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OPHTHALMOLOGY

Combined Clear Cornea Phacoemulsification, Vitrectomy, Foreign Body Extraction, and Intraocular Lens Implantation

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Aim. To analyze the outcome of combined clear cornea phacoemulsification, vitrectomy, foreign body extraction, and intraocular lens implantation in patients with traumatic cataract and intraocular foreign body.

Methods. Retrospective analysis included the results of combined cataract and vitreoretinal surgery in 16 patients. All patients had a penetrating eye injury, traumatic cataract, and intraocular foreign body. Twelve patients had a corneal entry site and in 4 patients intraocular foreign body entered through the sclera.

Results. After a mean follow-up of 25.2 months, 10 out of 16 patients had a visual acuity of 0.1 or better. Postoperative complications were encountered in 4 patients: 2 patients had retinal detachment, one had a massive retinal fibrosis, and one developed postoperative endophthalmitis.

Conclusion. Simultaneous posterior chamber intraocular lens implantation with vitreoretinal surgery is safe in certain cases of severe ocular trauma due to intraocular foreign body. Visual outcome was mainly related to the underlying posterior segment pathology.

Key words: *cataract; cornea; eye foreign bodies; eye injuries, penetrating; lens, crystalline; phacoemulsification; vitrectomy; vitreous body*

Penetrating eye injuries caused by intraocular foreign bodies are often complicated with traumatic cataract. Removal of the intraocular foreign body in the presence of traumatic cataract and associated retinal pathology is difficult (1). The traumatic cataract can be removed together with the intraocular foreign body or later on in a separate surgical procedure (1,2).

The primary indication for the primary removal of cataract and vitrectomy is significant lens opacification that diminishes visualization of the posterior segment and hinders the removal of the intraocular foreign body (1-3). The methods for removal of traumatic cataracts include lensectomy (1,4), extracapsular cataract extraction (5,6), and phacoemulsification (8-10). Lensectomy is the removal of the traumatic cataract during a vitrectomy procedure. It is performed either with a vitrectomy probe, or a phacofragmentor. The lens is usually removed completely, with its anterior and posterior capsule. Extracapsular cataract extraction is performed through an 8-mm corneal, or corneoscleral, incision. The anterior lens capsule is removed, and the nucleus is mechanically expressed through the incision. Intraocular lens is implanted in the capsular bag. The incision must be sutured at the end of the procedure. Phacoemulsification is performed through a 3.5-mm corneal incision. The nucleus of the lens is aspirated with an ultrasound probe. A foldable intraocular lens is implanted in the capsular bag. The incision requires no suturing at the end of the procedure. Phacoemulsification has many advantages over lensectomy and extracapsular cataract extraction (8). Smaller incision induces less astigmatism, makes the globe more stable, and decreases the possibility of a wound leak. Postoperative rehabilitation is also faster (11). Phacoemulsification is not recommended in cases with lens-vitreous mixture and large posterior capsule tear (8).

We analyzed visual outcome and intraoperative and postoperative complications in patients with traumatic cataract after penetrating eye injury with a retained intraocular foreign body. All patients underwent simultaneous procedure, which included phacoemulsification, pars plana vitrectomy, removal of the intraocular foreign body, and the implantation of the intraocular lens.

Patients and Methods

Patients

We reviewed medical records of 97 patients with a penetrating eye injury and retained intraocular foreign body. We excluded 81 patients from this study. Exclusion criteria were the absence of cataract, intraocular foreign body larger than 4 mm, presence of prominent lens/vitreous mixture, prolapsed iris, and evidence of zonular dehiscence.

Sixteen patients had clinically significant lens opacification (Fig. 1) and intraocular foreign body with concomitant vitreoretinal pathology. Intraocular foreign bodies were of ferrous origin. All patients except one sustained their injuries while hammering on metal. One female patient was injured as an innocent bystander. All patients were surgically treated at the Eye Clinic, Sisters of Mercy University Hospital, Zagreb, between September 1998 and May 2003. There were 15 male patients and a single

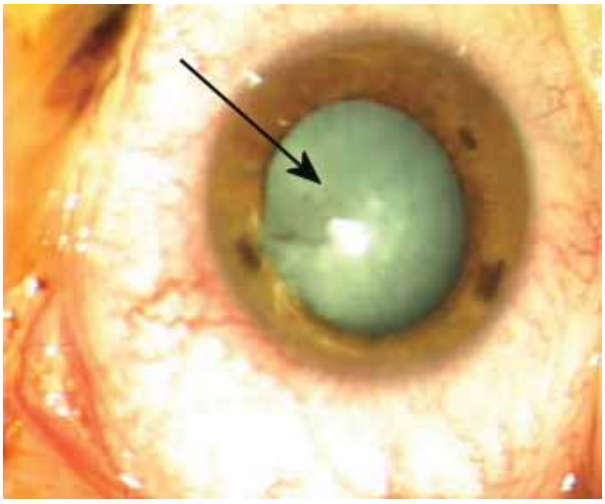

Figure 1. Total cataract (arrow) after a penetrating injury with an intraocular foreign body.

female patient. The median age was 29 years (range, 13-68). The right eye was involved in 7 and left eye in 9 patients (Table 1).

Ophthalmological Tests

All patients underwent a complete general ophthalmological examination before the surgical procedure, as well as keratometry and biometry of the injured eye. In cases where this was not possible, measurements from the non-affected eye were used. Intraocular lens power was calculated using the SRK II formula (7). Ultrasound examination (B-scan, Fig. 2) and/or computerized tomography were performed in all patients to locate and evaluate the intraocular foreign body. Postoperatively, best corrected visual acuity, intraocular pressure, anterior segment findings on slit-lamp biomicroscopy, and posterior segment findings on indirect ophthalmoscopy were recorded at each visit. The length of follow-up period and deviation from the target refraction and postoperative procedures (repeated vitreoretinal surgery) were also noted.

The main aims of the surgery were the improvement of the visualization of the posterior segment by removing opacified lens and/or vitreous hemorrhage, safer foreign body removal, and endolaser treatment if necessary.

Surgical Procedure

Fourteen patients were surgically treated in general anesthesia, whereas two were operated on under the peribulbar block. In 4 cases, the foreign body entered through the sclera. Scleral wounds were sutured with interrupted 7-0 absorbable sutures. In 8 patients, corneal entry wound was self-sealing and required no further treatment. Finally, in 4 cases corneal entry wound was closed with interrupted 10-0 nylon sutures.

In all cases, phacoemulsification was performed before the vitreoretinal procedure. A clear cornea incision was followed by continuous curvilinear capsulorhexis and hydrodissection. Sodium hyaluronate (Healon GV, Pharmacia, Uppsala, Sweden) was injected in the anterior chamber. Phacoemulsification was done in the capsular bag, followed by the irrigation/aspiration of the remaining cortical lens material. Very low phaco-power was used because the nuclei were relatively soft. In some cases, only irrigation and aspiration mode of the phacoemulsification machine was used for the cataract removal. More sodium hyaluronate (Healon GV) was injected in the anterior chamber to deepen the capsular bag.

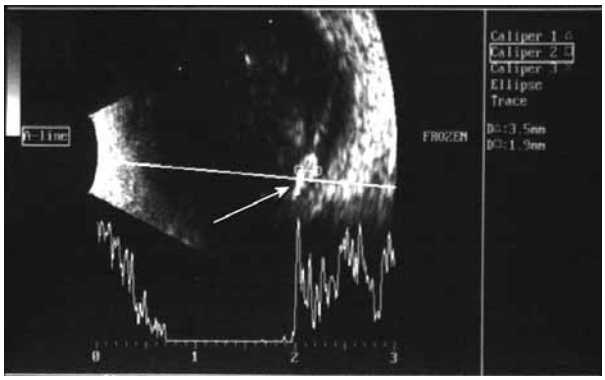

Figure 2. B-scan ultrasound of an intraocular foreign body (arrow) embedded in the retina.

A foldable acrylic intraocular lens (Acrysof, Alcon, Forth Worth, TX, USA) was implanted in the capsular bag in 4 cases. In 12 cases, intraocular lens was implanted after vitrectomy, and in 6 of these 12 cases before retinal endotamponade. Corneal incision was temporarily closed with a single 10-0 nylon suture.

A standard 3 port pars plana vitrectomy was performed with a 20-gauge vitreous cutter and handheld light source under a non-contact wide-angle viewing system (BIOM; Oculus Optikgerate GmbH, Wetzlar, Germany). Three sclerotomies were placed at 10, 2, and 4 o'clock position. Vitrectomy was performed and intraocular foreign bodies were removed with a forceps, under direct visual guidance (Fig. 3). Endolaser was used in cases with a retinal rupture or where an intraocular foreign body was found embedded in the retina.

Posterior capsulorhexis was performed in 12 cases with an irregular posterior capsule rupture. Retinal endotamponade with silicone oil (Oxane 1300 cs; Bausch and Lomb, Rochester, NY, USA) was performed in four cases with retinal detachment. In two cases fluid-gas exchange with perfluoropropane (C3F8, Alcon) was performed. Sodium hyaluronate (Healon GV) was aspirated from the anterior chamber.

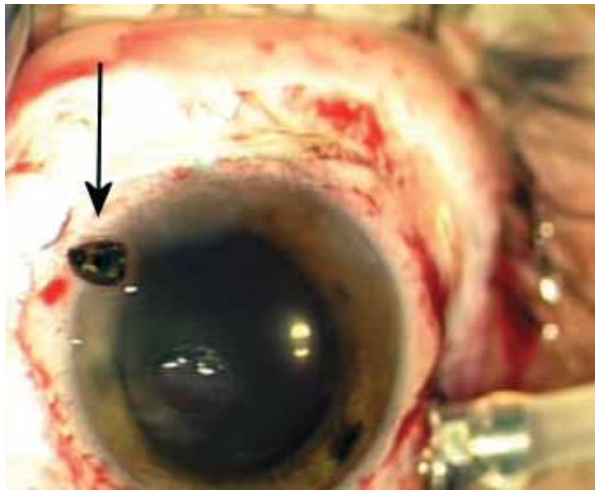

Figure 3. Extracted intraocular foreign body (arrow) placed on a cornea for reference at the end of the vitrectomy procedure (intraocular lens is already implanted).

After surgery, sclerotomies and conjunctiva were closed, and 0.4% dexamethason and gentamycine sulphate 20 mg were injected subconjunctivally.

Postoperatively, all patients received topical dexamethasone-neomycine drops and ointment for 3-4 weeks, with gradual tapering.

Table 1. Clinical and demographic characteristics of the patients*

	Patients characteristics							
							visual acuity	
Patient No.	age	wound size (mm)	entry site	cataract formation	time to surgery	follow up (months)	preoperative	postoperative
1†	27	2	C	localized opacity	12 hours	25	0.4	0.8
2	22	3	C	total lenticular opacity	2 days	42	0.05	0.4
3	13	3	C	total lenticular opacity	3 days	22	HM	0.1
4	25	4	S	posterior subcapsular	18 hours	28	0.025	0.2
5	36	3	C	cortical material in AC	4 days	26	LP	HM
6	40	5	S	posterior subcapsular	4 days	24	LP	0.05
7	33	2	C	localized opacity	22 hours	29	0.3	0.6
8	21	4	C	cortical material in AC	26 days	28	LP	HM
9	28	3	C	total lenticular opacity	9 days	33	HM	0.075
10	26	2	C	localized opacity	11 days	18	0.4	0.8
11	68	3	C	total lenticular opacity	8 days	16	HM	0.05
12	23	4	S	posterior subcapsular	6 days	22	0.01	0.075
13	29	4	S	posterior subcapsular	6 days	31	0.1	0.5
14	31	2	C	total lenticular opacity	2 days	24	HM	0.4
15	23	1	C	posterior subcapsular	14 hours	4	0.5	0.8
16	18	3	C	total lenticular opacity	10 days	31	HM	0.3

*Abbreviations: C – cornea; S – sclera; AC – anterior chamber; HM – hand motion; LP – light perception.
†Female patient.

Results

Most patients were young males, except for one older male patient and one female patient (Table 1).

After a median follow up of 25 months (range, 4-42), 10 out of 16 patients had a visual acuity of 0.1 and better. Five patients had a visual acuity of 0.5 or better. In 6 patients, visual acuity was 0.1 or less due to a macular location of the intraocular foreign body, central or paracentral corneal scar, and postoperative complications. Intraocular lens was stable in all cases. None of the patients was lost to follow-up. Three patients had a deviation from the target refraction (0.75-1.5 D). Posterior capsule opacification developed in a single case, but this complication was successfully resolved by Nd:YAG laser capsulotomy. Posterior capsulorhexis, performed in 12 patients, prevented the formation of posterior capsule opacification.

Intraoperative Complications

We encountered intraoperative complications in 5 patients. In a patient with the dislocation of lens material into vitreous cavity, the posterior capsule tear was converted to the primary posterior capsulorhexis. Dislocated lens fragments were extracted during vitrectomy.

In two patients, iatrogenic retinal tears were encircled with three rows of endolaser spots. Vitreous hemorrhage was observed in two patients. Raising the infusion bottle increased the intraocular pressure, and the hemorrhage subsided in both patients. All these intraoperative complications were solved immediately, without further consequences.

Postoperative Complications

Postoperative complications were observed in four patients. In patients No. 6 and 9, retinal detachment occurred on the postoperative day 20 and 38, respectively. In both patients reoperation was performed with vitrectomy, endolaser, and silicone oil tamponade. In the patient No. 8, massive retinal fibrosis developed 53 days after the surgery. Reoperation with vitrectomy, endolaser, and silicone oil tamponade was performed. In all three patients visual acuity was less than 0.1 at the last follow-up.

In the patient No. 12, endophthalmitis developed five days after the surgery. The patient was immediately taken to the operating room; conjunctival smears, as well as vitreous samples were taken and sent for the bacteriological analysis. After vitrectomy the patient received intravitreal injection of 1 mg/mL of vancomycin. Vitreous samples were positive to *Staphylococcus epidermidis*. Ceftazidime IV was administered according to the antibiogram. At the last follow-up visit (22 months after the operation), visual acuity was 0.075, also due to previous retinal pathology (intraocular foreign body close to the macula).

Discussion

We reviewed outcomes and complications in 16 patients with significant lens opacification and intraocular foreign body with concomitant vitreoretinal pathology, who underwent phacoemulsification, pars plana vitrectomy, removal of the intraocular foreign body, and implantation of the intraocular lens. The simultaneous procedure was chosen due to the presence of a traumatic cataract, which diminished the visualization of the posterior segment and prevention of lens-induced uveitis due to a ruptured posterior capsule. In some cases, a combined approach is used to treat the injuries of the anterior and posterior segment caused by an intraocular foreign body, including cataract extraction, vitrectomy removal of the intraocular foreign body, and intraocular lens implantation (8).

We performed intraocular lens implantation after vitrectomy in 12 eyes. Most authors prefer Mackool's approach (12), where the implantation of the intraocular lens is done after the vitreoretinal procedure because it allows better visualisation of the retinal periphery and avoids prismatic effects of the optic edge of an intraocular lens. We decided to implant the intraocular lens before the vitrectomy in four cases with a large posterior capsule rupture, because the intraocular lens formed a barrier between the anterior and posterior segments. We used acrylic intraocular lenses in all patients, as they are a better choice in pa-

tients where retinal endotamponade with silicone oil can be expected (13,14). We also performed posterior capsulorhexis in 12 patients, thus preventing the postoperative formation of a posterior capsule opacification, which was encountered in a single case.

Ten out of 16 patients had a visual acuity of 0.1 or better, and 5 out of those 10 patients had a visual acuity of 0.5 or better. Batman et al (15) reported that useful vision was achieved in 13 out of 17 patients. Despite a smaller number of patients with postoperative complications in comparison with Batman et al (15), useful visual acuity (0.1 or better) in our study was achieved in fewer patients. The reasons for poor visual outcome were central or paracentral corneal scar, intraretinal foreign body in the macular region, retinal detachment, massive retinal fibrosis despite a careful removal of the posterior vitreous body, and postoperative endophthalmitis in a single case. On the other hand, 5 out of 16 patients had a very good visual acuity in our study, which is comparable to the results of Lam et al (2), who reported a best corrected visual acuity of 0.5 or better in all 4 patients in their study. The shortcoming of our study was a small study sample.

Combined simultaneous cataract and vitreous surgery with modern foldable intraocular lenses offers not only faster visual rehabilitation (1), but also reduces the number of hospital stays (11). Progression of cataract is often noted after vitrectomy, and cataract operation is more difficult to perform as a secondary procedure because of weak zonules and the absence of vitreous support (16,17).

In conclusion, we did not see any complications during the combined procedure that would not occur in phacoemulsification or vitrectomy performed separately (18). Posterior capsulorhexis effectively prevented the formation of a posterior capsule opacification, leaving a clear visual axis, and facilitating future follow-up. In our hands, simultaneous posterior chamber intraocular lens implant with vitreoretinal surgery is safe in selected cases of severe ocular trauma due to intraocular foreign body.

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