

How to prevent endophthalmitis in cataract surgeries?

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Postoperative endophthalmitis is a very devastating complication and every step should be taken to reduce its occurrence. Unattended air conditioning filter systems are often the culprits and regular maintenance of the filters is of paramount importance. Shedders of pathogenic organisms amongst the theater personnel should be identified by regular screening and should be promptly treated. In addition to the use of Povidone iodine 5% solution in the conjunctival sac few minutes prior to surgery, proper construction of wound, injectable intraocular lenses, use of prophylactic intracameral antibiotics or prophylactic subconjunctival antibiotic injection at the conclusion of cataract surgery, placing a patch after the surgery for at least 4 h and initiating topical antibiotics from the same day of surgery helps to lower the frequency of postoperative endophthalmitis. Intraoperative posterior capsule rupture and anterior vitrectomy are risk factors for acute endophthalmitis, and utmost care to prevent posterior capsular rent should be taken while performing cataract surgery. Also, in case of such complication, these patients should be closely monitored for early signs of endophthalmitis in the postoperative period. In the unfortunate event of endophthalmitis the diagnosis should be prompt and treatment must be initiated as early as possible.

Key words: Intracameral antibiotics, operating room cleaning, operating room disinfection, postoperative endophthalmitis, subconjunctival antibiotics

Indian J Ophthalmol 2008;56:403-7

Endophthalmitis is a devastating eye complication that can occur following an intraocular surgery. The diagnosis should be prompt as the most important aspect of management is early recognition and early initiation of therapy. Endophthalmitis can occur after any ocular surgical procedure including cataract surgery, radial keratotomy, anterior chamber paracentesis, trabeculectomy and intraocular lens repositioning.¹ The incidence of culture-proven endophthalmitis in a review of over 30,000 procedures at the Bascom Palmer Eye Institute, Miami, was found to be 0.9/1000 cases.² Rosha *et al.*, reported a cumulative incidence of 0.057% whilst Li *et al.*, reported rates of 0.03-0.4%.^{3,4} In a study conducted by Lalitha *et al.*, the average two-year incidence of post cataract surgery endophthalmitis was 0.05%.⁵ The exact pathogenesis of endophthalmitis after cataract surgery is unknown. Potential sources of such bacterial contamination are from the conjunctival and lid margin flora, contaminated surgical intraocular instruments, or contaminated environment.⁶⁻⁸ Fungal endophthalmitis has been linked to environmental sources, ventilator systems and unattended air conditioning filter systems.^{9,10} The objective of this communication was to review the literature to identify various etiologic factors related to post cataract surgery endophthalmitis and to suggest possible preventive measures.

The information, for the above article, has been collected by reviewing standard books like 'Principles and Practice

of Ophthalmology' by Albert and Jackobie. Then a full literature search was undertaken on www.pubmed.com and www.Cochrane.org. The key words used for the search included, postoperative endophthalmitis, theater cleaning and disinfection, intracameral antibiotics, subconjunctival antibiotics. Journals like 'Indian Journal of Ophthalmology', 'Ophthalmology' and 'Journal of Cataract and Refractive Surgery' were searched for related information. There were no constraints based on language or publication status.

Environmental factors

There is a general relationship between aerobic bacterial count and risk of infection. The risk of infection is significant with counts in the range of 700 to 1800 bacteria carrying particles (BCP) per cubic meter but the risk becomes insignificant when the BCP load is less than 180 per cubic meter.¹¹ Fridkin *et al.*, reported a case of fungal endophthalmitis linked to an environmental source. They identified that the source of fungal endophthalmitis was the ventilator system.⁹ Unattended air conditioning filter systems are often the culprits and regular maintenance of the filters is of paramount importance.¹⁰ It has been suggested that no intraocular surgery should be undertaken while the air-conditioning system is undergoing repairs or service. A case of fungal endophthalmitis following cataract surgery caused by *Paecilomyces variotii* due to operation room contamination caused by the air conditioner that was being repaired has been reported.¹² Unwanted instruments and old unused machines should not be kept in the operation room. Cleaning procedures should be carried out in a manner that protects both patients and personnel from exposure to potentially infectious microorganisms. Cleaning measures are needed before, during, and after surgical procedures and at the end of each day. At the completion of the day's schedule, each operation room, whether or not it was used

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Manuscript received: 30.10.06; Revision accepted: 27.11.07

that day, should be terminally cleaned. The 'Association of Operation Room Nurses' (AORN) "Recommended Practices for Environmental Cleaning in the Surgical Practice Setting" states that, "surgical procedure rooms and scrub/utility areas should be terminally cleaned daily."¹³ This is done to reduce the number of microorganisms, dust, and organic debris present in the environment. The following routine is recommended at the end of the day's schedule. Furniture is scrubbed thoroughly, using mechanical friction. Casters and wheels are cleared of suture ends and debris and washed with a disinfectant solution. Equipment such as electrosurgical units or lasers needs special care and attention when cleaning to avoid saturation of the internal machine. Ceiling and wall-mounted fixtures and tracks are cleaned on all surfaces. Kick buckets, laundry hamper frames, and trash receptacles are cleaned and disinfected. Floors are wet vacuumed thoroughly. Walls and ceilings should be checked for soil spots and cleaned as needed. Cabinets and doors should be cleaned, especially at the contact points. Air intake grills, ducts, and filter covers should be cleaned.¹⁴

Hygiene of patients and healthcare personnel

Staphylococcus aureus (*S. aureus*) and β hemolytic *Streptococci* can persist in the environment for extended periods. *S. aureus* and β hemolytic *Streptococci* have been linked to airborne transmission in operation theaters, burns and neonatal units.^{15,16} Patient infections can occur when healthcare personnel are heavily colonized with *S. aureus* and shed them. Colonized employees are generally asymptomatic, although they are a potential reservoir of infections acquired by patients.¹⁷ Colonized or infected hospital personnel may serve as reservoirs and disseminators of Methicillin-resistant *S. aureus* (MRSA) in hospitals.¹⁸ Failure to identify healthcare workers who are persistently colonized or infected can lead to continuing transmission despite implementation of barrier precautions and hand hygiene.¹⁹ It is advisable to screen all the theater personnel for carriage of *S. aureus* periodically. It is suggested that the frequency of evaluation of operating room (OR) staff for *S. aureus* carriage should be twice in a year.²⁰

The following seven-day protocol applies to staff colonized with methicillin-resistant *S. aureus*:

- Nasal preparation of mupirocin (Bactroban) or chlorhexidine or naseptin
- Medicated soap (Cidal or Sterzac)
- Medicated bath sachets (Sterzac hexachlorophene, 10%)
- Chlorhexidine hair wash (Hibascrub 100 ml)²¹

Surgical gloves

Starch powdered surgical gloves should be avoided. Sellar *et al.*, reported that starch powder contamination of ophthalmic materials could occur and it is a possible cause of sterile intra- and extraocular inflammation.²²

Health of patients

Patients with local risk factors such as those with chronic blepharitis, conjunctivitis or discharge as well as dacryocystitis, and systemic risk factors such as diabetes, autoimmune, immunodeficient or skin disorders, asthma and those taking

immunosuppressant medications are more likely to harbor methicillin-resistant (MR) organisms.²³ It is, therefore, prudent to ensure that patients undergoing an ocular surgery are free from local or systemic infections.

Endogenous sources

The majority of patients who develop endogenous endophthalmitis have a variety of pre-morbid conditions such as diabetes mellitus, chronic renal failure, mitral valve prolapse and bific aortic valve. Infection has also been observed as a complication of numerous invasive procedures like hemodialysis and gastrointestinal endoscopy. The endogenous sources for endophthalmitis include meningitis, endocarditis, urinary tract infection and wound infection. Other sources of infection include pharyngitis, pulmonary infection, septic arthritis, pyelonephritis, intraabdominal abscess and gastrointestinal malignancy.²⁴⁻²⁶ Diabetic patients are at higher risk for endophthalmitis than the non-diabetics. Phillips and Tasman reviewed records of 162 consecutive patients of endophthalmitis and found that 21% of these were diabetics.²⁷

It is recommended therefore that a thorough preoperative clinical assessment of the patient should be done and the clinical illnesses be well controlled or treated before proceeding for surgery.

Povidone iodine

It is an iodine-releasing polymer, which has the capacity to destroy bacteria within 30 sec. Solution of 5% povidone iodine in the conjunctival sac for a few minutes before surgery decreases the microbial load to levels comparable to those achieved with the use of preoperative antibiotic drops.²⁸

In an open-label nonrandomized parallel trial conducted by Speaker and Menikoff, a significantly lower incidence of culture-positive endophthalmitis ($P < 0.03$) was observed in the operating rooms using povidone-iodine (2 of 3489 or 0.06%) compared with those using silver protein solution (11 of 4594 or 0.24%). Also, use of topical povidone iodine in over 3000 cases was not associated with any adverse reactions.²⁹

It is therefore advisable to use 5% povidone iodine in the eye before the surgery to reduce the incidence of endophthalmitis.

Care of eyelashes and lacrimal system

The cutting of eyelashes and flushing of the lacrimal drainage system are no longer considered necessary before cataract surgery. The eyelashes should be properly covered by the sterile drape. Such modern drapings excludes the lashes from the surgical field. Schmitz *et al.*, reported that flushing the lacrimal drainage system, using eye shields, and cutting the eyelashes had no demonstrable effect in preventing endophthalmitis.³⁰

Incision

Post cataract endophthalmitis is more likely with corneal incisions. In a study conducted on cadaveric eyes by Ernest *et al.*, to determine relative abilities of incisions to resist leakage and iris prolapse, eyes were tested at external pressures of up to 525 pounds per square inch (psi) at one of two intraocular

pressure (IOP) ranges: 10 to 15 mm Hg or 20 to 25 mm Hg. Results showed that the square scleral corneal incision (3.2 mm × 3.2 mm) with 1.5 mm internal corneal lip offered greater stability and safety than the conventional rectangular clear corneal incision (3.2 mm × 2.0 mm).³¹

In a retrospective, case-controlled study by Cooper *et al.*, clear corneal incisions were found to be a statistically significant risk factor for acute endophthalmitis post cataract surgery when compared with scleral tunnel incisions.³² This was confirmed by Taban *et al.*, who showed, in their systematic review of the literature, that the incidence of endophthalmitis was temporarily associated with the development of clear corneal incisions.³³ This is probably because of the transient fluctuations in intraocular pressure, which may result in gaping of the unhealed wound margins.³⁴

Incision design and construction play pivotal roles in increased rates of infection with corneal tunnels. Poorly constructed and distorted wounds could contribute to a greater chance of postoperative anterior chamber contamination. In cases of clear corneal incisions, a relationship between wound leakage the day after surgery and endophthalmitis has also been suggested.^{35,36}

Intracameral antibiotics

Vancomycin added to the irrigating solution used during cataract surgery has been found in effective concentrations in the anterior chamber at the end of the surgery.³⁷ The addition of gentamicin and vancomycin to the irrigating fluid during phacoemulsification results in a highly significant reduction in the microbial contamination of anterior chamber aspirates.³⁸

A study conducted by Mendivil and Mendivil (2001) found a lower rate of positive cultures in the group that received vancomycin (20 microg/ml) in the irrigating fluid than the group which did not receive any antibiotic in the irrigating fluid.³⁹

Also, many studies have proven the efficacy of intracameral antibiotics in prevention of postoperative endophthalmitis. Intracameral bolus injection of cefazolin (1 mg in 0.1 mL solution) and also intracameral cefuroxime 1 mg at the end of cataract surgery have shown to reduce the rate of postoperative endophthalmitis without toxic effects on the cornea or retina.⁴⁰⁻⁴²

Intraocular lens

The type of intraocular lens (IOL) material, and whether it is foldable or not, has significant influence on the incidence of endophthalmitis. Injectible IOLs are associated with the lowest risk of postoperative endophthalmitis (0.028%). This lower rate of endophthalmitis with injectible IOLs is due to the ease of insertion and non-contact with the ocular surface.⁴³

It has been shown that implanting a heparinized IOL may also reduce the chances of endophthalmitis.⁴⁴

Hydrophilic polymer surfaces (hydrogel and probably hydrophilic acrylic) are useful in avoiding the development of bacterial colonies (*S. epidermidis* strains). These lenses either inhibit or delay bacterial colonization.⁴⁵

Intraoperative complications

A study conducted by Lalitha *et al.*, concluded that the occurrences of intraoperative complications are major risk factors for developing endophthalmitis.⁵

Wong *et al.*, reported that intraoperative posterior capsule rupture is associated with an 8- to 11-fold higher risk of acute endophthalmitis.⁴⁶ In another study, Javitt *et al.*, reported that the risk of endophthalmitis is about four times higher in patients with cataract surgery and anterior vitrectomy compared to those with cataract surgery alone.⁴⁷ This is probably because of the increased duration of the operation, introduction of more instruments into the eye and increased intraocular manipulations associated with surgery when posterior capsule rupture occurs. Close monitoring for signs of infection in the immediate postoperative period is necessary.

Subconjunctival antibiotic injections and postoperative topical antibiotics

Prophylactic subconjunctival antibiotic injections at the conclusion of cataract surgery decrease the incidence of postoperative endophthalmitis.⁴⁸ This is because the very high concentrations of antibiotics achieved in the anterior chamber from such injections destroy any bacteria that may have been introduced during surgery. Wallin *et al.*, recommend that the topical antibiotic should be started from the same day of operation and not from the next day.⁴⁹

Eye patch

It has been recommended that placing a patch after the surgery is protective and should be kept for approximately 4 h. It helps to keep the wound sealed and hence reduce the chance of endophthalmitis.⁴⁹

Acknowledgment

Prof. Harminder Singh Dua FRCS, FRCOphth, PhD - Departmental Chair, Queens Medical Center, Nottingham, UK; Dr. Shreekant Kelkar MS, DO-Director, National Institute Of Ophthalmology.

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Source of Support: Nil, **Conflict of Interest:** None declared.