

Clinical Analysis of Cataract Surgery Complicated by Endophthalmitis

Jing Zhu¹, Yuli Pi¹, Qing Guo¹, Zhaohui Li²

1 Department of Ophthalmology, the First Affiliated Hospital of Chinese PLA General Hospital, Beijing 100038, China

2 Department of Ophthalmology, PLA General Hospital of Beijing Haidian District, Beijing 100856, China

Abstract

Purpose: To assess the efficacy of vitrectomy combined with intravitreal injection in the treatment of endophthalmitis after phacoemulsification and IOL implantation.

Methods: Five patients (5 eyes), who had undergone conventional phacoemulsification combined with IOL implantation at another treatment facility, presented with endophthalmitis. The subjects ranged in age from 41 to 79 years (65.8 ± 0.5 years on average), and three were male. All five cases received bacterial culture susceptibility testing. On the basis of the treatment of primary disease, 3 cases had anterior chamber irrigation, and posterior vitrectomy followed by intravitreal injection of 1 mg vancomycin plus 2.25 mg ceftazidime.

Results: Four out of the five cases of endophthalmitis had a positive bacterial culture testing results (two cases of staphylococcus epidermidis, one case of enterococcus faecalis and one case of head-like staphylococcus), and the remaining case had no bacterial growth. Four cases showed restored visual acuity, clear vitreous cavity, and no retinal detachment or other complications.

Conclusion: Management of patients presenting with endophthalmitis subsequent to cataract surgery should include; prompt bacterial culture and drug sensitivity tests, and where appropriate, vitrectomy combined with intravitreal injection of vancomycin. (*Eye Science 2012; 27:147–151*)

Keywords: cataract surgery; postoperative complications; endophthalmitis

Infectious endophthalmitis is the most severe complication following cataract extraction combined with IOL implantation, which can threaten visual acuity, even lives of patients. Previous studies indicated that although the incidence of endophthalmitis

decreased since cataract operations were widely applied in 1990s¹, rapid progress and poor prognosis of infectious endophthalmitis must be stressed by clinical surgeons. Here, we reported the findings of adopting vitrectomy combined with intravitreal injection in the treatment of endophthalmitis after phacoemulsification and IOL implantation.

Materials and methods

Study subjects

Five patients, previously undergoing phacoemulsification combined with IOL implantation, were admitted to our hospital between May 2008 and December 2011, 3 male (3 eyes), 2 female (2 eyes), aged from 41 to 79 years (65.8 ± 0.5 years on average), and 3 of them underwent vitrectomy in combination with intravitreal injection of vancomycin.

Surgical approach

All the five patients (5 eyes) presented with endophthalmitis following undergoing conventional phacoemulsification combined with IOL implantation in alternative hospitals and were admitted to our hospital for further treatment. The enrolled patients had PHACO plus IOL combined surgery previously in other hospitals. After admitting to our hospital, 3 cases received vitrectomy combined with intravitreal injection. Preoperative preparations were performed according to vitreoretinal surgery.

Clinical presentations

The patients presented with acute decreased vision of various degrees, red eye and ophthalmalgia, etc. at 2 to 9 days postoperatively. Patient 1 had red eye and ophthalmalgia at 9 days after surgery. Examination: visual acuity:0.1, slit-lamp examination: bulbar conjunctival hyperaemia (+), mild corneal edema, aqueous humor Tyn (++) . Patient 2 showed ev-

ident ophthalmalgia on day 4 after surgery. Examination: visual acuity:0.05, slit-lamp examination: mixed bulbar conjunctival hyperaemia (++) , corneal edema (+) , aqueous humor Tyn (++) . B-ultrasound found no vitreous opacity. Peripheral blood WBC was $11.2 \times 10^8/L$. Patient 3 showed apparent red eye and ophthalmalgia at 7 days postoperatively. Examination: visual acuity: hand movement/10 cm, slit-lamp examination: mixed bulbar conjunctival hyperaemia (+++), corneal edema (++) , aqueous humor Tyn (+++). B-ultrasound indicated that vitreous opacity (+) , fibrous exudation noted on the surface of IOL. Peripheral blood WBC was $12.5 \times 10^8/L$. Patient 4 presented with significant red eye, ophthalmalgia accompanied by mild headache at 2 days after surgery. Examination: visual acuity:hand move-

ment/10 cm, slit-lamp examination: mixed bulbar conjunctival hyperaemia(+++), corneal edema (++) , aqueous humor Tyn (+++), hypopyon, fluid surface was approximately 3 mm and fibrous exudation was observed on the surface of IOL. B-ultrasound found vitreous opacity (++) . Body temperature rose up to $39^{\circ}C$. Peripheral blood WBC was $13.8 \times 10^8/L$. Patient 5 showed evident ophthalmalgia and red eye on day 8 postoperatively. Examination: visual acuity: index/10 cm, slit-lamp examination: mixed bulbar conjunctival hyperaemia(+++), corneal edema (++) , aqueous humor Tyn (+++), hypopyon, fluid surface was approximately 1 mm and fibrous exudation was observed on IOL surface. B-ultrasound found vitreous opacity (+) . Body temperature rose up to $38.5^{\circ}C$ Peripheral blood WBC was $12.8 \times 10^8/L$.

Table 1 Treatment of endophthalmitis post cataract operation

No./Gender/Age	Cataract surgery	Days between cataract surgery and onset	Microbiological examination	Preoperative visual acuity	Postoperative visual acuity
1/male/41	PHACO+IOL	9	head-like staphylococcus	0.1	0.8
2/female/65	PHACO+IOL	4	staphylococcus epidermidis	0.05	0.5
3/male/69	PHACO+IOL	7	staphylococcus epidermidis	Hand movement/10 cm	0.3
4/male/75	PHACO+IOL	2	enterococcus faecalis	Hand movement/10 cm	Index/30 cm
5/female/79	PHACO+IOL	8	undetected	Index/10cm	0.2

General condition

One patient suffered from diabetes and hypertension for 15 years and complicated with renal insufficiency for 3 years. Two cases had diabetes for 3 years. One patient had systemic rheumatism arthritis for 8 years and the remaining one case had coronary atherosclerotic heart disease.

Clinical treatment

On the basis of the treatment of primary disease, 3 among 5 cases had anterior chamber irrigation, then posterior vitrectomy and followed by intravitreal injection of 1 mg vancomycin plus 2.25 mg ceftazidime. The aqueous humor and vitreous fluid were sampled for bacterial culture testing before intravitreal injection was given. A systemic injection of 1 g vancomycin was administered, intravenous drip, bid and topical administration of 0.5% levofloxacin plus 1% atropine eye drops, twice to three times daily. The experiment was adjusted according to bacterial culture and drug sensitive test outcomes. One patient received periocular injection of antibiotics combined

with vancomycin (5 mg/0.5 ml) and ceftazidime (10 mg/0.5 ml) plus systemic injection of antibiotics, 1 case had systemic injection of antibiotics plus 1 g vancomycin bid, 1 g ceftazidime tid, 40 mg methylprednisolone via intravenous drip daily plus intravitreal injection of 1 mg vancomycin (0.1 ml)+2.25 mg ceftazidime (0.1 ml).

Results

Microbiological examination

All patients underwent bacterial culture and drug sensitivity testing of aqueous humor and vitreous fluid. Two of them had negative results for vitreous fluid, while positive outcomes for aqueous humor: 1 case of enterococcus faecalis, sensitive to penicillin drugs; 1 case of head-like staphylococcus, sensitive to rocephin and ciprofloxacin. Another 2 cases were positive for vitreous fluid culture, whereas negative for aqueous humor. Two cases had staphylococcus epidermidis, sensitive towards vancomycin. One patient was negative for both aqueous humor and vitre-

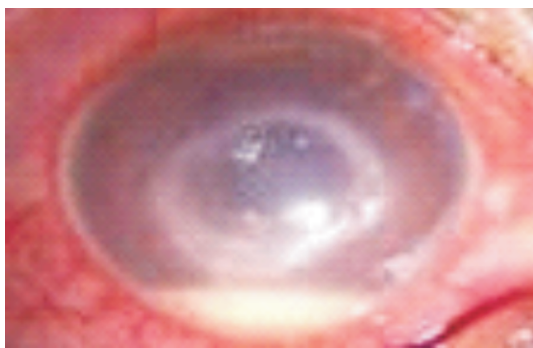


Figure 1 One patient with diabetes and renal insufficiency presented with hypopyon at day 2 after cataract surgery

ous fluid bacterial culture.

Treatment efficacy

In this study, the symptoms of endophthalmitis were all significantly alleviated and IOP was well maintained. Two cases with hypopyon showed that fibrous exudation in the anterior chamber was absorbed, no hypopyon left and aqueous humor Tyn (+). Neither aqueous flare in the anterior chamber nor vitreous opacity was observed in the other patients. Four cases restored visual acuity except one patient had index/30 cm. (Table 1)

Discussion

Recently, the incidence of endophthalmitis post cataract surgery has been sharply reduced due to the improvement in ophthalmological microscopy and sterile operation. Once occurred, endophthalmitis can profoundly affect visual function and ocular tissues. Timely and effective therapy is of significance to clinical prognosis and surgical outcomes. In general, endophthalmitis occurring following cataract extraction plus IOL implantation tends to be classified as acute and chronic onset depending on pathogenic bacterial virulence. Acute endophthalmitis is characterized as early onset, rapid progress of disease and severe state of illness, typically attacking within 1 week postoperatively; Low virulence leads to chronic endophthalmitis, which occurs in several weeks/months after surgery². In this study, two patients had endophthalmitis at day 2 and 4 postoperatively, regarded as acute endophthalmitis.

Diabetes, upper respiratory tract infection and renal insufficiency are the systemic factors causing infection. Previous findings³ suggested that age, gen-

der and race are closely associated with the incidence of endophthalmitis. The incidence of endophthalmitis increased in patients > 80 years, while that of those > 90 years was elevated by 1.83 times. Although some reports noted a potential association between the incidence of endophthalmitis and aqueous humor bacteria intraoperatively, it is unconvincing to conclude that the presence of microbe acts as the pathogenic bacteria of endophthalmitis. Therefore, aqueous humor possibly has certain antibacterial function. Endophthalmitis may occur when the patients' resistance was weakened and physical defense mechanism was disrupted. Previous studies reported that the incidence of endophthalmitis in diabetic patients was higher compared with that in non-diabetic counterparts after cataract surgery regardless of IOL implantation or not⁴. Since the blood-aqueous humor barrier is vulnerable to injuries, especially under the condition of capillary dysfunction, the deferment or relapse of endophthalmitis is likely to occur. The three diabetic patients, although their blood glucose levels were stably maintained, had significantly lower resistance compared with those without systemic complications. Especially, the patients complicated with renal insufficiency presented with postoperative endophthalmitis earlier than other subjects (Table 1).

Blepharitis, conjunctivitis, lacrimal canaliculus dacryocystitis and lacrimal duct obstruction are the primary topical factors leading to infection. Human conjunctival sac was open normally, with a large amount of meibomian gland and accessory lacrimal gland mouths. Approximately two thirds of normal subjects had microflora in their conjunctival sacs. Conjunctival sac and ocular adnexa are regarded as the most common sources of infection. Thus, antibiotics eye drops were not administered before surgery or given for an insufficient time, which acts as one of vital reasons of the incidence of postoperative endophthalmitis. After explicit inquiry, we knew that two patients suffered from chronic lacrimal duct obstruction and chronic blepharitis and were given antibiotics eye drops preoperatively for less than 24 h. One case with diabetes was discharged at 24h post-surgery and failed to take antibiotics eye drops timely.

Some studies revealed that the incidence of endophthalmitis was 0.31% after extracapsular cataract

extraction, while 0.07% following phacoemulsification, suggesting that the size of surgical incision positively correlated with the probability of pathogenic bacteria entering eyes⁵. Some scholars reported that the incidence of endophthalmitis was elevated by over three times if scleral tunnel incision was changed to transparent corneal incision during cataract surgery, acting as a major factor increasing the incidence of postoperative endophthalmitis⁶. However, Lundstrom⁷ found no convincing evidence to confirm the association between transparent corneal incision and the incidence of endophthalmitis, though transparent corneal incision might play a role in the occurrence of endophthalmitis under occasional circumstances. At present, it has been widely recognized that neither transparent corneal incision nor scleral tunnel incision is a risk factor of endophthalmitis within 3 mm incisional size. But incisional leakage and poor healing may be risk factors of the incidence of postoperative endophthalmitis. At day 1 after cataract surgery, 45% patients were positive for bacterial culture. Therefore, early eye care after surgery is of great significance⁸.

The vitreous which has no vascula and removes metabolites at a low rate serves as a suitable medium for bacteria and microbe. So, pathogenic bacteria are likely to multiply in case of infection. Anterior chamber irrigation combined with vitrectomy are effective for acute cases, which not only eliminates pathogenic bacteria, bacterial toxin, inflammatory exudation and necrotic tissues, but completely destroys the microenvironment of bacteria and attains high-dose efficacy in topical lesions in combination with intravitreal injection. In this study, the patients received vitrectomy plus intravitreal injection immediately after the incidence of endophthalmitis and two patients undergoing combined therapy had better visual acuity than those receiving injection alone, indicating that the patients with severe disease and poor systemic condition should undergo vitrectomy immediately rather than when the visual acuity decreased to light perception level. In addition, for the patients with endophthalmitis for a long time, bacterial toxins may attack retina and other ocular structures, leading to permanent serious damages to visual function. The visual acuity was elevated by at least

two lines in four among five eyes (80%) postoperatively. One patient who had diabetes, hypertension complicated with renal insufficiency presented with the characteristics of acute endophthalmitis including acute onset, rapid progress and serious course of disease. After receiving vitrectomy combined with intravitreal injection and repeated anterior chamber irrigations, the patient's visual acuity was not significantly improved although the symptoms of endophthalmitis were basically controlled, suggesting that early vitrectomy plus intraocular injection of drugs can improve efficacy and prognosis while cause severe injuries to those with systemic disorders and poor visual acuities.

Thus, the following treatment principles have been widely recognized based upon the serious damages to visual function induced by endophthalmitis: 1. First phase: only slight opacity was noted in the anterior chamber without hypopyon or vitreous opacity, which should be monitored every 4 to 6 h, even 2 h if it progressed rapidly. Antibiotics irrigation was performed in the anterior chamber when necessary. It should be noted that aqueous humor should be collected for bacterial culture and drug sensitivity testing prior to irrigation. Irrigation solution contained vancomycin diluted by PBS and dissolved solution consisted of vancomycin (0.02 mg/ml) and ceftazidime (0.04 mg/ml). A portion of 1 ml of irrigation solution was added into 500 ml ophthalmic balanced salt solution using a syringe for anterior chamber irrigation. 2. Hypopyon was observed while no vitreous opacity was noted. Anterior chamber irrigation combined with intravitreal injection of drugs was performed. Currently, the optimal drugs for intravitreal injection were vancomycin (1mg/0.1 ml)+ceftazidime (2~2.25 mg/0.1 ml) or vancomycin (1~2 mg/0.1 ml)+amikacin (0.4 mg/0.1ml). Aqueous humor and vitreous fluid were sampled for bacterial culture and drug resistance testing before a portion of 0.1 ml of the solutions above were administered via intravitreal injection. 3. Hypopyon occurred accompanied with vitreous opacity. Vitrectomy combined with intravitreal injection was given correspondingly. In clinical settings, the course of disease should be monitored every 4 to 6 h to identify the stage of diseases and adjust treatment accordingly.

The following preventive measures should be considered;

1. Preoperative preparations: the infectious eyelid, conjunctiva, lacrimal duct and other ocular adnexa should be treated. The incidence of endophthalmitis should be prevented especially in the patients with systemic diseases such as diabetes. The risk factors of postoperative infection should be comprehensively evaluated. Antibiotics eye drops were given three days before surgery. The lacrimal duct and conjunctival sac were thoroughly irrigated, especially the fornix, palpebral conjunctiva and medial and lateral canthi.

2. Intraoperative preventive measures: before operation, the sterilization area covered from eyebrow to the midline of nose bridge of the operated eyes, and isolated by aseptic film to avoid soaking the hole-towel. Surgical skills should be strengthened and surgical time shortened. IOL should be unwrapped until usage under aseptic condition to reduce the exposure time to surroundings.

3. Postoperative preventive measures: the patients and their relatives should be educated after surgery to carefully protect operated eyes, prevent wound infection. The eyes drops should be given timely and those used before and after surgery should be separated. The possibility of infection might be minimized by taking the preventive measures above. Sample testing and combined surgery of vitrectomy and intravitreal injection should be performed when infection suspected. These measures contribute to controlling disease progress and restoring visual acuity.

References

- 1 Mayer E, Cadman D, Ewings P, et al. A 10-year retrospective survey of cataract surgery and endophthalmitis in a single eye unit; injectable lenses lower the incidence of endophthalmitis. *Br J Ophthalmol*, 2003; 87 (7): 867–869.
- 2 Winward KE, Pflugfelder SC, Flynn HW Jr, et al. Post-operative Propionibacterium endophthalmitis. Treatment strategies and long-term results. *Ophthalmology*, 1993; 100(4): 447–451.
- 3 Li J, Morlet N, Ng JQ, et al. Significant non-surgical risk factors for endophthalmitis after cataract surgery: EP-SWA fourth report. *Invest Ophthalmol Vis Sci*, 2004; 45 (5): 1321–1328.
- 4 Kattan HM, Flynn HW Jr, Pflugfelder SC, et al. Nosocomial endophthalmitis survey. Current incidence of infection after intraocular surgery. *Ophthalmology*, 1991; 98 (2): 227–238.
- 5 Mayer E, Cadman D, Ewings P, et al. A 10 year retrospective survey of cataract surgery and endophthalmitis in a single eye unit; injectable lenses lower the incidence of endophthalmitis. *Br J Ophthalmol*, 2003; 87 (7): 867–869.
- 6 Cooper BA, Holekamp NM, Bohigian G, et al. Case-control study of endophthalmitis after cataract surgery comparing scleral tunnel and clear corneal wounds. *Am J Ophthalmol*, 2003; 136(2): 300–305.
- 7 Lundstrom M. Endophthalmitis and incision construction. *Current Opinion Ophthalmology*, 2006; 17(1): 68–71.
- 8 Apt L, Isenberg SJ, Yoshimori R, et al. The effect of povidone-iodine solution applied at the conclusion of ophthalmic surgery. *Am J Ophthalmol*, 1995; 119 (6): 701–705.