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RESEARCH ARTICLE

VISUAL OUTCOMES AND PROGNOSTIC FACTORS IN PATIENTS WITH OPEN GLOBE INJURIES MANAGED BY VITRECTOMY

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ABSTRACT

Background: Ocular trauma refers to any injury to the eye. Mechanical trauma to the eye is subdivided into open and closed globe injuries. An open globe injury is defined as a full thickness wound of the eye wall and intraocular structures. The annual global incidence rate is 3.5/100000 persons. The Ocular Trauma Classification group has developed a classification system based on Birmingham Eye Trauma Terminology (BETT) and features of globe injury at initial examination. **Objective:** To assess risk factors prognosticating final visual outcome of post vitrectomy patients with open globe injuries. **Methods:** The patients with open globe injuries of all age groups on follow up for atleast6 months were included in the study. Patients were assessed by clinical examination, indirect ophthalmoscopy, X-Ray/CT scan, B scan in cases with opaque media, timing of Pars planavitrectomy, final visual outcome and retinal reattachment. Patients underwent primary repair followed by vitrectomy depending on type, severity, duration of trauma and were followed up at 1week,1month,2 months and 6months post vitrectomy. **Results:** The study population consisted of 75 males and 3 females, ratio of male: female was 25:1 with mean age of 20.9±7.16 years. Time duration from primary repair upto vitrectomy was <15 days in 34 (43.65%), anterior chamber was maintained in 63 (80.8%) eyes, relative afferent pupillary defect was present in 12 (15.4%) eyes. Mean visual acuity showed significant improvement from 2.26± 1.82logMAR (Hand movements) preoperatively to 1.76± 1.39 logMAR (p=0.014) at 1 month, 1.51±1.071 logMAR (p=0.007) at 2 months, 1.23±0.96 logMAR (6/96) (p<0.001) at 6 months. Retinal detachment was present in 10 (12.8%) eyes and showed poor visual outcome compared to rest 68 (87.1%) of eyes with no retinal detachment (p=0.01) which was statistically significant. Out of 78 eyes, 1 (1.3%) eye presented with vision of 6/18, 2 (2.6%) eyes with 6/36, 20 (25.6%) eyes with finger counting 1 metre, 32 (41.0%) eyes with hand movements, 23 (29.5%) eyes perception of light. Postoperatively at the end of 6 months 17 (21.8%) eyes had 6/6-6/9 vision, 13 (16.7%) eyes had 6/12-6/24 vision,16 (20.5%) eyes had 6/36-6/60, 11 (14.1%) eyes had finger counting at 1 metre, 12 (15.3%) eyes had hand movements, 8 (10.3%) eyes had perception of light and only one patient remained with no light perception as he presented with optic nerve avulsion preoperatively. **Conclusion:** Good preoperative visual acuity had good prognosis, but poor visual acuity did not correlate with poor visual outcome, which means that with vitrectomy the prognosis could improve in patients with lower initial visual acuity.

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INTRODUCTION

Ocular trauma is leading cause of visual disability and can contribute up to 65% of the cases of unilateral blindness worldwide (Eballe, 2009; Kuhn, 2002). Ocular trauma refers to any injury to the eye. Mechanical trauma to the eye is subdivided into open and closed globe injuries (Kuhn, 2002). The annual global incidence rate is 3.5/100000 persons (Negrel, 1998).

The Ocular Trauma Classification group has developed a classification system based on Birmingham Eye Trauma Terminology (BETT) and features of globe injury at initial examination (Kuhn) (Kuhn, 2002; Pieramici, 1997).

This system categorizes trauma by four parameters:

- Type-based on mechanism of injury.

- Grade-defined by visual acuity measurement at initial examination.
- Presence or absence of a Relative afferent pupillary defect (RAPD).
- Extent of the injury/zone of injury-wound location in open globe injuries or the most posterior extent of damage of closed globe injuries. For open globe injuries;
- Zone I injuries are confined to the cornea and limbus.
- Zone II injuries involve the anterior 5mm of the sclera (i.e., not extending into the retina).
- Zone III injuries involve full-thickness defects whose anterior most aspect is at least 5mm posterior to the limbus.
- In perforating injuries the posterior defect, usually the exit site is used to judge the zone of involvement.

Ocular Trauma Score is a set of criteria devised in 2002, to determine functional outcome (visual recovery) after open globe injuries (Kuhn, 2002). Ocular Trauma Score compares preoperative visual acuity with post operative visual acuity [vision assessed after trauma and primary treatment] and also six injury parameters which predicts the poor visual outcome. The Ocular Trauma Score is used to correlate the postoperative visual acuity after open globe injury (OGI) in both children and adults (Schorkhuber, 2014; Unver, 2009). Besides being a prognostic tool used in ocular trauma, it is also used to determine prognosis of patients who undergo 23-G Pars Plana Vitrectomy (PPV) for surgical removal of metallic posterior segment intraocular foreign bodies (IOFBs) (Yasa, 2018).

For the open wound and tissue prolapsed, restoration of anatomy of the globe is to be done with watertight closure of the wound. Investigations such as B-scan, ultrasound biomicroscopy, computed tomography are used for the diagnosis. Initial repair of cornea, sclera must be done immediately, a second surgery is performed 2 weeks later (Bi, 2013). Traumatic retinal detachment accounts for 10-40% of all detachments (Bales 1994). Retinal detachment may accompany both open and closed globe injuries (Erdurman, 2011; Ryan, 1979), but is more prevalent after closed globe injury (70-85%) (Goffstein, 1982). Retinal detachment has been reported to occur in upto 30% of open globe injuries and 6-36% of those with posterior segment intraocular foreign bodies (Wickham, 2006).

Scleral laceration with vitreous haemorrhage and incarceration of vitreous in the wound gives rise to intraocular fibrovascular proliferation which results in tractional retinal detachment or ciliary body detachment. This membrane grows over the ciliary body and causes ocular hypotony. To prevent these grave complications vitrectomy is indicated as a secondary procedure after a primary repair (Cleary, 1981). It allows reconstruction of the posterior segment, clear vitreous opacities, controls healing process and prevents endophthalmitis (Andreoli, 2012; Sayen, 2013). There is however controversy over the timing of vitrectomy, some advocating early within 3 days (Coles), some delayed upto 14 days (Vatne, 1958). Early vitrectomy performed in first four days, is good for management of retinal tears and detachment and prevention of fibrocellular proliferation. However the complications of early vitrectomy are bad visualisation, wound leakage, increased bleeding and increased difficulty to detach the posterior hyaloid and control suprachoroidal haemorrhage. The two strong indications for delayed vitrectomy i.e., vitrectomy performed within 5-14 days after trauma are choroidal haemorrhage and large posterior wound in perforating open globe injury (Quiroz-Mercado, 1997; Meier, 2000; Martin, 1991). Pars Plana Vitrectomy (PPV) is considered the effective and the safest approach for the removal of retained ocular foreign bodies and repair of retinal injuries. Advances in small guage (25 guage or 27 guage) vitrectomy instrumentation allow better visualization, 25 guage being equipped with high cut rates with preserved duty cycle allows surgeon to perform a peripheral vitrectomy over detached retina thereby attaching retina more safely and treating dense haemorrhage, so improving functional as well as anatomical outcome (Sborgia, 2017).

Anatomical success is high after the removal of posterior segment intraocular foreign body (IOFB) despite a delay in surgery, while as functional outcome (visual outcome) is determined by initial ocular injury (Falavarjani, 2013). There are certain significant factors which determine favourable outcome in open globe injuries they include: time between initial trauma and initial treatment less than 12 hrs, laceration length less than 10mm, presenting visual acuity better than perception of light (Jiang, 2017). The poor prognostic factors affecting final visual outcome in open globe injuries managed by vitrectomy are: Zone III injuries and relative afferent pupillary defect (RAPD) (Mansouri, 2016). Retinal detachment(RD) is a known risk factor for severe visual impairment (Rahman, 2006). Vitreous haemorrhage (VH) accompanies the development of retinal detachment (RD) in most open globe injuries (Stryjewiski, 2014; Nashed, 2011) and is the independent risk factor related to poor visual outcome (Rao, 2010; Texiera, 2014).

MATERIALS AND METHODS

After obtaining the ethical clearance from Institutional Ethical Committee (GMC Srinagar), the present hospital based prospective and retrospective study was carried out at Postgraduate Department of Ophthalmology, Government Medical College, Srinagar from Sept 2018 to March 2020. Patients with open globe injuries of all age groups who gave written informed consent and were on follow up for atleast 6months were included in the study whereas patients having previous history of trauma or surgery in injured eye or having diseases which may affect outcomes like diabetes, glaucoma etc were excluded from the study.

Patient assessment was done by clinical examination, indirect ophthalmoscopy, X-Ray/CT scan, B scan in cases with opaque media, Timing of Pars plana vitrectomy and final visual outcome and retinal reattachment. Initially at the presentation primary repair was done, intravitreal antibiotics (ceftazidime and vancomycin) were given and were keenly observed, patients who required vitrectomy according to type, severity and duration of trauma, presence of intraocular foreign body were taken up for second surgery. Patients were followed up at 1 week, 1 month, 2 months and 6 months post vitrectomy. Data was compiled and entered in Microsoft Excel spreadsheet and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Categorical variables were summarized as frequency and percentages, continuous variables were summarized as MD±SD.A repeated measure ANOVA was employed to compare preoperative vision with postoperative vision. A P-value of less than 0.05 was considered statistically significant.

RESULTS

In this prospective and retrospective hospital based study, we studied 78 eyes with open globe injuries managed by vitrectomy. The patients were in the age group (18 months-57 years) with the mean age of 20.9±7.16 years. Maximum patients (39.7%) were in the age of 15-19 years. The study population consisted of 75 males and 3 females, ratio of male: female was 25:1. Right eye was involved in 38 patients, left eye was involved in 40 patients. Mechanism of injury was pellet in 71 eyes, iron nail in 2 eyes, iron wire in 2 eyes, blast injury in 1 eye, knife in 1 eye, needle prick in 1 eye. Type of injury - penetrating injury was in 29 (37.2%) eyes, perforating was in 6 (7.7%) eyes, penetrating and intraocular foreign body was in 36 (36%) eyes, perforating and intraocular foreign body (9%) was in 7 eyes. Zone of injury - Zone I in 35 eyes, Zone II in 40 eyes, Zone III in 3 eyes, Zone III injuries had poorer visual outcome ($p<0.01$) when compared with Zone I and II ($p=0.001$).

Time duration from primary repair upto vitrectomy was <15 days in 34 (43.65%) eyes, 15-30 days in 34 (43.65%) eyes and >30 days in 10 (12.8%) eyes, when compared no significant improvement was seen in visual outcome ($p<0.001$). Anterior chamber was maintained in 63 (80.8%) eyes with hyphaemapresent in 12 (15.4%) and lens matter in 3 (3.8%) eyes. Lens was clear in 48 (61.53%) eyes, traumatic cataract was present in 26 (33.33%) eyes, while 4 (5.12) eyes had no view of lens due to hyphaema. Relative afferent pupillary defect was present in 12 (15.4%) eyes and 66 (84.6%) eyes had no relative afferent pupillary defect, postoperative visual outcome was better ($p<0.001$) in latter eyes. B scan was done in 29 eyes in whom media was hazy, 5 (17.24%) showed vitreous haemorrhage, 13 (44.8%) showed vitreous haemorrhage with intraocular foreign body, 7 (24.13%) showed retinal detachment, 4 (13.79%) showed vitreous haemorrhage with vitreous incarceration. Pars Plana Vitrectomy was done in 78 eyes, scleral buckle was used in 2 retinal detachment eyes along with vitrectomy, additionally fluid air exchange was done in all and endolaser was done in 76 eyes.

Table 1: Age and gender distribution of study patients

		No. of Patients	Percentage
Age in Years	< 15	7	9.0
	15-19	31	39.7
	20-24	19	24.4
	25-29	13	16.7
	≥ 30	8	10.3
	Mean ±SD (Range)=20.9±7.16 (18 months-57 Years)		
Sex	Male	75	96.2
	Female	3	3.8

Table 2. Laterality, Mechanism, Type and Zone of Injury

		No. of Eyes	Percentage
Laterality	Right	38	48.7
	Left	40	51.2
Mechanism of Injury	Pellet	71	91.0
	Iron nail	2	2.6
	Iron wire	2	2.6
	Blast injury	1	1.3
	Knife	1	1.3
	Needle prick	1	1.3
Type of Injury	Penetrating	29	37.2
	Perforating	6	7.7
	Penetrating + Intraocular foreign body	36	46.2
	Perforating + Intraocular foreign body	7	9.0
Zone of Injury	Zone I	35	44.9
	Zone II	40	51.3
	Zone III	3	3.8
	P < 0.01		

Table 3.

		No. of Eyes	Percentage
Preoperative BCVA	6/18	1	1.3
	6/36	2	2.6
	Finger counting 1metre	20	25.6
	Hand movements	32	41.0
	Perception of light (PL)	23	29.5
Duration of primary repair to vitrectomy	< 15 days	34	43.6
	15-30 days	34	43.6
	> 30 days	10	12.8
Status of anterior chamber	Maintained	63	80.8
	Hyphaema	12	15.4
	Lens matter	3	3.8
Status of pupil	NO RAPD	66	84.6
	RAPD	12	15.4
Status of lens	Clear	48	61.53
	Traumatic cataract	26	33.33
	No view due to hyphaema	4	5.12

Table 4: Indirect ophthalmoscopy, B scan, Final Diagnosis & Procedure Involved

		No. of Eyes	Percentage
Indirect ophthal-moscopy	Vitreous haemorrhage with intraocular foreign body	30	38.46
	No glow (dense vitreous haemorrhage)	29	36.25
	Vitreous haemorrhage	14	17.9
	Retinal detachment	3	3.8
	Vitreous haemorrhage with exit wound	2	2.6
B scan of rest of study eyes (29)	Vitreous haemorrhage with Intraocular foreign body	13	44.8
	Retinal detachment	7	24.13
	Vitreous haemorrhage	5	17.24
	Vitreous haemorrhage with vitreous incarceration	4	13.79
Final diagnosis	Traumatic cataract+Vitreoushaemorrhage+Intraocular foreign body	25	32
	Vitreous haemorrhage	23	29.48
	Vitreous haemorrhage+Intraocular foreign body	15	19.2
	Retinal detachment	7	9.0
	Retinal detachment+Intraocular foreign body	3	3.8
	Traumatic cataract+vitreoushaemorrhage+Endophthalmitis	4	5.1
	Vitreous haemorrhage+Optic nerve avulsion	1	1.3
Procedure involved	Lensectomy+Vitrectomy+Intraocular foreign body removal+Fluid air exchange+Endolaser+Silicon oil injection	25	32
	Vitrectomy+Intraocular foreign body removal+Fluid air exchange+Endolaser+ SF6Gas	18	23.1
	Vitrectomy+Fluid air exchange+Endolaser	16	20.5
	Vitrectomy+Fluid air exchange+Endolaser+SF6Gas	13	16.7
	Lensectomy+Vitrectomy+Fluid air exchange+Endolaser +Silicon oil injection+Intravitreal antibiotics	3	3.8
	Lensectomy+Vitrectomy+Perflurocarbon-liquid+Fluid air exchange+Endolaser+ Silicon oil injection	1	1.3
	Scleral buckle+Vitrectomy+ Fluid air exchange+SF6Gas	2	2.6

Table 5. Visual acuity and Anatomical Outcome at different times

		No. of Eyes	Percentage
Visual acuity of study eyes at 1 week	6/12	1	1.3
	6/18	2	2.6
	Finger counting At 1 metre	17	21.8
	Hand movements	42	53.8
	Perception of light	15	19.2
	No light perception	1	1.3
Anatomical outcome in study eyes at 1 week	Retina attached	70	89.74
	Retina attached with vitreous cavity haemorrhage	7	8.9
	Retina attached, optic nerve avulsion	1	1.3
Visual acuity of study eyes at 1 month	6/9 - 6/12	2	2.6
	6/24 - 6/18	7	9.0
	6/60 – 6/36	18	23.1
	Finger counting At 1 metre	22	28.2
	Hand movements	19	24.4
	Perception of light	9	11.5
	No light perception	1	1.3
Anatomical outcome in study eyes at 1 month	Retina attached	72	92.3
	Proliferative vitreoretinopathy	2	2.56
	Retinal detachment	3	3.8
	Avulsed optic nerve	1	1.3
Visual acuity of study eyes at 2 months	6/6-6/9	3	3.8
	6/12	21	26.9
	6/18	15	19.2
	Finger counting At 1 metre	16	20.5
	Hand movements	14	17.9
	Perception of light	8	10.3
	No light perception	1	1.3
Anatomical outcome in study eyes at 2 months	Retina attached	76	98.7
	Epiretinal retinal membrane at macula	1	1.3
	Avulsed optic nerve	1	1.3
BCVA of study eyes at 6 months	6/6-6/9	17	21.8
	6/12-6/24	13	16.7
	6/36-6/60	16	20.5
	Finger counting at 1 metre	11	14.1
	Hand movements	12	15.3
	Perception of light	8	10.2
	No light perception	1	1.3
Anatomical outcome in study eyes at 6 months	Retina attached	77	98.71
	Avulsed optic nerve	1	1.3

Table 6. Pre and post operative visual acuity (logMAR) in study eyes

Time interval	Mean	SD	Comparison	P-value
Preoperative	2.26	1.82		
1 week	2.23	1.95	1week vs preoperative	0.872
1 month	1.76	1.39	1month vs preoperative	0.014*
2 months	1.51	1.07	2months vs preoperative	0.007*
6 months	1.23	0.96	6months vs preoperative	<0.001

Tamponading agents-silicon oil was used in 29 (37.12%) eyes, SF6 gas in 33 (42.3%) eyes and perfluorocarbon liquid in 1 (1.3%) eye. In the rest 16 eyes (20.5%) only fluid air exchange and endolaser was done. Endophthalmitis was present in 4 eyes, out of which 3 eyes additionally received intravitreal antibiotics intraoperatively, andone had already received 2 doses of intravitreal antibiotics one day prior to surgery. Mean preoperative vision (BCVA in logMAR units) of 78 affected eyes was compared with postoperative at 1 week, 1 month, 2 months and 6 months. Mean visual acuity showed significant improvement from 2.26± 1.82logMAR (Hand movements) preoperatively to 1.76± 1.39 logMAR (p=0.014) at 1 month, 1.51±1.071 logMAR (p=0.007) at 2 months, 1.23±0.96 logMAR (6/96) (p<0.001) at 6 months postoperatively which is statistically significant (p<0.05).

In terms of decimal notation visual acuity improved from 0.0052 to 0.06 with a change of +0.055 that is approximately 1.3 fold increase in vision post treatment. Retinal detachment was present in 10 (12.8%) eyes and showed poor visual outcome compared to rest 68 (87.1%) of eyes with no retinal detachment (p=0.01) which was statistically significant. Intraocular foreign bodies were present in 43 (55.12%) eyes which showed improvement in vision from 2.3logMAR preoperatively to 1.3 logMAR (p<0.001) postoperatively at 6 months which was statistically significant. Endophthalmitis was present in 4 patients who showed improvement in visual acuity from 2.3logMAR preoperatively to 1.3 logMAR (p<0.001) postoperatively at end of 6months. 1 eye had no light perception at end of 6months due to presence of optic nerve avulsion preoperatively. Out of 78 eyes, 1 (1.3%) eye presented with vision of 6/18, 2 (2.6%) eyes with 6/36, 20 (25.6%) eyes with finger counting 1 metre, 32 (41.0%) eyes with hand movements, 23 (29.5%) eyes perception of light. Postoperatively at the end of 6 months 17 (21.8%) eyes had 6/6-6/9 vision, 13 (16.7%) eyes had 6/12-6/24 vision,16 (20.5%) eyes had 6/36-6/60, 11 (14.1%) eyes had finger counting at 1 metre, 12 (15.3%) eyes had hand movements, 8 (10.3%) eyes had perception of light and only one patient remained with no light perception as he presented with optic nerve avulsion preoperatively.

DISCUSSION

In our study, the patients were in the age group of 18 months-57 years with the mean age of 20.9±7.93 years. The most common age group of patients was 15-19 years. Our findings were in contrast, to a study done by Petrovic G *et al.* (2004) in which the mean age of patients was 29.5 years. The younger age group in our study was due to the pellet injuries which were sustained by these younger age groups in this part of region.The breakup based on sex in our study was 75 (96.2%) male patients and 3 (3.8%) female patients, with male to female ratio of 25:1 which indicate that males, participate in these demonstrations. Apart from pellet injuries males are also prone to other open globe injuries. This finding is in concordance with the study done by Petrovic *et al.* (2004) in 51 patients with open globe injuries managed by vitrectomy that has reported only one female. In terms of laterality, in our study right eye was involved in 38 (48.7%) patients, left eye was involved in 40 (51.2%) patients. Our results were consistent with finding of the study done by Fujikawa *et al.* (2018) showing left predominance. Our study showed that in majority of the patients mechanism of injury included pellet in 71 eyes (91%), iron nail injury in 2 eyes (2.6%), iron wire injury in 2 eyes (2.6%), blast injury in 1 eye (1.3%), knife injury in 1eye (1.3%), needle prick in 1 eye (1.3%) which was in contrast to a study of 62 patients by Rajesh H *et al. (2020)*, in which majority of cases included work/household injuries 28 (45.16%), blunt trauma 12 (19.35%), sports injuries 4 (6.46%), projectile (6%), assault 10 (16.13%), firecracker 2 (3.22%). The pellet injuries in our study outnumbered other causes due to prevailing law and order situation in the valley, while as in other places it is work related injuries that comprise majority of the cases.

In our study it was found that out of 78 patients of open globe injury, 29 eyes (37.2%) were having penetrating injury, 6 eyes (7.7%) were having perforating injury, while penetrating and intraocular foreign body were seen in 36 eyes (46.2%), perforating and intraocular foreign body were seen in 7 eyes (9%). Our results were consistent with the study done by Khouier C *et al (2015)* which reported presence of intraocular foreign body in 50% of pellet gun injury that underwent vitreoretinal surgery.35 eyes (44.9%) of patients had injury in Zone I, 40 eyes (51.3%) of patients in Zone II, 3 eyes (3.8%) of patients in Zone III (table 6), and postoperatively visual acuity in Zone I and II was better (P<0.001), but patients with injury in Zone III had significantly poorer visual outcome (P<0.01), which was statistically significant. Pre-operative vision in our study eyes was 6/18 in 1 eye (1.3%), 6/36 in 2 eyes (2.6%), finger counting 1 metre in 20 eyes (25.6%), hand movements in 32 eyes (41%), perception of light in 23 eyes (29.5%) which was the most useful factor in determining final visual outcome. This was in concordance with the study done by Petrovic G, *et al (2004)* in which good preoperative vision was positive prognostic factor for final vision outcome. When visual acuity was compared with respect to time duration from primary repair to vitrectomy, 34 eyes were operated in <15 days, 34 eyes were operated in 15-30 days and 10 eyes were operated >30 days, however this had no prognostic bearing on final visual outcome (p<0.001). Our results were in concordance with study of Agarwal *et al.* (2012) where visual improvement in early and late vitrectomy had no significant difference, rather type and extent of trauma determined the final visual acuity. However early vitrectomy decrease the chance of fibrocellular proliferation. Anterior chamber was maintained in 63 eyes (80.8%), hyphaema was present in 12 eyes (15.4%) and lens matter in anterior chamber was present in 3 eyes (3.8%). Eyes with hyphaema due to injury had poor visual outcome (2.3logMAR). Our results were consistent with the study done by Nowomiejska *et al.* (2017) that reported all the eyes of the patients with hyphaema had poor visual outcome after intraocular foreign body removal.Relative afferent pupillary defect was found in 12 eyes (15.4%). The postoperative visual acuity in these patients was significantly poorer in comparison to patients without Relative afferent pupillary defect (P<0.001), which was in concordance with the study done by Petrovic G *et al.* (2004) thereby indicating relative afferent pupillary defect is significant predictor of final visual outcome.

In our study, 48 eyes (61.53%) had clear lens, 26 eyes (33.33%) had traumatic cataract and 4 eyes (5.12%) had no view of lens due to hyphaema. Traumatic cataract does not affect the final visual outcome (P=0.2) because of simultaneous lensectomy done with vitrectomy and in majority cases eyes are kept aphake. These findings were in concordance with the study done by Nowomiejska *et al*. (2017) showing no significant visual outcome postoperatively. In our study, 43 eyes had vitreous haemorrhage with intraocular foreign bodies, 23 eyes had vitreous haemorrhage among them 4 eyes were associated with endophthalmitis and 1 eye with optic nerve avulsion, 10 eyes had retinal detachment, traumatic cataract was present in 29 eyes with vitreous haemorrhage. Fundus was seen by indirect ophthalmoscopy in clear media and in rest 29 eyes with dense vitreous haemorrhage B scan was done. The main aim of performing vitrectomy after primary repair was to remove vitreous haemorrhage, intraocular foreign bodies, reattach retina, to treat endophthalmitis. Additional procedure like lensectomy was done in eyes with traumatic cataract, endolaser around exit wound and impact site in some cases, belt buckle was done for sealing of multiple breaks. In our study, 43 eyes with intraocular foreign body had visual acuity improvement from 2.3 logMAR (hand movements) to 1.3 logMAR (6/120) postoperatively. The results were in concordance to the study done by Nicoara *et al*. (2015) in which visual outcome was improved to 1 logMAR in 13eyes. In terms of anatomic outcome, retina was attached in all eyes with scar either at macula or juxta macula according to impact site preoperatively. Intraocular foreign body was removed via linear pars plana scleral access, using intraocular forceps and a retractable basket which was in concordance to study done by Sborgia G *et al (2017)* , where either clear corneal or linear pars plana scleral access was used to remove intraocular foreign body. Retinal detachment was present in 10 eyes (12.8%) out of 78 in our study, and post-operative vision in these eyes was poor as compared to the rest 68 eyes without retinal detachment (p=0.01). Our findings were comparable to study done by Nowomiejska *et al*., (2017) where eyes without retinal detachment had better visual outcome (p=0.012).

Tamponading agents- silicon oil was used in 29 eyes, SF6 gas in 33 eyes, perflurocarbonliquid (PFCL) in 1 eye (to stabilize retina intra-operatively and preventing iatrogenic breaks) and in the rest, air was used as tamponading agent. The main aim was to attach retina, prevent proliferative vitreoretinopathy and endophthalmitisdueto the antibacterial property of silicon oil. When compared in terms of visual acuity,silicon oil filled eyes had better visual acuity 5/200 (50-60%) than eyes with SF6 gas (in 30-40%) in post-traumatic retinal detachment patients (p<0.05). In terms of anatomical outcome, macular attachment was more frequent in eyes with silicon oil as compared to SF6 gas (70%vs 60%). Our results were comparable to The Silicon oil study 1 (Silicon Study Report, 1992) where vision in eyes with silicon oil was 5/200 in50%-60% patients and eyes with SF6 gas were having vision 5/200 in 30%-40% patients (p<0.05), macular attachment was more frequent in eyes that received silicon oil vs SF6 gas (80% versus 60%). In our study, 4 eyes (5.1%) had endophthalmitis with associated traumatic cataract, all patients showed improvement in visual acuity from 2.3 logMAR (hand movements) to 1.3 logMAR (6/120) at the end of 6months. Endophthalmitis was completely resolved due to complete removal of vitreous, lens, use of silicon oil and simultaneous use of intravitreal antibiotics.

Endophthalmitis was not reported in eyes with intraocular foreign bodies in our study which may be due to early closure of the wound (primary repair) and use of intravitreal antibiotics at the time of primary repair in all of our cases. Our findings were in concordance with a study done by Sborgia G *et al (2017)* where 25 gauge vitrectomy was done with foreign body removal and endophthalmitis was also never reported. At one week postoperatively, 1 eye (1.3%) had visual acuity of 6/12, 2eyes (2.6%) had vision of 6/18, 17 eyes (21.8%) were having vision of finger counting 1 metre, 42 eyes (53.8%) had vision of hand movements, 15 eyes (19.2%) had vision of perception of light and 1 eye (1.3%) had no light perception. Retina was attached in 70 eyes (89.74%), retina attached with vitreous cavity haemorrhage was seen in 7 eyes (8.9%) and retina attached with optic nerve avulsion in 1 eye (1.3%).At 1 month follow up postoperatively our study showed, 2 eyes (2.6%) with vision in the range of 6/9-6/12, 7 eyes (9%) with vision in the range of 6/24-6/18, 18 eyes (23.1%) with vision in the range of 6/60-6/36, 22 eyes (28.2%) with vision of finger counting 1 metre, 19 eyes (24.4%) with vision of hand movements, 9 eyes (11.5%) with vision of perception of light and 1 eye (1.3%) had no light perception (table 18). In our study, 72 eyes (92.3%) had retina attached, 1 eye (1.3%) had avulsed optic nerve, 2 eyes (2.56%) with perforating injuries had proliferative vitreoretinopathy (table 19), which was comparable to Hutton *et al*. (1984) where patients developed proliferative vitreoretino-pathy in perforating injuries. Martin *et al*. (1991) have also reported rates of proliferative vitreoretinopathy in perforating injuries. At 2 months follow up postoperatively our study showed, 3 eyes (3.8%) with vision in the range of 6/6-6/9, 21 eyes (26.9%) with vision in the range of 6/12-6/24, 15 eyes (19.2%) with vision in the range of 6/36-6/60, 16 eyes (20.5%) with vision of finger counting 1 metre, 14 eyes (17.9%) with vision of hand movements, 8 eyes (10.3%) with vision of perception of light and only 1 eye with no light perception. In our study retina was attached in 76 eyes (98.7%), epiretinal membrane was seen in one eye in whom revitrectomy with membrane peeling was done, avulsed optic nerve was seen in one eye.At 6 months follow up postoperatively our study showed, 17 eyes (21.8%) had 6/6-6/9 vision, 13 eyes (16.7%) had 6/12-6/24 vision, 16 eyes (20.5%) had 6/36-6/60 vision, 11 eyes (14.1%) had finger counting at 1 metre, 12 eyes (15.3%) had hand movements, 8 eyes (10.3%) had perception of light and only one eye remained with no light perception which presented with optic nerve avulsion preoperatively. In our study at 6 months, retina was attached in 77 eyes, only one eye had optic nerve avulsion with no light perception.

Pre-operative mean visual acuity in our study was 2.26±1.82 logMAR values and post-operative visual acuity at 1 week was 2.23±1.95 logMAR values which showed statistically insignificant (p=0.872) improvement, while at 1 month, 2 months and 6 months logMAR values were 1.76±1.39, 1.51±1.07, 1.23±0.96 and P=0.872, P=0.014, P<0.001 respectively which was statistically significant (P<0.05) (table 24), which was in concordance with the study done by Fujikawa M *et al* (2018) where vitrectomy shows improvement in final visual acuity (P=0.033) as compared to those in whom vitrectomy was not performed. Other study done by Mansouri MR *et al*. (2016) reported that half of eyes managed with pars planavitrectomy for open eye injury had a good visual outcome.

CONCLUSION

Ocular trauma continues to be a major cause of visual impairment. Ocular trauma with intraocular foreign bodies contribute to a significant component of ocular morbidity but with prompt treatment useful vision can be restored. Pars Plana vitrectomy after primary repair in open globe injuries is not just for anatomic reconstruction but also helps in restoration of useful vision to the patients. Use of tamponading agents help to stabilize retina and prevent proliferative vitreoretinopathy and endophthalmitis. Good preoperative visual acuity had good prognosis, but poor visual acuity did not correlate with poor visual outcome, which indicates that with vitrectomy the prognosis could improve in patients with lower initial visual acuity. Final good visual outcome was associated with zone I and II injuries, retinal attachment at presentation and absence of afferent papillary defect and was not associated with timing of vitrectomy.

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