

Topical-intracameral anesthesia in manual small incision cataract surgery: A pilot study in a Tertiary Eye Care Center in Africa

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Abstract

Background: Cataract remains a leading cause of blindness worldwide. Manual small incision cataract surgery (MSICS) is currently practiced as the technique of choice in Sub-Saharan Africa to reduce the backlog of cataract blindness. Optimal pain control during surgery remains a challenge to cataract surgeons.

Aim: To evaluate the efficacy and safety profile of the use of aqueous topical/intracameral anesthesia in MSICS.

Materials and Methods: In this hospital-based case series, consecutive patients presenting at the eye clinic with operable cataract and willing to have surgery were enrolled. Baseline sociodemographics (age, sex, and occupation), type of cataract by morphology, pain perception, and surgeons experience were recorded. Descriptive and comparative statistical analyses were performed. A $P < 0.05$ was considered statistically significant.

Results: The surgeries were performed on 30 eyes of 16 (53.3%) males, and 14 (46.7%) females (sex ratio, 1:0.9) who were aged 60.3 ± 16.32 standard deviation (SD) (95% confidence interval [CI] of mean; 53.94–66.13) (range; 20–98 years). Using the visual analog scale, the mean pain score was $2.7 \text{ SD} \pm 2.215$ (1.87–3.53 95% CI). There was no correlation between degree of pain perception and gender ($P = 0.806$) or age ($P = 0.388$). Patient's cooperation was excellent in 22 (73.3%) of patients. Intraoperative complications occurred in 3 (10%) of patients.

Conclusion: The mean pain score in this study is low. There is no correlation between perception of pain with gender or age. Surgeons experience is excellent in most of the cases. This method of anesthesia in MSICS is adequate for patient's comfort and safe cataract surgery.

Key words: Anesthesia, cataract surgery, intracameral, topical

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Introduction

Globally, cataract is the leading cause of blindness and visual impairment and accounts for 50% of avoidable

blindness in Sub-Saharan Africa.^[1] Nigeria with a population of 140 million currently has 1.13 million blind people aged ≥ 40 years with another 3 million people aged ≥ 40 years having low vision.^[2] Cataract accounts for 43% of blindness,^[3] and cataract extractions are one of the most cost-effective of all surgical interventions.^[4,5] Surgical removal of the opaque lens with implantation of intraocular lens is the only treatment option available to restore vision,

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and various surgical techniques have been described. About two decades ago, large – incision extracapsular techniques were performed for most cataract surgeries with over 50% done under general anesthesia.^[6,7] To effectively address the significant challenge of large and increasing backlog of cataract blindness in low and medium income countries (LMICs) through high volume surgical procedures, manual small incision cataract surgery (MSICS) is currently advocated as the surgical technique of choice.^[8] It has so far been shown to yield similar outcomes in comparison with phacoemulsification; however, it is less expensive, faster, and requires less technology making it more ideal for developing countries.^[9,10] The strategies used to achieve optimal local anesthesia in MSICS vary from retrobulbar, peribulbar, sub-Tenon, intracameral, and subconjunctival to topical techniques. Topical and topical-intracameral anesthesia techniques have been reportedly associated with lower rates of serious complications such as retrobulbar hemorrhage, globe perforation, and traumatic injury to the optic nerve when compared to retrobulbar and peribulbar methods.^[11] Furthermore, they have also been shown to reduce the time spent during administration of local anesthesia thereby reducing the overall duration of surgery.^[12] Sub-Tenons anesthesia has now been associated with globe perforation.^[13] In 2001, a United Kingdom survey showed that sub-Tenon and topical anesthesia were the preferred methods of anesthesia in cataract surgery in 28% and 21.5% of ophthalmic surgeons, respectively.^[14] There is currently no available data in Sub-Saharan Africa evaluating the use of topical/intracameral anesthesia in MSICS. This study aims to evaluate patient's level of comfort, pain perception, safety profile, as well as surgeon's experience with the use of topical anesthesia supplemented with intracameral lignocaine (without adrenaline) in patients with cataract blindness treated using the technique of MSICS. Findings from this study will inform an evidence-based insight that could influence a paradigm shift to a more patient/surgeon-friendly anesthetic technique in the surgical treatment of cataract patients using the MSICS technique among eye care providers.

Materials and Methods

The University of Nigeria Teaching Hospital (UNTH), Enugu, established in 1971 is one of the first generation public Tertiary Health Care Institutions in Nigeria. Enugu is the administrative capital of Enugu state, one of the five component states of Nigeria's South-East geopolitical zone. UNTH's eye unit provide medical, refractive, and surgical eye care services to inhabitants of Enugu state, other states in South-East Nigeria and beyond.

This was a hospital-based case series. Consecutive patients presenting at the eye clinic with operable cataract and willing to have surgery were enrolled.

Inclusion criteria

- Willingness to participate
- Patients who are 18 years and above.

Exclusion criteria

- Uncooperative patient/unwilling patient
- Previous intraocular surgery
- Eye movement disorder
- Hypersensitivity to lignocaine
- Small pupil not dilating
- Inability to understand surgeon's language.

Patients were investigated for fitness for cataract surgery. Ocular examination including visual acuity and morphology of cataract were recorded. All surgeries were carried out by one experienced surgeon. Pain scores were marked by the patient on a 10-point visual analog scale (VAS) pain score after surgery to assess each patient's overall severity of pain intraoperatively [Appendix 1]. Pain scores are allocated as follows: 0 – no pain, 2 – mild annoying pain, 4 – nagging uncomfortable troublesome pain, 6 – distressing miserable pain, 8 – intense, dreadful, horrible pain, and 10 – worst possible, unbearable, excruciating pain. An independent observer (ophthalmologist) performed the pain score recording in all patients. Surgical experience and complications were noted on a questionnaire by operating surgeon immediately after surgery. Surgical experience is scored as; 1 – excellent, 2 – good, and 3 – poor.

Surgical procedure

The patient was adequately counseled on nature of surgery. Preoperative preparation included 500 mg of tablet acetazolamide, prophylactic topical antibiotic, and pupillary dilation with 0, 8% tropicamide/5% phenylephrine combination eye drops.

A preservative-free aqueous 2% lignocaine (Rotex-Germany) drops were instilled on the ocular surface in the preoperative room 10 min before surgery (3 doses, 2 drops/dose at 5 min interval). With the lid speculum in place, 5% povidone-iodine was instilled on the conjunctival cul de sac and irrigated after 1 min. The conjunctiva is retracted, and bleeding vessels gently cauterized. A partial thickness 6 mm-length linear scleral incision is made 3–4 mm behind the limbus. A sclera-corneal tunnel is created into the clear cornea using a crescent knife. A side port is made creating a controlled entry into the anterior chamber. A preservative-free (to prevent corneal toxicity) 2% lignocaine (0.5 ml) diluted with 0.5 ml of ringers lactate was instilled intracamerally after entry into the anterior chamber and allowed for 2 min. A keratome is used to enter the anterior chamber from the incision site. A can – opener technique of capsulotomy is done using a cystotome under a viscoelastic cover. The nucleus is prolapsed into the anterior chamber with the same cystotome (fish hook) in fishing-like manner and delivered

with the hydroxypropyl methylcellulose viscoelastic agent. The residual cortical matters are irrigated and aspirated using a Simcoe irrigation-aspiration cannula. The capsular bag and anterior chamber are filled with a viscoelastic agent, and posterior chamber intraocular lens inserted into the capsular bag. The viscoelastic is washed out with ringers lactate. Subconjunctival injection each of 0.5 ml of gentamycin (40 mg) and dexamethasone (2 mg) is given. Topical gentamycin (antibiotic), maxitrol (steroid-antibiotic combination), and ointment Beoptic-N (steroid antibiotic combination) are instilled and the eye padded for 24 h.

Data management

Baseline sociodemographics (age, sex, and occupation), type of cataract by morphology, pain perception, and surgeons experience were recorded. Data analysis was performed on the Statistical Package for Social Sciences version 18 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics yielded percentages, frequencies, and proportions; comparative statistical tests for significance of observed intergroup differences utilized Chi-square for categorical variables and Student's *t*-test for continuous variables. For all comparisons, significance level was at $P < 0.05$.

Ethical approval

Ethics approval was obtained from the Health Research Ethics Committee of the UNTH Ituku-Ozalla. The study was conducted in line with the tenets of the National Health Research Code of Ethics (Nigeria) and the Declaration of Helsinki.

Results

All the consecutive 30 patients met the inclusion criteria. The surgeries were performed on 30 eyes of 16 (53.3%) males, and 14 (46.7%) females (sex ratio, 1:0.9) who were aged 60.3 ± 16.32 standard deviation (SD) (95% confidence interval [CI] of mean; 53.94–66.13) (range; 20–98 years). The demographic characteristics of cataract surgical patients are as shown in Table 1. A total of 12 patients (40%) had nuclear cataract, 14 (46%) cortical cataract, 3 (10%) posterior subcapsular cataract, and 1 (3.3%) anterior capsular cataract. Using the VAS, the mean pain score was $2.7 \text{ SD} \pm 2.215$ (1.87–3.53 95% CI), with a range of 0–10. A total of 20 patients (70%) had a VAS score of < 4 representing mild pain [Figure 1]. Pain was felt most during subconjunctival injection. There was no correlation between degree of pain perception and gender ($P = 0.806$) or age ($P = 0.388$).

Patient's cooperation was excellent in 22 (73.3%) of patients. Surgeon's score of surgical experience is as shown in Table 2. Intraoperative complications occurred in 3 (10%) of patients all involving a small posterior capsular tear which was unrelated to the anesthetics method and did

Table 1: Age and sex distribution of cataract surgical patients (n=30)

Age	Sex		Total
	Males	Females	
20-40	3	1	4
41-60	7	1	8
61-80	5	10	15
81-100	1	2	3
Total	16	14	30

Table 2: Frequency distribution of surgeons scores for surgical experience

Surgeons score	Patient co-operation (%)	Unwanted ocular movements (%)	Anterior chamber stability (%)
1	23 (76.6)	23 (76.7)	25 (83.3)
2	6 (20.0)	6 (20.0)	4 (13.3)
3	1 (3.3)	1 (3.3)	1 (3.3)

Lower score indicates favorable experience

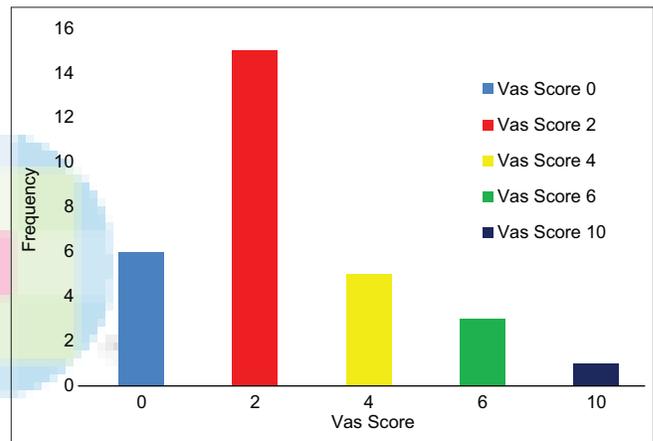


Figure 1: Frequency distribution of pain score among cataract surgical patients (n = 30)

not preclude effective posterior chamber intraocular lens implantation. The average duration of surgery was 15 min.

Discussion

The use of topical anesthesia for cataract surgery was first described by Smith^[15] and has been on the increase due to patient's demands.^[16]

The sensitive terminations of the fifth cranial nerve are concentrated in the cornea and ciliary body in the anterior part of the eye. These fibers are generally nonmyelinated Type A-delta and Type C. They are able to transmit the sensations of pain, temperature, and touch, and are blocked by lower concentrations of drugs in comparison with motor fibers. Sensory termination block is the most important feature of topical anesthesia. It involves the inhibition of sodium channels at nerve endings or receptors by the

anesthetic agents, thus blocking the production (and not the transmission) of nervous impulses.

Anesthetics topically applied to the eye act directly on the corneal epithelium and stroma, and the portion of drug penetrating into the anterior chamber suppresses pain arising from the iris and ciliary body. The duration of effect of topically applied anesthetics depends on the properties of the drug used. Usually, it lasts up to 15–20 min for the commonly used agents, but eye drop instillation or intracameral irrigation can be repeated at intervals during surgery if needed. The intraocular muscles are affected by topical/intracameral anesthesia, producing mydriasis, but there is no way to block extraocular muscles or to obtain akinesia of the eyeball. The advantages of topical anesthesia over periocular injections include not only a higher safety level but also the better consistency of analgesia during surgery and lower intraocular pressure. The return of sensitivity soon after surgery allows prompt discovery of any unexpected ocular pain suggesting complications.

MSICS under topical anesthesia has many advantages over traditional paraocular anesthesia: No pain from the anesthetic application, no need to discontinue systemic anticoagulants or aspirin, and immediate visual recovery.^[17] Nevertheless, topical anesthesia has also its limitations: The surgeon must be very competent to be comfortable, and not every patient is a good candidate: That is, the reason why very anxious patients, patients with communication problems, with miotic pupils should be excluded.^[18] The main disadvantage of topical anesthesia is the absence of akinesia.

All the consecutive 30 patients qualified and were included in this study. The demographic data in this study showed a marginal male preponderance with a modal age group of 61–80 years accessing cataract surgical services. Various studies on gender distribution of cataract surgical patients have reported significant male preponderance,^[19,21] marginal male dominance,^[22,23] and female preponderance.^[24] The observed discrepancies are likely due to socioeconomic and cultural differences between study areas/settings. In LMIC's, the prevailing socioeconomic settings characterized by unhindered male access to family finance and by extension healthcare may account for this trend.^[23] In addition, as reported by Geneau *et al.*,^[25] women have poor self-esteem and low expectations and tend to cope with the activity of daily living, even when severely visually handicapped. This is worrisome when viewed against the backdrop of Lewallen and Courtright^[21] series wherein women accounted for 63.0% of all cataract cases. This study further projected that if females accessed surgery at the same rates as males, the global prevalence of cataract blindness would be reduced by a median of

12.5%.^[21] To restore gender-neutral access to cataract surgical services, the investigators suggest public eye health education, socioeconomic reorientation, grass-root economic empowerment of women, and reduction of cataract surgical fees for females.

The mean age of the study cohort is lower than 67.6 ± 9.2 years observed in related studies by Al-Qrainy *et al.*^[26] in Saudi Arabia and 62.1 ± 10.5 years in Teshome and Regassa^[27] and Ethiopian cohort. The observed age discrepancies are attributable to between-survey differences in participant's age characteristics which reflect the study specificity for particular age group. While this study had wider participant age range 20–98 years, those of Al-Qrainy *et al.*,^[26] 50–96 years, and Teshome and Regassa. 47–91 years,^[27] were comparatively older. The modal age in the report 61–80 years is similar to the findings elsewhere^[22,28-29] and probably reflects the age group most at risk for age-related cataract, the most common type of cataract. The present age data underscores the need for eye-care planners, implementers, and eye health policy makers to deploy the necessary resources and logistics for cataract care in the elderly.

The mean pain score of 2.7 obtained in this study shows a favorable pain experience as scores < 4 are classified as mild pain. Several investigators had reported lower mean pain scores ranging from 0.24 to 1.4.^[12,30-32] However, comparison with these studies is difficult due to major differences in the technique of the cataract surgical procedure. These included phacoemulsification using a clear corneal section^[30,31] which will require a smaller wound size and lesser pain, and the use of lignocaine jelly in MSICS^[12,32] which tend to have a longer duration and superior anesthetic action.^[33,34] The lower sample size and younger age range of our studied cohort could account for this difference. While these studies^[12,30-32] support the favorable pain tolerance observed in this study, the unreliability of patient-reported data on pain perception and variation in study areas/ethnicity, the considerably wider range of pain score of 0–10 in this study, may account for the differences in the mean pain scores. In this study, fish hook technique was used to deliver the nucleus which is preferable over irrigating vectis because the latter technique tends to increase the intraocular pressure.^[35] Gupta *et al.* in their series^[12] concluded that the combination of lignocaine gel, sclerocorneal tunnel, and use of fish hook is helpful in performing painless MSICS under topical anesthesia.

Similar to findings in Gupta *et al.*'s series,^[12] surgeon's score outcome was favorable as shown by the fact that patient's cooperation was excellent 22 (73.3%) and good in 4 (13.3%). The use of intracameral preservative-free lignocaine enhanced the anesthesia of intraocular anterior

chamber structure and guaranteed anterior chamber hand stability during surgery due to better patient cooperation. While akinesia is a potential disadvantage that could affect the surgeon's experience, it has been suggested that it could be an added advantage if patients are well-instructed as they could move their eye to different positions as may be preferred by the operating surgeon.^[36] This study recorded very few minor intraoperative complications unrelated to the technique of ocular anesthesia. There was no postoperative complication making this technique of ocular anesthesia in MSICS safe and patient friendly.

Limitation of study

The extrapolation of the conclusions drawn from this study is limited to its noncomparative nature and small sample size. A larger sample size, comparative, randomized, and multi-center design is warranted.

Conclusion

The mean pain score in this study is low independent of age and gender with excellent surgical outcome and nil serious complications. This method of anesthesia in MSCIS is adequate for patient's comfort and safe cataract surgery.

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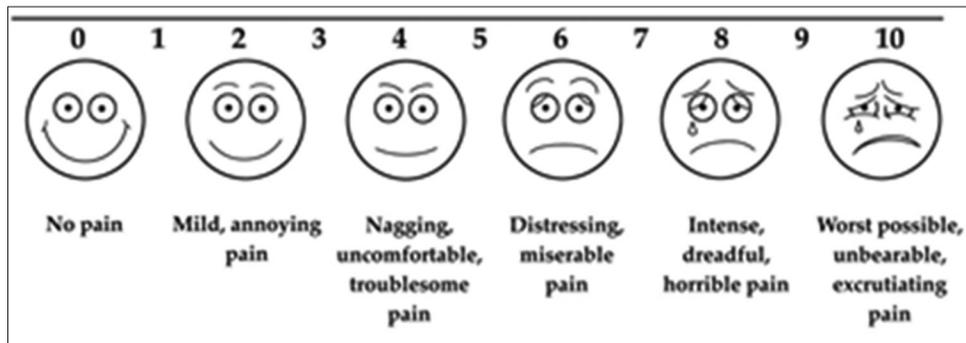
Conflicts of interest

There are no conflicts of interest.

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Appendix



Appendix 1: Visual analog scale

