Sub-tenon Versus Sub-conjunctival Anaesthesia for Intraocular Surgery

Abstract
Objective: To compare the pain relief achieved using sub-Tenon anesthesia with that of sub-conjunctival anesthesia technique in intraocular surgery at the Guinness Eye Centre Onitsha, Nigeria. Materials and Methods: Consecutive adult patients who had intraocular surgery under local anesthesia were randomized into having sub-Tenon (3 mL) or sub-conjunctival (0.5 mL) injections using xylocaine ± adrenaline. The manual suture-less surgery technique was used for cataract surgery alone and cataract surgery with pterygium excision; the extra-capsular cataract extraction technique was adopted for combined trabeculectomy and cataract surgery. Surgery duration was recorded. Patient’s pain perception graded as none, mild, moderate or severe. Results: 100 patients made up 51 (51.0%) males and 49 (49.0%) females, age range was 31–88 years, median – 68 years, participated. Sub-Tenon anesthetic technique was used in 52 (52.0%) and sub-conjunctival in 48 (48.0%) participants. Seventy-eight (78.0%) patients had cataract surgery; 10 (10.0%) had trabeculectomy; 7 (7.0%) had combined trabeculectomy and cataract surgery and 5 (5.0%) had pterygium excision with cataract surgery. The mean surgery duration in the sub-Tenon anesthesia group was 31.8 ± 8.5 minutes and 30.2 ± 9.8 minutes in the sub-conjunctival group (P > 0.05). Fifty (96.2%) patients in the sub-Tenon group and 38 (79.2%) in the sub-conjunctival group experienced mild or no pains; 2 (4.2%) patients in the sub-Tenon group and 10 (20.8%) in the sub-conjunctival group experienced moderate to severe pains (P < 0.05). Conclusions: Both sub-conjunctival and sub-Tenon anesthetic achieved effective analgesia in intraocular surgery. But sub-Tenon anesthesia is significantly associated with lower incidence of severe pains.

Keywords: Intraocular surgery, local anesthesia, sub-conjunctival, sub-tenon

Introduction
Intra-ocular surgery in adults can be performed with general or local anesthesia.[1] Frequently, local anesthesia is preferred in adults, some of whom may have comorbidities that make general anesthesia risky.[2] Generally, local anesthesia techniques have the advantages of ease of administration with simple instruments, no need for expensive equipment, short learning curve and good safety margin even in patients with systemic co-morbidity. The Joint Committee of the Royal College of Anesthetists and the Royal College of Ophthalmologists had noted that in the United Kingdom, ophthalmic surgery under local anesthesia is preferred by most patients and it is associated with the least disruption of patient’s normal activity.[3]

In resource poor settings non-physicians such as nurse anesthetists are trained to and indeed routinely administer local anesthetics to patients undergoing intraocular surgery. They also monitor these patients and alert the surgeon of any untoward event during surgery. Techniques of local anesthesia include topical, retrobulbar, peribulbar, sub-Tenon, sub-conjunctival and intracameral.[1-4] The effectiveness of each of these techniques in terms of pain relief varies. Hitherto, retrobulbar, peribulbar and sub-conjunctival anesthetic techniques were the methods of anesthesia used for intraocular surgery in our hospital. In 2016, sub-Tenon technique was introduced with the availability of the sub-Tenon cannula.

The objective of this study was to compare the pain relief achieved using sub-Tenon anesthesia with that of sub-conjunctival anesthesia technique in intraocular surgery.

Materials and Methods
This study was approved by the institutional review board of the Centre for Eye Health Research and Training, Nnamdi Azikiwe University Awka, Nigeria. The study adhered to the

How to cite this article: Nwosu SN, Nwosu VO, Akudinobi CU, Uba-Oblano CU, Nnubia CA, Ubaka CO, et al. Sub-tenon versus sub-conjunctival anaesthesia for intraocular surgery. J West Afr Coll Surg 2022;12:27-30.
tenets of the Declaration of Helsinki on research involving humans. The study was conducted between 01 February 2017 and 31 January 2018. The minimum sample size was calculated using the formula for comparative study based on 95% confidence interval and a power of 90%; the minimum difference in main outcome measure that would be of statistical significance was 15%. The minimum calculated sample size was 96 (i.e. 48 for each group).

A written informed consent was obtained from each participant. The participants were consecutive adult patients undergoing cataract surgery alone, cataract surgery with pterygium excision or combined cataract and glaucoma surgeries. Excluded were patients that had had previous surgery in the eye to be operated upon.

All the participants were operated upon using local anesthesia using 2% xylocaine with 1:100,000 adrenaline. For hypertensive patients plain xylocaine was used. Only one person (SNN) administered the anesthetic. Two experienced ophthalmic surgeons (SNN and CUA) performed all the surgeries. An experienced nurse anesthetist (VON) monitored the patients throughout surgery duration.

The patients were randomly assigned to receive either sub-Tenon or sub-conjunctival anesthesia. Facial block was not used in either technique. The simple randomization technique was employed viz: on a 2 cm x 2 cm plain sheet of paper was written sub-conjunctival or sub-Tenon. The paper was folded and put in a bag and churned. Before administering the anesthetic a nurse not involved in the study picked one of the folded papers from the bag and unfolds it. Whatever that was written on the paper was the anesthetic technique used.

For the sub-conjunctival anesthetic technique, the lids were separated with speculum and 0.5ml 2% xylocaine plus 1:100,000 adrenaline (or plain xylocaine for hypertensive patients) was injected in the peri-corneal conjunctiva in all quadrants using 27G needle. There was no ocular massage. For the sub-Tenon anesthetic technique, the eyeball was exposed with speculum; a 2 mm incision made about 2 mm from inferior limbus. Thereafter a curved blunt ended cannula was used to enter the sub-Tenon space down to the post-equatorial zone of the eyeball; then 3ml 2% xylocaine plus 1:100,000 adrenaline (or plain xylocaine for hypertensive patients) was injected. Ocular massage immediately following the injection was carried out for 3 minutes.

The anesthetic was administered with the patient lying supine on the surgical operation table. The time interval between the end of anesthetic administration and commencement of surgery was timed with a stop clock. Also timed was the duration of surgery. For all patients irrespective of technique, the interval between end of anesthetic administration and commencement of surgery did not exceed one minute. For the sub-Tenon anesthesia, stopping ocular massage signaled the end of anesthetic administration; for the subconjunctival technique, anesthetic administration ended with removal of the subconjunctival needle after injecting the last quadrant. The duration of surgery was recorded beginning from the conjunctival incision until a pad was placed on the closed lids.

The main outcome measure was subjective pain perception by the patient which was graded as follows:

- None: no complaint or movement during surgery
- Mild: Wincing requiring reassurance
- Moderate: crying but head/eyes steady; no additional medication
- Severe: restless; moving head away from operation field; rolling eyes; require additional medication

The data obtained were analyzed using descriptive and inferential statistics (chi square and t-tests) with alpha at 0.05.

**Results**

One hundred patients made up of 51(51.0%) males and 49(49.0%) females participated. The age range was 31 – 88 years; median – 68 years. Table 1 shows the age and sex distribution of the participants. Sub-Tenon anesthetic technique was used in 52(52.0%) and sub-conjunctival in 48(48.0%) participants. Seventy-eight (78.0%) patients had cataract surgery alone; 10(10.0%) had trabeculectomy alone; 7(7.0%) had combined trabeculectomy and cataract surgery and 5(5.0%) had combined pterygium excision with cataract surgery. The manual small incision suture-less cataract surgery (SICS) technique was used for cataract surgery alone and also for cataract surgery with pterygium excision; the extra-capsular cataract extraction (ECCE) technique was adopted for the combined trabeculectomy and cataract surgery. All cataract surgeries, including the combined surgeries, had posterior chamber intraocular lens implant.

Concerning the duration of surgery, the sub-Tenon group had a range of 18 – 45 minutes; mean- 31.8 ± 8.5 minutes. The sub-conjunctival anesthetic group had a mean of 30.2 ± 9.8 minutes; range 16 -46 minutes. The difference in mean duration of surgery between the two techniques was not statistically significant (t- 0.072; df-98; P >0.05). While almost all patients who had cataract surgery or

| Age (Years) | Male | Female | Total (%) |
|-------------|------|--------|-----------|
| 30 – 39     | 1    | 1      | 2 (2.0)   |
| 40 – 49     | 5    | 6      | 11 (11.0) |
| 40 – 59     | 7    | 11     | 18 (18.0) |
| 60 – 69     | 15   | 12     | 27 (37.0) |
| 70 – 79     | 19   | 14     | 33 (33.0) |
| 80 – 89     | 4    | 5      | 9 (9.0)   |
| Total       | 51   | 49     | 100 (100.0) |

Table 1: Age and sex distribution
of this serious complication led to adoption of other techniques including topical, sub-Tenon and sub-conjunctival techniques.

We have had longer experience with other techniques of local anesthesia including subconjunctival, peribulbar and retrobulbar approaches. When our hospital acquired sub-Tenon cannula, we commenced using sub-Tenon anesthetic technique for intraocular surgery. After a year experience we decided to compare it with the sub-conjunctival anesthetic technique.

The techniques used in the present study essentially obviated or minimized the chances of needle injury. With the subconjunctival technique, the anesthetist directly visualized the end of the needle; secondly visible conjunctival, subconjunctival or episcleral vessels were avoided at the point of needle entry thus minimizing the chance of hemorrhage. With sub-Tenon technique, a blunt ended curved cannula was used which also minimized the incidence of peri- or retro-ocular hemorrhage.

In a previous study in which we had compared retrobulbar with subconjunctival anesthesia, both techniques were found to be effective in maintaining analgesia and minimal discomfort to the patient during the surgery. However, the sub-conjunctival technique had advantages of (1) being performed with the anesthetist directly seeing the tip of the needle and (2) using markedly less quantity of anesthetic drug.

In its most recent preferred practice pattern for anesthesia in cataract surgery the American Academy of Ophthalmology noted that there was lack of evidence for a single optimal local anesthesia strategy for cataract surgery. The Academy therefore advised that the type of local anesthesia management should be determined by the patient’s need.

The results of our study suggest that pain relief with either technique of local anesthesia is effective with most patients perceiving little or no pains. However, the subconjunctival anesthetic technique was more likely to be associated moderate to severe pains in a few patients. The smaller quantity of anesthetic and the injection under direct viewing are advantages of the sub-conjunctival technique. The relatively larger quantity of anesthetic used in the sub-Tenon technique, conceptually may be associated with increased intraorbital volume which secondarily raises the intraocular pressure. A previous study had demonstrated significant intraocular pressure rise following retrobulbar injection of 3ml of anesthetic. While this possibility was not specifically investigated in the present study, we took the precaution of massaging the globe after sub-Tenon injection. This may have spread the anesthetic to a larger orbital area leading to what was observed clinically as significant reduction in moderate-to-severe pains. The effect of sub-Tenon anesthetic on intraocular pressure is the subject of another study.

In conclusion, both sub-conjunctival and sub-Tenon anesthesia are effective in achieving analgesia in intraocular surgery. Both techniques leave room for additional injection if the patient experiences severe pains. Sub-Tenon anesthesia is significantly associated with lower incidence of severe pains during surgery. However, it required a larger quantity of anesthetic and concern for possible associated elevation of intraocular pressure makes ocular massage a routine with this technique. On the other hand the sub-conjunctival technique involves use of smaller quantity of anesthetic. Given our findings, it is recommended that either technique could be used but where the surgery would last long or the patient is apprehensive or has low pain threshold and facilities for general anesthesia are not available, sub-Tenon anesthesia is advised.

Table 2: Degree of pain versus anesthetic technique

| Degree of pain | Sub-Tenon | Sub-conjunctival | Total (%) |
|---------------|-----------|-----------------|-----------|
| None          | 44        | 34              | 78 (78.0) |
| Mild          | 6         | 4               | 10 (10.0) |
| Moderate      | 0         | 6               | 6 (6.0)   |
| Severe        | 2         | 4               | 6 (6.0)   |
| Total         | 52        | 48              | 100 (100.0)|

X² – 6.75; df – 1; p<0.05. (Significant difference in moderate to severe pains between the 2 techniques)

Discussion

The hazards of some techniques of local anesthesia such as peribulbar and retrobulbar techniques include needle stick injury (with globe penetration or perforation). There could also be inadvertent piercing of periocular or retrobulbar vessels leading to periocular or retrobulbar hemorrhage. This is because these are blind procedures using sharp objects and the ends of the needle are not visible to the anesthetist during the injection. The fear of this serious complication led to adoption of other techniques including topical, sub-Tenon and subconjunctival techniques.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.
References

1. Peyman GA, Sanders DR, Goldberg MF. Editors. Principles and Practice of Ophthalmology. Philadelphia: WB Sander. Vol 1, 1980: 605-7.

2. Roper-Hall MJ. Stallard’s Eye Surgery. Bristol: John Wright & Sons Ltd; 1980: 65-92.

3. Alhassan MB, Kyari F, Ejere HOD. Peribulbar versus retrobulbar anesthesia for cataract surgery. Cochrane Database of Systematic Reviews 2008; Issue 3. Art. No. CD004083. DOI: 10.1002/14651858.CD004083.pub2.

4. Kumar CM, Eke T, Dodds C, Deane JS, El-Hindy N, Johnston RL, et al. Local anesthesia for ophthalmic surgery. Joint guidelines from the royal college of anaesthetists and the royal college of ophthalmologists. Eye 2012;26:897-8.

5. Sommer A. Epidemiology and statistics for the ophthalmologist. Oxford: Oxford University Press; 1980:61-3.

6. Nwosu SN, Nwosu VO, Anajekwu C, Ezenwa A. Retrobulbar versus subconjunctival anesthesia for cataract surgery. Niger J Clin Pract 2011;14:280-3.

7. Miller KM, Oetting TA, Tweeten JP, Carter K, Lee BS, Lin S, et al.: American Academy of Ophthalmology Preferred Practice Pattern Cataract/Anterior Segment Panel. Cataract in the adult eye preferred practice pattern. Ophthalmology 2022;129:P1-P126.

8. Nwosu SN, Apakama AI, Ochiogu BC, Umezurike CN, Nwosu VO. Intraocular pressure, retrobulbar anaesthesia and digital ocular massage. Niger J Clin Pract 2010;13:125-7.