

Effects Of Atracurium Added To Local Anesthetics On AkiniseiaIn Sub- Tenon's Block

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ABSTRACT

Aim: This study was designed to compare between the effect of adding atracurium (5 mg) to anesthetic mixture on akinesia of eyelid and globe regarding onset and duration in cataract surgery using sub-Tenon's technique. The study included 60 adult patients of either sex scheduled for elective cataract surgery .

Patients& methods: This is a single randomized controlled study, where patients were randomly allocated into two equal groups, 30 patients in each group; according to the medications they received: with a total volume of 5 ml;group I (control group) received 2 ml of 2% plain lidocaine +2 ml 0.5% plain bupivacaine+ 1 ml saline 0.9% and group II (study group) received 2 ml of 2% plain lidocaine + 2 ml of 0.5% plain bupivacaine +0.5 ml atracurium (5mg) + 0.5 ml saline 0.9%. The onset and duration of lid and globe akinesia were assessed every 1 minute until maximum blockade and then every 15 minutes after surgery until complete recovery of the block.

Results:Onset of anaesthesia was much faster in group II (study group) compared to group I (control group), also the duration of action was significantly longer in group II than group I These results are statistically highly significant that adding atracurium in group II hastens the onset and prolonged the duration of lid and globe akinesia.

Conclusion: The addition of low dose atracurium 0.5 mg to local anaesthetic solution shortens the onset time and prolongs the duration of akinesia without known complications.

Introduction:

The provision of anesthesia for ophthalmic surgical procedures varies worldwide with an increasing tendency towards orbital regional and local anesthesia. ⁽¹⁾ Although rare, many serious complications have been reported following needle blocks and this has led to the introduction of newer sub-Tenon's block as a safer alternative ⁽²⁾ . In sub-Tenon's block, local

anesthetic agent is injected under the Tenon's capsule this block is also known as parabulbar block, pinpoint anesthesia and medial episcleral block ⁽³⁾ . The delivery of sub-Tenon's anesthetic, directly irrigating the immediate retro bulbar region, is effective and reliable in providing both analgesia and akinesia. However, akinesia is variable and may not be

complete (4).The use of an adjuvant to accelerate onset of akinesia could further improve its efficacy. Atracurium is used as an adjuvant to local anesthetics in order to provide better akinesia and accelerate the onset of anesthesia.

Patients and Methods:

The study was conducted in ophthalmology department in Benha University Hospitals after approval from local ethical committee. An informed consent was obtained from each patient and a detailed explanation to the patient about the technique, the advantages of the block and possible complications was done.

The study included 60 adult patients of either sex scheduled for elective cataract surgery of age ranges from 45 -65 years old all those patients were classified according to the American Society of Anesthesiologists (ASA I, II, III). This is a single randomized controlled study, where patients were randomly allocated into two equal groups, (30 patients in each group) according to the medications they received (with a total volume of 5 ml):

Group I (control group): local anesthetic 2 ml of 2% plain lidocaine +2 ml 0.5% plain bupivacaine+ 1ml saline 0.9%.

Group II (study group): local anesthetic 2 ml 2% plain lidocaine + 2 ml 0.5% plain bupivacaine +0.5 ml atracurium (5 mg) + 0.5 ml saline 0.9%.

All blocks were performed by the same investigator and the surgeries were done by different surgeons. Once the decision is made to operate, anesthetic and surgical procedures are explained to the patients and the anaesthetic mixture is freshly prepared by anesthesia doctor.

Preoperative assessment (history, examination and investigations) was done to all patients. The onset and duration of lid and globe akinesia were assessed every 1 minute until maximum blockade and then every 15 minutes after surgery until complete recovery of the block. Routine investigations of patients undergoing cataract surgery is not essential and does not improve health or outcome of surgery but tests can be done to improve general health of the patient if required. The preoperative assessment included specific enquiry about bleeding disorders and drugs, as there is an increased risk of haemorrhage in patients receiving anticoagulants and a clotting profile assessment is required prior to injection. All monitoring and anaesthetic equipment in the operating environments should be fully

functional . Blood pressure (BP), oxygen saturation and electrocardiogram (ECG) leads are connected and baseline recordings are obtained , a secure i.v. line was done to every patient.

The following parameters were observed:

Regarding the drugs:

1- **Onset of action.**

2- **Local measurements:**

A. Eye lid movement scoring:

Eye lid akinesia was assessed by asking the patient to squeeze the eye while it is opened in by the anaesthetists hand.

- score of 2= if eye lid moves freely
- score of 1=if it is flickering only
- score of 0=if there is no movement

B. Globe movement scoring:

The system used to score akinesia was that described by **Bramha; 1994⁽⁵⁾**, degree of akinesia was assessed by asking the patients to move their eyes in 4 different directions; up, down, right and left. The globe movement was scored for each directions of gaze with a

total sum of 12. The time needed for satisfactory anaesthesia was noted. Failure of the block was considered when the score was still unsatisfactory (4 or more) 10 minutes after injection.

- Score of 3 = full movement
- Score of 2 = moderate movement
- Score of 1 = flicker movement
- Score of 0 = no movement.

Failure of the block was considered when the score was still unsatisfactory 10 minutes after supplementation.

C. Pain

Pain was assessed postoperatively by first analgesic request. And supplementation with non-steroidal anti-inflammatory (NSAID) was given when needed.

Results:

There were no significant statistical differences between the two groups as regards age, sex distribution, ASA class and duration of surgery ($P > 0.05$). Table (1)

Table (1) Patient Demographic Data; Age, Weight And Duration Of Surgery.

		N	Mean	Std. Deviation	T	P
AGE/ YEAR	1	30	53.73	8.175	0.1	>0.05
	2	30	53.49	7.489		
WEIGHT/ Kg	1	30	79.93	16.747	1.1	>0.05
	2	30	75.69	13.103		
DURATION of surgery/ Minute	1	30	28.30	5.914	1.6	>0.05
	2	30	30.60	5.348		

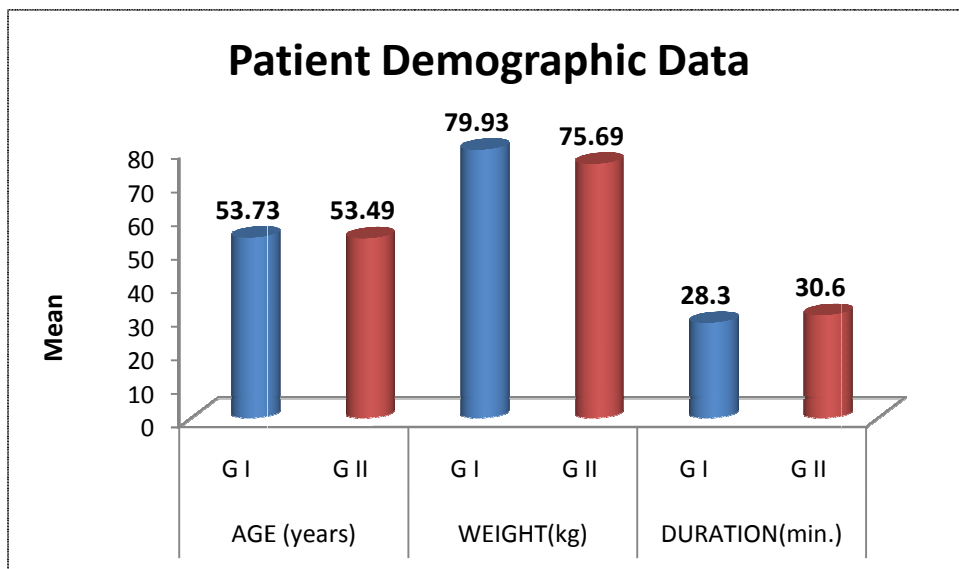


Fig.(1) Patient demographic data; age, weight& duration of surgery.

Regarding onset of lid akinesia measured at one minute in group I only 3 patients representing 10% of the group show complete lid akinesia, while 12 patients representing 36% of group II show complete lid akinesia at 1 min. At three minutes 18 patients (60%) of group I show complete akinesia all 30 patients (100%) of group II show complete akinesia at three minutes. At five minutes 27 patients

(90%) of group I show complete lid akinesia. And then the last 3 patients in group I had complete lid akinesia at 10 minutes. These results are statistically highly significant proving that adding atracurium in group II hastened the onset of lid akinesia. Duration of lid akinesia in group I was 148.7 ± 3.9 while in group II it was 175.7 ± 2.98 which is statistically highly significant. (Table 2).

Table (2): Onset and Duration Of Lid Akinesia.

Lid akinesia	Group I		Group II		P
	No.	%	No.	%	
Onset					
1 min.	3	10	12	36	<0.001
3 min.	18	60	30	100	
5 min.	27	90	0	0	
10 min.	30	100	0	0	
Duration of lid akinesia	148.7 ± 3.9		175.7 ± 2.98		<0.001

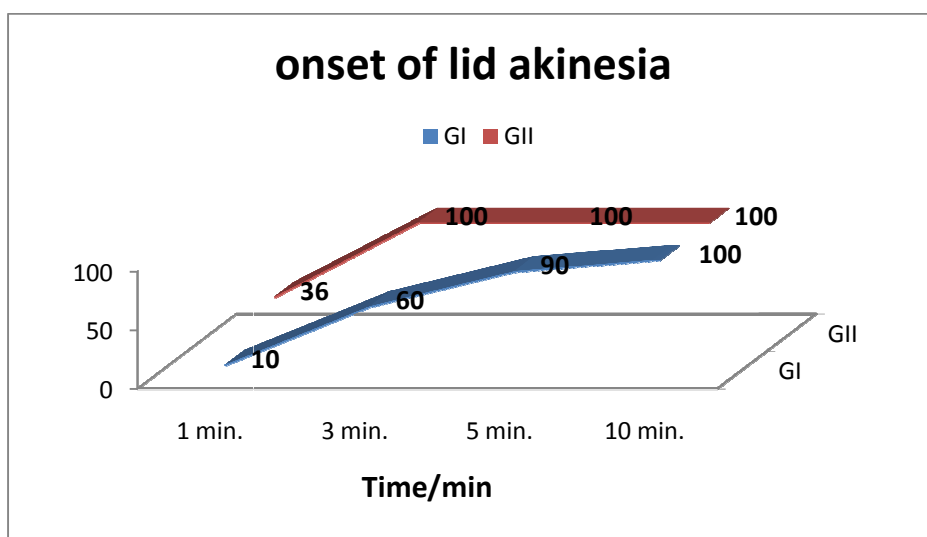


Fig.(2): onset of lid akinesia.

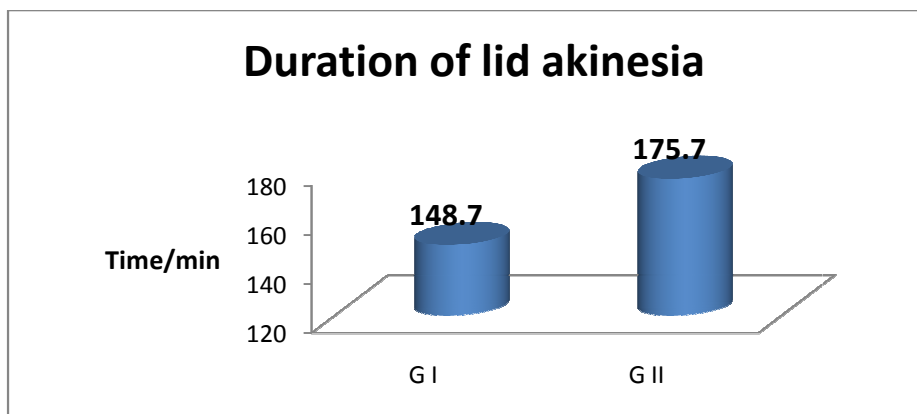


Fig. (3): Duration of lid akinesia

Regarding the onset of globe akinesia at one minute no patients in group I show akinesia while, in group II three patients (10%) show complete globe akinesia at one minute. At three minutes 5 patients (16.7%) of group I had complete globe akinesia compared to 25 patients (83.3%) of group II. Then at five minutes 23 patients (67.7%) of group I had akinesia compared to 30 patients (100%) of group II. And then at ten minutes 28 patients (93.3%) of group I had akinesia. And lastly

rest of the patients in group I had complete globe akinesia at 15 minutes. These results show highly significant statistical difference between the two groups proving that atracurium added to local anaesthetic mixture in group II hastened the onset of the block than group I. Duration of globe akinesia was 117.4 ± 3.5 in group I compared to 150.93 ± 2.4 in group II which is statistically highly significant.

Table(3) Onset And Duration Of Globe Akinesia.

Globe akinesia	Group I		Group II		P
	No.	%	No.	%	
Onset					
1 min.	0	0	3	10	<0.001
3 min.	5	16.7	25	83.3	
5 min.	23	67.7	30	100	
10 min.	28	93.3	0	0	
15 min.	30	100	0	0	
Duration of globe akinesia	117.4 ±3.5		150.93±2.4		<0.001

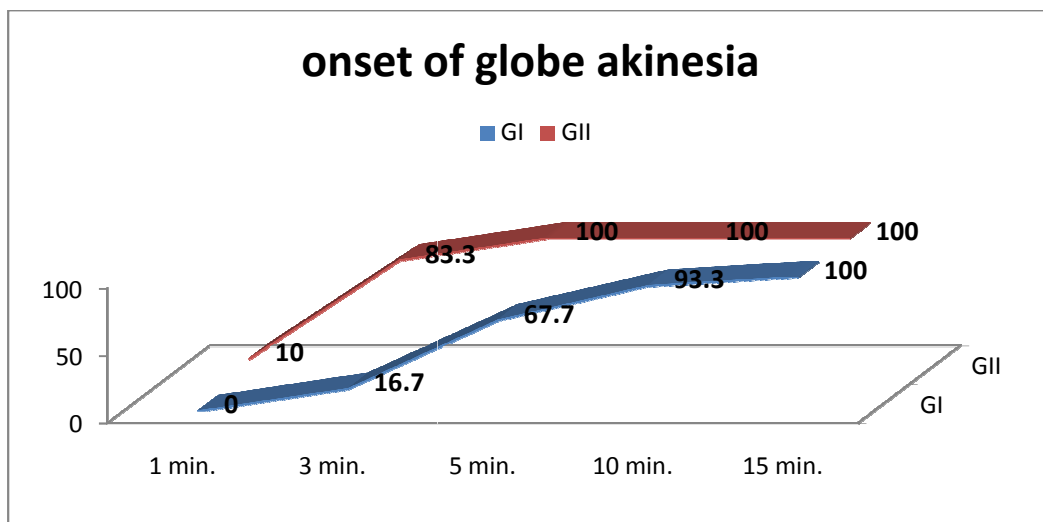


Fig. (3) Onset of globe akinesia.

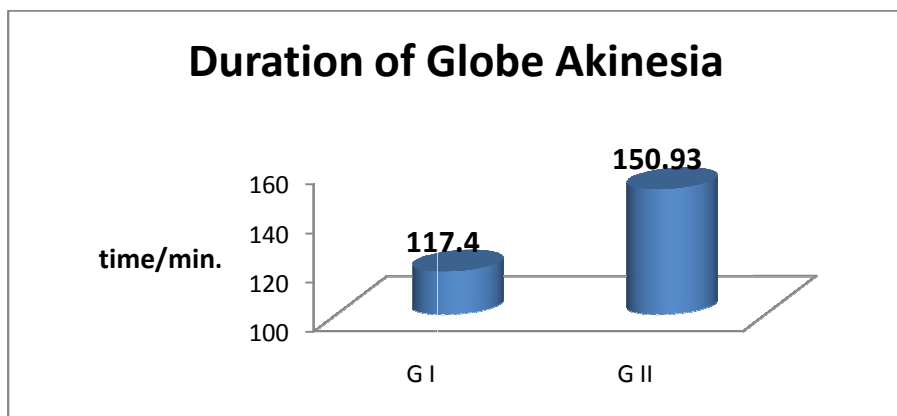


Fig.(4) Duration Of Globe Akinesia.

Regarding first analgesic request the following was observed; in the *first hour* 12 patients(40%) of patients in group I requested analgesic compared to 9 patients (30%) in group II. In *second hour* 15 patients (50%) of patients in group I requested analgesic

compared to 18 patients (60%) of patients in group II. And at the *third hour* 3 patients (10%) in either group requested analgesic. Statistically those results show no significant difference between both groups

Table (5) First Analgesic Request

1 st analgesic req.	Group I		Group II		P
	No.	%	No.	%	
1 hr.	12	40	9	30	>0.05
2 hr.	27	90	27	90	
3 hr.	30	100	30	100	

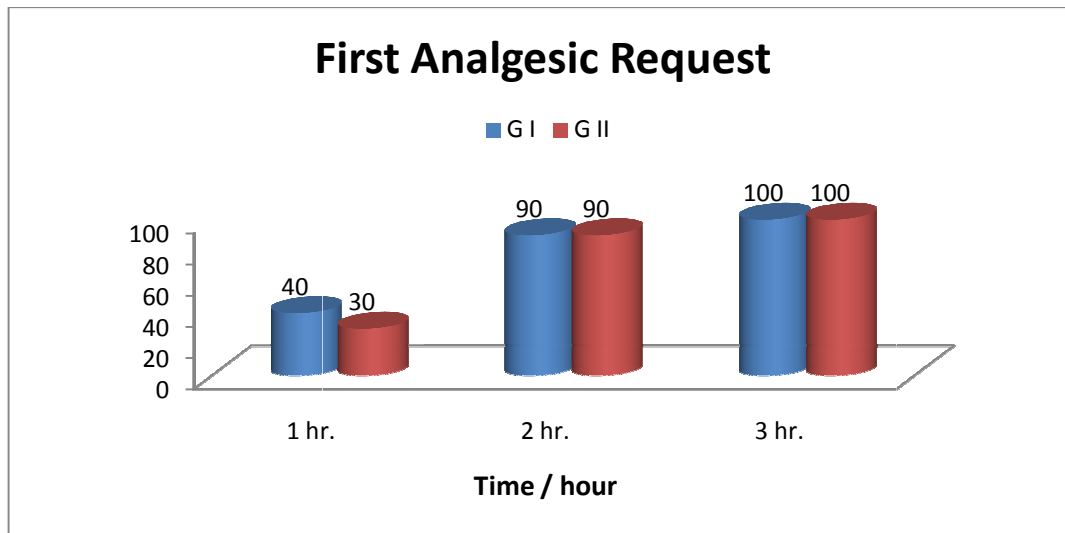


Fig.(5): First analgesic request.

Discussion:

Local anaesthesia is the anesthetic technique of choice for surgery on the eye in many instances. The expansion of day-case facilities has encouraged its use, and the development of less invasive surgical techniques has rendered general anesthesia largely unnecessary⁽⁶⁾. In UK the use of local anaesthesia has risen from around 20% in 1991 to over 75% in 1996 and 86% in 1997 and the use of sedation with local anesthesia has fallen from 45% in 1991 to around 6% in 1996⁽⁷⁾. Although rare, many serious complications have been reported following needle blocks⁽⁸⁾. These complications arise because of trauma produced by passing a sharp needle blindly into the retrobulbar

space. This led to the introduction of the newer Sub-Tenon's block as a safer alternative⁽⁹⁾. Recent reports suggest that the use of Sub-Tenon's block is becoming more widespread amongst anesthesiologists and ophthalmologists. It has been suggested that it has a more acceptable risk profile than traditional ophthalmic anaesthesia techniques⁽⁶⁾. It does not need a large injectate volume and is found to achieve a better success rate when compared to retrobulbar, peribulbar and topical anaesthesia alone, as shown in many published studies relating to this block^{(4),(6)(10),(21),(22)}. **Roman and his colleagues,⁽¹¹⁾** reported that 99.1% of 109 patients scored the anesthetic procedure as

painless ,and 97% reported the various surgical producers as devoid of pain. When pain associated with injection is compared, sub-Tenon's is comparable to topical, or subconjunctival anaesthesia and appears less painful than either peribulbar or retrobulbar blocks. Sub-Tenon's provides a similar degree of intraoperative analgesia compared to retro- and peri-bulbar anesthesia and more adequate analgesia than topical methods particularly if scleral cautery is used. However, akinesia is variable and may not be complete ⁽¹²⁾. Akinesia is volume dependent and if 4–5mL of local anesthetic agent is injected, a large proportion of patients develop akinesia. Superior oblique muscle and lid movements may also remain active in a significant number of patients ⁽¹³⁾. The use of an adjuvant to accelerate onset of akinesia could further improve its efficacy. Atracurium is used as an adjuvant to local anaesthetics in order to provide better akinesia and accelerate the onset of anaesthesia. Atracurium has been used in regional blocks in humans, such as Bier's block and local intravenous regional anesthesia. ^{(14) ,(15), (16)} The addition of atracurium to local anaesthesia does not affect analgesia, but because of its effect on motor nerves, it induces akinesia in extraocular muscles and

orbicularis oculi therefore optimizing the setting for ophthalmic surgeries. In the present study, onset of anaesthesia was much faster in group II (study group) compared to group I (control group), also the duration of action was significantly longer in group II than group I. These results are statistically highly significant that adding atracurium in group II hastens the onset and prolonged the duration of lid and globe akinesia. The above results were in agreement with the following study conducted by **Zuhal;** ⁽¹⁷⁾, On 60 patients of either sex for elective cataract surgery. Patients were allocated into two groups to receive peribulbar (PBA) injections with two different solutions, Group I (n = 30) of 2% plain lidocaine + 0.5% plain bupivacaine ;and group II (n = 30) received 2% plain lidocaine + 0.5%plain bupivacaine + 0.5 ml of atracurium (5 mg) were used. In this double blind, prospective, randomized study, atracurium shortened the onset time of peribulbar block compared with plain solution. The onset of complete block was more rapid in the atracurium group in that study compared with control group. Twenty-nine patients of group II achieved an akinesia score of zero in that study. But, duration of akinesia and time to complete recovery was not different between the two groups in that

study. The eye seems to be a suitable region in which to demonstrate possible local effects of neuromuscular blockers. Though the mechanism is still unclear, the hypothesis that the neuromuscular blockers probably interfere with muscle spindle activity. As a result, muscle tone and spasm decreased⁽¹⁸⁾. The local action of atracurium in that study is probably explained by the same mechanism. **Reah et al;**⁽¹⁹⁾ studied vecuronium in PBA and they reported that the addition of 0.5 mg vecuronium to the standard anesthetic mixture improves the quality of the globe and eyelid akinesia. In another study that was conducted by **Eghbal et al,**⁽²⁰⁾ on sixty-four, ASA I or II patients scheduled for cataract surgery under local anesthesia. The patients were assigned to two treatment groups in a randomized, double-blind manner. The case group received 2 ml of 2% lidocaine (40 mg) and 0.5 mL atracurium (5 mg) and the control group received 2 ml of 2% lidocaine and 0.5 ml 0.9% NaCl. The onset and duration of akinesia and also adverse effects and complications of each method were recorded throughout the study. There were no significant differences between the case and control groups. 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 ($P < 0.001$). This study demonstrated that atracurium had a local action on the extraocular muscles. It shortened the onset period of retrobulbar block, prolonged its duration, and provided excellent surgical conditions without any specific complications⁽²⁰⁾. The results of the study done by Eghbal was in agreement with the present study, plus the advantages of sub-Tenon technique in comparison to retro- or peribulbar techniques that was used in the above studies.

Conclusion

In conclusion, the sub-tenon's technique appears to get closer to the characteristics of an ideal block than with retrobulbar block, avoiding many serious complications of the later. Another advantage of sub-tenon's technique is that it is usually associated with only minor discomfort, which may explain the excellent degree of patient acceptance.

The addition of low dose atracurium 0.5 mg to local anaesthetic solution shortens the onset time and prolongs the duration of akinesia without known complications.

Further studies are required to optimize the dose of neuromuscular blockers to be added to local anaesthetics to make sub-Tenon's block more effective.

References

- (1) **Eke T, Thompson JR.** Serious complications of local anaesthesia for cataract surgery: a 1 year national survey in the United Kingdom. *Br J Ophthalmol* 2007; 91: 470-5.
- (2) **Ripart J, Prat-Pradal D, Vivien B, Charavel P, Eledjam JJ.** Medial canthus episcleral (sub-Tenon) anesthesia imaging. *Clin Anat* 1998;11:390-5.
- (3) **Ripart J, Lefrant JY, Vivien B, Charavel P, Fabbro-Peray P, Jaussaud A, et al.** Ophthalmic regional anesthesia: medial canthus episcleral (sub-tenon) anesthesia is more efficient than peribulbar anesthesia: a double-blind randomized study. *Anesthesiology* 2000;92:1278-85.
- (4) **Guisse PA.** Sub-Tenon anesthesia: a prospective study of 6,000 blocks. *Anesthesiology* 2003; 98: 964–968.
- (5) **BrahmaAK, PembertonCJ, AyekoM, MorganLH.** Single medial injection peribulbar anaesthesia using prilocaine. *Anaesthesia* 1994;49:1003-5.
- (6) **Kim Chishti, AndreyVarvinskiy, Consultant** -TorbayHospital,UK; Anaesthesia For Ophthalmic Surgery- Regional Techniques ,Anaesthesia Tutorial Of The Week 135 ;25th May 2009
- (7) **RCOA&RCOO** (Royal collage of anaesthesia and royal college of ophthalmologists,2002).
- (8) **Rubin A.** Eye blocks. In: Wildsmith JAW, Armitage EN, McLureJH,editors. Principles and Practice of Regional Anaesthesia.London:Churchill Livingstone,2003.
- (9) **Hamilton RC.** Complications of ophthalmic regional anesthesia. In: Finucaine BT, editor. Complications of regional anesthesia.Philadelphia7 Churchill Livingstone; 2000.p. 39–55.).
- (10) **Mathew Alan ;** Sub-Tenon's Anaesthesia for Ophthalmic Procedures, anaesthesia UK; 2010
- (11) **Roman SJ, Chong Sit DA, Boureau CM, et al.** Sub-Tenon's anaesthesia: an

efficient and safe technique. *Br J Ophthalmol* 1997;81:673–6.

(12) **Kumar CM, Dowd TC.** Ophthalmic regional anaesthesia. *Current Opin Anaesthesiol* 2008;oct 21(5):632-7

(13) **Kumar CM, Dodds C.** Evaluation of Greenbaum sub-Tenon's block. *Br J Anaesth* 2001; 87: 631–633.

(14) **Torrance JM, Nikki P, Paloheimo M.** Orbicular muscle akinesia in regional ophthalmic anaesthesia with pH- adjusted bupivacaine: Effects of hyaluronidase and epinephrine. *Can J Anaesthesia* 1993; 40:1028-1034.

(15) **McGlone R, Heyes F, Harris P.** The use of muscle relaxant to supplement local anaesthetics for Bier's blocks. *Archives of Emergency Medicine* ;1988;5(2):79–85

(16) **Kurt N, Kurt I, Aygünes B, Oral H, Tulunay M.** Effects of adding alfentanil or atracurium to lidocaine solution for intravenous regional anaesthesia. *Eur J Anaesthesiol* 2002;19:522-525.

(17) **Zuhalkucukyavuz** ;Effects of atracurium added to local anesthetics on akinesia in peribulbar block; 2002)by

American Society of Regional Anesthesia and Pain Medicine.

(18) **SztarkF,Thiocoip M, Favarel-Garrigues JF, Lassie P, Petitjean ME, Dabadie P.**The use of 0.25% lidocaine with fentanyl and pancuronium for intravenous regional anaesthesia.*Anaesth Analg* 1997; 84:777-779

(19) **Reah G, Bodenham AR, Braitwait P, Esmond J, Ménage MJ.** Peribulbar anaesthesia using a mixture of local anaesthetic and vecuronium.*Anaesthesia* 1998; 53:551-554.

(20) **EghbalMH,Tabei H, Taregh SA, Razeghinejad MR,** The effect of addition of low dose atracurium to local anesthetic in retrobulbar block for cataract surgery. *Middle East J Anasthiol*;2010.

(21)**Kumar CM, Williamson S, Manickam B.** A review of sub-Tenon's block: Current practice and recent development. *Eur J Anaesth.* 2005; 22:.567-77.

(22) **SoufiaFarrukh,** D.O.M.S, FCPS; Sub-Tenon anaesthesia; an efficient and safe technique for cataract surgery. *Professional Med J Sept.* 2005; 12(3): 300-303.