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Research Article

Peribulbar versus sub-Tenon block in cardiac patients undergoing cataract surgery during warfarin therapy

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KEYWORDS

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Abstract *Objective:* To compare sub-Tenon's block with peribulbar block in patients on oral warfarin therapy undergoing cataract surgery.
Materials and methods: We studied 100 patients on warfarin undergoing cataract surgery; randomly allocated into one of two groups; sub-Tenon's group (group S, $n = 50$), and peribulbar group (group P, $n = 50$). In group (S), sub-Tenon's injection of 3–5 ml of anesthetic agent was done using a 25 mm sub-Tenon's cannula. In group (P), the peribulbar block with 3–4 ml of 2% lidocaine–hyaluronidase (10 IU/ml) and 0.5% bupivacaine was done. Pain and akinesia and postoperative complications were assessed.
Results: Sub-Tenon group showed significantly higher frequency of hemorrhage compared to peribulbar group (30% versus 8%, $p = 0.041$), mainly of grade I. The two groups had comparable frequency of subconjunctival hemorrhage ($p = 1.000$). No patients experienced sight-threatening hemorrhagic complications. Pain was significantly lower in the sub-Tenon group. Akinesia was significantly better ($p = 0.025$) 2 min after injection and comparable from 4 to 10 min after injection in the peribulbar group. The majority of patients in the two groups reported satisfaction ($p = 0.372$). The surgeon expressed higher satisfaction with peribulbar block (94%) compared to sub-Tenon's block (81%) ($p = 0.064$).

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Conclusion: Peribulbar and sub-Tenon techniques were relatively safe in patients on anticoagulants during cataract operation. We recommend peribulbar technique owing to significantly less bleeding and more satisfactory akinesia response and hence surgeon comfort.

1. Introduction

Peribulbar, retrobulbar and sub-Tenon's techniques are widely used methods for regional anesthesia in ocular surgery. Cataract extractions could be performed under topical anesthesia but some of the patients need peribulbar or retrobulbar block for their eye surgery [1]. Compared to retrobulbar block, peribulbar block is often preferred owing to the lower risk of complications. The same applies to the sub-Tenon's block which is getting more popular in the last few years [2]. Sub-Tenon's block involves transconjunctival infiltration of local anesthetic after instillation of topical local anesthetic in the conjunctiva to alleviate the pain of injection.

With a growing aging population, management of the anticoagulated patient having cataract surgery is an important issue. The hemorrhagic risks from continuing warfarin on one hand and the thromboembolic risks from discontinuing the drug on the other hand can make management challenging [2,3]. Warfarin is a widely used oral anticoagulant that is clinically indicated for patients with atrial fibrillation, valve disease and venous thromboembolism.

The Royal College of Ophthalmologists of the United Kingdom (RCOphth) [4] has published guidelines on the preoperative management of the anticoagulated patient. These guidelines state the following: 1 – Warfarin is effective at reducing health and life threatening thrombotic events. 2 – To stop warfarin risks stroke and death, the risk for stroke increases to 1:100. 3 – The INR should be checked to ensure that a patient is within the desired therapeutic range (set by the treating physician). 4 – If needle local anesthesia is performed, the risk for orbital hemorrhage is increased by 0.2–1.0%. 5 – Considerations should be given to using sub-Tenon's or topical anesthesia.

The therapeutic range for oral anticoagulation control is that proposed by the British Society for Hematology [5]: atrial fibrillation INR 2.0 (2.0–3.0), heart value disease INR 3.8 (3.0–4.5) and pulmonary embolism or deep venous thrombosis INR 2.5 (2.0–3.0).

To our knowledge, there was no study in the literature comparing sub-Tenon's block with the more popular peribulbar block in patients on oral anticoagulants. This study thus aimed to compare the two methods with respect to hemorrhagic complications, pain score, akinesia and surgeon comfort in cardiac patients under warfarin oral anticoagulant therapy undergoing cataract surgery.

2. Materials and methods

Approval was granted by the ethics committee from the Research Institute of Ophthalmology for this prospective randomized study. We studied 100 patients undergoing elective cataract surgery in the period from November 2011 to July 2013. Patients were interviewed preoperatively for detailed medical and drug intake history. Patients on warfarin with atrial fibrillation, pulmonary embolus or deep venous thrombosis who had their INR adjusted between 2 and 2.5 for prophylaxis, were asked to continue their medication as usual. INR was checked preoperatively on the day of surgery. Patients on other anti-coagulants, pre-existing disorders as congenital coagulopathies, deficit in blood coagulation factors, severe liver or renal disease, uncontrolled hypertension or diabetes were excluded.

The patients were randomly allocated using computer generated numbers into one of two groups; sub-Tenon's block group (group S, $n = 50$), and peribulbar block group (group P, $n = 50$). After verbal explanation of the risk of hemorrhage, a written consent was obtained from all patients. Upon arrival to operating theater, an intravenous line was inserted, and standard monitors; namely pulse oximetry, electrocardiography and non-invasive blood pressure, were applied. A short acting sedative; midazolam 0.5–1 mg was given intravenously 5 min before block to patients who seemed very anxious.

The surgery and the sub-Tenon's block were performed by the same surgeon. Two anesthetists were involved in the study. The first anesthetist was in charge of data collection while the second anesthetist, who was an experienced ophthalmic anesthetist, performed the peribulbar.

In group (S), patients were draped and prepared using topical proxymetacaine 0.5%, tetracaine 1% and povidone iodine. Sub-Tenon's injection of 3–5 ml of anesthetic agent was administered through a small conjunctival incision in the inferonasal quadrant, using a 19-gauge sub-Tenon's cannula 25 mm in length. The mixture used was 1:1 lignocaine 2% bupivacaine. After injection, digital ocular pressure was applied for 5 min.

In group (P), the peribulbar block was done using a single injection technique with 3–4 ml of 2% lidocaine–hyaluronidase (10 IU/ml) and 0.5% bupivacaine with a ratio of 1:1 using a 28 G, 12 mm beveled needle. The site of injection was limited superiorly with the inferior lacrimal canaliculus, medially with the lateral margin of the nose, an imaginary line that joins inferior lacrimal papilla to inferior margin of the orbit laterally and inferior orbital margin inferiorly. The needle was advanced slowly antero-posteriorly for half of its length then obliquely in the direction or the optical foramen until the needle was on the same plane of the bony margin of the orbit. After negative aspiration, the local anesthetic mixture was slowly injected. Digital ocular compression was performed for 5 min. A tono-pen XL (Reichert, Technologies, USA) which provides intraocular pressure (IOP) readings, was used to measure intraocular pressure before performing the block, immediately after local anesthetic injection and after 5 min of the compression after the completion of block.

Patients were followed up during the first 24 h postoperatively, then 1 and 6 weeks after surgery to record postoperative complications. Bleeding was assessed on a 4-grade scale of hemorrhage developed by Kallio et al. [1]; grade 1 = spot ecchymosis; 2 = lid ecchymosis involving half of the lid surface area or less; 3 = lid ecchymosis all around the eye with

no increase in intraocular pressure and 4 = retrobulbar hemorrhage with increased intraocular pressure.

Postoperative complications of subconjunctival hemorrhage as well as sight threatening hemorrhage defined as hyphema, vitreous hemorrhage, subretinal hemorrhage, choroidal hemorrhage of more than a minimal degree were recorded.

Globe elevation, depression, adduction and abduction were separately assessed by akinesia score scale of 0–3; 0 = no movement, 1 = minor movement, 2 = moderate movement, and 3 = normal movement. A fully mobile eye scored 12, whereas an immobile eye scored zero. Mobility was assessed at 2 min interval until 10 min after injection. A total score <4 was considered satisfactory for surgery, and if score was $\geqslant 4$ at 10 min, a supplementary injection was given.

Patients estimated pain on the visual analogue score (VAS) on a scale of 0–10; (0 representing no pain and 10 representing the worst imaginable pain) during administration of the block, during surgery, after completion of surgery and 4 h postoperatively. Data recorded included age, sex, reason for anticoagulation, preoperative INR, pre- peri- and postoperative complications specifically bleeding, akinesia and pain scores.

The primary outcome measure was the rate of complications as a direct result of anticoagulation. Secondary outcome measures were patient and surgeon satisfaction, pain scores and globe akinesia.

2.1. Statistical methods

Data was analyzed using IBM SPSS Advanced Statistics version 20.0 (SPSS Inc., Chicago, IL). Numerical data were expressed as mean and standard deviation or median and range as appropriate. Chi-square test (Fisher's exact test) was used to examine the relation between qualitative variables. For quantitative data, comparison between two groups was done using independent sample *t*-test or Mann–Whitney test as appropriate. A p-value < 0.05 was considered significant.

3. Results

The two groups were comparable regarding age, gender and preoperative INR (Table 1). Intraocular pressure (IOP) was statistically lower in the sub-Tenon group preoperatively ($p = 0.004$) and 5 min after block completion ($p = 0.002$). However, the levels of IOP were within the clinically normal values pre- and postoperatively. The two groups showed statistically significant increase of IOP, but the increase was of no clinical significance. Pain scores were significantly lower in the sub-Tenon group from block administration up to 4 h postoperative (Table 2).

Sub-Tenon group showed significantly higher frequency of hemorrhage ($p = 0.041$), mainly of grade I. Fifteen patients (30%) of sub-Tenon group suffered hemorrhage compared to 4 (8%) of the peribulbar group. On the other hand, the two groups had comparable frequency of subconjunctival hemorrhage ($p = 1.000$). No patients experienced sight-threatening local anesthetic or operative hemorrhagic complications (see Table 3)

The peribulbar group showed significantly lower akinesia scores 2 min after injection ($p = 0.025$). However, there was no significant difference in akinesia scores between the two groups from 4 to 10 min after injection (Table 4). The majority

Table 1 Age, gender and baseline INR of the two studied groups.

	Sub-Tenon group $n = 50$	Peribulbar group $n = 50$	p-Value
Age (mean ± SD, years)	58.7 ± 2.7	57.9 ± 2.3	0.114
Gender (male/female)	32/18	29/21	0.293
Preoperative INR, mean ± SD	2.2 ± 0.1	2.2 ± 0.2	1.000

p-Value < 0.05.

Table 2 Intraocular pressure (mmHg) and VAS score of pain in the two studied groups.

	Sub-Tenon group $n = 50$	Peribulbar group $n = 50$	p-Value
Intraocular pressure			
Preoperative	17.5 ± 1.4	18.4 ± 1.5	0.004
Post-injection	18.1 ± 1.2	18.8 ± 1.3	0.006
5 min after block completion	18.3 ± 1.5	19.3 ± 1.6	0.002
VAS score			
On block administration	3 (2–4)	3 (2–5)	0.026
Intraoperative	2 (1–4)	2 (1–5)	0.044
Immediate postoperative	2 (1–3)	2 (1–4)	0.016
4 h Postoperative	2 (1–3)	2 (1–5)	0.001

p-Value < 0.05.

Table 3 Postoperative complications in the two studied groups (number (%)).

	Sub-Tenon group $n = 50$	Peribulbar group $n = 50$	p-Value
Hemorrhage grade			0.041
Grade I	10 (20%)	3 (6%)	
Grade II	3 (6%)	1 (2%)	
Grade III	2 (4%)	0 (0%)	
Grade IV	0 (0%)	0 (0%)	
Subconjunctival hemorrhage	2 (4%)	2 (4%)	1.000

p-Value < 0.05.

Table 4 Intraoperative values of Akinesia score in the two studied groups.

	Sub-Tenon group $n = 50$	Peribulbar group $n = 50$	p-Value
Akinesia score (0/1/2/3)			
2 min	0/4/30/16	0/10/34/6	0.025
4 min	4/38/8/0	6/38/6/0	0.710
6 min	28/22/0/0	30/20/0/0	0.686
8 min	50/0/0/0	47/3/0/0	0.078
10 min	50/0/0/0	50/0/0/0	[a]

p-Value < 0.05.
[a] The two groups had the same distribution.

of patients reported satisfaction with peribulbar procedures (84%) and sub-Tenon's block (90%) with no significant difference between the two groups ($p = 0.372$). The surgeon expressed higher satisfaction with peribulbar block (94%) compared to sub-Tenon's block (81%). However the difference between the two techniques showed only a tendency toward statistical significance ($p = 0.064$).

4. Discussion

This study demonstrated significantly higher bleeding tendency in the sub-Tenon's group compared to the peribulbar group ($p = 0.041$). However, the two techniques had comparable frequency of chemosis and subconjunctival hemorrhage. There was no sight threatening bleeding complications with both techniques, either related to anesthesia or surgery itself. Pain was significantly higher in the peribulbar group. Akinesia was significantly lower in the peribulbar group in the first few minutes after injection and comparable in the two groups from 4 to 10 min after injection.

Continuation of anticoagulant use may pose an increased risk of intraoperative hemorrhage during intraocular surgeries [2,6]. On the other hand, a significant proportion of the old aged population needing cataract surgery might be on anticoagulants. Examples include myocardial infarction, valvular heart disease, diabetes mellitus and pulmonary embolism patients.

Conflicting results were presented in the literature. Some studies showed that continued anticoagulant intake during intraocular surgery did not lead to serious intraocular hemorrhage [7]. On the other hand, other studies stated a higher though not eye threatening tendency to more bleeding [2].

Furthermore, several studies warned of the hazards to discontinue anticoagulants in old aged individuals prior to surgery. To support this, the RCOpth guidelines [4] have suggested the continuation of warfarin during intraoperative ocular operations. Withdrawal of warfarin, preoperatively, for example was shown to increase both hemorrhagic and or thromboembolic complications [8,9–11].

Hence, a need for identifying the preferred anesthetic technique to avoid or decrease tendency to intraocular bleeding is highly warranted. We compared peribulbar to sub-Tenon block techniques in terms of bleeding, akinesia and pain scores.

In the current series, the sub-Tenon technique was associated with significantly higher proportion of hemorrhagic complications (30%) compared to the peribulbar group (8%). Three cases of the former group had grade II and two had grade III bleeding. On the other hand only 1 patient of peribulbar group had grade II bleeding. This emphasizes the relative safety of peribulbar technique in these cases under anticoagulant therapy. However, both techniques are basically safe; we did not record sight threatening bleeding with both techniques, either related to anesthesia or surgery itself. This was similar to the findings by Kumar et al., who found no sight threatening complications using the sub-Tenon technique in patients on warfarin or clopidogrel intraoperatively [2].

Parkar et al. [12] reported a slightly higher level of subconjuctival hemorrhage after sub-Tenon block compared to peribulbar block. It is noteworthy, though, that their patients were not on any anticoagulants, hence explaining the exaggerated difference in the number of patients affected between our study and theirs.

Pain was significantly higher in the peribulbar group in our study. This was in agreement with Parker et al. [12] findings. They showed statistically lower level of pain and discomfort during administration of sub-Tenon anesthesia compared to the peribulbar technique. This was verified by the topical instillation of local anesthetic in the sub-Tenon group prior to the subconjunctival incision.

Similar to the current study, Parker et al. reported a significantly higher level of akinesia for the peribulbar group (average akinesia 1.2) when compared to sub-Tenon group (average score 8.4) on range of 1–12.

Hence, it may be safe to say that while peribulbar anesthesia might provide a slightly higher discomfort for the patient when compared to the subtenon technique, surgeons found sub-Tenon technique uncomfortable due to the less control of eye movement.

Previous studies comparing those two techniques in eye surgery, not using anticoagulants, found more or less equal surgical outcomes [4,7]. This could be different from our findings due to the added hazard of using anticoagulants in the current series. To the best of our knowledge, after reviewing the literature, no other study has compared these two techniques in patients on anticoagulant therapy. Larger scale studies are needed to confirm our findings.

In conclusion, our study showed significantly less bleeding using the peribulbar technique in comparison with the sub-Tenon technique in patients on anticoagulants during cataract operation. The two techniques were free of severe or sight threatening hemorrhage. Peribulbar technique also showed more satisfactory akinesia response hence better ease of surgery in such patients.

Finally, both techniques offered relatively safe profiles for use with patients on anticoagulants. Nevertheless, we recommend the use of peribulbar to sub-Tenon technique in patients on anticoagulant therapy during surgery owing to lower risk of bleeding and better akinesia and hence surgeon comfort.

Conflict of interest

No conflict of interest.

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