23-gauge vitrectomy with intraocular foreign body removal via the limbus: An alternative approach for select cases

Ramandeep Singh, Swapnil Bhalekar, Mangat R Dogra, Amod Gupta

Purpose: To study the outcome of removal of retained intraocular foreign bodies (RIOFBs) via limbus using 23-gauge transconjunctival sutureless vitrectomy (TSV). Materials and Methods: In this prospective, non-comparative interventional case series, fourteen eyes of 14 patients fulfilling the inclusion criteria were enrolled. They underwent 23-gauge TSV for management of posterior segment RIOFB and reviewed at 1 day, 7 days, 6 weeks, 3, 6 and 12 months. Eyes with penetrating eye injury involving cornea or limbus (corneal injury not so severe to hinder vitrectomy), cataract associated with anterior and/or posterior capsular tear requiring cataract surgery and posterior segment RIOFB with minimal posterior segment involvement were included. Main outcome measures include success in removal of RIOFB without enlarging sclerotomy, ability to preserve capsular support, improvement in visual acuity and complications, if any. Results: All eyes underwent the successful RIOFB removal through limbal port without enlarging scleral ports. None of the eyes required suturing of the sclera, cornea or conjunctiva. Anterior capsular rim could be preserved in all eyes except one. Postoperatively, follow up ranged from one year in 8, 6 months in 4 and 3 months in 2 eyes. The mean logMAR visual acuity at 3, 6, and 12 months showed significant improvement. There were no intraoperative complications. Postoperative complications include microscopic hyphema and loose blood in vitreous cavity in one eye. Conclusion: The advantages of 23-gauge TSV for removal of RIOFB may be passed on to select cases. RIOFB removal through limbal route obviated the need for scleral port enlargement and preserved capsular support for early visual rehabilitation.

Key words: Microincisional vitreous surgery, retained intraocular foreign bodies, transconjunctival sutureless vitrectomy

Retained posterior segment intraocular foreign bodies (RIOFBs) in open globe ocular injuries account for 18-40% of all ocular trauma cases.[1,2] Management of RIOFBs remains a challenge despite the advances in the surgical techniques. Most commonly posterior segment RIOFBs are removed after enlarging one of the sclerotomy ports. Enlargement of sclerotomy is associated with intraoperative complications such as hypotony, vitreous hemorrhage, incarceration of the retina in the wound intraoperatively and retinal detachment postoperatively.[3-5] Late onset complications such as macular pucker, fibrovascular proliferations, retinal detachment and proliferative vitreoretinopathy also remain the major causes of concern in these eyes.[6-8] Limbal route of RIOFB has also been described for large RIOFBs with standard 20-gauge vitrectomy.[9]

Improvement in surgical techniques has resulted in less invasive and less traumatic procedures for the treatment of posterior segment disorders. Sutureless posterior segment surgery has the advantages of faster wound healing, minimal surgical trauma, decreased convalescence period besides reduced postoperative astigmatism.[10]

Theoretically speaking, sutureless transconjunctival surgery may have no role in cases with RIOFB, as scleral port enlargement is necessary to facilitate the removal of foreign body. Kiss et al.[11] have described 25-gauge transconjunctival sutureless pars plana vitrectomy for removal of RIOFB after enlarging one port to 20-gauge. Enlargement of the sclerotomy port makes these eyes prone to risk of developing sclerotomy-related complications. In a pilot study, we did 23-gauge vitrectomy for IOFB removal via limbus successfully with small RIOFBs and lens damage.[12]

In the present prospective study, we study the outcome of removal of RIOFBs via limbus using 23-gauge TSV.

Materials and Methods

We prospectively enrolled consecutive 14 eyes of 14 patients between April 2009 and March 2010, and surgeries were done by single surgeon (RS). Patients were deemed eligible to undergo 23-gauge TSV if they met the inclusion criteria: History of penetrating eye injury (PEI) involving cornea or limbus (corneal injury which will not allow vitrectomy), cataract associated with anterior and/or posterior capsular tear requiring cataract surgery i.e., lensectomy and small posterior segment RIOFB with minimal posterior segment involvement, not requiring prophylactic buckle. Patients were excluded if they had peripheral intraretinal foreign body, foreign body in ocular coats, dense vitreous hemorrhage, associated retinal detachment, endophthalmitis or any other vitreoretinal pathology. Informed consent was obtained from all patients.

Follow-up visits after baseline took place at 1 day, 7 day, 4 weeks, 3, 6 and 12 months. Ocular assessment included best corrected visual acuity (BCVA), Goldmann applanation tonometry for intraocular pressure (IOP), slit-lamp...
biomicroscopy for anterior segment and posterior segment examination with indirect ophthalmoscopy. Anterior segment examination with slit lamp was done for localization and assessment of corneal injury, anterior segment inflammation and lenticular injury. Indirect ophthalmoscopy was done for evaluation of media clarity, retina and localization of foreign body. In cases with poor media, ultrasonography (USG) was done preoperatively to evaluate position of the RIOFB, size of the RIOFB, vitreous involvement and status of retina. All patients underwent 23-gauge TSV to remove posterior segment RIOFB through limbus without enlarging any sclerotomy.

Surgical technique
Surgery was performed under peribulbar injection of 10 ml of a 50:50 mixture of 2% lidocaine and 0.15% bupivacaine. Pre-loaded single step transconjunctival 23-gauge three-port vitrectomy set up was used for all cases. Trans-scleral cannulas were placed through the pars plana in the superotemporal, superonasal, and inferotemporal quadrants, with the inferotemporal cannula reserved for the infusion port. Incisions with trocars were created in an angled approach. The conjunctiva was displaced 2-3 mm with a pressure plate with a central opening 3.5 mm from the edge. Careful pars plana lensectomy was done [Figure 1a]. Iridocapsular adhesions were broken wherever required. An adequate anterior capsular rim was preserved for secondary intraocular lens (IOL). Core vitrectomy was done. Foreign body was localized and surrounding vitrectomy was done as a standard procedure. Encapsulated foreign bodies were released out of their capsules. Barrage laser was done where ever there was a suspicion of retinal break. A self-sealing superior limbal incision was made. A 20-gauge diamond-coated IOFB forceps was inserted through the limbal wound and foreign body was grasped along its longest dimension and removed through the limbal port [Figure 1b]. Foreign body was held carefully with the forceps so that its sharp edges do not tear the anterior capsule during extraction. Pars plana vitrectomy was completed after removing the posterior hyaloid. The limbal port was hydrated before removing the 23-gauge cannulas [Figure 1c]. At the end of the surgery, 23-gauge cannulas were removed and the sites were inspected for any wound leak [Figure 1d]. No air or gas tamponade was given. Topical moxifloxacin 0.5% was instilled in the eye at the end of the surgery and operated eye was patched after instilling antibiotic ointment.

Intraoperative findings such as preservation of anterior capsule, location of RIOFB, status of retina, need to apply scleral buckle, need for tamponade, need to suture sclera, cornea, or conjunctiva and any intraoperative complication if any, were noted down. Postoperatively, inflammation in the immediate postoperative period was controlled by topical steroids, antibiotics and cycloplegics.

Main outcome measures were ability to perform sutureless vitrectomy successfully i.e., no enlargement of sclerotomy to remove the RIOFB, preservation of anterior capsular rim for secondary intraocular implantation, improvement in BCVA and intraoperative and postoperative complications if any.

Statistically significant differences in the change from mean BCVA and comparisons before and after surgery were determined by paired sample t tests.

Results
A total of 14 eyes of 14 patients with posterior segment RIOFB were enrolled in the study. Eight of the 14 patients completed one year follow up. Four patients completed six months and two patients completed 3 months of follow up. All the cases had hammer and chisel injury. All the patients were men with mean age 27.62 ± 8.2 (range: 17-46 years) [Table 1]. Preoperatively, eight patients had paracentral, 3 had limbal and 3 had central corneal injuries. Four eyes had already been repaired for PEI prior to referral to us. Eight cases presented late after PEI. They were treated as self-sealed corneal lacerations as Siedel’s test was negative in these cases. All eyes had post-traumatic cataract with capsular rupture. Posterior segment evaluation and foreign body localization was possible with indirect ophthalmoscopy in six eyes. In rest of the eyes with hazy media, ultrasonography was used for posterior segment evaluation. USG revealed posterior capsular ruptures in all eyes, mild-to-moderate vitreous hemorrhage in seven eyes and attached retina in all cases. Localization of RIOFBs was done with USG [Table 1].

RIOFB was removed successfully in all eyes with the above surgical technique, through the limbus with 20-gauge diamond dusted foreign body forceps. All foreign bodies were metallic in nature. None of the eye required air or gas tamponade. Suturing of the sclera, cornea or conjunctiva was not required in any of these cases at the end of the procedure. There were no intraoperative complications. Adequate anterior capsular rim could be preserved in all but one eye after careful lensectomy. Care was taken to make round anterior capsulotomy for secondary intraocular lens (IOL) implantation. RIOFB was carefully removed through this capsulotomy to avoid tearing edge of the anterior capsule. One eye had large central corneal perforation with large tears in anterior as well as posterior capsule; in this eye capsular rim could not be preserved.

The eyes undergoing surgery had a significant improvement in mean BCVA throughout the follow-up period. The mean preoperative logMAR visual acuity was 1.51 ± 0.93, whereas mean postoperative logMAR visual acuity at 3 months was
0.17 ± 0.18, and improvement was significant (P < 0.001, paired t test) for 13 eyes. We did not include patient no. 14 in visual acuity analysis because of unavailability of BCVA at last follow up [Table 1]. The significant improvement at 3 months was maintained at 6 and 12 months. The mean preoperative logMAR visual acuity was 1.2 ± 0.75, whereas mean postoperative logMAR visual acuity was 0.15 ± 0.17, and improvement was significant (P < 0.001) for 12 eyes, which completed 6 months follow up. The mean preoperative logMAR visual acuity was 1.28 ± 0.89, whereas mean postoperative logMAR visual acuity at 12 months was 0.1 ± 0.11, and improvement was significant (P < 0.001) for eight eyes, which completed 12 months follow up. There was no loss of BCVA in any of the eyes.

Postoperative complications include microscopic hyphema and loose blood in vitreous cavity seen in one eye, which resolved with conservative management within the next 7 days. We did not see any hypotony, choroidal detachment or any other complication in the immediate postoperative period. Late complications like IOP rise, epiretinal membranes, retinal detachment were not seen in this series.

### Discussion

Our study highlights the successful use of 23-gauge TSV in removal of posterior segment RIOFB via limbus as an alternative procedure in select cases. Case selection is the key to the success in this kind of intervention. We recommend using this technique as an alternative in cases with small posterior segment RIOFB with minimal posterior segment pathology, small corneal laceration and cataract requiring lensectomy.

The advantages of sutureless vitrectomy surgery are similar to phacoemulsification for cataract extraction. It leads to less postoperative astigmatism, less operative times and less discomfort to patients. Kiss et al. described using 25-gauge sutureless vitrectomy in situations like nucleus removal and RIOFB by enlarging one of the port. We believe that the hybrid vitrectomy i.e., one port 20-gauge and two 23-gauge leads to increase in the risk of intraoperative and postoperative complications as with any 20-gauge vitrectomy. We used limbal route for removal of RIOFB, avoiding the need for enlarging sclerotomy ports. This was possible because we had simultaneous cataract to deal with in our cases. Limbal route has been described earlier with 20-gauge vitrectomy for removal of the large RIOFBs. RIOFB was grasped with 20-gauge diamond-coated IOFB forceps and removed through the self-sealing limbal wound avoiding injury to residual capsule.

Another advantage of this technique was that scleral buckle was not required, as sclerotomy was not enlarged to remove the RIOFB. The use of prophylactic buckle in cases with RIOFB, has been shown to decrease the sclerotomy-related complications such as retinal detachment. The role of prophylactic scleral buckle, though supported by a few studies, is not established in cases with RIOFB. We excluded cases that may require scleral buckle or internal tamponade in this series.

Preservation of anterior capsule with due care during vitrectomy lead to early visual rehabilitation in these cases. In this study, pars plana lensectomy could be done in all cases because of the soft cataracts of young patients. This technique cannot be used with hard cataract because of non-availability of a 23-gauge fragmatome. However, careful phacoemulsification may be possible for hard cataract followed by removal of RIOFB through the same incision used for phacoemulsification.

We did not plan primary IOL insertion in this series. Primary IOL implantation has also been studied with good outcomes in various studies. However, biometry in injured eyes or taking fellow eye measurements for the power calculation are still debatable. Mahapatra et al. reported good visual outcome by using standard 20-gauge pars plana vitrectomy with intraocular foreign removal through sclerocorneal tunnel and sulcus-fixated intraocular lens implantation as a single procedure in case of RIOFB and traumatic cataract in young patients. We think that primary IOL implantation with this procedure is a feasible option.
Visual acuity improved in all the cases in our series and there was no case with reduction in visual acuity over the period of follow up. In one of the patient, BCVA could not be done at his last follow up i.e., 3 months. Out of 14 patients, 9 underwent secondary IOL implantation at 4-6 weeks after PPV uneventfully. Three piece foldable IOL was implanted after enlarging the previous limbal incision. This time frame was chosen in order to use the same limbal incision to implant secondary IOL. Secondly, the eyes were quiet and comfortable enough to carry out the biometry. Five patients did not undergo secondary IOL implantation due to personal reasons. Rest of the patients showed significant improvement in BCVA with aphakic correction.

One case had microscopic hyphema and loose blood in the vitreous cavity, which resolved with conservative management. None of the patients in this series had postoperative retinal detachment. The development of retinal detachment has been shown to be significantly associated with scleral or corneoscleral entry wound, size of IOFB, preoperative retinal detachment and location of IOFB. Mahapatra et al. reported five cases of postoperative retinal detachment in their cases. These are the eyes where more aggressive intervention is required to reduce the incidence of postoperative retinal detachment. In the present series, all eyes had corneal lacerations, IOFB size ≤5 mm, no preoperative retinal detachment, and IOFBs were either in vitreous cavity or lying on the retina. Other complications common with 23-gauge TSV such as hypotony, choroidal detachments etc., were not seen in this study.

The present study has several limitations. The small number of patients is due to strict inclusion criteria. Penetrating eye injury with RIOFB presents commonly with endophthalmitis due to injuries in rural areas, late presentation and delay in repair. Endophthalmitis was one of the exclusion criteria. A single surgeon, based in a tertiary referral center, operated all the patients in the present series and the results may not be generally applicable to patient seen in other settings. Finally in view of the small sample size, less frequent complications cannot be identified.

Our study clearly shows that transconjunctival 23-gauge vitrectomy, with limbal removal is possible in select cases of posterior segment RIOFB. It leads to good anatomical and functional outcome. Careful preoperative examination and case selection is the most important criteria for the success of the procedure. Primary as well as secondary IOL implantation is feasible option depending on the personal choice of the surgeon. The visual outcome and observations in this series shows that it is a safe procedure with minimal intervention. We believe that early visual rehabilitation, patient comfort and lesser complications with this technique calls for use of 23-gauge TSV for removal of RIOFB in select cases. This technique offers an alternative approach in managing these select cases of RIOFBs.

References