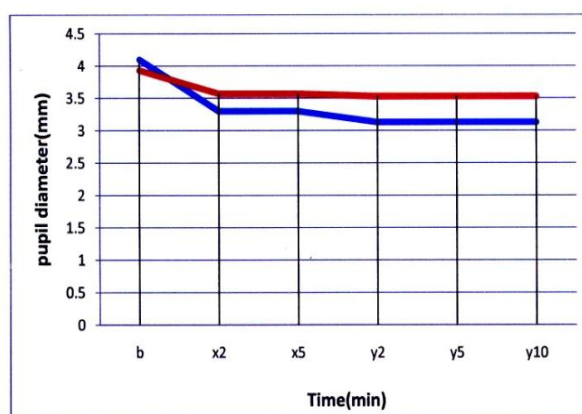


Figure 2. Changes of pupillary diameter in atracurium and cisatracurium groups

Blue line: Group A, Red line: Group B
 b: Before anesthesia (Base line)
 X2: 2 minutes after induction of anesthesia
 X5: 5 minutes after induction of anesthesia
 Y2: 2 minutes after intubation
 Y5: 5 minutes after intubation
 Y10: 10 minutes after intubation

IOP and PD decreased after administration of both muscle relaxants. In both groups, IOP was reduced 2 and 5 minutes after induction of anesthesia, but following laryngoscopy and intubation, IOP increased rapidly and returned to baseline values within 10 minutes. PD was decreased in both groups; but in comparison to IOP, it was not changed after intubation. Generally, the trend of reduction in IOP and PD ($p > 0.137$) was similar in both groups ($p = 0.125$). Atracurium caused a greater fall in IOP more than cisatracurium 2 and 5 minutes after induction of anesthesia but raised more 2, 5 and 10 minutes following intubation, although the difference was not statistically significant.

PD was decreased in both groups at all studied times (more prominent in atracurium group), however not significant, statistically.

Discussion

From an anesthetic viewpoint, control of the factors affecting IOP and extraocular muscle tone pose the major challenges. Adequate depth of anesthesia, maintenance of stable cardiovascular status, avoidance of cough and movement during operation will prevent vascular congestion and increasing IOP.⁸

Atracurium and cisatracurium offer shorter duration of action, significant lack of cardiovascular effects and less cumulative tendency rather than other non depolarizing muscle relaxants.

Previous studies have shown conflicting results. In most studies, reduction of IOP had been reported,^{2-4,6} but others revealed no changes in IOP.^{5,7}

In our study, mean of PDs was decreased after induction of anesthesia, and thereafter remained steady even following intubation. IOP was decreased following induction of anesthesia and increased after intubation, facilitated by atracurium or cisatracurium but again dropped rapidly and reached near baseline levels.

Conclusion

It is concluded that atracurium and cisatracurium have no significant difference considering the course of changes IOP ($p = 0.125$) and PD ($p > 0.137$) during induction of anesthesia and endotracheal intubation.

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References

1. Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL. Miller's Anesthesia. 7th ed. New York: Mosby; 2010.
2. Maharaj RJ, Humphery D, Kaplan N, Kadwa H, Blignaut P, Brock-Utne JG, et al. Effects of atracurium on intraocular pressure. *Br J Anaesth* 1984;56(5):459-63.
3. Schneider MJ, Stirt JA, Finholt DA. Atracurium, vecuronium, and intraocular pressure in humans. *Anesth Analg* 1986;65(8):877-82.
4. Murphy DF, Eustace P, Unwin A, Magner JB. Atracurium and intraocular pressure *Br J Ophthalmol* 1985;69(9):673-5.
5. Badrinath SK, Vazerry A, McCarthy RJ, Ivankovich AD. The effect of different methods of inducing anesthesia on intraocular pressure. *Anesthesiology* 1986;65(4):431-4.
6. Polarz H, Böhrer H, von Tabouillot W, Martin E, Tetz M, Völcker HE. Comparative effects of atracurium and vecuronium on intraocular pressure. *Ger J Ophthalmol* 1995;4(2):91-3.
7. McMurphy RM, Davidson HJ, Hodgson DS. Effects of atracurium on intraocular pressure, eye position and blood pressure in eucaptic and hypocapnic isoflurane-anesthetized dogs. *Am J Vet Res* 2004;65(2):179-82.
8. Kornblueth W, Aladjemoff L, Magora F, Gabbay A. Influence of general anesthesia on intraocular pressure in man; the effect of diethyl ether, cyclopropane, vinyl ether, and thiopental sodium. *AMA Arch Ophthalmol* 1959;61(1):84-7.