The Effect of Addition of Atracurium to Local Anesthetic in Peribulbar Block in Patients Undergoing Cataract Surgery

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Abstract: This study was carried out in Ain Shams University Hospital and included 62 patients of both sexes undergoing cataract surgery using peribulbar block. The aim of the study was to evaluate the effects of adding Atracurium (5mg) to local anesthetic mixture on akinesia of globe and eyelid regarding onset and duration in cataract surgery. Patients were randomly allocated into two equal groups, (32 patients in each group) according to the medications they had received (with a total volume of 8 ml): Group I (study group): Local anesthetic 4 ml 2% Lidocaine +3.5ml 0.5% plain Bupivacaine + hyalurinidase in a dose of 15 IU/ml of local anesthetic + 0.5ml Atracurium (5mg). Group II (control group): Local anesthetic 4 ml of 2% Lidocaine +3.5 ml 0.5% plain Bupivacaine + hyalurinidase in a dose of 15IU/ml of local anesthetic + 0.5ml saline 0.9%. Both groups were assessed for onset and degree of eyelid and globe akinesia using the OASS at 5, 7 and 10 minutes after injection, duration and degree of globe akinesia postoperatively and presence of complications or side effects during or after the block. The main finding in this study was that Atracurium group (group I) demonstrated significantly rapid onset of lid and globe akinesia compared to the control group (group II). Regarding complete lid akinesia (demonstrated by complete loss of levator and orbicularis oculi muscles function) a high statistical difference between the Atracurium and control groups was detected at 5 and 7 minutes postinjection. As 26 patients (81.3%) in group I showed complete lid akinesia versus 6 patients (18.8%) in group II at 5 minutes, while at 7 minutes 29 patients (90.6%) in group I compared to the 15 patients (46.9%) in group II. Also, The Atracurium group showed better complete globe akinesia scores overall. Globe akinesia scores were significantly better at 5 minutes post injection. The effect of the globe block in the Atracurium group was longer than the control group, but there was no statistical significant difference. One patient from the atracurium group and two patients from the control group showed subconjunctival hemorrhage. There were noother significant complications or adverse effects observed in both groups.

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1. Introduction

The provision of anesthesia for ophthalmic surgical procedures varies worldwide with an increasing tendency towards orbital regional local anesthesia**. (Eke and Thompson, 2007)**

There are different approaches to the delivery of local anesthesia for cataract surgery. The two main approaches are retrobulbar and peribulbar blocks. Both can provide adequate analgesia, akinesia and control of intraocular pressure as well as postoperative analgesia. **(Alhassan et al., 2008)**

The addition of neuromuscular blockers to local anesthetics does not affect analgesia, but because of their effect on neuromuscular junction, they induce akinesia in extraocular muscles and therefore optimizing the setting for ophthalmic surgeries. **(Rizzo et al., 2005)**

Atracurium is a benzylisoquinolinium non-depolarizing neuromuscular blocker used to facilitate endotracheal intubation and to provide skeletal muscle relaxation during surgery or mechanical ventilation. Atracurium has intermediate onset and duration of action**. (Peck and Hill, 2014)**

Like all muscle relaxants, atracurium has a quaternary group; however, a benzylisoquinoline structure is responsible for its unique method of degradation. The drug is a mixture of 10stereoisomers. Atracurium is so extensively metabolized that its pharmacokinetics are independent of renal and hepatic function, and less than 10% is excreted unchanged by renal and biliary routes. **(John et al., 2013).**

Some clinical trials have shown that addition of a neuromuscular blocker to the local anesthetic solution improves the quality of anesthesia in different regional techniques. **(Reah et al., 1998)**

Aim of the Study

To evaluate the effects of adding Atracurium (5mg) to local anesthetic mixture on akinesia of globe and eyelid regarding onset and duration in cataract surgery using peribulbar technique.

Primary objective:

Evaluation of adding Atracurium (5mg) to local anesthetic mixture on akinesia of eyelid and globe; regarding onset and duration in cataract surgery using peribulbar technique.

Secondary objective:

Evaluation of any specific complications related to Atracurium as an adjuvant to local anesthetics.

2. Patients and Methods

Type of Study: controlled single blind study

Study Setting: Ain Shams University Hospitals

Study Period: from July to December 2018

Study Population:

Inclusion Criteria:

(ASA Grade I, II and III) aged from (50 to 75) years old of both sexes scheduled for elective cataract surgery (phacoemulsification and intraocular lens implantation).

Exclusion Criteria:

1- Any disorder of the neuromuscular systems known from history or clinical examination eg. Guillain barre syndrome, Myasthenia gravis and Myopathies (eg. Duchenne muscular dystrophy, Becker muscular dystrophy, Amyloid myopathy) & patients known to have history of fits.

2- Patients on medication known to interact with neuromuscular blocking drugs e.g. Antibiotics (aminoglycosides and tetracycline), anticonvulsants (Phenytoin, carbamazepine), antiarrhythmics (calcium channel blockers and quinidine) and magnesium sulfate.

3- Patients with contraindication to local anesthetic procedure eg. Patients with history of bleeding disorders or receiving anticoagulants or allergy to local anesthetics, high myopia and monocularity (axial length >_30 mm)

Sampling method:

Patients were randomly allocated into two equal groups, (32 patients in each group) according to the medications they had received (with a total volume of 8 ml): Group I (study group): Local anesthetic 4 ml 2% Lidocaine +3.5ml 0.5% plain Bupivacaine +hyalurinidase in a dose of 15 IU/ml of local anesthetic + 0.5ml Atracurium (5mg)**.** Group II (control group): Local anesthetic 4 ml of 2% Lidocaine +3.5 ml 0.5% plain Bupivacaine +hyalurinidase in a dose of 15IU/ml of local anesthetic + 0.5ml saline 0.9%.

Sample Size: 64 patient

Ethical Considerations:

The study will be performed after ethical committee approval and informed consent from the patients. The study protocol was explained to the patient after taking their consent to the type of anesthesia and surgical procedure.

Pre-operative Preparation:

All patients were given IV 0.5 – 1 mg/ kg propofol 1min before local anesthetic injection.

Patients Monitoring:

Monitoring equipments were attached to the patient including non-invasive arterial Blood pressure (NIABP), oxygen saturation (SpO_2) and 3 leads electrocardiogram (ECG) leads connected and data obtained.

Anesthetic Technique:

All patients breathed oxygen via nasal prongs. Once the decision was taken to operate, anesthetic and surgical procedures were explained to the patients and the anesthetic mixture freshly prepared.

Topical anesthesia of the conjunctiva and cornea using 0.4% Benoxinate hydrochloride, two drops instilled and repeated 3 times at one minute intervals.

In the peribulbar approach, a needle was inserted extraconal (outside the muscle cone formed by the extraocular muscles) through peribulbar two-point injections technique. (infrotemporal-supraorbital)

The anesthetist used one index finger to palpate the groove between the eyeball and the inferolateral orbital margin and gently displaced the eyeball superiorly. A single transcutaneous inferotemporal injection using fine 25 gauge disposable needle on a 5ml syringe of local anesthetic was directed backwards in a sagittal plane, tangentially to the globe and parallel to the floor of the orbit with the bevel of the needle faced the globe. The inferotemporal injection was done to a depth of no more than 30mm from the infraorbital margin.

Aspiration test was done followed by injection of 5ml of anesthetic mixture over 30 seconds. The last 3ml injection were injected superior and nasal between the medial third and the lateral two thirds of the orbital roof edge with the index finger pushing the eye ball gently inferiorly and time interval between the two injections less than one minute. Injection of the intended volume of the study drug was stopped when there was fullness of the orbit and/or drooping of the upper eyelid during injection. All injections performed slowly to ensure patient comfort and promote spreading of local anesthetic within the orbit.

Following orbital injection, intermittent gentle digital pressure and massage by a piece of gauze placed over the eyelids to disperse the anesthetic and reduce IOP. All blocks were performed by the same investigator.

Data collection:

1- Ocular Anesthetic Scoring System (OASS)

OASS is a simple system for assessing non-topical local anesthesia in which a score between 0 (poor) and 14 (excellent) was devised measuring motor (ocular motility, levator and orbicularis function) and sensory functions (digital spear pressure at limbus and topical anesthetic sting).

There are three objective measures in OASS of motor function: first the degree of ptosis assessing levator function, second the lid closure assessing orbicularis function and third extraocular eye movements (EOM) assessing akinesia. Grading of each parameter was based on a scoring system between 0 and 2. No ptosis scores zero points, partial one and complete ptosis a maximum of two points. Lid closure was examined by holding the lids gently open and asking the patient to squeeze their eyes shut. Normal closure scores zero points, limited closure one and no or flicker closure two points. Third, eye movements were tested in four positions of gaze: elevation, depression, levo and dextroversion. Conjugate movements scored zero in each direction, disconjugate movements one and no movement two for each direction. Therefore, zero points were given for normal eye movements, and a total of eight points was given for complete akinesia. There are also two subjective measures in OASS, digital spear pressure at the limbus and topical anesthetic sting using a drop of 1% amethocaine. These are related to sensory function and, if active, can cause unwanted reflex blinking and squeezing of the eyelids. Each was scored zero if sensation was appreciated and one point if there was no sensation. All these scores were added up to give a total score with a maximum of 14 points. Patients were categorised into three groups according to the quality of the block and level of anesthesia achieved: poor (0–3), average (4–9) and good block (10–14). The Ocular Anesthetic Scoring System is shown in table (1).

Table (1): Ocular anesthetic scoring system

Objective measures					
Motor function	**Degree of function**	**Ocular Anaesthetic Score**			
Levator function	No ptosis	0			
	Partial ptosis	1			
	Complete ptosis	2			
Orbicularis function	Normal closure	0			
	Limited closure	1			
	No/flicker closure	2			
		Up	Down	Med	Lat
EOM	Conjugate EOM	0	0	0	0
	Disconjugate EOM	1	1	1	1
	No/flicker EOM	2	2	2	2
Subjective measures					
Sensory function	**Degree of function**	**Ocular Anaesthetic Score**			
Digital spear pressure	Sensation felt	0			
	No sensation	1			
Topical anaesthetic sting	Sensation felt	0			
	No sensation	1			
		Poor	Average	Good	
Total block		0–3	4–9	10–14	

EOM, extraocular movements.

Evaluation of onset and degree of akinesia is done at 5,7and 10 minutes after administration of local anesthetic. If level of anesthesia achieved is poor (0-3), a supplementary dose of the same mixture (3 ml) is injected supraorbitally to improve the degree of the block.

2-Evaluation of the duration and degree of akinesia postoperatively by using the scoring system for the motion range of the extraocular muscles:

1. **Total akinesia** 0-1 mm motion in 1 to 2 main directions.
2. **Relative akinesia**1mm motion in each of the main directions or 2 mm motion in 2 or many other main directions.
3. **No akinesia**more than 2 mm motion in range in each of the main directions or 2mm motion range in 2 or more main directions.
4. Evaluation was done every 45 min after surgery.

3-Incidence of complications:

Complications during or after the block: Such as episodes of nausea or vomiting, arrhythmia, convulsions, allergy, weakness, respiratory distress, diplopia, ptosis and subconjunctival hemorrhage were recorded.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD).

Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x^2) test of significance was used in order to compare proportions between qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:
- Probability (P-value)

– P-value <0.05 was considered significant.

– P-value <0.001 was considered as highly significant.

– P-value >0.05 was considered insignificant.

3. Results

The results of the present study are demonstrated in the following tables.

Table (2): Comparison between groups according to demographic data.

	Group I: LA & Atracurium (n=32)	Group II: LA Only (n=32)	t/x2#	p-value
Sex				
Female	15 (46.9%)	9 (28.1%)	2.400#	0.121
Male	17 (53.1%)	23 (71.9%)		
Age (years)				
Range	54-75	57-76	1.731	0.372
Mean±SD	63.52±4.3	64.09±4.75		

t-Independent sample t-test; #x^2: Chi-square test
p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

This table shows no statistically significant difference between both groups according to age and sex.

Table (3): Comparison between groups according to assessment by ocular anesthetic scoring system at 5min after injection.

OASS at 5min.	Group I: LA & Atracurium (n=32)		Group II: LA Only (n=32)		Chi-square test	
	No.	%	No.	%	x2	p-value
Motor function						
Levator function						
No ptosis	0	0.0%	15	46.9%	28.971	<0.001**
Partial ptosis	6	18.8%	11	34.4%		
Complete ptosis	26	81.3%	6	18.8%		
Orbicularis function						
Normal closure	0	0.0%	15	46.9%	28.971	<0.001**
Limited closure	6	18.8%	11	34.4%		
No/flicker closure	26	81.3%	6	18.8%		
Extraocular movements						
Up						
Conjugate EOM	6	18.8%	3	9.4%	1.168	0.558
Disconjugate EOM	15	46.9%	17	53.1%		
No/flicker EOM	11	34.4%	12	37.5%		
Down						
Conjugate EOM	6	18.8%	0	0.0%	6.758	0.034*
Disconjugate EOM	15	46.9%	20	62.5%		
No/flicker EOM	11	34.4%	12	37.5%		
Medial						
Conjugate EOM	3	9.4%	3	9.4%	10.069	0.007*
Disconjugate EOM	15	46.9%	26	81.3%		
No/flicker EOM	14	43.8%	3	9.4%		
Lateral						
Conjugate EOM	3	9.4%	0	0.0%	13.419	0.003*
Disconjugate EOM	12	37.5%	26	81.3%		
No/flicker EOM	17	53.1%	6	18.8%		
Globe akinesia						
Score <8	24	75.0%	29	90.6%	4.756	0.048*
Scores 8 (complete akinesia)	8	25.0%	3	9.4%		
Sensory function						
Digital pressure						
Sensation felt	0	0.0%	3	9.4%	5.148	0.036*
No sensation	32	100.0%	29	90.6%		
Topical anesthetic sting						
Sensation felt	0	0.0%	3	9.4%	5.148	0.036*
No sensation	32	100.0%	29	90.6%		
Total block						
Poor	0	0.0%	0	0.0%	5.020	0.041*
Average	12	37.5%	20	62.5%		
Good	20	62.5%	12	37.5%		

x^2: Chi-square test p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

This table illustrates the statistical difference at 5 minutes post injection between groups according to OASS, it shows highly significant difference in both levator and orbicularis muscle functions. Atracurium group had 26 patients (81.3 %) with completeloss of both muscles versus the 6patients (18.8%) of the control group. There was also a significant difference in the globe akinesia score as 8 patients (25%) in the Atracurium group had complete akinesia compared to 3 patients (9.4%) in the control group. Significant difference was found in sensory function between Atracurium group [32 patients (100%)] and Control group [29 patients (90.6%)]. Atracurium group had a significantly better block quality than control group by 20 patients (62.5%) with good block compared to the control group's 12 patients (37.5%) and 12 patients (37.5%) with average block quality versus 20 (62.5%) in the control group.

Table (1): Comparison between groups according to assessment by ocular anesthetic scoring system at 7min after injection.

OASS at 7min.	Group I: LA & Atracurium (n=32)		Group II: LA Only (n=32)		Chi-square test	
	No.	%	No.	%	x2	p-value
Motor function						
Levator function						
No ptosis	0	0.0%	0	0.0%		
Partial ptosis	3	9.4%	17	53.1%	14.255	<0.001**
Complete ptosis	29	90.6%	15	46.9%		
Orbicularis function						
Normal closure	0	0.0%	0	0.0%		
Limited closure	3	9.4%	17	53.1%	14.255	<0.001**
No/flicker closure	29	90.6%	15	46.9%		
Extraocular movements						
Up						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	12	37.5%	14	43.8%	0.259	0.611
No/flicker EOM	20	62.5%	18	56.3%		
Down						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	15	46.9%	9	28.1%	2.400	0.121
No/flicker EOM	17	53.1%	23	71.9%		
Medial						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	3	9.4%	12	37.5%	7.053	0.008*
No/flicker EOM	29	90.6%	20	62.5%		
Lateral						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	6	18.8%	6	18.8%	0.000	1.000
No/flicker EOM	26	81.3%	26	81.3%		
Globe akinesia						
Scores <8	16	50.0%	20	62.5%	3.572	0.097
Scores 8 (complete akinesia)	16	50.0%	12	37.5%		
Sensory function						
Digital pressure						
Sensation felt	0	0.0%	0	0.0%	0.000	1.000
No sensation	32	100.0%	32	100.0%		
Topical anesthetic sting						
Sensation felt	0	0.0%	0	0.0%	0.000	1.000
No sensation	32	100.0%	32	100.0%		
Total block						
Poor	0	0.0%	0	0.0%		
Average	3	9.4%	9	28.1%	3.692	0.049*
Good	29	90.6%	23	71.9%		

x^2: Chi-square test p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

This table illustrates the statistical difference at 7 minutes post injection between groups according to OASS, it shows a highly significant difference in both levator and orbicularis muscle functions.

Atracurium group had 29 patients (90.6%) with complete loss of both muscles versusthe 15 (46.9%) of the control group. However there was a non-significant difference in the globe akinesia score as 16 patients (50%) in the Atracurium group had complete akinesia compared to 12 patients (37.5%) in the control group. Non-significant difference was found in sensory function between Atracurium group [32 patients (100%)] and Control group [32 patients (100%)]. Atracurium group had a significantly better block quality than control group by 29 patients (90.6%) with good block compared to the control group's 23 patients (71.9%) and 3 patients (9.4%) with average block quality versus 9 (28.1%) in the control group.

Table (2): Comparison between groups according to assessment by ocular anesthetic scoring system at 10 min after injection.

OASS at 10min.	Group I: LA & Atracurium (n=32)		Group II: LA Only (n=32)		Chi-square test	
	No.	%	No.	%	x2	p-value
Motor function						
Levator function						
No ptosis	0	0.0%	0	0.0%		
Partial ptosis	0	0.0%	3	9.4%	3.148	0.076
Complete ptosis	32	100.0%	29	90.6%		
Orbicularis function						
Normal closure	0	0.0%	0	0.0%		
Limited closure	0	0.0%	3	9.4%	3.148	0.076
No/flicker closure	32	100.0%	29	90.6%		
Extraocular movements						
Up						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	6	18.8%	8	25.0%	0.366	0.545
No/flicker EOM	26	81.3%	24	75.0%		
Down						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	6	18.8%	6	18.8%	0.000	1.000
No/flicker EOM	26	81.3%	26	81.3%		
Medial						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	3	9.4%	6	18.8%	1.164	0.281
No/flicker EOM	29	90.6%	26	81.3%		
Lateral						
Conjugate EOM	0	0.0%	0	0.0%		
Disconjugate EOM	3	9.4%	0	0.0%	3.148	0.076
No/flicker EOM	29	90.6%	32	100.0%		
Globe akinesia						
Score <8	9	28.1%	11	34.4%	0.273	0.487
Score 8 (complete akinesia)	23	71.9%	21	65.6%		
Sensory function						
Digital pressure						
Sensation felt	0	0.0%	0	0.0%	0.000	1.000
No sensation	32	100.0%	32	100.0%		
Topical anesthetic sting						
Sensation felt	0	0.0%	0	0.0%	0.000	1.000
No sensation	32	100.0%	32	100.0%		
Total block						
Poor	0	0.0%	0	0.0%		
Average	0	0.0%	0	0.0%	0.000	1.000
Good	32	100.0%	32	100.0%		

x^2: Chi-square test p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

This table illustrates the statistical difference at 10 minutes post injection between groups according to OASS, it shows non-significant difference in both levator and orbicularis muscle functions as they both had 32 (100%) patients with complete loss of function versus the 29 (90.6%) of the control group. There was also a non-significant difference in the globe akinesia score as 23 (71.9%) patients in the Atracurium group had complete akinesia compared to 21 (65.6%) patients in the control group. Non-significant difference was found in sensory function between Atracurium group [32 patients (100%)] and Control group [32 patients (100%)]. Non-significant difference in block quality between Atracurium group by 32 patients (100%) with good block compared to the control group's 32 patients (100%) and there were no patients with average block quality in both study groups by 10 minutes.

Table (3): Comparison between groups according to intensity of akinesia.

Duration of akinesia	Group I: LA & Atracurium (n=32)		Group II: LA Only (n=32)		Chi-square test	
	No.	%	No.	%	x2	p-value
0-45 Min. Postop.						
Total akinesia	30	93.75%	24	75.0%		
Relative akinesia	2	6.25%	6	18.75%	4.667	0.097
No akinesia	0	0.0%	2	6.25%		
45-90 Min. Postop.						
Total akinesia	2	6.25%	0	0.0%		
Relative akinesia	6	18.75%	4	12.50%	2.708	0.258
No akinesia	24	75.0%	28	87.50%		
90-135 Min. Postop.						
Total akinesia	0	0.0%	0	0.0%		
Relative akinesia	3	9.37%	0	0.0%	3.222	0.073
No akinesia	29	90.63%	32	100.0%		

x^2: Chi-square test *p-value <0.05 S; **p-value <0.001 HS

This table shows the statistical difference between groups regarding akinesia duration. No significant difference occurred between Atracurium and control groups at different time intervals postoperatively.

Table (4): Comparison between groups according to complications.

	Group I: LA & Atracurium (n=32)		Group II: LA Only (n=32)		Chi-square test	
	No.	%	No.	%	x2	p-value
Complicated (subconjunctival hemorrhage)	1	3.13%	2	6.25%	0.350	0.554

x^2: Chi-square test; p-value >0.05 NS

One patient in Group I showed subconjunctival hemorrhage while 2 patients in Group II had subconjunctival hemorrhage.

This table shows no statistical difference in complications between both groups.

4. Discussion

The main finding in this study was that Atracurium group (group I) demonstrated significantly rapid onset of lid and globe akinesia compared to the control group (group II).

Regarding complete lid akinesia (demonstrated by complete loss of levator and orbicularis oculi muscles function) a high statistical difference between the Atracurium and control groups was detected at 5 and 7 minutes postinjection. As 26 patients (81.3%) in group I showed complete lid akinesia versus 6 patients (18.8%) in group II at 5 minutes, while at 7 minutes 29 patients (90.6%) in group I compared to the 15 patients (46.9%) in group II.

Also, The Atracurium group showed better complete globe akinesia scores overall. Globe akinesia scores were significantly better at 5 minutes postinjection. The effect of the globe block in the Atracurium group was longer than the control group, but there was no statistical significant difference. One patient from the atracurium group and two patients from the control group showed subconjunctival hemorrhage. There were no other significant complications or adverse effects observed in both groups.

Eghbal et al. (2010) conducted a study on 64 unpremedicated, ASA I or II patients scheduled for cataract surgery under local anesthesia. The patients

were assigned to one of the two treatment groups in a randomized, double-blind manner. All patients received retrobulbaranesthesia. The case group received 2ml of 2% Lidocaine (40mg) and 0.5ml Atracurium (5mg). The control group received 2ml of 2% Lidocaine (40mg) and 0.5ml normal saline. Complete akinesia was not achieved in 4 out of 64 patients and statistical analysis was done on the other 60 with complete akinesia. The onset of complete akinesia was quicker and duration longer in the case group than in the control group. The onset of complete block was 4.7 ± 1.1 minutes in the case group and 6.9 ± 0.96 minutes in the control group ($p < 0.001$). The duration of akinesia was 104.07 ± 17.6 minutes in the case group and 87.1 ± 16.2 minutes in the control group ($p<0.001$). The study Concluded that muscle relaxant as adjuvant shortened the onset period of retrobulbar block, prolonged its duration, and provided excellent surgical conditions without any specific complications. (**Eghbal et al., 2010)**

This study differs in the technique with Eghbal study, as we used peribulbar injection instead of retrobulbar injection, but we agreed that muscle relaxant as adjuvant shortened the onset period of peribulbar block, prolonged its duration, and provided excellent surgical conditions without any specific complications.

Kucukyavuz and Arici (2002) reported that the effect of 8mL of a Lidocaine-Bupivacaine mixture, plus 0.5mL (5mg) Atracurium was better than the 8mL of the same local anesthetic mixture plus 0.5ml NaCl. Time to the onset of akinesia in minutes was 7 ± 2 in the Atracurium group and 10 ± 3 in the control group. The duration of akinesia in minutes was the same in both groups (192 ± 99 versus 194 which was not statistically significant ($p >0.05$) Moreover, no side effects related to peribulbar block or drugs were observed in any patient.

Our results were consistent with that obtained by Kuçukyavuz and colleague, they concluded that addition of low dose Atracurium to local anesthetic solution shortened the onset time of peribulbar block and provided excellent surgical conditions without known complications.

Our study differs in adding 15 IU hyaluronidase per ml of local anesthetic mixture and we use Ocular Anesthetic Scoring System (OASS) which is more comprehensive to assess the quality of the block.

In the study of **Mehrdad et al. (2010)** 90 patients were subcategorized into 3 groups randomly. GroupI received a mixture (8ml) containing equal parts of bupivacaine 0.5%, Lidocaine 2% and Hyaluronidase 90 IU plus 0.5ml normal saline; group II received the mixture (8ml) plus 0.5ml Atracurium (5mg), and group III received the mixture (8ml) plus 0.5 ml cis-Atracurium with the help of peribulbar blockage technique. The score of akinesia were evaluated in the 1st, 3rd, 5th, 10th minutes after administration of the medications. Although the quality of akinesia in the 1st and 3rd minute with cis-Atracurium was comparatively better than that of other two groups and they reached the zero akinesia in a shorter time, the quality of akinesia in the 5th and 10th minute was better in the Atracurium group. They concluded that addition of low dose Atracurium and cis-Atracurium to the anesthetic drug is recommended in order to accelerate the onset of akinesia resulted by the peribulbar block and to enhance the quality of akinesia especially when Hyaloronidase is not added.

In their study,5 minutes after injection the number of subjects reaching to total akinesia was 27 (88.9%) with Atracurium, 26 (85.2%) with cis-Atracurium, 24 (77.8%) with placebo. Also; in the 10th minute after the injection, the number of subjects reaching to total akinesia was 28 (92.6%) with Atracurium, 26 (85.2%) with cis-Atracurium, and 26 (85.2%) with placebo. The comparison of the of akinesia intensity in different times of injection for three groups of Atracurium, cis-Atracurium, and placebo, didn't show any statistically meaningful difference.

While in our study, at 5 minutes, the number of patients reaching total akinesia was 8 (25%) in the Atracurium group versus the 3 patients (9.4%) in the control group and 23 patients (71.9%) showed complete akinesia in the Atracurium group versus 21 patients (65.6%) in the control group with statistically significant difference in the 5th minute after injection. Mehrdad stated that for the three groups of his study the difference was however not statistically significant, probably due to small sample size or because of adding hyaluronidase as adjuvant to the anesthetic solution in all three groups but the difference was significant at the 5th minute in our study probably due to using a higher dose of hyaluronidase (120 IU) compared to the (90 IU) in his study.

In another study by **Aissaoui et al. (2010)** 60 ASA physical status I and II patients presenting for cataract surgery under peribulbar anesthesia were included. Patients were randomized to two equal groups; Rocuronium group received a local anesthetic mixture (Lidocaine 2%+ Bupivacaine 0.5%) to which was added 0.06mg/Kg of Rocuronium and control group received the same mixture to which was added saline. Akinesia, the need for supplementary injection, adverse effects and complications were recorded. Peribulbar block was performed using a single injection technique (inferotemporal) and the neuromuscular function was monitored in only 10 patients by TOF ratio for some convenience reasons excluding systemic toxicity and weakness,

Rocuronium group demonstrated significantly better akinesia scores than control group at 2, 5 and 10 minutes post PB (p <0.05), supplementary injection was necessary in 4 patients (13%) in Rocuronium group versus 12 patients (40%) in control group) p =0.039), no significant complications were recorded and no difference in pain scores between the two groups was noted during or after the surgery. The study done by Aissaoui was in agreement with our study regarding the effect of addition of muscle relaxants to LA mixture used in peribulbar block. But in our study we performed peribulbar block by two injection (inferotemporal and supraorbital) and we used Atracurium not Rocuronium.

(Reah et al. (1998) added a dose of 0.5mg of Vecuronium to a mixture of Bupivacaine-Lidocaine with 15UI/ml of Hyaluronidase. They found that Vecuronium improves the quality of globe and lid akinesia without side effects

Conclusion & Recommendations

Adding low dose of Atracurium to local anesthetic mixture in peribulbar block during cataract surgery enhances ocular akinesia in terms of rapid onset, long duration without complications or side effects. Atracurium acts peripherally on extraocular muscles as an adjuvant to local anesthetic in peribulbar block.

Further studies are recommended for optimizing the minimum dose of Atracurium to be used as an adjuvant for optimum block quality. It would also be beneficial to compare between the effect of Atracurium and other muscle relaxants as adjuvants in ophthalmological blocks. More comprehensive assessment of the effect of addition of Atracurium as adjuvant to local anesthetic would be obtained by increasing the sample size and including longer duration procedures eg. Vitrectomy and retinal detachment repair.

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