

Prophylactic Practices Against Endophthalmitis Following Cataract Surgery Among Nigerian Ophthalmologists and a Review of Evidence

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ABSTRACT

Background: This study examined the prophylaxis practices against postoperative endophthalmitis among Nigerian ophthalmologists in the perioperative period in cataract surgery and review evidence for such practices. **Materials and methods:** A semi-structured self-administered questionnaire survey was conducted on ophthalmic surgeons who attended the annual general meeting of Ophthalmological Society of Nigeria in September 2017 in Kaduna, North West-Nigeria. A search on prophylaxis against endophthalmitis pre, Intra and post-cataract surgery was reviewed and a summary made. **Results:** A total of 150 Ophthalmologists were surveyed, 64(42.7%) use preoperative antibiotics with a majority using fluoroquinolones 51(34%), most surgeons 138(92.0%) used povidone-iodine to prepare the skin and instilled in the conjunctival sac. Intraoperatively, a large number of surgeons 143(95.3) use sub-conjunctival antibiotic gentamycin at the end of surgery but less intracameral 53(35.3%). The most common intracameral antibiotic used is ceftazidime 32(21.3%). In the postoperative, almost all surgeons 146(97.3%) use antibiotic eyedrops prophylaxis especially, ciprofloxacin 118(78.7%) for about 3 weeks 84(56%). Evidence review suggests the effectiveness of povidone-iodine ocular surface decontamination and intracameral injection in the prevention of endophthalmitis post-cataract surgery. **Conclusions:** The predominant methods of prophylaxis are preoperative eye drops and povidone-iodine, intraoperative subconjunctival gentamicin and postoperative eye drops. Only few surgeons used Intracameral antibiotic prophylaxis in Nigeria despite its effectiveness.

Key words: antibiotics, cataract, endophthalmitis, povidone-iodine, prophylaxis, surgery

INTRODUCTION

Surgical interventions world over are sometimes associated with complications, which in severe forms may permanently affect the function of the tissue/organ or even threaten

survival. In ophthalmic practice, postoperative endophthalmitis (POE) is one such serious complication. It results from inflammation of intraocular tissues following ocular surgery. POE is

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rare, estimated to have a prevalence of 0.013 to 0.7%^[1-4] and may be acute or chronic depending on the onset of the condition after surgery^[5]. Most cases present in acute form following bacterial infection in cataract operated eyes.^[6]

The ocular surface is the source of the infectious organisms and gram-positive coagulase-negative staphylococci (staph epidermidis) is the main causative agent.^[5,7-10] The most common organism in chronic POE are Propionibacterium acnes, Staph epidermidis, and fungal infections.

The Association of POE with vision loss, phthisis bulbi or anophthalmos and threat to life when infection extends to the brain is a serious concern to the Ophthalmologist whose core mandate is vision preservation and improving the quality of lives. Despite that treatment, the outcome is not encouraging even in most advanced countries because of difficulty in intravenous and oral antibiotics accessing the avascular vitreous cavity that serves as a culture media to infectious agents,¹¹ this is why the emphasis is on prevention. Interestingly, over the last decades, there have been improved surgical techniques and equipment that provide more important prophylactic measures. Consequently, the high prevalence of POE reported several decades ago has dropped. We, therefore, studied the prophylactic practices by ophthalmologists in Nigeria and reviewed available literature on best practices worldwide.

METHODS

This is a cross-sectional study carried out during the 42nd Annual Scientific and General Congress of the Ophthalmological Society of Nigeria (OSN) held in August 2017, Kaduna, Nigeria. It was a mix of surgeons of different status who came from all over Nigeria that practice in tertiary or teaching centers, private and general hospitals, in cities and rural areas of Nigeria. Self-administered, semi-structured questionnaire was filled by 150 participating ophthalmologists. The questionnaire was prepared after a comprehensive literature review of postoperative endophthalmitis prophylaxis was carried out. Questions were asked

to ascertain the location, status of surgeon and practices of prophylactic antibiotic and antiseptic use preoperatively, intraoperatively and postoperatively. Preoperative measures included the methods of antisepsis and antibiotic prophylaxis. Intraoperative measures regarded the use of intracameral antibiotics or subconjunctival antibiotic injections at the end of surgery. Postoperative prophylaxis is practices used after the eyes are padded by the surgeon.

Extensive literature search on preventive practices against post-cataract surgery infection was conducted in PubMed, Medline and the Cochrane Library. The studies were reviewed and the narrative summary of findings was reported.

The study was approved by the Ethics Committee of BarauDikko Teaching Hospital and adhered to the tenets of the Declaration of Helsinki.

RESULTS

Ophthalmic surgeons that participated in the study were 150, by geographical zone; 51(34%) from the northwest (NW), 37 (24.7%) southwest (SW), 39(26.0) northcentral (NC), 10(6.7%) northeast (NE), 7(4.9%) southeast (SE) and 6(4.0%) southsouth (SS). Majority practice in cities 101(67.3%) and 49(32.7%) other cities and most were general ophthalmologists 115(76.67%). Table1 and figure 1. Almost the entire few specialists 33 of 35(%) are in tertiary hospitals. Figure 2, duration of practice of study participants.

Table 1. Specialization distribution of study participant.

| Specialization | Frequency (%) |
|-----------------------|---------------|
| General ophthalmology | 115(76.6%) |
| Paediatric | 10(6.7%) |
| Retina | 9(6.0%) |
| Plastic | 7(4.7%) |
| Neuro | 4(2.7%) |
| Cornea | 2(1.3%) |
| Glaucoma | 3(2.0%) |
| Total | 150(100%) |

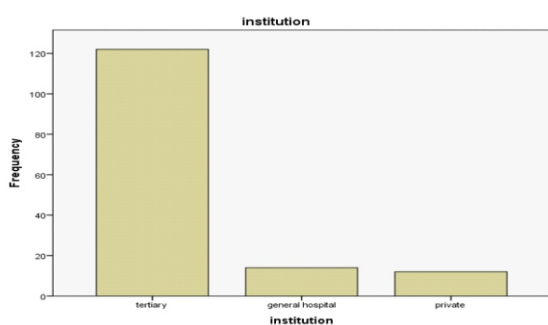


Figure 1. Type of institution of practice among study participants

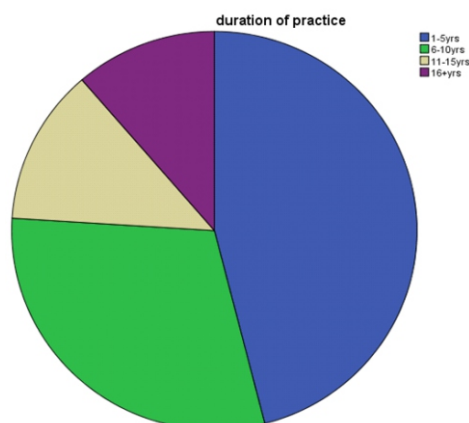


Figure 2. Duration of practice of surgery by study participants

Table 2. prophylactic practices by categories of study participants.

| Characteristics | Preoperative | | | Intraoperative | | Post operative | Total |
|------------------------------|------------------------|-----------------|-----------------------------|-------------------|----------------------|-------------------------|-------|
| | Topical antibiotics(%) | Trim lashes (%) | Povidone iodine surface (%) | Intra-Cameral (%) | Sub-Conjunctival (%) | Topical antibiotics (%) | |
| General Practitioners | 47(40.87) | 71(61.74) | 103(89.56) | 40(34.68) | 109(94.78) | 111(96.52) | 115 |
| Specialist | 17(48.57) | 13(37.14) | 35(100) | 13(37.14) | 34(97.14) | 35(100) | 35 |

Preoperative Prophylaxis

Of the 150 participants, 84(56%) practiced trimming of eyelashes, 64(42.7%) use preoperative antibiotics as follows; fluoroquinolones 51(34%), chloramphenicol 15(10%) and gentamicin 2(1.3%). The Duration of antibiotic use was; 1 day 40(26.7%), 2 days 11(7.3%) and 3 days 10(6.7%). Almost all surgeons 138(92.0%) use povidone Iodine on the face and conjunctival fornices before surgery. Table 3.

Intraoperative prophylaxis

A large number of surgeons 143(95.3%) use sub-conjunctival antibiotics at the end of surgery but less of intracameral 53(35.3%). The common intracameral antibiotic used is ceftazidime 32(21.3%) then cefuroxime 12(8%), moxifloxacin 7(4.7%) and NA 2. Intracameral antibiotics are

more popular among retinal surgeons 5 of 9(55.6%) than the general surgeon population 53(35.3%), see table.

Postoperative prophylaxis

Almost all surgeons 146(97.3%) use postoperative antibiotic eyedrops prophylaxis especially, ciprofloxacin 118(78.67%) then chloramphenicol 12(8.0%) and gentamicin 6(4%) and others 10(6.67%) for about 3 weeks 84(56%) postoperative.

DISCUSSION

Ophthalmic surgeons that participated in the study were from all the geographical zones in the country. The majority of whom are young less than 10 years of practice and are concentrated in specialized hospitals in the capital cities of the country. This

may be because ophthalmology is a highly specialized field and those teaching hospitals are mainly located in the capital cities of the country. The maldistribution of specialists is also found in other disciplines and has been a factor affecting health care delivery in Nigeria¹²⁻¹⁴.

From data obtained, preventive measures against POE are taken seriously starting with patients' selection by many Nigerian ophthalmic surgeons. Patients with active conditions such as conjunctivitis, dacryocystitis, blepharitis, and other lid abnormalities are always sorted out. Once these conditions are identified, they must be addressed before surgery because they are important risk factors of POE,^[1] that in time past, irrigation of nasolacrimal path was advocated. Other measures during and after surgery while handling these patients involves strict adherence to aseptic techniques.

The ocular surface has been implicated as the source of causative organisms in POE.^[5,10] The infecting organisms were genetically found to be indistinguishable from the patients' own periocular flora in 82% (14/17) of cases of endophthalmitis.¹⁵ Therefore, prophylactic measures in patients undergoing intraocular surgery target decontaminating the ocular surface. In this study, the preoperative practices showed the majority of surgeon's trim eyelashes, use topical antibiotics most instilling fluoroquinolones a day before surgery and almost all surgeons use povidone Iodine on the face and conjunctival fornices before surgery.

The trimming of eyelash before intraocular surgery is practiced by half of eye surgeons in this study. In studies by Cooper et al and Schimitz et al, the practice has not been proven to significantly reduce bacterial flora nor prevent endophthalmitis and thus it is not recommended.^[16,17] In more advanced settings, special drapes are used to keep the lashes well away from the surgical site so that it does not obstruct the view or repeatedly enter and

contaminate the AC in the course of surgery. However, in our setting, the popularity of trimming eyelash may be attributed to an inadequate supply of consumables and special drapes compared to other parts of the world.

During intraocular surgery, antibiotic and antiseptic prophylaxis is achieved at two levels; first is preoperative topical antibiotics and antiseptics to reduce ocular surface flora before surgery and second is, the use of intracameral, subconjunctival and topical antibiotics to eradicate bacteria that enter the eye during surgery.¹⁸

In this study, preoperative topical antibiotics instillation to decontaminate bacteria in the ocular surface and reduce its risk of causing endophthalmitis is the practice by 64(42.7%) surgeons, with the majority using fluoroquinolones 51(34%) and 15(10%) chloramphenicol then 2(1.3%) gentamicin, mostly a day before surgery 40(26.7%). The topical antibiotic used 3 times a day for 3 days was reported to reduce ocular surface flora.¹⁹ The use of fluoroquinolones up to 3 days before surgery in this study fulfilled the criteria for being bactericidal and broad-spectrum to cover both gram-positive and negative. In a systematic review and meta-analysis of Antibiotic prevention of post-cataract surgery endophthalmitis, Kessel et al,^[20] did not find evidence to conclude that topical antibiotic therapy prevents endophthalmitis.

A European Society of Cataract and Refractive Surgeons (ESCRS) study^[21] did not encourage the use of preoperative antibiotics, because their study on the use of perioperative levofloxacin eye drops reported a reduction in the observed incidence rate of postoperative endophthalmitis, but the effect was small and was not statistically significant. Another study on Preoperative antibiotic administration found a significant decrease in conjunctival bacterial colony counts after the use of certain antibiotics but did not show superiority to antiseptics with povidone-iodine^[22]. It has been reported¹⁹ that one drop of 5% povidone-iodine

preoperatively is equivalent to the topical antibiotic used three times a day for 3 days in reducing ocular surface flora. Suggesting that, the use of preoperative topical antibiotics does not provide additional benefit when other methods such as instillation of povidone-iodine are used in intraocular surgery.

Antiseptic instillation into the conjunctival sac is another method of decontamination of ocular flora. Almost all surgeons 138(92.0%) in this study use povidone Iodine on the face and conjunctival fornices before surgery. Antiseptic instillation into the conjunctival sac started with the use of mild silver protein (Argyrol). However, its use was discontinued after a 1983 study showed that Argyrol had a little bactericidal effect.^[23] it was the report that Povidone-iodine has more efficacy in reducing the bacterial load in the conjunctival fornices and is more effective than silver protein solution that leads to a change of practice.^[24] Povidone-iodine developed in the 1950's, has a broad-spectrum bactericidal disinfectant effect, has no resistance, is cheap and readily available. It has two components; polyvinylpyrrolidone, which has no antimicrobial activity, but has an affinity to bacterial cell membrane delivering an active agent to the intended site; iodine, which binds the saturated fatty acid in the cell membrane and substitutes covalently bind H⁺, leading to pore formation on the cell membrane and bacterial death.^[25] Povidone-iodine studies on the ocular surface showed a 96.7% kill rate within 60 seconds and lasts for at least one hour after irrigation, confirming its effectiveness in preoperative preparation for ophthalmologic surgeries.^[17,26]

A study reported that decontaminating the ocular surface, with a single topical instillation of 5% povidone-iodine in the conjunctival sac for 3 minutes prior to cataract surgery achieves a significant reduction in organisms such as Coagulase Negative Staphylococci from the lid and conjunctival flora^[7] and reduced the rate of POE.^[24,17] Another study that compared Povidone-

iodine to preoperative antibiotic instillation in reducing ocular surface flora, reported that one drop of 5% povidone-iodine was equivalent to instillation of topical antibiotic three times a day for 3 days.^[19] Halachimi-Eyal et al^[27] also reported that the addition of moxifloxacin drops had no significant effect above the effect of povidone-iodine 5% alone.

In this study, almost all surgeons use povidone-iodine prophylaxis, 10% on the face and 5% on conjunctival sac before surgery. But, a study reported that at a lower concentration of 0.25% povidone-iodine, an extremely low bacterial contamination rate in the anterior chamber at the completion of cataract surgery can still be achieved.^[28]

The anterior chamber occasionally is contaminated during intraocular surgery, Jorge E Valdez-García^[9] in a study of 32 patients whose aspirates were obtained during cataract surgery found that, 3 (9.37%) yielded positive cultures preoperative and increased to 10 (31.25%) postoperatively. This, suggests the most recent method in the prophylaxis of POE; which includes the use of antibiotics in irrigation fluid or as intracameral injection decontaminate any bacteria introduced into the anterior chamber during surgery immediately by ensuring the antibiotic is in the anterior chamber at the time of introduction or shortly thereafter.

However, in this study, the practice of Intracameral antibiotic prophylaxis is not common among Nigerian eye surgeons, 53(35.3%). This may be due to a lack of awareness. Among the few ophthalmologists that practice it, the common intracameral antibiotic used is ceftazidime 32(21.3%) then cefuroxime 12(8%) and moxifloxacin 7(4.7%). In a systematic review and meta-analysis of Antibiotic prevention of post-cataract endophthalmitis, Kessel et al,^[20] reported high-to-moderate quality evidence for a marked reduction in the risk of endophthalmitis with the use of intracameral antibiotic administration of cefazolin, cefuroxime, and moxifloxacin.

Endophthalmitis occurred on average in one of 2855 surgeries when intracameral antibiotics were used compared to one of 485 surgeries when intracameral antibiotics were not used.

Based on the Endophthalmitis Vitrectomy Study,^[5] gram-positive susceptible antibiotics are best for Intracameral use because they will act on the common ocular surface bacteria that cause POE. Vancomycin was the first antibiotic concentration in the irrigating solution shown to be adequate for bacterial inhibition in the anterior chamber of the eye at the end of cataract surgery.^[29] Vancomycin is a bactericidal antibiotic with good gram-positive coverage administered either as infusion 10 to 50µg/ml or in the capsular bag up to 1mg/mL. Vancomycin (20 mg/L) in the intraoperative irrigating fluid during cataract surgery has been reported to reduce culture-positive intraocular aspirates from 13% to 5%, 2 hours after surgery and 47% of the initial concentration remained in the anterior chamber.³⁰

Rush SW,^[31] evaluated the safety and efficacy of intracameral vancomycin during cataract surgery among 20,719 number of cataract surgeries and reported postoperative endophthalmitis 0.97 cases per 1,000 in the group that did not receive intracameral vancomycin, whereas there were no cases of postoperative endophthalmitis in the group that received Intracameral vancomycin (p=0.0015). No cases of toxic anterior segment syndrome occurred in either group during the study period.

The drawback on the use of intracameral vancomycin is its ineffectiveness against gram-negative organisms and concerns that intracameral prophylactic use may increase the chances of drug resistance because of its use in bacterial infections that are life-threatening or not responding to other antimicrobials. It was also associated with increased cases of Cystoid Macular Edema.

Cefuroxime has also been recommended for intracameral use, it is a bactericidal second-

generation cephalosporin with less gram-positive coverage than vancomycin, but provides some gram-negative coverage. Although POE from Gram negative organisms occur much less frequently but have been found to be more virulent and to result in poorer visual outcomes. Montan et al^[32] reported a drop in postoperative infectious endophthalmitis from 0.26% to 0.06% (P<.001) in 34,100 and 32,180 consecutive intraocular surgeries cases, respectively, after introducing intracameral cefuroxime injections. The report also showed that antibiotic levels exceeded the minimum inhibitory concentration for several relevant species for up to 5 hours after surgery. A national prospective study in Sweden reported rates of postoperative infectious endophthalmitis 0.22% in patients not receiving and 0.053% receiving intracameral antibiotics (98.5% cefuroxime) (P<0.001).^[33] The Endophthalmitis Study Group of the European Society of Cataract and Refractive Surgeons reported reductions in post-operative endophthalmitis incidence following cataract surgery in patients receiving intracameral cefuroxime injection in addition to povidone-iodine.^[21] However, cefuroxime does not cover major causes of POE, high rate of resistance by bacteria, short stability, can cause macular edema, potential contamination at mixing, hypersensitivity, errors of mixing can cause Toxic Anterior Segment Syndrome, other Intra Cameral antibiotics can cause endothelial loss, aminoglycosides retinal toxicity.

Cefazolin is another intracameral antibiotic studied. In a retrospective observational study of 7000 patients, it was reported that Cefazolin significantly reduced rate of postoperative endophthalmitis (0.055%) compared with those who did not use it (0.63%).^[34] Cao et al^[35] reported that non-use of intracameral cefazolin (in combination with cefuroxime) in clear corneal incision was a risk factor for acute endophthalmitis. Subconjunctival(SC) injection is another method of antibiotic prophylaxis administered at end of surgery that has been shown to increase the

antibiotic concentrations in the anterior chamber, inhibit/kill bacteria introduced during surgery and decreased the incidence of endophthalmitis. This is practiced by almost all surgeons 143(95.3%) in Nigeria. Collea KM,^[36] reported a retrospective study in cataract surgery in which use of SC antibiotics decrease post-operative endophthalmitis from 0.179% to 0.011%.

The first SC antibiotic prophylaxis in intraocular surgery was reported by Pearlman in 1956 in which penicillin and streptomycin were injected at the end of surgery without one infection in 3226 cataract surgeries.^[37] This was confirmed in a study carried out by Chalkey and his group.^[37] Since then, the practice became a routine in most intraocular surgeries world over. Other studies^[38,39] carried out later, also reported a reduced risk of POE with the use of SC antibiotics prophylaxis.

However, in the guideline that recommended the use of intraocular cefuroxime, the European Society of Cataract and Refractive Surgeons (ESCRS)^[21] does not encourage SC antibiotics for the following concerns;^[21,40] 1. Intracameral cefuroxime achieves higher aqueous concentration after surgery than SC cefuroxime. 2. The use of SC antibiotics has been questionable in their affectivity in preventing postoperative endophthalmitis. Talpur et al^[41] studied 1140 eyes that had Conventional extracapsular cataract extraction, phacoemulsification with IOL and Trabeculectomy. The eyes were divided into SC gentamicin injection and no injection. But one case developed postoperative endophthalmitis in the SC antibiotic injection group but none in the control group. They concluded that operative subconjunctival gentamicin does not always protect against endophthalmitis and did not occur even when operative gentamicin was not administered. 3. There are potential complications with the use of SC injections; SC hemorrhage and penetration of sclera & the extraocular muscles.^[21]

The practice of prophylactic antibiotic in

prevention of endophthalmitis is done in the pre, intra and postoperative periods. However, there are conflicting reports on the significance of post-operative antibiotic prophylaxis in intraocular surgeries. In this study, almost all surgeons 146(97.3%) practice instillation of postoperative antibiotics especially, ciprofloxacin 118(78.7%) then chloramphenicol 12(18.0%), gentamicin 6(4%) and others 10(6.7%) for at most 3 weeks 84(56%).

Though there are conflicting reports and insufficient data on the effectiveness of the postoperative use of topical antibiotics in reducing rates of endophthalmitis,^[1] but instillation is important in the presence of factors such as wound gap, prolapse, vitreous incarceration and postoperative ocular hypotony which are risk factors for POE. Postoperative hypotony may lead to wound gaping, allowing contaminated fluid from the ocular surface to migrate along the incision and enter the anterior chamber. Moshirfar M,^[42] in a retrospective, observational case series of 20,013 patients from 9 cataract surgery units, in whom 20,013 patients received either postoperative topical gatifloxacin or moxifloxacin reported a total of 14 patients (0.07%) developed endophthalmitis. More importantly, 6 cases of endophthalmitis occurred after the drops were stopped at 7 days and all but one case developed within 9 days of surgery. The case that occurred 22 days postoperatively was attributed to wound leakage. This, therefore, suggests that, preventing postoperative contamination with watertight wound closure is important in the non-use of postoperative antibiotics. RaenM et al^[43] assessed whether omitting prophylactic postoperative topical antibiotics (chloramphenicol) influenced the risk of developing endophthalmitis after cataract surgery but did not find a difference in the frequency of POE following cataract surgery when changing the postoperative topical medication from a mixture of corticosteroids and antibiotics to only corticosteroids.

In conclusion few surgeons used Intracameral

antibiotic prophylaxis in Nigeria despite its effectiveness, there may be need to enlighten and encourage ophthalmic surgeons on its use in addition to ocular surface decontamination using Povidone-iodine during cataract surgery to reduce POE.

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