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Assessment of value of adding low dose of intermediate-acting nondepolarizing muscle relaxant to local anesthesia and hyaluronidase mixture percaruncular and peribulbar anesthesia for high myopes in ophthalmic surgery

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Abstract

Objective

The purpose of this study was to assess the value of adding low-dose intermediate-acting nondepolarizing muscle relaxant to local anesthesia and hyaluronidase mixture percaruncular and peribulbar anesthesia for high myopes in ophthalmic surgery.

Patients and methods

A total of 82 patients with American Society of Anesthesiologists I–III planned for elective ophthalmic surgery with high myopes enrolled in a double-blind comparative study. The patients were randomized into one of the two groups: group A ($n = 42$) patients received lidocaine, bupivacaine (local anesthesia), hyaluronidase, and atracurium (intermediate-acting nondepolarizing muscle relaxant) percaruncular and peribulbar. Group B patients received local anesthesia, hyaluronidase percaruncular, and peribulbar.

Results

As regards demographic data, hemodynamic changes, and oxygen saturation there was no statistically significant difference between the two groups. About block criteria, the onset of akinesia is shorter in group A than in group B. About duration akinesia, there was no significant difference between the two groups. About analgesia, no significant difference between the two groups. It was noticed that adding atracurium to local anesthesia solution did not significantly increase the risk of complication.

Conclusion

Thus in the present clinical study, adding atracurium to percaruncular and peribulbar local anesthesia in high myopes undergoing ophthalmic surgery is sufficient and showed excellent safety profile.

Keywords: Anesthesia, atracurium, hyaluronidase, nondepolarizing muscle

INTRODUCTION

Majority of patients prepared for ophthalmic surgery were elderly and had preexisting medical illness. Unless contraindicated, local anesthesia is the technique associated with the least morbidity. Although general anesthesia may be recommended for ophthalmic surgery in myopes, the patients liable for ophthalmic surgery may have some medical disorders that obligate the use of a regional technique that can be applied for high myopes. It may prove to benefit when general anesthesia is contraindicated [1]. Patients of axial myopia are

at high risk of globe perforation when axial length is more than 26 mm. A myopic eye has thin sclera and the space between the globe and the orbit, available for peribulbar technique, is limited. Moreover, these patients with myopia may have staphyloma, which increased the risk of perforation [2]. Vohra

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and Good[3] have showed using B-mode ultrasound that the probability of staphyloma is more significant in high myopic than in slight myopic eyes. Moreover, the posterior pole of the globe the more frequently location of staphyloma (accounting for perforation after retrobulbar anesthesia) or in the inferior area of the globe (considering for perforation after inferior and temporal punctures, both peribulbar and retrobulbar) [3]. Several studies examined the benefit of single medical canthal peribulbar injection (percaruncular) as a regional anesthesia technique for ophthalmic surgery. They found it to be the alternative to conventional two-injection peribulbar [4]. Peribulbar block has the disadvantage of slow onset of orbital akinesia and the frequent need for block supplementation. Many adjuvant drugs such as adrenaline, sodium bicarbonate, and hyaluronidase have been added to the local anesthetic mixture used for a peribulbar block to augment its efficacy and hasten its speed of onset; however, their effect has been variable [5]. According to some studies, the impact of using intermediate-acting nondepolarizing muscle relaxant as an adjuvant to the peribulbar block in developing ameliorated conditions with no adverse impact and in accelerating the onset of akinesia have been implicated [6].

Aim

In the current study, adding low-dose intermediate-acting nondepolarizing muscle relaxant to local anesthesia and hyaluronidase mixture would provide an early onset of akinesia and favorable surgical condition in percaruncular, peribulbar anesthesia for high myopes undergoing ophthalmic surgery.

PATIENTS AND METHODS

Our study conducted on patients between October 2016 and November 2017.

Inclusion criteria

Eighty-two patients between the age of 50 and 80 years with the American Society of Anesthesiologists I–III planned for elective ophthalmic surgery with high myopia (axial length 26 mm) were enrolled in a double-blind comparative study, after obtaining approval by way of written informed consent from parents to the study.

Exclusion criteria

The exclusion criteria included local anesthesia allergy, orbital infectious, taking an anticoagulant, unable to lie flat, psychiatric illness, bleeding diathesis, and failure of the block. Preoperatively, the following routine investigation was done in all patients such as ECG, echocardiography, complete blood count, coagulation profile, liver, renal function, ultrasound biometry, and B-scan. In the preparation room, intravenous access was established, and midazolam 0.05 mg/kg was given to anxious patients. In Operation room (OR), standard monitoring of pulse oximeter, ECG, and noninvasive arterial blood pressure was connected, and the nasal O₂ cannula was placed. Benoxinate 0.4% eye drop was instilled in the eye to be operated upon three times separated by a one-minute interval. The

patients lied in a supine position and were asked for focusing on a fixed point on the ceiling. A medial canthus injection was given using a 25 G, 25 mm needle under complete aseptic condition. The needle insertion point was medial to caruncle; parallel to the medial orbital wall to 15–20 mm depth, after negative aspiration, the already chosen local anesthetic mixture was injected slowly. During injection, the globe was palpated, and tension was frequently tested if the tension was felt to rise in the globe, the infusion would be stopped. After injection, there was external compression for 5 min and was removed every 2 min to test akinesia and anesthesia [6]. Patients were randomized to one of the two groups: group C ($n = 41$) patients received 2.5 ml of lidocaine 2%, 2.5 ml bupivacaine 0.5% with hyaluronidase 93.7 IU, and 1 ml normal saline to make a total volume of 6 ml from which the patients receive 5–6 ml. While in group A ($n = 41$) patients have received 2.5 ml lidocaine 2%, 2.5 ml bupivacaine 0.5% 2.5 ml with hyaluronidase 93.7, and 5 mg atracurium in 1 ml normal saline to make a total volume of 6 ml from which the patients received 5–6 ml.

The following data were recorded:

- (1) Blood pressure and heart rate; baseline, 5 min after local anesthetic injection, 5 min after the beginning of the operation, and after regaining of full ocular motility.
- (2) Baseline SpO₂ and 5 min after local anesthetic injections.
- (3) The onset time of glober akinesia ocular movement score (OMS) was recorded, as follows: more than 2 mm: 2, 1–2 mm: 1, and no movement: 0, a total score of 2 or less was considered adequate akinesia for surgery [7].
- (4) Eyelid movement score was recorded as follows: full movement gave a score of 2, flicking was given a score of 1, and no movement given a score of 0.
- (5) Time from onset of akinesia to regain of full ocular movement.
- (6) The occurrence of major complications or minor complications was recorded.
- (7) A three-point scoring system for pain was assessed by direct questioning (no pain = 0, discomfort = 1, and pain = 2) throughout the operation.

RESULTS

A comparative, randomized study of 82 patients randomly divided into two groups: with 41 patients in group A (lidocaine 2%, bupivacaine 0.05%, hyaluronidase, atracurium, and normal saline) and 41 patients in group B (lidocaine 2%, bupivacaine 0.05%, hyaluronidase, and normal saline 0.9%). We undertake to study the efficacy and safety of the drugs in relation to the duration of analgesia, akinesia, and hemodynamic stability, ocular movement score, eyelid score, pain point score, the occurrence of complication, and time of regaining of the ocular movement were compared using Kruskal–Wallis test with Mann–Whitney *U*-test for post-hoc analysis. Hemodynamic variables were compared using repeated measure analysis of variants with post-hoc Tukey test. Statistical software namely SPSS 15.0 (IBM, Armonk, NY, United States), Stata 8.0 (StataCorp LLC, Texas, USA), MedCalc 9.0 (MedCalc

Software, Ostend, Belgium), and Systat 11.0 (Systat Software, Inc., San Jose, CA, USA) were used for the analysis of the data and Microsoft Word and Excel have been used to generate tables, etc.

As regards the demographic characteristic of both groups, there were no statistically significant difference (Table 1).

As regards the hemodynamic changes between the two groups, there was no statistically significant difference between the two groups. Additionally, there was no statistically significant difference between the hemodynamic readings inside each group (Fig. 1).

As regards oxygen saturation, there was no statistically significant difference between the two groups (Fig. 2).

As regards the onset of ocular motor block (akinesia), it was statistically significantly shorter in group A, but as regards the duration of akinesia, there was no statistically significant difference between the two groups. As regards the onset of eyelid akinesia it is shorter in group A than in group B but with no statistical significance (Fig. 3).

As regards the incidence of complication, there was no major complication in any cases. As regards minor complication, there was no statistical difference in the rate of minor complication between both groups (Table 2).

As regards the incidence occurrence of intraoperative pain, it was observed that the pain occurred in five (12.2%) patients in group A compared with six (14%) patients in group B and both groups were comparative ($P = 0.746$; Table 3).

DISCUSSION

In the present study, the two groups were compared concerning age, sex, axial length; posterior staphyloma, and American Society of Anesthesiologists physical status, there was no significant difference observed between the two groups.

There were no statistically significant differences in peripheral oxygen saturation, mean blood pressure, and heart rate values between groups A and group C during the study. This was comparative with the findings of Eghbal *et al.*'s [8]. Also, the mean blood pressure and heart rate variability were not significant within each group. Other previously mentioned studies did not comment on hemodynamic changes or SpO₂ changes.

In the present study, as regards the onset of akinesia, it was observed that the motor block ocular movement score (OMS_{≤6}) in group A started at 2.5 ± 0.87 min and reached full akinesia (OMS_{≤2}) after 6 ± 4.19 min, which was significantly shorter than group B (3.7 ± 1.54 and

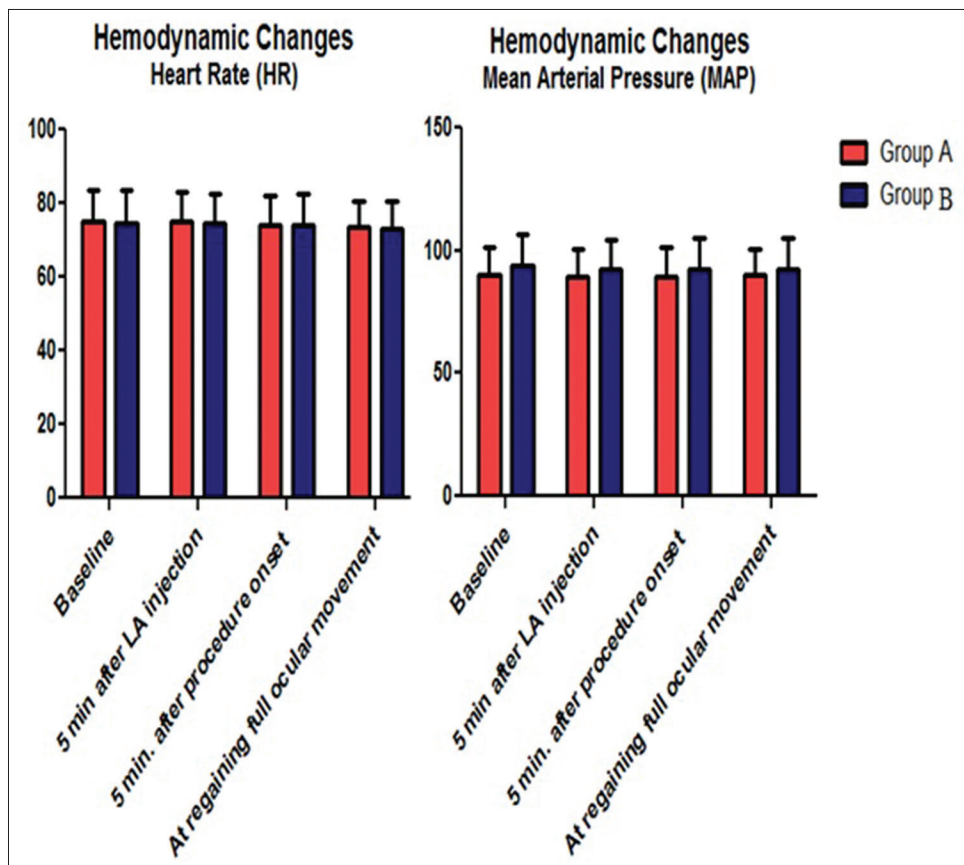


Figure 1: Hemodynamic changes.

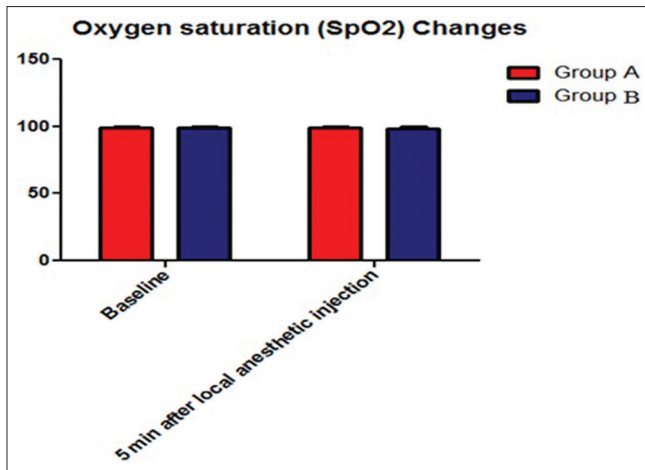


Figure 2: Oxygen saturation changes.

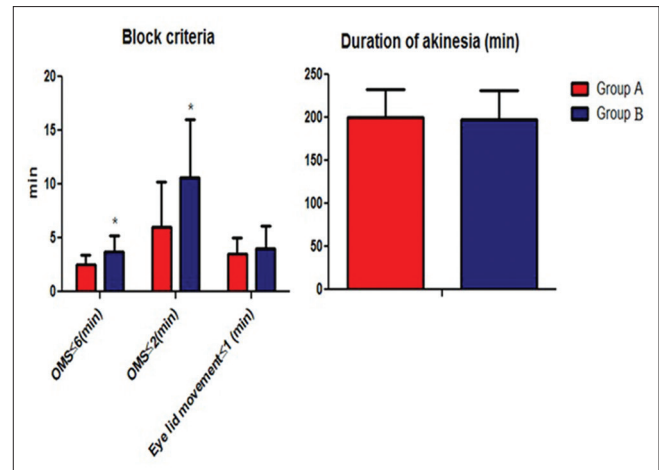


Figure 3: Block criteria.

	Group A (n=41)	Group B (n=41)	P
Age (years)	49.2±8.21	52.3±9.32	0.493
Sex			
Female	22 (53.7)	22 (53.7)	1
Male	19 (46.3)	19 (46.3)	
Axial length (mm)	29.1±2.12	29±2.28	0.677
Posterior staphyloma	3 (7.3)	4 (9.7)	0.765
ASA-PS			
I	19 (46.3)	17 (41.5)	0.656
II	20 (48.8)	18 (43.9)	0.658
III	2 (4.9)	6 (14.6)	0.264

Numerical data were presented as mean±SD; categorical data were presented as frequency (%). ASA-PA, American Society of Anesthesiologists physical status. $P < 0.05$, statistically significant.

	Group A (n=41)	Group B (n=41)	P
Total number of complications	10 (24.3)	12 (29.3)	0.666
Chemosis	5 (12.2)	10 (24.3)	0.153
Subconjunctival hemorrhage	2 (4.9)	2 (4.9)	1
Local hyperemia	3 (7.3)	0 (0)	0.241

Categorical data were presented as frequency (%). $P < 0.05$, statistically significant.

	Group A (n=41)	Group B (n=41)	P
Incidence of intraoperative pain [n (%)]	5 (12)	6 (14.6)	0.6

10.6 ± 5.42 min, respectively). The results of this study were consistent with those reported by Küçükyavuz and Arici[9] who have demonstrated that the addition of atracurium 5 mg to a mixture of lidocaine 2% and

bupivacaine 0.5% with a volume of 8.5 ml injected in the inferotemporal quadrant and lateral to supratrochlear notch, improve orbital akinesia and hasten block (the onset time of akinesia was 10 ± 3 min in the control and 7 ± 2 min in the atracurium group; $P \leq 0.05$).

As regards the duration of akinesia in the current study, it was comparative between the two groups (200.5 ± 31.93 min in group A and 198 ± 34.00 min in group B). Our results were comparable with Küçükyavuz and Arici [9] (194 ± 53 and 192 ± 99 min in the atracurium and the control group, respectively). The similarity in the duration of akinesia in both groups might be due to the use of the same Local anaesthesia (LA) mixture in both groups. Atracurium might not affect the length of akinesia.

In contrast to our study, Eghbal *et al.* [8] reported that adding atracurium to retrobulbar anesthesia significantly increased the duration of akinesia (104.07 ± 17 vs. 87.1 ± 16.2 min in atracurium and control group, respectively; $P < 0.001$). Abdellatif *et al.* [10] and Godarzi *et al.* [11] did not report the duration of akinesia.

As regards the onset of eyelid akinesia in the current study it was observed that patients in group A reached eyelid akinesia in a shorter time than those in group B (3.5 ± 1.49 and 4 ± 2.10 min, respectively) but with no statistically significant difference. Our results were comparable with Abdellatif *et al.* [10] On the other hand, Küçükyavuz and Arici [9], Eghbal *et al.* [8], and Godarzi *et al.* [11] did not record the onset time of the eyelid akinesia.

Regarding the quality of analgesia (occurrence of intraoperative pain) in the current study, it was comparative between the two groups [12% (5/41) in group A compared with 14.6% (6/41) patients in group B].

In concern of the pain, it was mild and only reassurance was needed except for one patient in group A and two in group B suffered pain that required giving 50 µg fentanyl intravenously. The pain did not disturb the surgical technique or the outcome.

But it affected the satisfaction of the patient and doctor about operative conditions.

In contrast to the finding of the current study, Samir and Gabal [7] reported the occurrence of pain in 6.2% (5/80) and supplementation with intravenous opioid was required in two of the cases.

The higher incidence of intraoperative pain in the current study compared with Samir and Gabal [7] might be explained by that the block began to wear off due to prolonged procedure (surgeons under training, the procedure duration was 45.5 ± 12.73 min in group A and 47.3 ± 15.69 min in group B), and/or if there was lag time between block completion and starting the surgery.

No major complications were noted all through the study period. As regards the incidence of minor complications, there were no statistically significant differences between the two groups. Chemosis was observed in 12% (5/41) in group A and 24% (10/41) in group B, compared with 0.2% (2/80) in Samir and Gabal's [7] study. The higher incidence of chemosis in the current study might be attributed to that more supplementations were given in the present research and subsequently more anterior spread of higher volume of local anesthetic.

Subconjunctival hemorrhage occurred in four cases two in each group (4.9%) compared with 2.5% (2/80) in the Samir and Gabal [7] study. While Abdellatif *et al.* [10] reported subconjunctival hemorrhage in six (20%) patients in control and eight (27%) in rocuronium, this might be due to giving double injections from the start.

We observed three cases of local hyperemia in group A which was not reported in the studies that used atracurium in regional ophthalmic blocks. Local hyperemia was managed by giving intravenous steroid and was resolved at the time of completion of the procedure.

CONCLUSION

The current study concluded that adding of intermediate nondepolarizing muscle relaxant significantly reduced the time of onset of globe akinesia and reduced the need for the second injection when added to LA solution in the percaruncular

block. It did not affect the quality of analgesia nor the duration of akinesia with low risk of drug-related complications. It was noticed that adding intermediate-acting nondepolarizing muscle relaxant to local anesthetic solution did not significantly increase the risk of complication and did not affect the patients' hemodynamics.

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Conflicts of interest

There are no conflicts of interest.

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