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Incidence of Acute Onset Endophthalmitis after Cataract Extraction Surgery at Tripoli Eye Hospital

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Abstract

The aim of this study was to observe the incidence of acute onset endophthalmitis after cataract surgery in Tripoli Eyes Hospital between January 2015 until December2017. A retrospective study was reviewed all cases during three years by reviewing electronic surgical records.The study recorded the clinical and the microbial reultes of the recorded cases within the 6 weeks after cataract surgery . The study found that the The median age of patients was 74 years. The mean duration from day of cataract surgery to the day of diagnosis with endophthalmitis was 10 days. 5 of the 8 vitreous isolates produced culture positive growth. The 3 culture negative cases presented on postoperative days 5, 10 and 14.,topical 2% lidocaine gel was used in two (67%) before povidone-iodine preparation. Of the patients with endophthalmitis after a temporal clear cornea approach to phacoemulsification, 2 achieved a final visual acuity of counting finger or better, and 2 had a final visual acuity of hand motions or worse. One patient had a poor visual outcome due to endophthalmitis- not responding to the treatment ended with evisceration, whereas the other had a poor outcome .The study concluded thatthe incidence of endophthalmitis after clear cornea phacoemulsification (0.10%) was lower than the incidence after other approaches to cataract surgery (0.02%) in the current study,

Keywords:*Endophthalmitis,phacoemulsification,Cornea,Cataract*

INTRODUCTION

In the past 4 decades, cataract surgery has undergone remarkable technical refinement, with simplified postoperative care and faster visual recovery as consequences.(1) With improved instrumentation, small-incision phacoemulsification became possible in the late 1980s, leading to the current

state of the art of sutureless phacoemulsification surgery with foldable intraocular lens implantation.(2)

Removal of the lens through a corneal incision was reported as early as 1668; however, the current self-sealing clear corneal incision was first introduced in 1992 by I. Howard Fine, MD. (3)Since then, increasing popularity of clear corneal incisions over limbal and scleral tunnel incisions among cataract surgeons across the United States and Europe has resulted in greater intraoperative control, decreased surgical time, simplified postoperative care, less induction of astigmatism, and faster visual recovery. In the most recent survey of American Society of Cataract and Refractive Surgery members (2003), Leaming reported that clear corneal incision was preferred by 72% of US surgeons and the no-suture closure was preferred by 92%. This acceptance is part of a gradual uptrend from 1.5%, 12.4%, 30%, 40%, and 47% in 1992, 1995, 1997, 1999, and 2000, respectively. (4)Among European surgeons, a similar 51.4% prefer clear corneal incisions, while a 1999 French survey reported a more than 86% preference for clear corneal incisions. (5)Furthermore, sutureless cataract incisions are reportedly preferred among 92%, 94%, and 58% of cataract surgeons in the United States, New Zealand, and Japan, respectively. (3)

Endophthalmitis is an uncommon but serious intraocular infection that occurs most commonly as a complication of intraocular surgery and often causes severe visual impairment or even the loss of an eye. (6)The reported incidence of postoperative endophthalmitis varies by the specific surgical procedure and across studies, but the overall incidence has been declining since the late 19th to late 20th century. The incidence of endophthalmitis after cataract surgery was approximately 5% to 10% in the late 1800s and early 1900s, 1.5% to 2% during the 1930s,0.5% to 0.7% in the mid 1900s, and 0.06% to 0.09% according to nationwide patient registries in the early 1990s. (7)Improvements in microsurgical and aseptic techniques, advancements in surgical materials, and use of prophylactic broad-spectrum antibiotics, in combination with a better understanding of causes of the infection, may explain this favorable trend.

In a meta-analysis of studies published from 1979 to 1991, a period that predates the use of self-sealing clear corneal incisions, Powe et al reported a 0.13% incidence of acute postoperative endophthalmitis following cataract extraction.(8) However, recent reports suggest that the postcataractendophthalmitis rate may be substantially higher, suggesting a greater risk of endophthalmitis coincident with the increase in self-sealing clear corneal incisions. (8)Colleaux and Hamilton reported a 0.129% and 0.05% incidence of endophthalmitis following cataract extraction with sutureless clear corneal and scleral tunnel incisions, respectively. Similarly, 3 retrospective, comparative, case-controlled studies found a significantly higher

endophthalmitis rate associated with clear corneal incisions compared with scleral tunnel incisions. (9,10,11) In a study from the Massachusetts Eye and Ear Infirmary (Boston), the incidence of endophthalmitis was 0.68% for clear corneal incisions vs 0.18% for scleral tunnel incisions. (12)More recently, Nakagi et al reported a statistically increased risk with clear corneal incisions (0.29%) compared with sclerocorneal incisions (0.05%).(13)

Various other anecdotal reports by cataract surgeons and retinal specialists have also claimed a higher incidence of endophthalmitis with clear corneal incisions. (14)These studies indicate an apparently increased occurrence of endophthalmitis in the last decade and a several-fold increase in endophthalmitis risk associated with self-sealing clear corneal incisions compared with scleral tunnel and sclerocorneal wounds. However, the relative rarity of endophthalmitis following intraocular surgery poses significant difficulty in ascertaining accurate incidence rates or in analyzing effects of multiple risk factors.

Some studies found a three- to four-fold risk for endophthalmitis after clear cornea cataract surgery compared with scleral tunnel incisions.(14,15) In contrast, Lalwani et al reviewed 73 endophthalmitis cases after clear cornea cataract surgery and compared them with the data from the Endophthalmitis Vitrectomy Study (EVS), in which scleral tunnel and clear cornea incisions were used. They found that time to endophthalmitis diagnosis was longer in clear cornea cataract surgery cases but clinical features, causative organisms, and visual acuity outcomes were similar to those reported in the EVS.(17)

Most reports regarding the rates of endophthalmitis are based on the experience of individual institutions or groups of surgeons and are limited by the small sample sizes, thereby making comparisons and statistical validity of data difficult. Only more appropriate methods such as extensive reviews or multicenter, prospective studies can help reveal clinical and statistical trends for this adverse outcome.

Risk Factors for Acute Endophthalmitis following Cataract Surgery

The World Health Organization's Prevention of Blindness and Visual Impairment makes the global estimate that the number of people of all ages visually impaired is estimated to be 285 million, of whom 39 million are blind in 2010. The major causes of visual impairment are uncorrected refractive errors (43%) and cataract (33%) ; cataracts remain the leading cause of blindness (51%). (15) Cataract surgery is becoming more prevalent in the elderly as the life expectancy of the population increases. There has been a dramatic shift in surgical practice during the last 30 years with small-incision phacoemulsification being the predominant method of intervention used since

1990. Although cataract surgery is highly effective and relatively safe, owing to the enormous numbers, even uncommon surgical complications could potentially harm many patients. Endophthalmitis is one of the most serious complications of cataract surgery and often results in severe visual impairment. Nationwide surveys and large case series of postcataractendophthalmitis (POE) in different countries estimated that the incidence for endophthalmitis ranged from 0.012% to 1.3% since 2000, in part because of differences in study design, time, and region [3, 17 ~ 32]. Earlier literatures stratified the results over time and noted decreasing endophthalmitis rates, from 0.327% in the 1970s to 0.158% in the 1980s and 0.087% in the 1990s.(16,17)

The optimal means to prevent POE remains controversial because conducting the large studies required to investigate an uncommon problem is difficult. While preoperative preparation with 5% povidone-iodine solution dropped into the conjunctival sac is the best established method of chemoprophylaxis based on the current clinical evidence, the benefit of other forms of perioperative factors remains uncertain. (18) Several extensive reviews have been written regarding this topic despite the variable evidence and strength of association [6~11].

Postoperative endophthalmitis following cataract surgery could have potentially devastating consequences of severe vision loss or even blindness. the most common pathogen is *Staphylococcus epidermidis*. (19) The average time from surgery to presentation of endophthalmitis is usually 6-7 days (20). There were described a case of immediate postoperative endophthalmitis from *Staphylococcus haemolyticus*. (21) This is a rare cause of endophthalmitis in the postoperative setting following cataract surgery, with an incidence of 0.002% in the Endophthalmitis Vitrectomy Study . (22) Wound integrity also seems to be an important feature influencing the risk for developing endophthalmitis in pars plana vitrectomy. In general, the incidence of endophthalmitis after pars plana vitrectomy is low (0.03%–0.05%). Nevertheless, recent data indicate that the use of sutureless small incision techniques (eg, 23- or 25-gauge incision size) is significantly associated with a higher rate of postoperative endophthalmitis than the sutured 20-gauge technique.(23) However, endophthalmitis can also complicate other ocular surgeries and procedures such as intravitreal injections. Some data suggest that penetrating keratoplasty, trabeculectomy, and glaucoma drainage device implantation have a higher risk of being complicated by endophthalmitis than cataract surgery.(24) Regarding glaucoma filtering surgery, endophthalmitis is reported to occur after 0.2%–9.6% of trabeculectomies, and its incidence seems to increase with the rising use of antifibrotic agents, such as mitomycin-C or 5-fluorouracil. (25) Endophthalmitis rarely occurs after external ocular surgeries including scleral buckling, pterygium excision, removal of corneal sutures, and strabological interventions.

In general, secondary intraocular lens placement seems to be associated with the highest risk for developing endophthalmitis (0.2%–0.37%) and pars plana vitrectomy with the lowest (0.03%–0.05%).(25)Preoperative risk factors include eyelid abnormalities, blepharitis, conjunctivitis, cannuliculitis, lacrimal duct obstructions, contact lens wear, and ocular prosthesis in the fellow orbit.(26)The ocular surface and the adnexa are considered the primary sources of infection in postoperative endophthalmitis. However, contaminated agents or surgical equipment used perioperatively may also be a source of infection. In addition, perioperative variations seem to have some impact on postoperative endophthalmitis rate; different intraocular lens (IOL) materials potentially act as vectors for bacterial spread into the eye and viscoelastic substances, such as sodium hyaluronate, or hydroxypropylmethylcellulose may facilitate transmission of bacteria to the eye.(27) Knowledge about the cause of endophthalmitis is essential because the spectrum of organisms may change, warranting different therapeutic approaches. Bacteria infections are the most common cause of postoperative endophthalmitis, and Gram-positive isolates account for most cases. Fungal infections may also occur, particularly in association with the use of contaminated ocular irrigation fluids.

Postoperative endophthalmitis can be either sterile or infectious. In the EVS, only 69.3% of cases met the criteria for laboratory-confirmed infection.The reasons that more than 30% of cases failed to obtain positive results from culture vary and include low microbial counts, spontaneously sterilizing during the ocular inflammatory response of certain strains (eg, *Staphylococcus epidermidis*), or even noninfectious inflammations.(28)

In addition, the etiology of endophthalmitis might differ depending on the location in the world where the disease occurs. Whereas the microbiologic spectrum in Europe or in the US seems to be generally comparable, it might be very different in other parts of the world. According to the EVS, 94.2% of culture-positive endophthalmitis cases involved Gram-positive bacteria; 70% of isolates were Gram-positive, coagulase-negative staphylococci, 9.9% were *Staphylococcus aureus*, 9.0% were *Streptococcus* species, 2.2% were *Enterococcus* species, and 3% were other Gram-positive species. Gram-negative species were involved in 5.9% of cases.(29) In contrast, a recent survey from India reported that Gram-positive bacteria accounted for only 53% of postoperative endophthalmitis cases, but 26% were Gram-negative isolates and 17% were of fungal origin.(30) Depending on the infecting organism, a correlation is thought to exist between clinical presentation and microbiologic spectrum. Gram-positive, coagulase-negative micrococci seem to cause less severe infections compared with more virulent Gram-negative and “other” Gram-positive organisms.7 Streptococcal endophthalmitis often results in earlier onset and notably worse outcomes than infections by staphylococcal

species. Endophthalmitis cases that failed to obtain positive results from culture tended to have a later onset and a better visual outcome.

Specific factors influencing bacterial adhesion, including IOL material and surface irregularities, might have a role in the development of certain forms of endophthalmitis. *S epidermidis* carrying the intercellular adhesion locus might play a part in the pathogenesis of some forms of endophthalmitis.(31)

In most cases the diagnosis of endophthalmitis is made on clinical grounds. Any eye with inflammation that is out of proportion to the previous surgical trauma or greater than the predicted postoperative clinical course must be suspected as indicating postoperative endophthalmitis. If doubt cannot be erased, frequent observations should be conducted until the clinical course can be determined. Symptoms can be variable, from very little inflammation in the anterior chamber and the anterior portion of the vitreous to extremely painful panopthalmitis with no fundus view, corneal edema, or complete anterior chamber hypopyon.

According to the EVS, hypopyon can be seen in nearly 75% of patients, whereas ocular pain, often regarded as pathognomonic for endophthalmitis, was absent in 25% of patients.(32) In the European Society of Cataract and Refractive Surgeons Endophthalmitis Study (ESCRS) of prophylaxis for postoperative endophthalmitis after cataract surgery, hypopyon was present in 80% of culture-proven cases and 56% of unproven cases, resulting in an overall incidence of 72%.(33) Most common presentations include decreased vision, ocular pain and redness, corneal edema, and vitritis. In addition, retinal vasculitis, retinal hemorrhages, and posterior pole hypopyon may occur.

The current study investigates the incidence and clinical settings of acute-onset endophthalmitis after cataract surgery in the new millennium and assesses visual acuity outcomes after treatment among patients who developed endophthalmitis after cataract surgery at Tripoli eye hospital.

Methods and Materials

The study was a retrospective, observational cross section. Annual cataract surgery statistics were determined by reviewedof Tripoli Eye centerrcords(statistic of electronic surgical department), a copy of records was attached at appendix A. The data for this study come from the medical files of all patitients thathad cataract surgery in Tripoli Eye Hospital, Tripoli, Libya. Surgeries were categorized as either phacoemulsification or extra capsular cataract extraction (ECCE). Clinical records were reviewed of all cataract surgeries patients who developed acute-onset postoperative endophthalmitis, defined as clinically diagnosed endophthalmitis that occurred within 6 weeks of cataract surgery.

Preioperative precautions, such as skin scrraping by 10% povidine iodine , conjunctiva wash by 5% povidineDrapping of eyelids, Vancomycin in irrigation bottle, Intracameralvigamox, Subconjunctival antibiotic, Time of presentation after operation Visual acuity at presentation, Management , Vitreous tap, Culture results Type of organism, Intravitreal antibiotic injection, Intravitreal Antibiotic used, Outcome either Improved on intravitreal injections, Refered for vitrectomy, Refeard for evaceration, Patient dischared against medical advice.Both culture positive and culture negative cases were included.

As a part of operating room protocol during the time of the study (2015-2017), povidone-iodine solution was used to prepare the lids, lashes, and conjunctiva before cataract surgery. No antibiotics were placed in the surgical infusion fluid during the study period. The diagnosis of endophthalmitis was based on decreased visual acuity and typical clinical features, including marked intraocular inflammation. In all clinical diagnosed patients, anterior chamber and/or vitreous cultures were obtained, and intravitreal antibiotics were administered on the day of diagnosis. Stored bacterial isolates from culture-positive cases were tested in vitro for sensitivity to vancomycin, ceftazidime, gentamicin, ciprofloxacin, ofloxacin, levofloxacin, gatifloxacin, and moxifloxacin by disk diffusion method. Zones of inhibition were measured after 24, 48, and 72 hours of incubation at 35 C. Cataract surgeries that were combined with any other procedure, including penetrating keratoplasty, pars plana vitrectomy, or trabeculectomy, were excluded from the study. Patients with delayed-onset endophthalmitis (infection diagnosed later than 6 weeks aftersurgery) and endophthalmitis referred to the Trippoli Eye Hospitalafter cataract surgery performed elsewhere were excluded from the current study.

Results

Between January 2015 and December 2017, 4886 cataract surgeries were performed. eight cases about (0.16%) were diagnosed with presumed infectious postoperative endophthalmitis. **Table 1**shows thatthe distribution of types of procedures that have been done also the incidence of endophthalmitis. The highest incidence of endophthalmitis cases occurred in the ECCE. The incidence in the ECCE group was statistically significantly higher than the incidence in the phacoemulsification group (P=.016).

The three years incidence rate of acute onset endophthalmitis after cataract surgery was 0.16% (8/4886) for cataract surgeries of all methods, 0.10% (2/1915) for cataract surgery by phacoemulsification, and 0.20% (6/2971) for cataract surgery through methods other than clear cornea phacoemulsification .

The incidence of endophthalmitis by year is displayed in **Table 1**. The median age was 74 years (range: 50-83 years). Clinical data are summarized in **Table 2**. The mean duration from day of cataract surgery to the day of diagnosis with

endophthalmitis was 10 days (range: 1-14 days). Five of the eight vitreous isolates produced culture positive growth: four coagulase-negative Staphylococcus and one Streptococcus pneumoniae. The S. pneumoniae case presented on the fifth postoperative day, whereas the coagulase- negative Staphylococcus cases presented at a median postoperative day 11 (range: 5-14 days). The three culture negative cases presented on postoperative days 5, 10 and 14.,topical 2% lidocaine gel was used in two (67%) before povidone-iodine preparation (Table 2, cases 2 and 3).

Perioperative antibiotics were selected at the discretion of each surgeon and are summarized **in Table 3**. Although all patients received a povidone-iodine preparation to the lids, lashes, and conjunctiva, no preoperative antibiotic was used in three patients. Of the four patients who received preoperative antibiotics, two received ofloxacin and two received gentamicin. In vitro testing demonstrated that two of the five (40%) bacterial isolates in this study were resistant to all tested fluoroquinolones, including commercially available fourth generation fluoroquinolones.

Two of five (40%) were resistant to gentamicin, and three of five (60%) were resistant to ceftazidime. None of the isolates was resistant to vancomycin. On the day of endophthalmitis diagnosis, each patient received intravitreal vancomycin 1 mg, ceftazidime 2.25 mg, and dexamethasone 0.4 mg. Of the six patients with endophthalmitis after a temporal clear cornea approach to phacoemulsification, two achieved a final visual acuity of counting finger or better, and two had a final visual acuity of hand motions or worse. One of these patients had a poor visual outcome due to endophthalmitis- not responding to the treatment ended with evisceration, whereas the other had a poor outcome

Table 1. EndophthalmitisAfter Cataract Surgery: Annual

Incidence

years	Number of Cases/Number Cataract Surgeries	Incidence (%) of Endophthalmitis
2015	3/1233	0.24
2016	2/1123	0.17
2017	3/2530	0.11
Total	8/4886	0.16

Table 2. Distribution of endophthalmitis according to type of surgery and patient

Surgery Type	Patients, n	Endophthalmitis Cases, n (%)
Phacoemulsification	2, 1915	0.10
ECCE	6, 2971	0.20
Total	8, 4886	0.16

Table 3. Clinical Settings, Treatment, and Visual Acuity Outcomes of Acute-onset EndophthalmitisAfter Cataract Surgery

Patient	Age	Day of diagnosis	Preoperative precautions	Cultured organism	Management	Final VA	outcomes
1	**83**	**13**	**Yes**	**Staphylococcus epidermidis**	**Tap & inject (V, C, Dexa)**	**No LP**	**Referred for evisceration**
2	**55**	**6**	**Unknown**	**None**	**Tap & inject (V, C, Dexa)**	**LP**	**Improved on intravitreal injections**
3	**74**	**10**	**Yes**	**None**	**Tap & inject (V, C, Dexa)**	**HM**	
4	**63**	**9**	**No**	**Staphylococcus auricularis**	**Tap & inject (V, C, Dexa)**	**CF**	**Improved on intravitreal injections**
5	**81**	**11**	**Unknown**	**Staphylococcus epidermidis**	**Tap & inject (V, C, Dexa)**	**No LP**	**Referred for vitrectomy**

6	**68**	**5**	**Yes**	**Streptococcus pneumoniae**		**HM**	
7	**57**	**14**	**Yes**	**None**	**Tap & inject (V, C, Dexa)**	**LP**	**Patient discharged against medical advice**
8	**78**	**7**	**No**	**Staphylococcus epidermidis**	**Tap & inject (V, C, Dexa)**	**CF**	**Improved on intravitreal injections**

Discussion

Controversy exist regarding the possible Increased risk of postoperative endophthalmitis after cataract surgery through clear cornea incision. Anexperimental study of corneal wound dynamics in cadaver and rabbit corneas reported that even properly constructed corneal wounds may allow communication between the intraocular and extraocular environments.(3) Some studies reported an increased risk of endophthalmitis in clear cornea cases,(4,5) whereas another reportedno significant difference.6 The overall incidence of endophthalmitis in the current series (0.16%) is similar to incidence rates published in recent international studies (6).

In a retrospective case-control study including 38 endophthalmitis patients and 371 control patients, Cooper and associates reported a threefold higher risk of endophthalmitis after cataract surgery with a clear cornea incision compared with a superiorscleral tunnel incision (odds ratio, 3.36 with a 95% confidence interval).4 Among 12,317 cataract procedures, Nagaki and coworkers reported a 4.6-fold (*P* _.037) higher relative risk of endophthalmitis with clear cornea incisions vs superior scleral tunnel incisions.(15)Colleaux and Hamilton retrospectively reviewed 13,886 cataract surgeries performed at a hospital-based surgical unit in Canada. Although the incidence of endophthalmitis was higher in clear cornea (0.129%) vs sclera tunnel (0.05%) incisions, the difference was not statistically significant.(26) In a recent endophthalmitis outbreak in an Australianmulti-surgeon center, 10 of 11 endophthalmitis cases followed clear cornea phacoemulsification occurring in the right eye.6

However, the surgeon's hand dominance was not described in this report. In the current series, 86% of endophthalmitis cases occurred in the right eye, where theright-handed surgeons placed the corneal incision inferotemporally.Inferiorly placed filtering blebs have been associated with an increased risk of both acute- and delayed-onset endophthalmitis, perhaps associated with the proximity of the bleb to the inferior tear lake and inferior lid margin.(17)The most commonly

used preoperative antibiotics in the current study were gentamicin and ciprofloxacin. At the present time, the fourth generation fluoroquinolones are commonly used for prophylaxis during cataract surgery and have a broad range of coverage for both grampositive and gram-negative bacteria. However, resistant organisms may be encountered, including two of five (40%) isolates in the current study. None of the five gram-positive isolates was resistant to vancomycin, confirming its continued role as initial endophthalmitis treatment. A higher incidence of endophthalmitis has been associated with foldable (1.21%) vs injectable (0.028%) intraocular lenses.(8) Although the overall incidence of endophthalmitis among patients with foldable vs injectable lenses is not known (20), there were twiceas many endophthalmitis cases after surgery with foldable lenses than with injectable lenses. Subconjunctival antibiotics at the conclusion of cataract surgery have been associated with a lower incidence of endophthalmitis when compared with the incidence after surgery with no injected antibiotics.(5,9 –11) Only two of the eight cases in the current study received subconjunctival antibiotics (Table 3, cases 1 and 6).

Conclusion and Recommendations

The incidence of endophthalmitis after clear cornea phacoemulsification (0.10%) was lower than the incidence after other approaches to cataract surgery (0.02%) in the current study, but the decreased incidence

is not statistically significant (*P* _ .681, Fisher's exact test). Depending on the projected incidence, a study would need to include as many as 100 000 patients to have sufficient study power to detect even a 50% difference in the risk of endophthalmitis .

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