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Optimizing Outcome of Cataract Surgery in Resource Scarce Sub-Saharan Africa

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Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/intechopen.71799>

Abstract

Background: Sub-Saharan Africa disproportionately accounts for high number of avoidably blind largely caused by cataracts.

The blindness burden: Limitation in human and material resource for delivery of cataract surgical services, cost, gender, distance to hospital, time off for the care giver, fear of surgery, uncultured behavior of eye care personal, poor visual outcome, general governments neglect of health care, lack of health insurance for vast majority of the population, healthcare funded by individuals as out of pocket despite grinding poverty, reliance on poorly coordinated and unsustainable outreach program, malpractices of quacks and traditional eye healers amongst other reasons.

More than just a cataract: Cataract services require systematic evaluation of the patients' general condition as well as the eye. Appropriate counseling is required to understand the goal and expectation of treatment. Adequate planning of surgery includes ocular biometry and provision of the appropriate intra ocular lens. The management protocol must ensure adequate measures are taken to prevent/ manage critical incidents whenever such a need arises.

Conclusion: Cataract surgical services need to be patient centered with the goal of optimizing resources for quality outcome without compromising safety.

Keywords: cataract, surgery, resource, outcome, patients, safety

1. Introduction

Age-related cataract is the leading cause of avoidable blindness [1–4]. While Africa hosts 11.9% of the World population, it also disproportionately accounts for about 15% of those avoidably blind. Sub-Saharan Africa carries the worse burden with 4.8 million blind partly

due to 66% population growth [5]. Other factors accounting for this include scarcity of eye care personnel, limitation in technology and training for eye care, lack of local production of eye medicine, and other consumables leading to dependency on importation in the presence of limited foreign exchange availability, unrestrained and unregulated malpractices of quacks, and traditional eye care providers. It is not unusual for such unregistered practitioners to be patronized by the political class resulting in wide-scale eye couching with all the related complications. In Sub-Saharan African region where human and material resources are scarce, health care is on a free fall as health insurance is largely inaccessible to the vast majority of the population [6].

Unfavorable health indicators such as high maternal mortality, high infant and under five mortality [7], high morbidity and mortality from both communicable [8] and noncommunicable diseases [9], and reduced life expectancy are the norm [10]. The poor people pay for health care as out-of-pocket expenses. Whenever health personnel knock on their door to administer vaccines, they become suspicious, considering the fact that they have to wait long hours to be attended to at government hospitals and clinics and most times they buy drugs from unprofessional vendors in pharmacy shops. Clerics and community leaders who should have been carried along are uninformed and often unsupportive of such programs. As such “free” healthcare programs are shunned by some communities who are made to believe they are aimed at subtly curtailing their population.

Local eye care advocacy groups can spend months to years hoping to see government officials to suggest ways forward to no avail. Expatriate eye care teams who surface once or twice in a year to do a few hundred cataract surgeries are received almost immediately by the local authorities. Such teams are treated with care and concern providing a photo opportunity for the politicians and giving the impression that all the eye problems of the community have been solved. Dependence on inconsistent external outreach services by authorities lead to further complacency and neglect.

Inappropriate appointment of members into district, state and national blindness prevention committees is such that technocrats hardly have a say in decision making. Such committees hardly meet, and when they do, decisions are hardly transformed into action. Often there is no time scale for implementation, no mechanism for self-audit, and no follow-up on programs, and the roles of members are hardly clearly stated. Most eye care teams are bedeviled with lingering rivalry and leadership crisis, which tend to be prolonged and incapacitating causing inability to achieve the goal of the team. There is need for models of leadership capacity building to address the need for core technical and management competencies [11].

There are unlimited barriers to eye care, which include distance to facility, transportation cost, time off for the care giver to accompany the patient, gender, cost of cataract surgery, rude behavior of some eye care workers, cost of investigations (blood sugar level, hepatitis, HIV, etc.), multiple visits, long bookings for surgery, and poor outcome as perceived by those who preceded the index patient [12–18]. The need to optimally use available materials and human resource to ensure that patients get the best outcome of surgery despite the existing limitations is of paramount importance.

2. More than just a cataract

Cataract surgery is considered one of the most rewarding medical interventions. Suffice it to say that sight is restored almost immediately thus improving the patients' quality of life [19, 20]. This observation may result in considering the procedure so casually without taking meticulous steps that ensure that there is quality in terms of postoperative visual acuity and patient's safety. Removing the cataractous lens and inserting an intraocular lens no matter how fast and quick this is achieved are not synonymous with obtaining good postoperative vision and ensuring patient's safety.

Good clinical practice starts with obtaining reliable history. The ophthalmologist should be courteous and willing to listen to the patients' complaints. There should be no indication, behavior, or action to make the client feel he is in a police station facing interrogation or a courtroom on trial for what he did or should have done about his eye condition. Rural folks constitute majority of the population in the region and often tend to fear such formal interactions with unfamiliar personalities in an unusual environment. When the patient becomes fearful and suspicious, reliable history may not be obtained, thus heralding the first step toward not obtaining quality outcome.

Ordinarily, patients present with painless progressive loss of vision over a time frame often in months to years. Additional information related to pain could arise from a number of factors including secondary glaucoma from intumescent cataract, inflammation, and/or panophthalmitis due to infection from attempted couching. A positive history of application of (harmful) traditional eye medication (TEM) could be obtained by gentle probing. TEM use is not unusual despite its harmful effect [21, 22]. This may require making a suggestive comment such as "losing one's sight is quite disturbing, please were you able to obtain traditional medicine that someone has tried in your community in the hope that your eye will open?" Compare this statement with "did you apply damaging traditional eye medication instead of coming to see us here in the eye clinic where we can offer you the best treatment?" Some TEMs are potentially contaminated and may contain substances that can damage the cornea.

In other instances, patients could have had surgery elsewhere with improper guidance on follow-up or the postoperative medication has finished and nowhere/no means to buy. Postoperative inflammation tends to last more than 6 weeks perhaps due to environmental and genetic factors. Complain of pain should warrant careful probing of possible preexisting ocular and systemic diseases. There is need to ask for presence of discharge from orifices, skin, and other body parts. This is relevant to treat any source of infection before surgery. This will reduce the risk of transmission of microbes to the raw eye postsurgery.

The clinician needs to enquire whether the patient is a known hypertensive, diabetic, or living with HIV. This is necessary in order to ensure control of the preexisting medical conditions for the safety of the patient, the staff, and other clients. Patients with hypertension or cardiac disease could have exacerbations with adrenaline-containing local anesthetic

injection. Centers must have dedicated instruments set for those with hepatitis virus infection and HIV as these diseases are found among patients undergoing eye surgery [23]. Fore knowledge of these diseases will ensure taking measures to safe guard the health of all those attended to in the facility. A positive history of previous drug reactions and the type of medication must be solicited. Reaction can occur with both orthodox and traditional medications [24].

Knowledge of musculoskeletal diseases is important to ascertain that the patient can lie down properly in the supine position during the procedure. It is unforgiving to miss such crucial information from the history and/or during general clinical examination and make such discoveries while the patient is on the table.

History of urinary frequency must be obtained in older male patients to exercise caution in administration of carbonic anhydrase inhibitors pre-op as this may push them into acute retention. Similarly, patients with bladder outlet obstruction tend to have urinary frequency and may go into urge incontinence while on the operating bed. Thus, appropriate measures are taken to limit such distress during surgery.

2.1. Ocular examination

Visual acuity is measured at 6 m with good illumination. Illuminated charts are more helpful; where electricity supply is irregular, vision could be tested in the open. Snellen chart is for literate patients and Landolt C or "E" chart is for the nonliterate ones. Vision can be as low as perception of light (PL). Cataract no matter how dense should not lead to no perception of (NPL) vision. Presence of NPL vision should make the clinician curious to search for additional cause of ocular morbidity co-existing with the cataract. The lids are examined for position and alignment as cicatricial trachoma is still prevalent leading to entropion/trichiasis [25]. Periocular vascular congestion is a pointer of intraocular inflammation and/or infection. The superior limbus should be examined for tale-tell scar from possible previous surgery. A bleb indicates the patient had previous glaucoma surgery [26]. This knowledge is important in counseling the patient on visual outcome before surgery for cataract.

The cornea should be clear. Dot opacity may indicate transcorneal couching [27]. Couching is associated with worse vision outcome [28]. Cornea should be examined for climatic drop-let keratopathy or calcific band keratopathy in patients with prolonged ocular surface disease. Pseudophakic bullous keratopathy could be seen in cases of previous cataract surgery that had endothelial damage. If present in one eye, this should warrant additional precaution in operating the index eye by limiting unnecessary entry of instruments into the open eye, cushioning the endothelium with viscoelastic material, and reducing operating time. Such surgery should not be performed by a trainee on the learning curve. Similar advice is advocated for patients with an only eye. The anterior chamber (A/C) should be deep and quite even with pen light inspection. Shallow a/c with corneal edema may result from a swollen cataractous lens; in this instance, the intraocular pressure (IOP) is elevated. It is not unusual to observe cortical matter or nucleus in the A/C from previous couching. Fresh keratic precipitates (KPs) are indicative of active anterior uveitis and thus such cataract

could be secondary to the inflammation that requires treatment before any surgical intervention is considered.

The pupillary reaction should be brisk. Abnormal pupillary reaction should lead the clinician to evaluate for signs of gross retinal or optic nerve disease such as retinal detachment or optic atrophy from glaucoma or other causes. Direct fundal examination may not reveal even a red reflex with fully matured cataracts. Immature cataracts could allow examination of the posterior pole particularly with the binocular indirect ophthalmoscope (BIO). A normal optic disk and retina are expected in age-related cataract in the absence of ocular comorbidity. Gross retinal function could be assessed by using four-quadrant light projection. In the light projection test, the patient should be able to point in the direction of the light accurately when presented from above, below, and to the left and right sides of the index eye. Other techniques include shining two bright light spots on the index eye after occluding the contra lateral eye. The patient should be able to discern the 2 light sources apart at 5, 7, and 12 cm for visual acuity of counting finger, hand motion, and light perception, respectively. B mode ocular ultrasound scan can be used to rule out retinal detachments or intraocular mass particularly where there are equivocal clinical findings.

The intraocular pressure (IOP) is measured with Goldman's (or other tonometer where available) and should be within the normal limits. A normal IOP measurement does not rule out glaucoma. Noncontact and minimal contact tonometer such as Pulse air and Rebound are more tolerated albeit available in few eye centers. They are more expensive in the presence of lean health budget in the region. Low IOP may indicate retinal detachment warranting further investigation. Slit lamp bio-microscopy is done to inspect the cornea, anterior chamber (a/c), lens and iris, this may be associated with pupillary dilatation to detect presence of synechia, to determine morphologic appearance and grading of the cataract. Specular microscopy is performed to assess the endothelial cell density; low density is associated with the risk of corneal decompensation after surgery, although measures are always taken to prevent such occurrence. Less expensive handheld slit lamps could serve the same purpose.

2.2. Preparing the patient for cataract surgery

Eye care teams in the region must ensure that there is appropriate preoperative assessment of patients, proper counseling, and informed consent administration. Basic eye and general examination is essential in planning for good outcome of surgery. This does not necessarily have to be expensive. Preparation includes measurement of the pre operative visual acuity, the state of the corneal clarity, pupillary reaction and intra ocular pressure measurement. The anterior segment is assessed with slit lamp to identify age related degenerative changes, other ocular co-morbidity, presence of posterior synechia, dislocated lens from possible attempted couching, and anterior uveitis. Four quadrant light projection test is performed to grossly assess state of the retina.

Systemic examination is necessitated to ensure the safety of the patient. It includes blood pressure measurement and fasting blood glucose level estimation. The packed cell volume

should be no less than 10 mg/dl. Patients with diabetes mellitus must have adequate control where necessary and available 3-month sugar level pattern can be ascertained by determining the glycosylated hemoglobin (HbA_{1c} level 7.2% or less is considered normal) [29]. Diabetic eye complications are potentially blinding and can coexist with the cataract [30]. Cataract surgery is also known to exacerbate diabetic retinopathy, making proper counseling on projected visual expectation and the need for further treatment related to the underlying disease important. Cataract surgery is known to improve vision and vision-related quality of life in patients with diabetes [31, 32].

At this stage, it is worthy to ascertain clinically clear respiratory system, a normal cardiac examination consisting of blood pressure, regular normal volume peripheral pulse, undisplaced cardiac apex position, and first and second heart sounds. An electrocardiogram maybe requested for when needed and a cardiologist can be asked to review and stabilize the patient. The central nervous system is examined to rule out obvious cranial nerve palsy and motor dysfunction, and the patient should be in a stable mental state to understand and cooperate during the procedure.

An abdominal examination is needed to detect suprapubic distension caused by a full bladder in patients with suspected urinary outflow obstruction. The general physical examination protocol will determine the presence of any musculoskeletal anomalies that can interfere with positioning of the patient on the operating table.

Other investigations include screening for hepatitis and HIV for the safety of the patient, the eye care team, and other patients. Trimming of bushy lashes will make the eye neater intraoperatively and during postoperative dressing. Oral carbonic anhydrase inhibitor such as acetazolamide is administered the night before and on the morning of surgery. Tropicamide is used to dilate the eye. Consent to undergo surgery is obtained from the patient in the presence of the care giver. As much as can be allowed, day-case surgery should be encouraged. The advantages include reduced/abolished cost of admission to the patient and circumventing the issue of limited bed space, which will otherwise reduce the number of surgeries performed in a session. Perhaps, this is even more desirable particularly in hospitals where ophthalmic and other potentially septic surgical patients share common ward space.

2.3. Ocular biometry

This consists of A-mode ultrasound scan to determine the axial length of the eye and keratometry to obtain corneal power in the two principal meridians. IOL Master gives error message and is not useful in patients with fully matured cataract. The two values are factored into calculating the intraocular lens power. Various formulae are incorporated into determining the IOL power. To prevent obtaining postoperative refractive deficits, there is a need to obtain accurate IOL power [33]. The practice of using standard power IOL perhaps based on experiences on most frequently used power in parts of the region can be adopted out of necessity. Such patients depending on their visual needs may turn out to need further spectacle correction, an unnecessary additional out-of-pocket expense that could have been avoided. Ideally,

all patients should and must have the best, as residual refractive errors may manifest later. Manual keratometry will suffice where automated ones are unavailable though these are not as user-friendly.

2.4. The operating room (OR)

Standard requirement includes wall, floor, and ceiling that will not retain dirt and germs. There should be wall and floor tiling that can easily be washed and mopped. The windows need to be kept closed and ventilation provided by room air conditioning. Floor, wall, or ceiling fan will sprinkle dirt and other contaminants into the opened eye. Where grid energy is unavailable, a portable generator can be used. There should be no thoroughfare in the operation room. There should be a red line beyond which unauthorized persons are not allowed. Bidirectional swing doors are preferred to enable the surgical team move in and out of the operating suite without the need to handle the door. Patients have to substitute their clothes with the theater gown before going into the operating room (OR). The scrubbing area should be in an adjacent room. Where such an arrangement is not possible, moveable wash pans can be used on a stand. The changing room is adjacent to the theater. Windows should be cleaned regularly and kept closed. Open floor drains should as much as possible be avoided. Staff must not bring food items into the OR as this may encourage pests. Regular fumigation is advocated to improve sterility.

A simple examination couch can serve as operating bed. Where space allows, two couches can be placed. This will reduce transit time wasting in between cases. Two surgeons can man each station or one surgeon can alternatively switch between the stations. There should be a minimum of four cataract sets, whereby two can be sterilized alternating for patients with no identifiable communicable disease, in addition to one set dedicated for patients with HIV and the other for those with hepatitis. Boilers are ineffective in sterilization. Hot air oven does not blunt sharp instruments and is preferred to steam autoclave. A minimal of two trolleys is required to set the instruments. Trolleys are routinely washed and cleaned with appropriate disinfectant solution. Aluminum drip stands with tray are used to hang irrigation fluid and cannula. Cannula needs to be washed, flushed, and sterilized with activated glutaraldehyde solution not forgetting to flush again with saline before use on the patient. Plastic microscope handles and other control covers should be similarly treated. To ensure safety, a separate cannula should be used for each patient and sterilized in between cases. At the end of the session, unused fluids must be discarded.

A sharp box is required to dispose of used needles, whereas other used items can be thrown into the kick about bucket for conveyance to the incinerator later. There should be separate drape for each patient. Bilateral simultaneous cataract extraction must be avoided to limit morbidity in the event of postoperative endophthalmitis. There are low-cost ophthalmic microscopes from Far East countries, which despite having less versatility (stereopsis/zoom/camera attachment, etc.) can serve adequately.

The surgeon and assistant (ideally a trained ophthalmic nurse) should be properly scrubbed and gowned. Separate pair of gloves is to be used for each patient. An idle team should consist

of the surgeon(s) and two assistants, one to stay with the surgeon and the other to circulate ensuring used instruments are promptly removed and replaced by sterilized ones. An attendant should serve the role of bringing in the patients with their folder and appropriate power IOL. The surgeon can dictate critical incident to be recorded by the circulating assistant before full documentation in the patient's record note at the end of the session. The notes could be designed with tick boxes that the attendant can fill easily as dictated by the surgeon during the procedure.

2.5. Regional anesthesia

Cataract surgery is performed under local anesthesia unless there are indications to do otherwise. More often, lignocaine with adrenaline 1:100,000 dilutions is administered. This may be mixed with hyaluronidase to improve local spread with less amount of anesthetic. Retro bulbar block is preferred to periocular and topical anesthesia as patients tend to have a low pain threshold. Facial block is administered around the neck of the mandible (O'Brien), under the periosteum of the lateral orbital rim (Van Lint), or in between these two locations (Atkinson). Systemic absorption could result in tachycardia and elevation of blood pressure. Retro bulbar bleeding could give rise to instant proptosis, if significant it may be wiser to postpone and reschedule the surgery. Where possible, periocular regional anesthetic block should be administered outside the OR.

Extra capsular cataract extraction (ECCE) is widely practiced as transition to manual small incision (MSICS) and to phaco surgery spread gradually in the region. Trainers guide trainees to acquire surgical skills in that order. Sutures contribute significantly to the overall cost of surgery, thus MSICS provides some relief in cost [34]. Proper suture placement is essential with ECCE to reduce postoperative astigmatism, thus avoiding the use of high-power cylindrical correction on the pseudophakic eye. However, MSICS requires the use of keratome, crescent blades, and side port lance. These maybe used once and discarded in developed countries, and in resource-scarce regions, they are resterilized up to five times such that six patients can benefit from each one. Phaco services are available in few centers perhaps due to high cost of the equipment and limited training opportunity. Some studies have shown no statistically insignificant difference in visual outcome between phaco and ECCE in the long term. Patients who can afford should have a choice. Public-private partnership could be a solution to obtaining expensive equipment and training in this part of the world.

2.6. Extra capsular cataract extraction

The periocular skin is cleaned with 10% povidone iodine and a head towel is placed under and tied around the patient's head. A drape with appropriate widow is applied covering the rest of the face excluding the index eye. A speculum wire is placed to part the lids open. Povidone iodine 5% is applied onto the conjunctiva and a cotton tip applicator is used to clean as saline irrigation is performed simultaneously. A toothed forceps is used to pick the superior rectus muscle and bridle silk suture is passed under it. This is then stabilized by

fixing the suture with artery forceps to the face drape. The surgeon has numerous options of accessing the anterior chamber. A stab limbal incision can be made before filling the A/C with viscoelastic material and subsequent anterior capsulotomy. A superior corneal incision with razor fragment can be performed and extended with scissors. Alternatively, a keratome can be used to make a bevel stab corneal incision, which is later extended with scissors. There are various techniques of capsulotomy; can opener or continuous curvilinear capsulorhexis is appropriate. The nucleus is manipulated into the A/C and delivered with vectis while applying counter pressure with a muscle hook. The A/C is cleared of cortical matter using irrigation aspiration cannula. More viscoelastic material is injected into the eye, thus deepening the posterior capsule. The IOL is removed from the package, flushed with normal saline inserted, rotated, and dialed into position. When properly placed, the pupil appears round, regular, and central. Depending on the surgeon's choice, interrupted or continuous monofilament silk sutures are applied to close the wound. Sutures have to be well aligned to reduce/limit/ prevent postoperative astigmatism. The bite length should be a third on the corneal and two-thirds on the sclera sides and the bite depth is two third of the cornea/scleral thickness. Burying the suture on either of the two ends is advised as this limits irritation. Any remaining viscoelastic material is aspirated. Intracameral and subconjunctiva antibiotic is administered. In addition, subconjunctival steroid is administered and an eye shield is placed over the eye. Some studies obtained good visual outcome of ECCE in 47.5, 78.8, and 94.3%, respectively [35–37]. Biometric IOL power determination partly accounts for those with better outcome.

2.7. Manual small incision cataract surgery

Preliminary cleaning, draping, and bridle suture placement are similar to that in ECCE. The superior rectus muscle insertion ends about 7.5 millimeters from the limbus. A fornix-based conjunctiva flap is raised, and the underlying sclera is exposed. Limited bipolar wet field cautery may be applied to close bleeders. A horizontal incision of 6.5 to 7.0 millimeters is made 3 millimeters away from the limbus. A frown-shaped sclera incision produces less astigmatism. The proximal sclera lip is gently lifted to allow using the crescent blade to construct a tunnel into the A/C. Thin tunnel roof can lead to button hole and a thick roof may lead to premature entry into the A/C. The tunnel is widened with a keratome as it enters the A/C. The internal opening should be 30% wider than the entrance wound. After administering viscoelastic material into the A/C, a lance is used to make a side port. Anterior capsulotomy is then performed. Nucleus is separated from the cortex by hydrodissection and maneuvered into the A/C by gentle rotation and subsequent delivery with vectis. In some instance, the surgeon may prefer to break the nucleus into halves using a pair of forceps before delivery. Viscoelastic material is used to cushion the endothelium and allow insertion, rotation, and dialing of the lens into position. The side port can be used toward this aim. With the IOL in position, any residual cortical matter and viscoelastic material are aspirated. Lens matter at the sclera tunnel entrance into the A/C is approached via the side port. Any residual viscoelastic material is aspirated. Antibiotic and steroid administration is similar to that of ECCE. MSICS was demonstrated to show

better uncorrected postoperative vision when compared to ECCE [38]. Even when final visual recovery is similar in MSICS and ECCE, eyes in the small incision group tend to have significantly faster recovery [39].

2.8. Phaco surgery

After routine cleaning and draping, a superior rectus bridle suture is applied and the globe stabilized. A 3.2 mm keratome is used to make a stab bevel incision into the anterior chamber followed by viscoelastic material administration and side port stab incision. An A/C maintainer is placed to maintain stability of the intraocular pressure during the procedure. Continuous curvilinear capsulotomy is done minding that a well-delineated margin is required. Femto second laser for making corneal incision, capsulotomy, and lens fragmentation is largely unavailable in the region. A 25G cannula mounted on a syringe is used for hydrodissection by gently injecting saline in each quadrant with the aim of separating and lifting the nucleus away from the cortex. The surgeon has the option of cracking the nucleus into two halves at this stage. It appears easier to completely displace the nucleus into the anterior chamber. For those on the continuous learning process, this limits the risk of posterior capsular tear and drop nucleus. When the nucleus is fully in the A/C, a golden ring sign appears around it. The nucleus can be cracked in half with a fragmenter. The A/C is deepened to keep the postcapsule away during fragmentation/aspiration and to protect the corneal endothelium. The phaco tip is inserted through the keratome incision and a phaco spatula through the side port to stabilize the nucleus as it is fragmented and aspirated. Any remaining cortical matter is aspirated with simcoe double cannula. The A/C is further deepened with viscoelastic material in preparation for foldable IOL insertion. Preloaded lens tend to be more expensive when unavailable. Where such is unavailable, the lens is loaded onto the syringe, which contains viscoelastic material. The tip is inserted into the eye and with gentle pressure on the stylus the IOL glides into the posterior capsular sac (in the bag). Dialing maybe required infrequently. A miotic agent is administered to narrow the pupil. Any residual viscoelastic material is aspirated. Saline is injected to swell off the stab corneal wound site as suturing is not required. Phaco surgery has been demonstrated to give good postoperative visual acuity in the immediate and intermediate postoperative period [40].

2.9. Intraoperative challenges

Each procedure is unique and every patient is special and deserves to get the best. Despite adequate training and experience, challenges could arise during surgery that require diligence in decision making and appropriate action to ensure that the goal of safety and quality outcome is realized. Posterior capsular rent could occur with any of the three procedures described earlier. Minimal tears may not require derailment from completing the surgery as planned. Larger tears could interfere with the placement and stability of the IOL. Often times, such big tears are associated with vitreous in the A/C. This will require manual and where available phacovitrectomy. This may necessitate the need to use an anterior chamber or iris claw IOL instead.

The other disturbing scenario is when the nucleus drops into the vitreous. Where combined phacovitrectomy machine is available, this is used to clear lens remnants from the vitreous. Manual attempt to do so could lead to retinal detachment. Where material and human resource to assure appropriate intervention is lacking, it is imperative to immediately refer the patient to the few centers where such services are available.

2.10. Care after surgery

Patients are advised to lie on their back or on the side of the nonoperated eye perhaps to limit undue position-related pressure on the raw eye. Postoperative medications include topical antibiotic-steroid combination eye drops, a mydriatic agent with moderate cycloplegic effect, oral broad-spectrum antibiotic, and nonsteroidal anti-inflammatory agent. It is of importance to obtain drugs from a reliable source due to preponderance of fake and substandard makes.

Admitted and day-case patients are reviewed a day after surgery. The routine should start from asking the patient if there are any complaints. The visual acuity is then determined unaided and with pin hole, followed by careful inspection of the wound site for any leakages/iris prolapse. The IOP should be within limits. The cornea is examined for clarity. Presence of corneal edema and/or striate keratopathy is noted and these usually improve with medication. The pupil should be regular, central, and round. Any peaking is a sign of iris entrapment in the wound edge or improper IOL placement. Open wound will give rise to shallow A/C with low IOP and a positive Seidel's test may require secondary suturing. Cortical remnants may be observed with slit lamp in the A/C or behind the IOL and may require aspiration. Tilted or decentered IOL is to be redialed into position.

2.11. Postoperative infective endophthalmitis

Postoperative bacterial endophthalmitis is arguably the most dreaded complications of intraocular surgery, although relatively rare with some reports indicating an incidence of 0.6% [40], 0.13–0.7% [41]. The commonest agents are conjunctival commensals like *Staph epidermidis* 70%, *Staph aureus* 10%, *Strep species* 2%, and occasionally the devastating *Pseudomonas aeruginosa* [42]. This can arise within 48–72 hours after surgery. Typically, the patient develops ocular pain and drop in vision after initial postoperative improvement. On examination, the lids appear tense and tender, with periocular congestion. The cornea is cloudy and there are signs of intraocular inflammation, a hypopyon may be seen in the anterior chamber. Inflammatory reaction in the anterior vitreous is noticed with slit lamp examination. The posterior segment is poorly visible. This is an emergency and the patient requires admission. Appropriate intraoperative intracameral antibiotic administration has been demonstrated to reduce the incidence [43, 44].

Endophthalmitis management protocol involves preparing intravitreal injection of vancomycin 2 mg and ceftazidime 2 mg (or 0.5 mg amikacin). A vitreous tap is performed and aspirate is sent to the laboratory for gram staining, microscopy, culture, and sensitivity. The prepared intravitreal antibiotic is administered. In addition, subconjunctival vancomycin 50 mg and

ceftazidime 125 mg (or amikacin 50 mg in those with penicillin allergy) is administered. Topical ceftazidime 5% and vancomycin 5% eye drops are to be instilled hourly. Topical 1% atropine drop is used six hourly to relieve ciliary spasm. The patient's clinical condition is monitored. A reduction in ocular pain/inflammation is indicative of improvement. Treatment is continued as the patient is monitored. If there is no improvement, repeat vitreous tap and antibiotics. The choice of antibiotics maybe modified based on the culture results/clinical improvement. Topical or systemic steroids can be administered when there is indication that the infection is under control based on clinical parameters such as pain reduction, fibrin contracting, and hypopyon reducing. The treatment is tapered based on the patient's response and culture results [45].

Posterior capsular opacity: This is a cause of intermediate and long-term reduction in postoperative visual acuity. Nd:Yag capsulotomy is performed to restore vision. Open capsulotomy may be considered where laser services are unavailable.

2.12. Identifying recording and limiting critical incident

Critical incidents are events or incidents that cause harm to the patient [46]. There is hardly any documentation on prevalence of such events in sub-Saharan African countries. Such incidents may include failing to make the right diagnosis, faulty assessment and preparation of the patient, mislabeling of the index eye, theater-related mishaps comprising defective sterilization, contaminated irrigation fluids, intraoperative and postoperative complications, use of substandard medications, etc. Documenting such incidents and reviewing the patient's management protocol in order to forestall future occurrence is very important. Linking such events to individual is counterproductive as isolated blame game does not solve systemic failures [47].

2.13. Steps toward preventing critical incidents, obtaining successful visual outcome, and ensuring the patient's safety

Gaining trust of the patient and care giver by creating an enabling environment to make them believe they're not in a court under cross examination is essential in obtaining a reliable ocular and systemic history. The ophthalmologist must perform careful and purposeful ocular and systemic assessment to determine the correct diagnosis and identify any ocular co-morbidity. Prompt and appropriate management of underlining ocular and or systemic diseases will ensure the patient condition is optimal for obtaining a predictable favorable cataract surgical outcome. Patient should be counseled on the cause of vision loss (cataract), the preparations for surgery, the cost, logistics, the need to buy and use prescribed medications, the visual expectations after surgery and the symptoms that should alert the patient of potential complications. Ocular biometry must be done routinely to determine the correct IOL power is available and used for each patient. Similarly, consumables and post operative medications are to be obtained from a certified and reliable source. Obtaining and maintaining a conducive and safe operating environment is essential in securing favorable surgical outcome. Basic minimum eye clinic and theater equipments have to be provided as well as purpose built operating room. The clinician must

ensure that correct medication in appropriate dose is given to the patient. Obtaining and maintaining the basic minimum eye clinic and theater equipments necessary to getting good surgical outcome. Use of appropriate not necessarily purpose built operating space.

While in the operating room: Ensure the patient has bathed/is clean before coming to the O.R. The patient must exchange personal clothes with theater gown. Ensure that the correct eye is labeled by double checking and comparing with the patient's notes. Ensure all instruments are cleaned and sterilized. Ensure all drapings are washed and sterilized. Ensure separate and sterilized instruments are used for each patient. Use separate irrigation/aspiration cannula for each case. Resterilize all reusable instruments in between cases. The surgeon and assistant are to be properly gowned. Install purpose made water taps with long handle that are elbow controlled in the scrubbing area. Where unavailable, an assistant can pour water with a bowl for the person scrubbing. Appropriate scrubbing of the surgical team with antiseptic lotion. Trim dirty nails before surgery and ensure wrist watches, rings, and bangles are removed before scrubbing. Take meticulous and purposeful steps toward successful completion of the procedure. Avoid impulsive and erratic moves that can cause tissue damage leading to critical incident. Record all critical incidents for the purpose of internal audit and rectification of any short comings while avoiding individual blame. Provide dedicated instrument sets for patients with hepatitis and/or HIV. Ensure correct and appropriate eye medications are applied as the eye is padded. A perforated eye shield is better than a gauze pad. Provide dedicated instrument set for patients living with HIV/hepatitis.

Maintaining a committed and motivated eye care team. Timely and strategic training of the eye care team. Provision of refraction services. Ensuring staff and patient's safety in the operating room and at all times. Prompt documentation of procedure including critical incidents. Arranging follow-up visits till postoperative ocular status is stable.

2.14. Good visual outcome and safety-centered cataract outreach service

Cataract outreach entails an eye care team leaving the base hospital to provide services in locations within or even outside national boundaries. Often times, there is inadequate and improper planning of such programs with suboptimal preparation for the conduct of the camp services and patient monitoring till full recuperation. There is need to change from appearing, operating, and disappearing without proper arrangement on who cares for the patient when the outreach team is gone.

Guide toward successful cataract surgical outreach:

- There should be an advance team to evaluate the facility where the outreach will be conducted ensuring that basic minimal infrastructure is available without compromising patient safety.
- The advance team should liaise with and co-opt local eye care team in order to ensure joint participation in the conduct of the program.
- Any prior advocacy visit must include the local eye care team and their relevance highlighted to ensure continuity and success of the program.

- Proper screening and documentation of the selected patients are conducted by the joint advance and local team. This should include appropriate tests to detect communicable diseases such as hepatitis and HIV.
- Venue and date are agreed upon with the approval of relevant local health authorities.
- Biometry is performed on all the patients so that the correct power of IOL is determined and provided.
- Where possible, counselors are involved in discussing all issues related to the cause of the patient's blindness, the proposed intervention, the expected visual recovery, the use of medications, and postoperative follow-up. Patients must be given opportunity to ask questions.
- There has to be informed individual consent administration.
- The correct eye is labeled appropriately.
- Staggered scheduling is advised to reduce overcrowding, thus ensuring that the patients arrive and are operated and dispatched in manageable batches.
- Patient records must be kept at the facility used for reference whenever required and not be carried away by the outreach team.
- The local team is to continue the patients' care when the outreach team is gone.
- The philosophy is quality visual outcome based on integrated eye care team without compromising the patient's safety. The care is patient centered not client's eye.
- Collaborative long-term partnership, strengthening of local eye care teams, and sustained intervention program appear to yield better cataract prevention services in sub-Saharan African setting [48].

2.15. The big question and the final answer

Ophthalmologist and other eye care personnel need to ask themselves if they are willing to have cataract surgery in the centers they work. If the answer is not an affirmative "Yes," such institutions are not good enough to provide cataract surgery with favorable outcome and may not be safe for patients to patronize!

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