OPEN GLOBE INJURIES WITH INTRAOCULAR FOREIGN BODY: SURGICAL OUTCOME

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ABSTRACT

Objective: To determine surgical outcome and residual co-morbidities after surgical intervention in eyes having Open Globe Injury (OGI) with retained Intra Ocular Foreign Body (IOFB).

Methodology: A prospective interventional case series was carried out at the department of Ophthalmology, Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Hayatabad Medical Complex (HMC), Peshawar from 1st September 2012 to 30th November 2013. Patients who were followed post-operatively for at least 90 days were included. Eyes having open globe injury (OGI) and intraocular foreign body (IOFB) who had surgical intervention were included in our study. Visual outcome was determined comparing final best corrected visual acuity (BCVA) with initial BCVA. Co-morbidities were noted at final follow up. For data analysis, Snellen's VA was converted to log MAR VA. Data was analyzed by SPSS version 16.

Results: Total of 35 patients were included in our study. Male were 94.3% compared to 5.3% females. Mean age was 32.42 years. Bomb blast injury was cause of eye trauma in 60% cases while 40% were doing hammer and chisel work at the time of trauma. IOFB was impacted in anterior segment in 20% cases while it was impacted in posterior segment in 80% cases. IOFB removal was achieved in 33(94.28%) cases; silicone oil was used as temponade in 48.57% cases. Primary repair was required in 40% cases while rest 21(60%) eyes had self sealed wound. Primary surgical intervention in the form of Pars Plana Vitrectomy, IOFB removal with the use of intraocular magnet or forceps was carried out in 71% cases. Mean BCVA log MAR improved from initial BCVA of 2.20 to 1.20. Common comorbidities at final visit were corneal scars, macular scars and cataract.

Conclusion: Bomb blast injuries are most common cause of OGI with IOFB in our region. Significant visual improvement occurs in most of the cases after skilled vitreo-retinal surgical interventions. Common ocular co-morbidities are corneal scar, macular scar and cataract.

Key Words: Open globe injury (OGI), Intraocular foreign body (IOFB), Pars plana vitrectomy (PPV)

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INTRODUCTION

Open globe injury (OGI) is one of the common causes of visual morbidity in teenagers or young adults especially of male gender[1,2]. Open globe injuries comprise significant proportion of workload in our hospital. Open globe injury presents challenge to the ophthalmic surgeons especially to vitreoretinal surgeons. These cases are further complicated by retained intraocular foreign bodies (IOFB). Intraocular foreign body is usually associated with massive internal damage. Posterior segment IOFB causes more damage as compared to anterior segment IOFB. Intraocular foreign bodies have been previously classified according to their location (anterior segment, Posterior segment), their material characteristics (metallic and nonmetallic) size and mechanism of injury[3-5]. Intraocular foreign body can be acute or chronic. Besides collateral damage the eye with IOFB have increased risk of infection and may suffer from specific reaction due to chemical nature of IOFB like siderosis and chalcosis. Management of IOFB includes not only IOFB removal but to address the other issues like collateral damage, prevention and treatment of infection and specific chemical reactions[6]. Anterior segment IOFB can be removed only through limbal approach and may require lens or iris tissue removal depending upon its site of impact. Intraocular foreign body when present in the posterior segment is a significant cause of visual loss despite advances in surgical techniques and instrumentation. Posterior segment IOFB may or may not be associated with vitreous bleed and retinal detachment which then requires complex vitreoretinal procedures which may be adopted primarily or secondarily[7,8]. Previously the extraocular magnet use was standard for removal of IOFB in the posterior segment. But it was associated with higher rate of complications like cataracts, vitreous haemorrhage and retinal detachment. Since the invention of better technology and improvement in microsurgical skills the management of IOFB has changed from conventional use of extraocular magnet to more preferred technique of PPV and removal of IOFB by using intraocular magnet and forceps. Such interventions may be added with use of endolaser and performing internal tamponade[9,10]. It is obvious that improvement in these interventions has led to both anatomic and visual outcome. However with such improvement in instruments the prognosis is still guarded depending upon delay in presentation and surgical intervention, the site, size, shape and nature of IOFB, preoperative retinal detachment, presence of infection and occurrence of specific chemical reaction to IOFB[11-13]. Although after introduction of advanced microsurgical vitreoretinal interventions adequate international data exists regarding the management and prognosis of OGI with IOFB. However to our knowledge limited studies were reported in our province and nationally regarding the ultimate prognosis of OGI with IOFB. Therefore we designed this study to determine the ultimate visual outcome and co-morbidities in eyes which had suffered OGI with retained IOFB.

METHODOLOGY

A prospective interventional case series was carried out at the department of Ophthalmology, Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Hayatabad Medical Complex (HMC), Peshawar from 1st September 2012 to 30th November 2013.

All patients with eyes having open globe injury (OGI) and intraocular foreign body (IOFB) presenting to eye unit, KIOMS, HMC were included in our study after obtaining informed written consent. A predesigned proforma was used for data entry. Thorough ocular and systemic examination was carried out in all patients by vitreo-retinal consultant. Circumstances of eye trauma and information regarding nature of IOFB were availed. Initial Best Corrected Visual Acuity (BCVA), zone of entry, site of impacted IOFB, vitreous and retina status were determined preoperatively by ocular examination by using slit lamp, fundus examination by using 78D or indirect ophthalmoscope. X-rays and ultrasonography were used when required. Primary repair of entry wound was carried out if required. Pars plana vitrectomy, use of endolaser, silicon oil or air was used for internal tamponade whenever surgeon thought it to be necessary. Lens removal, iris excision and IOL implantation was done as per surgeon decision. Secondary surgical intervention was also carried out as indicated. Thorough clinical examination including BCVA and Intra Ocular Pressure (IOP) were noted. Co-morbidities at final follow-up were recorded. Patients were followed postoperatively daily for up to first five days, then on 15th, 45th, 90th day and then accordingly per surgeon decision. Only those cases were included in our study who had at least 90 days follow up. For data analysis, Snellen's VA was converted to log MAR VA. After pars plana vitrectomy was performed, the foreign body was gently mobilized with the foreign body forceps in our cases if it was adhered to the retina. If the foreign body was found to be surrounded by fibrous capsule, the capsule was incised with cutter or scissor and removed. All these manipulations were performed to avoid further tearing of retina. After IOFB is freed it can be either removed with forceps and intraocular magnet. Lens opacities and vitreous haemorrhage, bands, and membranes can be removed at the time of surgery. Data was analyzed by SPSS version 16.

RESULTS

Demographic data of patients is shown in Table 1. IOFB was metallic in 31 (88.57%) cases and was non metallic in 4 (11.43%) cases. Zone of entry is shown in Table 2. IOFB was impacted in anterior segment in 7 (20%) cases while it was impacted in posterior segment in 28 (80%) cases. In 2 (5.71%) eyes more than 2 intraocular foreign bodies were found while one eye (2.85%) had two intraocular foreign bodies. Rest of the 32 (91.4%) eyes had only one intraocular foreign body. Vitreous bleed was detected in 17 (48.57%) cases, while retinal detachment was found in 6 (17.14%) cases on slit lamp bio-microscopy or by ultrasonography.

Primary repair was required in 14 (40%) cases while rest 21 (60%) eyes had self sealed wound. Primary surgical intervention in the form of Pars Plana Vitrectomy, IOFB removal with the use of intraocular magnet or forceps was carried out in 25 (71%) cases. Intraocular foreign body was removed by using forceps and endo magnet together in 27 (77.10%) cases and with cutter in 3 (8.57%) cases. Only forceps was used in 4 (11.42%) cases for IOFB removal. In one (2.85%) case after PPV, removal of IOFB was achieved through external scleral approach as it was impacted in retina/choroid/scleral complex. Seventeen (48.57%) eyes had silicone oil (SO) tamponade. Air was used as internal tamponade in 4 (11.43 %) eyes. IOFB removal through limbus was carried out in 6 (17.14%) cases. Primary lensectomy or lens extraction was performed in 13 (37.14%) cases and secondary in 6 (17.14%) cases. Twelve (34.28%) eyes had posterior chamber IOL implantation while 2 (5.71%) had scleral fixated posterior chamber IOL. Six (17.14%) eyes were left aphakic after lens removal. IOFB removal was achieved in 33 (94.28%) cases while IOFB removal could not be achieved in 2 (5.71%) cases because of vitreous bleed retinal and choroidal detachment. Initial BCVA and final BCVA are compared in Table 3 and 4. Final BCVA in bomb blast and haemorrhagic cases is compared in Table 5. In our study 80 % of the cases had initial BCVA in the range of CF to PL. Three eyes had final BCVA of PL. Among these one eye had no fundus view with residual IOFB, vitreous bleed, cataract, choroidal and retinal detachment. Second eye had large glass IOFB and retina was found fibrotic intraoperatively. This second eye developed endophthamitis too. In 3rd eye the VA initially improved after removal of IOFB but retina redetached after silicon oil removal. Co-morbidities at final follow-up in our study are shown in Table 6.

DISCUSSION

Open globe injuries are reported to be almost half of the total ocular emergencies[7]. OGI has been reported more than closed globe injuries in admitted traumatic ocular emergencies[10]. Minimum estimated incidence of IOFB in United Kingdom was reported to be " 0.16 per 100000" population. IOFB have been reported in 10% to 41% of open globe injuries[14-16]. Mechanism of injury suggest about the presence of IOFB. High-velocity, relatively small particles are the most common foreign bodies found in the eye. Hammering, grinding and explosives exposure are particularly high risk[16-18]. Other common causes of open globe injuries such as falls, sports injuries, or blunt trauma do not produce as many IOFB. Ocular injuries including OGI with or without IOFB occur more frequently in children, young individuals and working age individuals. Especially male gender is more effected[19-21]. Similar to these studies, 94.3% cases were male with mean age of 32.42 years

Table 1: Demographics and clinical features (n = 35)

Age (Mean)		32.42 (5-60)
Gender	Male (%)	33 (94.3%)
	Female (%)	2 (5.7%)
Eye	Right (%)	25 (71.4%)
	Left (%)	10 (28.6%)
Specific injury mechanism	BBI	21 (60%)
	Hammering	14 (40%)

Table 2: Zone of entry of IOFB

	Cases	Percentage
Zone I	24	68.67%
Zone II	11	31.42%
Total	35	100%

Zone I= Corneal, Zone II= Scleral

Table 3: Pre-operative versus post-operative visual acuity

BCVA (log MAR values)	Pre-operative		Post-operative	
	N	Percentage	N	Percentage
0.00 to 0.5	02	05.71	09	25.71
0.6 to 1.0	05	14.27	14	40.00
2.0	19	54.30	09	25.72
3.0	09	25.72	03	08.57
Total	35	100.00	35	100.00

BCVA: Best corrected visual acuity, N: Number of eyes.

Table 4: Visual outcome (BCVA: initial versus final)

BCVA	Initial BCVA	Final BCVA
Mean log MAR	2.20	1.20
SD	0.76	0.611
P Value	0.000	

BCVA: Best corrected visual acuity, Log MAR: logarithm of the minimal angle of resolution, SD: Standard deviation

Table 5: Final BCVA in bomb blast and haemorrhagic cases

BCVA (log MAR values)	Bomb blast cases		Haemorrhagic cases	
	N	Percentage	N	Percentage
0.00 to 0.5	04	11.42	05	14.28
0.6 to 1.0	09	25.71	05	14.28
2.0	06	17.14	03	08.57
3.0	02	05.71	01	02.85
Total	21	60.00	14	40.00

BCVA: Best corrected visual acuity, N: Number of eyes.

Table 6: Co-morbidities

S No	Co-morbidities	Number	Percentage
1	Corneal scars	10	28.57
2	Corneal scars plus aphakia	05	14.28
3	Corneal scars plus macular scars	06	17.14
4	Silicon oil	04	11.42
5	Lens opacities	02	05.71
6	Corneal scars plus choroidal detachment and retinal detachment	02	05.71
7	No co-morbidities	06	17.14

in our study. Memon et al had reported from another province of our country that hammer and chisel work as the most common cause of OGI with IOFB (48% cases)[20]. Similarly hammering had been reported to be the most common mechanism in OGI with IOFB by many of the international studies. The causative agents were use of hammer in 72% of cases, while 10% of the trauma were caused by machine tools in a study done by Chiquet et al[22,23-25]. Jan et al[26] reported bomb blast injury in 64.3% cases while injury due to hammer and chisel work in 35.7 cases.However in our case series, bomb blast injuries (BBI) were responsible in 60% eyes followed by 40% cases due to hammer and chisel work. This high incidence of bomb blast related IOFB is related to increasing trends of bomb blast in our province and our neighbouring country Afghanistan. In our study, 20% cases had IOFB in the anterior segment while in 80% in posterior segment of their eyes which is similar to reported by Greven and Jan et al[7,26]. In our study, the site of entry was zone I in 68.67% cases which is higher than the previous studies done by Haider et al[28] and Memon et al[20]. In general, removal of an IOFB is recommended at the time of repair of entry site or soon afterwards. Because of inflammation caused by IOFB, they often are rapidly surrounded by a fibrous capsule that can make delayed surgical removal more difficult. Visual outcome in injuries involving intraocular foreign bodies depends upon multiple factors. These include IOFB size and weight, age, presenting VA, location of IOFB, uveal prolapse, large wound size, vitreous hemorrhage, and preoperative RD[19,21,22]. It has been proposed that the risk of endophthalmitis decreases with early IOFB removal. Traditionally, IOFB removal within 24 hours of injury has been advocated because of the increased risk of endophthalmitis[7,18,22]. Other authors have demonstrated that delayed IOFB removal was also appropriate when a primary wound was repaired promptly and broad spectrum antibiotic administration with no increased risk of endophthalmitis[19,22]. In our study `the incidence of endophthalmitis was 2.85%, which is comparable to other studies; range 0–20%[12,18,22]. Jan et al[26] reported endophthalmitis in none of their cases at presentation or after surgical intervention.Vitreous bleed was detected in 17(48.57%) cases, while retinal detachment was found in 6 (17.14%) in our study. Ghasemi et al[28] reported preoperative retinal detachment in 25.5% of their cases. It has been suggested that in the presence of a detached retina, surgical manipulations to remove the IOFB increase the risk of causing iatrogenic retinal breaks. Careful attention to the retina at the time of IOFB removal and the use of perfluorocarbon liquid for retinal protection may result in improved success rate. There has also been controversy over optimal management of a retinal tear caused by the foreign body. Some surgeon emphasizes the necessity of creating a chorioretinal adhesion at this site with either cryopexy or photocoagulation. In experience of many surgeons the inflammation caused by the foreign body impaction has been adequate to prevent retinal detachment. There has also been discussion of the need to place photocoagulation around the intraretinal foreign body preoperatively to decrease the risk of retinal detachment at the time of foreign body removal. Automated vitrectomy instruments have greatly aided the management of cases with IOFB. Primary lensectomy or lens extraction was performed in 37.14% cases of our study. The extent of retinal damage during surgery can be accurately assessed, and appropriate treatment can be carried out. In our study the IOFB removal was achieved in 94.28% cases compared to 76% in a case series by Haider et al[27]. In a study conducted by Jan et al[26], IOFB removal was achieved in 92.9% cases. The higher success rate of IOFB removal could be related to presence of IOFB in anterior segment in 20% of our cases. Before the availability of vitreoretinal services in our department, conventional (extraocular) magnet was used for IOFB removal. One study conducted by Babar et al showed IOFB removal with conventional magnet in 58.6% cases[29]. Direct removal of IOFB previously performed directly with magnet was usually associated with many complications. Direct posterior removal of IOFB with use of a magnet was performed in 61 cases in one series by Percival[31]. I n this group 53% developed cataracts, 39% had vitreous haemorrhage, and 20% had retinal detachments. In addition there was a 20% failure in removal of the IOFB at the first attempt[8]. In our study, IOFB was removed in 77.10% cases with forceps. The foreign body forceps designed to pass through the 20G or 19G sclerotomy sites is unable to grasp large IOFBs, such as pellets or large glass particles. When they can be grasped, they are too large to be removed through the sclerotomy and must be removed through a second incision created at the limbus. When one suspects that a foreign body cannot be removed by way of pars plana surgery, a scleral tunnel, a limbal opening, or an open sky approach should be considered. In our study metallic particles were removed through limbal opening in two cases because of their large size.

A wide range of final visual outcomes was reported in the literature, due to the variability of causes. Good final visual outcome (VA of 20/40 or better) was reported in 30 to 71% of patients[29,30]. In our study 80 % of the cases had initial BCVA in the range of CF to PL. Final BCVA was in the range of 6/6 to 6/18 in 25.71% of our cases while it was in the range of 6/24 to 6/60 in 40% of our cases. Memon et al reported final BCVA of 6/24 or better in 36% eyes. Initial VA in their study was CF or below which is also comparable to our study. Ghasemi et al[28] found BCVA of 6/12 or better in 19.1% eyes which is lower than our study. Their final anatomical success rate was 97.9%, so poor visual outcome may be due to the associated ocular injuries (e.g. corneal scar, retinal scar, etc). Common ocular co-morbidities which resulted in decreased final visual outcome in our study were corneal scars (59.99%), macular scars (17.14%) and aphakia (14.28%). According to Jan et al[26] common ocular comorbidities were corneal scars (42.9%) followed by chorioretinal scars involving macula (28.6%).Memon et al reported retinal detachment to be the most common visual morbidity in 22% cases followed by recurrent vitreous bleed in 20% cases. They reported corneal scar in 16% eyes compared to 59.9% cases in our study.[20]Although IOFB were successfully removed in our cases the vision may also be decreased due to associated comorbities. We recommend large sample size studies to determine other factors that may be important in achieving final visual outcome.

CONCLUSION

OGI with IOFB commonly affects male and young individuals. Bomb blast injuries are most common cause of OGI with IOFB in our region. Most of the IOFB are metallic and usually impacted in the posterior segment. Cornea is the most common site of entry of IOFB. Significant visual improvement occurs in most of the cases after skilled vitreo-retinal surgical interventions. Common ocular co-morbidities are corneal scar, macular scar and cataract.

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CONTRIBUTORS

ZH conceived the idea, planned the study, and drafted the manuscript. SUK and TS helped acquisition of data and did statistical analysis. SJ drafted and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.