Original Article

Management of Metallic Intraocular Foreign Body Retained at Different Levels in The Eye

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Abstract

Purpose: *The aim of this study was to analyse the clinical presentation and outcome of management in metallic retained intraocular foreign bodies.*

Material and methods: *60 patients with metallic retained intraocular foreign bodies were included in the interventional case series over a period of two years. The details of patients were retrospectively analyzed and all findings including mechanism of injury, best corrected visual acuity, anterior and posterior segment findings were recorded. The various preoperative, intraoperative and postoperative clinical factors were noted. The functional and anatomical outcomes were also evaluated after one year follow up.*

Results: *All patients (100%) were males with a mean age of 26.5 years. The most common cause of ocular injury was chisel hammer or nail hammer related. Intra-operatively the foreign body was located on the retina in 74% patients and was intralenticular in 11.5% cases. The most common complication was endophthalmitis which was noted in 35% of patients followed by retinal detachment in 10% of patients. Favourable visual outcome was achieved in 90% (n-54) of patients and anatomical success was achieved in 92% (n-55) patients at one-year of follow-up. There was a significant [p<0.05] difference between pre-operative and post-operative visual acuity.*

Conclusions: *Prophylactic intravitreal antibiotics and steroids are mainstay in preventing infection in penetrating injuries and helps in preserving useful vision. Better preoperative visual acuity, prophylactic buckle support and micro incision vitrectomy surgery were favourable factors related to better visual results in such cases.*

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Keywords: *Endophthalmitis, Intralenticular, Retinal Detachment, Retained Intraocular Foreign Body.*

Introduction

Ocular trauma is a major cause of monocular blindness and visual impairment which is a preventable public health problem throughout the world.[1,2] Unilateral permanent reduction of vision accounts for approximately nineteen million cases out of which 1.6 million are blinded due to eye injury.[3] In approximately 40% of the eyes, an open globe injury harbouring at least 1 intraocular foreign body-(IOFB) is seen.[4,5] Around 85% of patients present with a metallic IOFB. An open globe injury with ferrous [Iron] IOFB results in significant vision loss as it causes deposition of iron molecules in the ocular tissues causing siderosis bulbi. The visual prognosis depends on the zone of injury, type and size of FB and the subsequent complications. The final visual outcome depends on a number of visual prognostic factors which include (a) Visual acuity at presentation (b) Corneal involvement (c) Location and length of foreign body (d) Lens damage (e) Vitreous haemorrhage (h) Type of IOFB.

Amongst the complications, occurrence of endophthalmitis, optic nerve injury and proliferative vitreoretinopathy [PVR] are vision threatening. Hence, timely removal is required at the earliest to prevent serious complications.Acute and long-standing visual loss associated with IOFBs mostly affects children and young adults.[6-10]

The advent of Micro Incision Vitrectomy Surgery (MIVS) has revolutionized the management of RIOFB thus salvaging useful vision in many eyes that otherwise would have been lost.[12,13] In the pre vitrectomy era, an external electromagnet [EEM] was used for ferromagnetic materials, and early IOFB removal was encouraged to prevent IOFB encapsulation, which could overcome the pulling force of the EEM, especially when foreign body was intraretinal or encapsulated. The development of intraocular forceps, magnets and other latest vitrectomy techniques allows a controlled surgery and decrease the risk of endophthalmitis by removing virulent infectious organisms.[4]

The present case series analyses the clinical presentation and outcome of managing retained metallic intraocular foreign body at different levels in the eye.

Materials and Methods

Study Design: This retrospective, non-comparative,single-institutional, interventional case-study was done in a tertiary care referral centre in north India.

Study population: Sixty patients presenting to the vitreoretina services in a rural setting with a diagnosis of penetrating injury and metallic retained intraocular foreign body were enrolled in this study over a period of 2 years from June 2013 to June 2015. Approval from Institutional Ethics Committee was taken and the study followed the Tenets of declaration of Helsinki. Only those patients who gave a written informed consent were included. Patients coming with the complaint of broom stick, wood, glass and pellet injury were excluded from the study. IOFB was defined as intraocular if all or a

part of the foreign body was within intraocular space as per the Birmingham Eye Trauma Terminology System. The Ocular Trauma Classification Group system for zone of entry was applied.[11]

The records of patients were retrospectively reviewed for data regarding age and sex, mechanism and details of injury, visual acuity [VA] at presentation to the hospital, anterior and posterior segment findings. Ultrasound B-Scan and/or X-ray of orbit were performed in all patients to locate and evaluate the IOFB. CT scan and UBM could not be done in all the patients due to unaffordability. Surgical details including time between injury, surgery, type and number of procedures, intraoperative findings and timing of intravitreal drugs were noted. Preoperative visual acuity, site of entry of foreign body [FB], involvement of lens, any associated signs of endophthalmitis and retinal detachment were also noted.Endophthalmitis was diagnosed clinically if hypopyon, vitritis and exudation in vitreous cavity on B -scan was present.

Surgical technique

All patients were operated by a single surgeon. Primary repair was done followed by intravitreal Vancomycin 1mg/0.1ml and intravitreal Ceftazidime 2.25mg/0.1 ml with Dexamethasone 400ug/0.1 ml in all the patients. Injection tetanus 0.5ml intramuscular was also given. Well-formed globes were taken up for vitreoretinal procedures directly. Eyes after primary repair went through a full thorough workup to ensure stability of the globe and were taken up for FB removal within the next 3-7 days.

Extraction of IOFB

In cases with retained FB in anterior chamber, FB was removed through corneal incision and intracameral antibiotics were administered. In cases presenting with intrascleral FB, underwent FB removal and the vitreous was cut with 23-gauge cutter and wound sutured with 6-0 vicryl followed by retinal examination to rule out any trauma in posterior segment. In cases where FB was intralenticular, phacoemulsification with FB removal with intraocular lens implantation [IOL] was done in one sitting. Intracameral antibiotics and steroid were given. All the patients having IOFB in posterior segment were taken under general anaesthesia. Patients with confirmed endophthalmitis were taken up for FB removal on 3rd day of injection of prophylactic intravitreal antibiotics and oral steroids. Lensectomy was done in cases with trauma to the lens with sparing of anterior capsular margin around 360 degree of circumference in absence of endophthalmitis. FB in these cases was lifted to the pupillary plane using intraocular magnet and gently removed through the sclera-corneal tunnel. In patients where lens was clear, foreign body was removed by enlarging the sclerotomy site. Patients with IOFB retained in posterior segment underwent 3 port pars plana vitrectomy [PPV] by Faros vitrectomy machine [Oertli Instrumente AG, Switzerland] unit. For retinal visualization, Oculus BIOM 2 with Oculus SDI Inverter 2 [OCULUS Surgical, Inc. Port St. Lucie, USA] was used. Triamcinolone – assisted PVD induction was performed in most of the cases except in cases with severe endophthalmitis where it may have lead to breaks or giant retinal tears. Following sufficient clearance of the vitreous haemorrhage / exudation to allow visualization of the after posterior pole,thick encapsulated FBs, capsule around the FB was cut with in microvitreoretinal (MVR) blades or 24-gauge needle and FB was grasped with intraocular magnet. High speed 23-gauge cutter [up to 2500 cuts/ minute] was used to cut membranes very close to the retina. Central Landers lens was used as it facilitates removal of any membrane at the macula. Meticulous port-site vitrectomy was also performed. Three rows of laser photocoagulation were administered to barrage the area of break before inducing a PVD in cases where the IOFB or capsule was closely adhered to the retina or there were multiple breaks. Haemostasis was maintained by raising intraocular pressure or by administering endolaser or endodiathermy. The encircling band [2.5mm 240 silicone band] was anchored to the sclera with partial thickness scleral tunnels and tightened in superotemporal quadrant in all cases with foreign body in the posterior segment. If there was any retinal detachment (RD), peripheral dialysis or break, it was picked up intraoperatively and additional segmental scleral buckle [279 with 10 mm width] was placed in that quadrant. The decision to use air, C3F8 or silicone oil was taken intraoperatively. The IOFB was then safely preserved, pasted on file and size was measured in mm (length*breadth) and was shown to the patient for medico-legal reasons.

Postoperatively, all patients received oral and topical antibiotics and steroid for four weeks with gradual tapering. All patients were followed after 1 day, 7-day, 30 day, 6 months and upto one year after the repair. In each case BCVA, intraocular pressure measurement, slit-lamp biomicroscopy and indirect ophthalmoscopy findings were recorded on each visit. The outcomes primarily assessed included visual outcome and anatomical outcome at 12 months. Incidence of intraoperative and postoperative complications, incidence of additional vitreo-retinal surgery including the removal of silicone oil was also recorded. Cause of decreased vision was assessed considering site of entry of FB, site of lodgement of FB, endophthalmitis and postoperative complications like RD in each case.

Statistical Analysis

The data was tabulated as mean± standard deviation [Mean±SD]. Results were analyzed using non parametric tests [Chi-square Test], parametric tests [two tailed student t-test] and correlation [Pearson correlation coefficients] analysis. A P value of <0.05 was considered statistically significant.

Results

Patient demographics

A total of 60 male patients were enrolled in this study with mean age of 26.5 years. Thirty six patients [60%] were in the age group 20 years to 40 years, the working age group with equal incidence of affecting right and left eye [30 each].

Pre-operative Data

Mean time of presentation to the Ophthalmology department was 14.4 days with 35% and 45% cases reporting within one week and less than one month of trauma respectively. The patients gave history of hammer and chisel work in 95% cases [n-57]. Other preoperative findings were hypopyon [35%], traumatic cataract [60%] and visible entry wound [80%]. OTS score was good in 70% [n-42] and poor in 30% [n-18].The initial visual acuities ranged from 20/20 to light perception (LP).

Intraoperative data

The intraoperative findings regarding the location of FB showed that IOFB present in anterior segment was located intralenticular in 7 patients, intrascleral in one case and in the anterior chamber in two cases. In the posterior segment, in 73.4% [n-44] patients IOFB was found on retina and vitreous cavity. Primary repair was done in 15 cases [25%], primary IOL implantation with FB removal was done in all intralenticular IOFB i.e. 11.5% [n-7] patients. Vitreous haemorrhage was found in 50% [n-30], retinal detachment in 10% [n-6] patients and endophthalmitis was seen in 35% [n-21] patients. Vitreous biopsy revealed gram positive organisms in gram staining and KOH revealed no hyphae in 15 cases. A prophylactic encircling 240 band was placed in all the cases (n-50) with posterior segment foreign body. Internal tamponade most commonly used was silicone oil [43.4%] cases followed by C3F8 [33.7%]. Lensectomy was done in 60% patients [n-36]. Intravitreal antibiotics were given in posterior segment IOFB in all patients [n-50].A standard 3-port PPV was done in 50 cases.

Size of the IOFB varied with a median size of 6mm.Small IOFBs [<3mm] were removed through sclera where lens was clear in 14 cases. Bigger IOFB (>3mm diameter) and in presence of traumatic cataract underwent removal through cornea after lensectomy in 60% cases (n-36).

Postoperative data

The post-operative findings showed recurrent rhegmatogenous retinal detachment in 5% [n-3] patients, and secondary glaucoma in 10% [n-6] patients. Single surgery was done in 25% while 85% [n-45] patients underwent subsequent surgeries. Secondary IOL implantation was done in 48% [n-29] of these patients. Three patients had recurrent retinal detachment, out of which one eye underwent phthisis.

Successful anatomical outcome was achieved in 92% [n-55] of the patients and functional success was achieved in 90% [n-54] of the patients. Preoperative BCVA was 20/20-20/80 in six patients and postoperative BCVA was 20/20 -20/80 in 25 patients (41%). Preoperative BCVA was 20/120-20/200 in 9 cases (15%) and postoperative BCVA was 20/120-20/200 in 29 cases (48.3%). Statistically [p<0.05] significant improvement in BCVA was seen post-operatively (Table 1).

The patients presenting within one week of the injury had a statistically [p<0.05] significant improvement in visual outcome as compared to the patients presenting after one month (Table 2). The results also showed a statistically [p<0.05] significant improvement in visual acuity in patients who had endophthalmitis and had underwent PPV with intravitreal antibiotics(IVA)(Table 3). The Ocular Trauma Score (OTS) was good in 70% and poor in 30% cases preoperatively. The results also showed a statistically [p<0.05] significant improvement in visual acuity in the patients who had good OTS score.

Table 1: Showing comparison of visual Acuity at time of presentation and final visit.

Preoperative BCVA	Nor	%	Postoperative BCVA	%	Chi-square (at df=2)	p-value
20/20-20/80	6	10%	25	41.5%	52	0.000 0001**
20/120-20/200	9	15%	29	48.3%		
<20/400	45	75%	6	10%		

** Highly significant p value, less than 0.001.

Table 2: Showing Time of presentation (TOP) to the hospital and final visual outcome.

	20/2020/120	<20/200	Chi-square (at df=2)	p-value
<1 month	46	8	14.93	.000111
>1month	1	5		

Table 3 : Showing comparison of Preoperative Visual Acuity and Postoperative Visual Acuity in Endophthalmitis

Preoperative BCVA	NO.	%	Postoperative BCVA	%	Chi square (atdf=1)	P value
20/20-20/80	0		0	0		
20/120-20/200	2	9.5%	18	85%	24.44	0.0000 0007
<20/400	19	90%	3	14%		

P value highly significant

Discussion

Role of Prophylactic antibiotics

Our study retrospectively reviewed the visual outcome in 60 patients with penetrating intraocular injury with retained intraocular foreign body. Endophthalmitis was reported in 35% patients in this study which is quite high as compared to the incidence of post-traumatic endophthalmitis range of 2.4 - 17% of all open globe injuries reported in some studies.[15-17] Boldt HC et al showed in their study that this figure doubled and approached 30% in rural setting, which is quite similar to the results seen in our study conducted in a rural set-up. Further studies have shown that endophthalmitis following penetrating eye injuries has relatively poor prognosis due to delayed diagnosis, infection by more virulent and resistant organisms and polymicrobial infections.[18] Our study also showed that posttraumatic infectious endophthalmitis developed in significant number of patients. This observation is similar to various studies showing that presence of IOFB, delay in primary repair, disruption of crystalline lens and a rural setting are risk factor for the development of post-traumatic endophthalmitis.Prophylactic intravitreal antibiotics seem to prevent severe intraocular infection

following open globe injury which was corroborated by the results of our study.[19] Preoperative prophylactic antibiotics along with primary repair were an important contributory factor in improving the visual outcome in cases with endophthalmitis in our study.

Characteristics of IOFBs

Size of FB was also a significant factor in deciding the visual outcome in patients. This study revealed that smaller the size of foreign body better the visual outcome. As in one case, FB (traversing, nail) which passed through and through from anterior segment to posterior segment and with exit wound at the retina had worse visual outcome due to need of repeated surgery and eye ultimately went into phthisis bulbi.

One more prognostic factor seen was location of FB especially foreign body located in posterior segment, at the macula, traversing IOFBs or FB directly hitting the optic disc carries a very grave prognosis. One case in our study had scar formation after removing FB directly from macula and had worse visual outcome.(Figure 1 & Figure 2) Studies have demonstrated that intralenticular foreign bodies account for approximately 7-10% of all the IOFBs and have excellent prognosis as lens capsule limits the infection. These cases can be well managed by phacoemulsification and IOL implantation and FB removal in the same sitting. We obtained similar results in our study where 7 patients had intralenticular FB. Those patients had excellent visual outcome as corneal scar spared the visual axis and all had self-sealed wound. [25, 26]

Surgical Techniques

Some studies have demonstrated that retained IOFBs in the posterior segment requires pars plana vitrectomy to remove the scaffold of the injury tract, vitreous haemorrhage, IOFB, ruptured lens-vitreous admixture and to flatten the retina by removing subretinal haemorrhage and tamponading the retinal breaks.[20.21] Three port pars plana vitrectomy was done in our study and demonstrated good visual outcome,

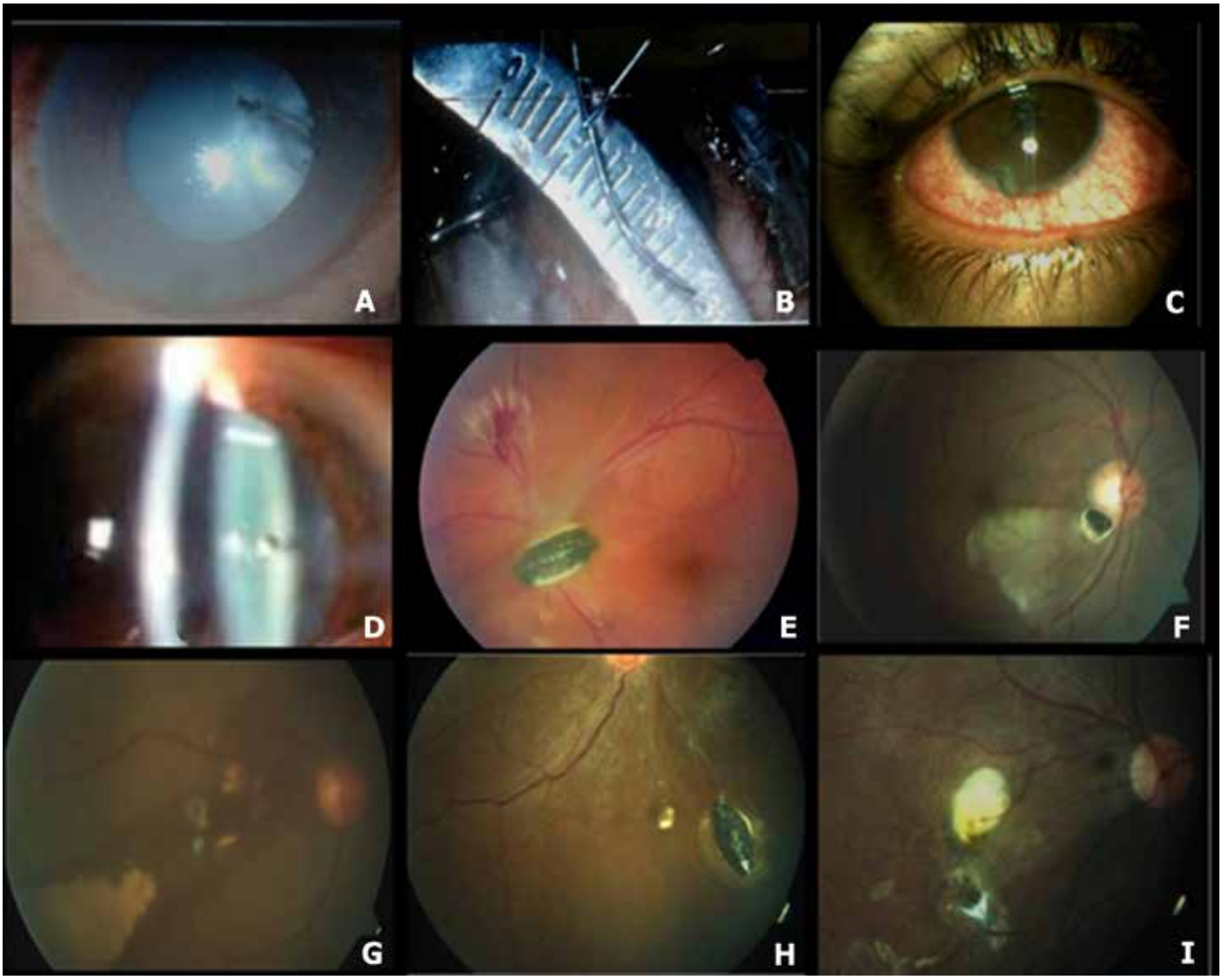

Figure 1: *showing RIOFB at different levels in eye: (a) traversing IOFB (b) FB after removal (c)FB in AC(d)intralenticular FB (e)FB in front of disc in vitreous cavity (f) FB near disc margin with retinal edema (g)subretinal FB (h)FB with barrage laser marks (i) scar at macula.*

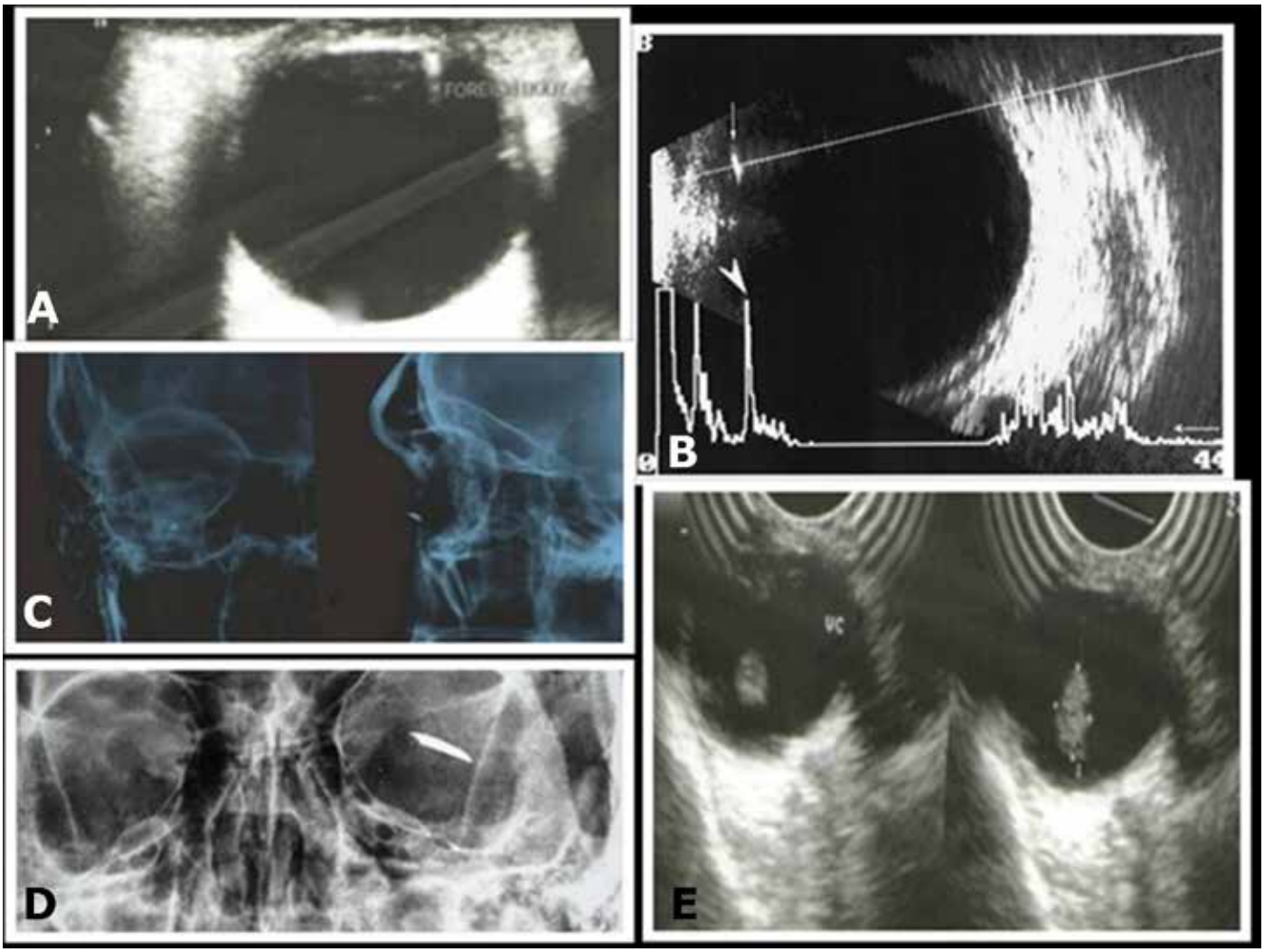

Figure 2 : *Figure 2 showing radiological findings in cases with IOFBs: (a) FB in the zonules on B scan b) intralenticular FB on B scan(c) and (d)intrascleral FB as seen on X-Ray on AP and lateral view (e) FB in the vitreous cavity as seen on B scan.*

speedy recovery, less postoperative astigmatism and less operative time thus revolutionizing the outcome even in complicated cases and it is in sync with other studies which showed considerable improvement in anatomical and functional results in post-traumatic endophthalmitis.[22,24] Decision to do early vitrectomy (<24 hrs) in the cases with endophthalmitis and retinal detachment is another well planned step for good outcome as shown in our study. We preferred to use encirclage in all cases with IOFBs retained in posterior segment with additional buckle placed in six cases with retinal detachment. Studies also show that placing a prophylactic scleral buckle with pars plana vitreous surgery for RIOFB may reduce the risk of late onset RD.[27-29] Another case-series described the use of primary silicone oil tamponade following IOFB removal in eyes with severe concomitant posterior pole injuries, including lacerations of the sclera, choroid and retina. The decision to use silicone oil for tamponade should be made intraoperatively based on the presence of (a) multiple breaks (b) associated RD (c) severe endophthalmitis and (d) retinal incarceration.

Associated Factors

Another study had found a positive association between preoperative BCVA and OTS; a negative association with final BCVA and no association in outcome based on time lapse and primary repair.[30] The results of our study also showed that there was positive association between preoperative BCVA and final BCVA. However, we observed that early presentation with good preoperative visual acuity is an important factor responsible for a good outcome both anatomically and functionally.

Limitations

Firstly, the sample size was small as this was a retrospective study. Secondly, a longer follow-up of more than a year was difficult due to poor compliance. Thirdly, this study included only metallic foreign bodies as including all foreign bodies would have been difficult for analysis point of view.

Conclusion

Prophylactic intravitreal antibiotics and steroids are mainstay in preventing infection in penetrating injuries and helps in preserving useful vision. Better preoperative visual

acuity, early presentation, prophylactic buckle support and vitrectomy with micro incision vitreous surgery (MIVS) are factors related to acceptable visual results in posterior segment IOFBs. Site of lodgement and size of FB is an important predictor in final visual outcome.

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