Surgical Technique

Minimally Invasive Surgery for the Removal of Posterior Intraocular Foreign Bodies

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Abstract

This is a prospective clinical assay that included six patients who were diagnosed with penetrating corneal injury, traumatic cataract, and posterior segment intraocular foreign body (IOFB). Following anterior segment repair and extraction of traumatic cataract by clear cornea phacoemulsification, a standard 25-gauge transconjunctival pars plana vitrectomy was performed to find and release the IOFB. With active suction using a 25-gauge silicone tipped cannula, the foreign body was retrieved and safely placed in the anterior chamber. After stabilization of the anterior chamber with viscoelastic injection, IOFB extraction through the main phaco incision was easily performed, followed by placement of an intraocular lens. Of the six patients, 66.6% showed a significant improvement of visual acuity. No complications associated directly with the surgical procedure occurred. Our surgical technique is a safe alternative for handling and removing a posterior IOFB. There was no need for a scleral incision.

Keywords: Cataract; Corneal Trauma; Intraocular Foreign Bodies; Eye Injury; Vitrectomy

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INTRODUCTION

The surgical approaches for posterior segment intraocular foreign bodies (IOFBs) include vitrectomy and extraction using a magnet or forceps.[1-5] Most surgeons extract the IOFB by extending the sclerotomy or through a sclerocorneal tunnel.[6] Some report extraction of IOFBs through a corneal incision using 25-gauge vitrectomy.[7] Riemann et al[8] reported a case using the 25-gauge technique assisted by magnetic forceps. Santos and Roig[9] published the extraction of a dislocated intraocular lens to the vitreous cavity through active suction using a 25-gauge transconjunctival vitrector and a silicone-tipped cannula.

This study describes a modified minimally invasive surgical technique in the management of IOFB in the posterior segment and to assess its functional and anatomical results.

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SURGICAL METHOD

The study was assessed and approved by our institution's ethics committee and followed the stipulations in the Declaration of Helsinki and the

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International Council for Harmonisation Guidelines for Good Clinical Practices.

A convenience sample technique was used including patients treated at our institution's Department of Ophthalmology between the years 2009 and 2012. Subjects included in the study were at least 18 years old, with a diagnosis of penetrating wound with perforated traumatic cataract (anterior and posterior capsular rupture) secondary to an IOFB embedded in the posterior segment. All patients signed an informed consent.

We considered an improvement of visual acuity in the postoperative stage as a parameter of functional success, and the presence of retinal detachment, ocular hypotonia, and/or endophthalmitis as complications. Patients with incomplete data or a follow-up period of less than three months were excluded.

Surgical Technique

Following corneal or sclerocorneal wound repair, the main phaco incision was created through clear cornea with a 3.2 mm keratome, along with an accessory corneal incision. Next, a continuous curvilinear capsulorhexis was made (if possible) without the use of trypan blue, followed by phacoemulsification and/or irrigation-aspiration, total removal of the viscoelastic, and closure of the main phaco incision entry port with a 10-0 nylon suture. Afterwards, a 25-gauge transconjunctival pars plana vitrectomy (Accurus Surgical System, Alcon Laboratories model 800 cs) was performed anteriorly [Figure 1], and continued with a proper posterior vitrectomy to find and release the IOFB. Subsequently, and using total continuous active suction with a 25-gauge silicone tipped cannula (with a maximum vacuum of 400–550 mmHg), the IOFB was suctioned and transferred to the anterior chamber angle through the posterior capsular defect and the anterior capsulorhexis [Figures 2 and 3]. Only with the IOFB is safely placed at the anterior chamber angle can the suction be interrupted. The IOFB was stabilized with viscoelastic to avoid its migration to the posterior segment. After removing the suture of the main phaco incision, filling the anterior chamber with viscoelastic, and positioning the intraocular lens (IOL) in the sulcus, the IOFB was easily extracted through the same incision [Figure 4]. An alternative process is to first remove the IOFB and then proceed to position the IOL in the sulcus. To avoid postoperative infectious endophthalmitis, we closed the entry port with 10-0 nylon in all cases. Finally, the 25-gauge scleral cannulas were removed and the procedure was considered complete [Figure 5].

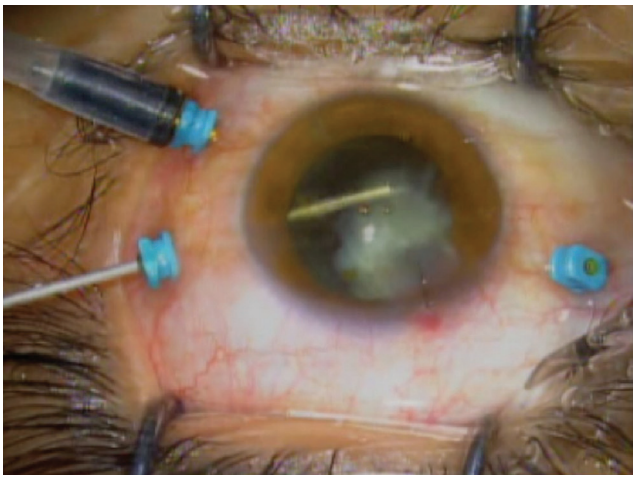

Figure 1. Removal of cataract remnants and trapped vitreous in the anterior chamber with a posterior vitrector.

If there was no safe area to place the IOFB in the anterior segment, an alternative is to get the IOFB with forceps directly from the active suction cannula [Figures 6a and b]. If the IOFB is larger than the width of the main corneal incision, enlargement of the incision is necessary [Figures 6c and d].

RESULTS

Six patients were included. All patients were men. The average age was 33.16 years (range: 22–51 years). The left eye was injured in 83% of cases. The average time between initial injury and diagnosis was 31.6 hours (range: 4–72 hours). The means of injury was hammering metal during occupational activities in 66% of patients. The preoperative ocular characteristics are shown in Table 1.

In the majority of cases, initial visual acuity was equal to or lower than hand movement. The cornea was the site of primary injury in 83% of cases. All cases presented with damage of the lens and iris.

Preoperative management consisted of ocular protection and the use of antibiotics and topical mydriatics in all patients. There was a great variability in the use of antibiotics and oral steroids. A simple head X-ray was used as a technical diagnostic aid in 60% of cases, a simple computed tomography (CT) scan in 30%, and an ultrasound in 10%.

Time between diagnosis and performance of the procedure was 60 hours on average. The IOL was calculated using an immersion biometry ultrasound and optical biometry (IOLMASTER, Zeiss) in the unaffected eye.

The duration of the procedure took an average of 90 minutes. There was no need to enlarge the defect of the posterior capsule since the tear was considerably large in all cases. Retrieval of the posterior hyaloid and vitrectomy of the vitreous base with indentation were achieved in all patients. Preservative-free triamcinolone acetonide (ATLC, Grin Laboratories, Mexico) was used in two patients for correct identification and separation of the posterior hyaloid. Average IOFB size was 3.5 mm in length, and 2.5 mm in width.

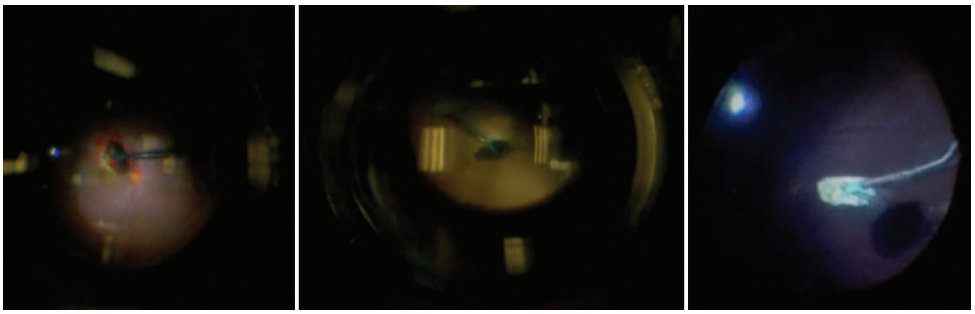

Figure 2. Active suction of different intraocular foreign bodies (IOFBs) with an active silicone cannula. The soft silicone point fastens onto the flat surface of the IOFB.

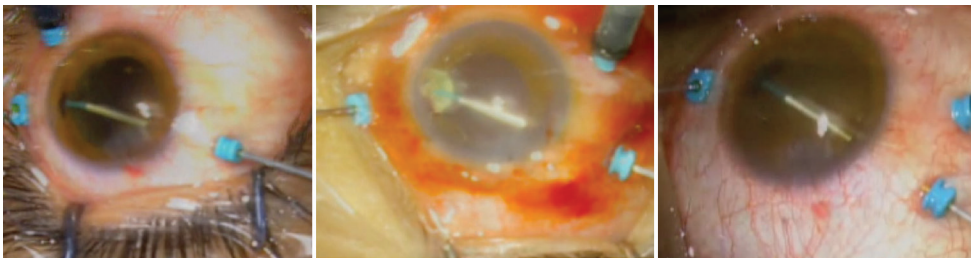

Figure 3. Positioning of different intraocular foreign bodies (IOFBs) within the anterior chamber.

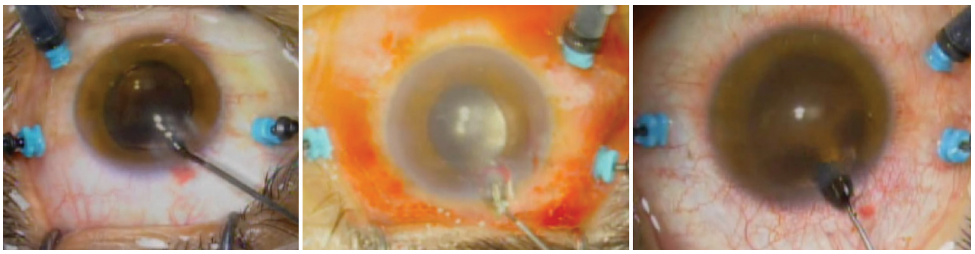

Figure 4. Removal of the intraocular foreign body (IOFB) through the main phaco incision.

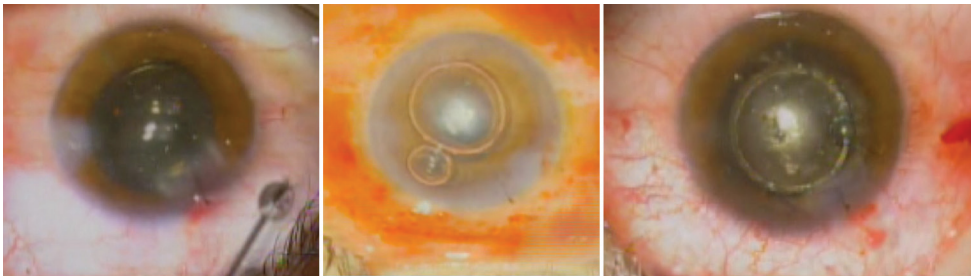

Figure 5. Finished procedure.

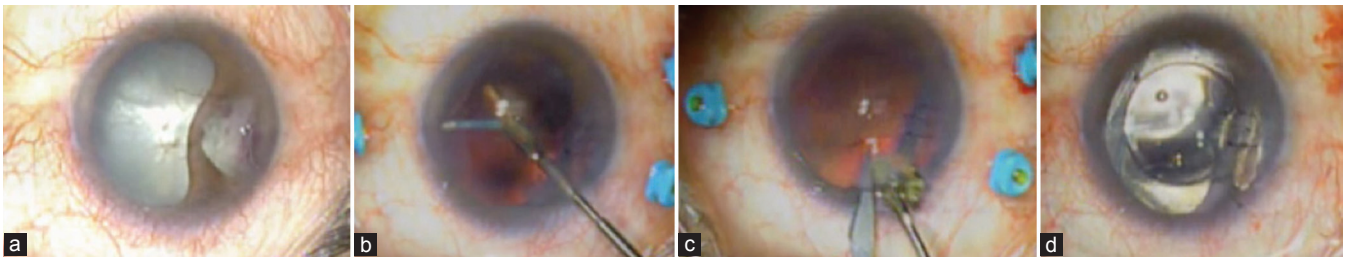

Figure 6. (a) Corneal wound with traumatic cataract. (b) Capture of the intraocular foreign body (IOFB) with forceps directly from the cannula with active suction. (c) Removal of the IOFB with widening of the main phaco incision. (d) End of the procedure.

Since no tears or holes were found, anterior retinal coagulation was performed in three rows with a laser diode as a preventive measure in all cases; it was also performed around the area of the retinal tear caused by the IOFB in four patients. Sulfur hexafluoride gas (SF6 at 20%) was used for tamponade in five patients, and 5000 cs silicone oil was used in the remaining patient because he had preoperative endophthalmitis. Intravenous antibiotics were used in none of the cases, trans- or post-operatively. Circumferential or segmental positioning of a scleral exoplant was not considered in any case. All IOLs where placed in sulcus, no iris or scleral fixation were required. Preoperative and trans-operative characteristics are shown in Table 2.

Postoperative management consisted of the use of antibiotics, mydriatics, and topical and/or systemic steroids. Complete ophthalmological reviews were made at regular intervals with a minimum follow-up of three months. No patient presented with an endothelial cell count less than 2000 cells/mm^2 at four weeks after the procedure.

In our series of cases, 66.6% of our patients ended with a best corrected visual acuity of 20/40 or better. Extensive injury was evident in the macular region during the initial trauma in the patients that did not have visual improvement [Table 3]. No complications related to the procedure were observed during the follow-up period, which may have been ocular hypotension/hypertension, tearing/detachment of the retina, or postoperative endophthalmitis.

DISCUSSION

Like other publications, the majority of our patients were young men of a productive age and the injuries were principally related to occupational activities.[1-15]

Currently, there is little information on the removal of IOFBs through minimally invasive surgeries, and in the majority of cases the amplification of the sclerotomy, or the creation of sclero-corneal tunnels is necessary.[6,7,13,14] With a directed search on PubMed, we found only one publication on minimally invasive techniques that removed IOFBs from the posterior segment through a central corneal wound,[7] but they did not use the active suction described in this article.

Sixty-six percent (66.6%) of our patients presented with significant visual improvement. Two of them with a final visual acuity of 20/25, similar to the rate reported by Kunikata, et al.[7]

In the cases where we did not observe an improvement in visual acuity, it can be directly related to the structural damage of the macular area during the initial injury. This has been established beforehand in multiple studies as

Table 1. Preoperative ophthalmological characteristics

	NO.1	NO.2	NO.3	NO.4	NO.5	NO.6
Initial Visual Acuity (Snellen)	20/30	HM	HM	20/30	HM	HM
Site of injury	cornea	cornea	corneoscleral limbus	cornea	cornea	cornea
Initial IOP	11	NDP	8	NDP	NDP	NDP
Cataract	Yes	Yes	Yes	Yes	Yes	Yes
Iris rupture	Yes	Yes	Yes	Yes	No	Yes
Seidel	negative	negative	positive	negative	positive	negative

HM, hand motion; IOP, intraocular pressure; NDP, normal by digital palpation

Table 2. Preoperative and surgical characteristics

	NO.1	NO.2	NO.3	NO.4	NO.5	NO.6
Time between first assessment and surgery	72 hours	24 hours	48 hours	96 hours	96 hours	24 hours
Anesthesia	BGA	S/RBB	BGA	S/RBB	BGA	S/RBB
Surgery time	75 min	60 min	120 min	60 min	100 min	85 min
Corneal wound	Yes	Yes	Yes	No	Yes	Yes
Cataract surgery	I-A	I-A	I-A	I-A	I-A	I-A
Vitreous surgery	VH RD	VH	VH Endophthalmitis	Clear Vitreous	VH RD	VH
PC 360°/PC around the IOFB	Yes/No	Yes/No	Yes/No	Yes/Yes	Yes/Yes	Yes/Yes
Intravitreal	Preservative-free triamcinolone	No	Preservative-free triamcinolone	No	No	No
Perfluorocarbon heavy liquids	No	No	No	No	No	No
SF6 GAS	Yes	Yes	No	Yes	Yes	Yes
Silicon Oil	No	No	Yes	No	No	No

BGA, balanced general anesthesia; VH, vitreous hemorrhage; I-A, irrigation-aspiration; IOFB, intraocular foreign body; PC, photocoagulation, RD, retinal detachment; S/RBB, sedation and retrobulbar block

Table 3. Functional results

	Initial VA (Snellen)	Initial VA (LogMAR)	Final VA (Snellen)	Final VA (LogMAR)
NO.1	20/30	0.18	20/25	0.10
NO.2	HM	2	20/40	0.30
NO.3	HM	2	20/400	1.30
NO.4	20/30	0.18	20/25	0.10
NO.5	HM	2	20/400	1.30
NO.6	HM	2	20/40	0.30

HM, hand motion; VA, visual acuity; LogMAR, logarithm of the minimum angle of resolution. ‡P=0.039

one of the most important visual prognostic factors in this type of ocular trauma.[7,10-13]

Removal of IOFB with active suction is more advantageous than the magnet because it does not require the IOFB to be magnetic. One limitation of our technique relates to the weight of the IOFB. The presence of heavy foreign bodies contraindicates this technique, since the foreign body can drop during the extraction and can damage the retina, or they simply cannot be lifted. In our experience the IOFBs did not drop during extraction. We had a drop when the viscolastic was placed in the anterior chamber before the retrieval of the IOFB, and the IOFB was thrown back when the silicone tipped cannula came in contact with the viscoelastic. Thus, we modified the technique so that the IOFB was first relocated to the anterior chamber angle and then stabilized with viscoelastic. Another IOFB drop occurred in a patient with poor angle support when the surgeon attempted to grasp the IOFB from the cannula with forceps. No retinal complications ensued. Another limitation is for large IOFBs that precludes their extraction through the anterior chamber. In cases with central corneal wounds, the drawback would be the lack of proper visibility of the IOFB and its path during the extraction. The decision to perform this technique should be individualized depending on the extent of the injury and the visibility attained trans-operatively.

In conclusion, minimally invasive surgery with active suction is an effective, safe, and quick technique in the management of posterior IOFBs associated with anterior segment and lens injury. Our triple procedure with an anterior approach, a 25-gauge transconjunctival pars plana vitrectomy, removal of the IOFB with active suction from the posterior segment and its extraction through the main corneal port, and primary implantation of an intraocular lens, showed considerable functional success and a low complication rate.

Beyond the fact that the active suction of the IOFB with a silicone tipped cannula avoids major trauma to the retina through manipulation, the avoidance of conjunctival dissection and extension of the scleral wound allows for minimal inflammatory reaction in the postoperative stage. It also provides prompt recovery and better comfort for the patient. Randomized controlled studies with a greater number of patients are necessary to compare our technique with other previously established methods.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

REFERENCES

1. Iqbal M. Retained Intraocular Foreign Body, Consensus Report. *Pak J Ophthalmol* 2010;26.
2. Katz G, Moisseiev J. Posterior-segment intraocular foreign bodies: An update on management. Risks of infection, scarring and vision loss are among the many concerns to address. *Retinal Physician*. 2009:1-9.
3. Luo Y, Wang Z, Lin X, Hu S. Removal of intraocular foreign bodies with intraocular magnet. *Yan Ke Xue Bao* 2003;3:142-145.
4. Venkatesh P, Keshavamurthy R, Verma L, Tewari HK. Removal of metallic intraocular foreign body impacted in the retina by magnetizing the mvr blade using an external magnet. *Clin Experiment Ophthalmol* 2003;31:451-452.
5. Coleman DJ. A magnet tip for controlled removal of magnetic foreign bodies. *Am J Ophthalmol* 1987;2:256-258.
6. Mahapatra SK, Rao NG. Visual outcome of pars plana vitrectomy with intraocular foreign body removal through sclerocorneal tunnel and sulcus-fixated intraocular lens implantation as a single procedure, in cases of metallic intraocular foreign body with traumatic cataract. *Indian J Ophthalmol* 2010;58:115-118.
7. Kunikata H, Uematsu M, Nakazawa T, Fuse N. Successful removal of large intraocular foreign Body by 25-gauge microincision vitrectomy Surgery. *J Ophthalmol* 2011;2011:940323.
8. Riemann CD, Mehta MC, Yeh EC. Innovative use of a magnetized pick for removal of an intraocular foreign body with 25-gauge transconjunctival sutureless vitrectomy. *Retin Cases Brief Rep* 2011;5:330-332.
9. Santos A, Roig-Melo EA. Management of posteriorly dislocated introcular lens: A new technique. *Ophthalmic Surg Lasers* 2001;32:260-262.
10. Babu N, Muraly P, Kim R. 23-20G Pars Plana Vitrectomy for Posterior Segment Intraocular Foreign Body. *AIOC* 2010 Proceedings 706-708.
11. Wani VB, Al-Ajmi M, Thalib L, Azad RV, Abul M, Al-Ghanim M, et al. Vitrectomy for posterior segment intraocular foreign bodies: Visual results and prognostic factors. *Retina* 2003;23:654-660.
12. Bauman JR, Wendall C. Management of penetrating injuries with a retained intraocular foreign body. *Ophthalmic Care of the Combat Casualty* 1917;41:225.
13. Mahapatra SK, Rao NG. Visual outcomes of pars plana vitrectomy with intraocular foreign body removal through sclerocorneal lens implantation as a single procedure, in cases of metallic intraocular foreign body with traumatic cataract. *Indian J Ophthalmol* 2010;26:115-118.
14. Bencic G, Vatavuk Z, Mandic Z. Novel approach in the treatment of intravitreal foreign body and traumatic cataract: Three case reports. *Croat Med J* 2004;45:283-286.
15. Chuang LH, Lai CC. Secondary intraocular lens implantation of traumatic cataract in open globe injury. *Can J Ophthalmol* 2005;40:454-459.