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A CLINICAL-EPIDEMIOLOGICAL STUDY ON BLUNT OCULAR TRAUMA AND ITS VISUAL OUTCOME IN A TERTIARY CARE HOSPITAL OF EASTERN INDIA.

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ABSTRACT.

Background:
Injury in the ocular region accidental or intended leads to ocular morbidity that accounts for poor visual prognosis and loss of quality of life, if not diagnosed and managed at the earliest. The study aims to observe clinical-epidemiological aspects of blunt ocular trauma and to determine the visual capacity.

Methodology:
An observational study was conducted. Patients with blunt ocular trauma at tertiary care hospitals were undertaken for the study. Relevant history with demographic data was noted. A detailed clinical and thorough ocular examination was done. Patients were managed with medical or surgical methods and follow-up was taken for the next six months.

Results:
Blunt ocular trauma, found in 0.24% of cases, primarily affected males aged 21 to 30 years, often laborers, agricultural workers, or rural residents. Sticks and fists were the main causes, with the right eye and anterior segment frequently affected. Traumatic glaucoma and hypotony occurred in 66% and 34% of cases, respectively, with most managed medically (67%). Refractive errors affected 36 patients, predominantly myopic (75%). Initially, best-corrected visual acuity (BCVA) was commonly 6/60-6/18 (33.2%), improving at 6 months to 6/18-6/6 (49.5%). Common B-scan findings included vitreous hemorrhage (32%), traumatic cataract (19%), lens subluxation (13%), posterior vitreous detachment (9%), retinal detachment (8%), and lens dislocation (7%).

Conclusion:
Ocular injuries lead to multiple complications; they cannot be examined accurately by routine methods. B-scan ultrasonography is recommended while investigating these injuries this aids in the preparation of the surgery with an accurate understanding of the injury.

Recommendation:
Educating people, and creating awareness to adopt protective measures in the workplace can prevent the occurrence of blunt ocular trauma, and at the same time rapid diagnosis, early referral, accurate investigations, and appropriate management can prevent complications following trauma.

Keywords: *Blunt ocular trauma, Visual outcome, B-scan, Traumatic cataract*
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INTRODUCTION.

The ocular surface accounts for only 0.1 of the whole-body surfaces. However, the number of injuries in the ocular region is much higher compared to other body surfaces. It also causes more complications. Generally, the outcome of ocular trauma is visual impairment which affects the individual not only physiologically but also in various social and economic aspects. According to the Singapore Malaya eye study1.2% of blindness is due to ocular injury alone [1]. It has caused single-eye blindness and decreased visual capacity around the globe [2]. Albataenah et al stated in their review that ocular trauma is the cause of single-eye blindness in half a million individuals [3]. 97% of the eye injuries occur due to blunt trauma [4].

Studies have reported that such blunt trauma injuries can be prevented by wearing eye-protective gear, especially during sports [3,4]. As per the Birmingham eye trauma terminology (BETT), ocular traumas can be divided into two categories one that has penetration due to a sharp object and the other one where blunt trauma occurs without any penetration [5]. The sharp penetrating type of injury often causes injury in the thickness of the whole eye on the other hand blunt trauma without penetration affects only a part of the eye.

According to the Singapore Malaya eye study, the risk factor that leads to ocular blunt trauma is usually the socioeconomic status, occupation, workplace, addiction, and gender of the patient [1]. The cause of blunt ocular injuries is multi-factorial. A Common object that causes ocular trauma is sticks/fists, cricket balls, stones, wires, buckles of belts, elastic luggage straps, falls, etc. Most accidental, work-related injuries are prevalent in developed countries, while assaults predominate in developing countries.

The basic pathophysiology is that the force of the blunt trauma leads to compression or the rupture of the eyeball which is an enclosed region. It also leads to the expansion of the eyeball in the equatorial plane when the trauma is on the anterior or posterior axis. Blunt trauma leads to coup injuries which can be abrasion of the cornea, hemorrhages in the subconjunctival and choroidal region, and necrosis of the retina, whereas countercoup injury includes commotio retinae [6]. The type of injury depends on the object that has caused blunt trauma, the part that is hit, the force with which the trauma occurs, and the force that is transferred to the eye. The impact of the trauma can occur on the surface of the eye that is at the lens and the diaphragm or it can affect the distant point on the posterior part of the lobe.

The outcome of blunt trauma is not just immediate visible injuries but long-term visual impairment. So, the prognosis of the injury caused by trauma has to be monitored with regular follow-ups. The outcome of the injury can be managed if the injury is examined early and treated appropriately. The development of the injury into visual impairment can be arrested with medical intervention. Due to the easy availability of agricultural lands, electricity & rapid industrial growth in eastern India, the population is mostly engaged in agricultural & industrial works, making these occupations more vulnerable to blunt ocular injuries.

Given public health importance, this study has been done to provide information on the magnitude and pattern of blunt ocular injuries at, a tertiary care hospital in Eastern India & to serve as the basis for designing and implementing preventive measures thereof. As the prevalence of blunt ocular trauma is peaking day by day, it is essential to have a detailed study on its incidence, clinical aspects, and etiopathogenesis so that early diagnosis and timely management can be sought at the earliest and visual prognosis can be improved. The present study is just a small paving stone that will encompass the above objectives and will throw some light onto the importance of the diagnosis using a B-scan of the cases with opaque ocular media as well as the role of medical and surgical management in predicting the final visual outcome.

Aims and Objectives.

The study aims to observe clinical-epidemiological aspects of blunt ocular trauma and determine its visual outcome.

Material and Methods.

Study design.

It was an observational study.

Study setting.

The study was conducted in prospectively at the Regional Institute of Ophthalmology (RIO), Eastern India.

Participants:

All patients suffering from blunt ocular trauma visiting the ED and ophthalmology outpatient department of the Regional Institute of Ophthalmology (RIO), Eastern India were enrolled in the study. Patients having penetrating object, perforating, chemical, and open lobe injuries, seriously ill poly-trauma patients, and patients having other ocular pathological conditions such as glaucoma were not included in the study

Bias.

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants identical information and hiding the group allocation while collecting the data.

Procedure.

Relevant history with special emphasis on circumstances leading to injury, duration since the injury, object causing the injury, and demographic data were noted. Inquiry was made regarding the receiving of first aid treatment by the patients. A detailed clinical examination was done by the following methods-

1. Recording of distant visual acuity by Snellen's chart, Landolt-Cchart and near vision with Snellen's near vision charts in adults, and Kay picture charts in verbal children. Fixing and following of light was used to assess the visual acuity in pre-verbal children.
2. Anterior segment examination with slit lamp bio-microscopy, lacrimal sac syringing, IOP evaluation with non-contact tonometry and applanation tonometry, gonioscopy (wherever

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necessary), and dilated fundus examination was done.

3. Patients with hazy media underwent a B-scan using 10 MHZ frequency.
4. Routine blood investigations X-ray, CT scan & MRI were done, whenever needed.

The treatment protocol was followed to choose an appropriate medical and surgical intervention according to the type of injury. Patients were given broad-spectrum antibiotics topically after the injury for 7 days (Eye drops and ointment) for at least 6 weeks & topical steroids wherever required. Secondary interventions like removal of the cataract, removal of IOFB, and detachment of the retina were performed as per the requirement of the injury. Patients were asked to follow up for the next six months and the visual acuity was measured. During the follow-ups, special emphasis was given to the condition of the injury. The sympathetic system responds to the existing inflammation due to injury and can lead to further exaggeration of the inflammation.

Ethical consideration.

The institutional ethics committee approved the study to be conducted. Written informed consent was obtained from the participants before the study.

Statistical Analysis.

The results were expressed as the mean ± standard deviation and percentages. Quantitative variables and not normally distributed in nature were analyzed using the Mann-Whitney Test and variables that were quantitative and normally distributed in nature were analyzed using the independent t-test. A paired t-test/Wilcoxon signed-rank test was used for comparison across follow-up. All statistical analyses were performed using SPSS version 21.0. A p-value of less than 0.05 was considered significant.

RESULTS.

A total no. of 1, 68,945 patients attended the ophthalmology OPD of the Regional Institute of Ophthalmology (RIO) of a tertiary eye care hospital in Eastern India, during the study period. Out of this, the number of trauma cases was 1471(0.87%), of which 413 cases were of blunt ocular trauma (28% of total trauma cases and 0.24% of the total OPD cases). The incidence of trauma was 0.87% and that of blunt ocular trauma was 0.24% of the total OPD patients in the present study. Out of the 413 cases of blunt ocular trauma, 319 cases were studied.

TABLE-1: AGE DISTRIBUTION.

AGE IN YEARS	MALE	FEMALE	TOTAL
0-10	14(4.38%)	6(1.9%)	20(6.28%)
11-20	57(17.86%)	22(6.9%)	79(24.76%)
21-30	65(20.4%)	34(10.6%)	99(31%)
31-40	45(14%)	18(5.64%)	63(19.64%)
41-50	27(8.5%)	10(3.1%)	37(11.6%)
51-60	9(2.8%)	4(1.25%)	13(4.05%)
>60	7(2.2%)	1(0.3%)	8(2.5%)

The mean age was 32.84+/- 21.12 years. Of the 319 patients studied, the majority were in the age group of 21-30 years (31%), followed by 11-20 years (24.76%) and 31-40 years (19.64%) (Table 1). Prevalence of blunt trauma was higher in the younger age group, because younger people are more active & energetic, hence more prone to injuries. Out of the 20 patients in the 0-10 years age group, 3 patients were newborn babies who sustained blunt ocular trauma during forceps delivery.9 patients were in the age range of 11-14 years. So, 29 (9.2%) of total cases belong to the pediatric age group.

There were 224 (70.2%) males and 95 (29.8%) females. The reason for more involvement of males may be due to their active involvement in outdoor activities as well as in violent and hazardous activities. Out of 319 patients 87(27.3%) were laborer, 79(24.8%) were agricultural worker, 74(23.2%) were students, 25(7.8%) were officials and 18(5.6 %%) patients were housewives. As laborers, agricultural workers & students were more exposed to outdoor activities, and hazardous objects, and due to a lack of awareness, so they were more prone. In the study, 60.2% of cases were below the poverty line and the majority of patients were from rural areas (63.6%).

The present study shows that sticks were the most common objects causing blunt ocular trauma in 71(22.2)% of patients followed by fists (17.8%), vehicles(14.1%), and wood (9%). Most of the patients were laborers or agricultural workers, so stick was the common object for them. In the study, the right eye was

involved in 172(54%) cases, left eye was involved in 134(42%).

Conjunctiva was found to be involved in 213(67%) patients, of which subconjunctival hemorrhage was seen in 123 (58%) patients and traumatic conjunctivitis was seen in 47 (22%) cases. Chemosis and conjunctival tear/ laceration were observed in 13% & 7% of cases respectively (Table 2). Cornea was affected in 150 patients, out of which epithelial defects were seen in 42(28%) patients, corneal edema in 32(21%) cases, abrasion in 26(17%) cases, corneal opacities and DM folds were seen in 15% & 13% cases respectively (Table-2). Lens was involved in 83(26%) patients out of 319 cases. Traumatic cataract was found in 29(34%) patients, subluxation in 23(28%) patients, dislocation in 13(1116%) cases and traumatic cataract with subluxation was seen in 12(15%) cases (Table-2).

TABLE 2: ANTERIOR SEGMENT FINDINGS.

1	LID AND ADNEXA	PERIORBITAL ECCHYMOSIS (61%)	LID LACERATION (17%)
1	CONJUNCTIVA	SUBCONJUNCTIVAL HAEMORRHAGE (58%)	TRAUMATIC CONJUNCTIVITIS (22%)
2	CORNEA	EPITHELIAL DEFECT (28%)	CORNEAL EDEMA (21%)
3	LENS	TRAUMATIC CATARACT (34%)	LENS SUBLUXATION (28%)
4	IRIS AND CILIARY BODY	HYPHAEMA (54%)	TRAUMATIC MYDRIASIS WITH SPHINCTER TEARS (13%)

Out of 319 patients Iris and the ciliary body were involved in 265 cases in the present study. Hyphema was most common finding seen in 144(54%) cases followed by traumatic mydriasis with sphincter tear 34(13%), traumatic mydriasis without sphincter tear 29(11%), iridodialysis 21(8%), traumatic iritis 24(9%), iridodonesis 13(5%) (Table-2). In this study, RAPD (Relative afferent pupillary defect) was present in only 39(12%) cases. Lid was involved in 182 Patients. Ecchymosis was seen in 112(61%) cases, black eye and crush wounds were seen in 13(7%) cases, lid tear/laceration29 (16%), lid edema in 18(10%) cases, abrasion and ptosis were seen in 3% case each (Table-2).

Out of the 319 Patients, vitreous involvement was seen in 115 Cases. Vitreous hemorrhage was most common 82(71%), followed By Vitreous hemorrhage with PVD 13(11%), Vitreous Opacity10 (9%), Posterior Vitreous detachment 7(6%), and Vitreous degeneration 3 (3%) (Table-3). Retinal involvement was seen in 101 cases. Berlin's edema was the most common finding seen in 57(57%) cases, followed by retinal hemorrhages 21(21%), tractional RD 9(8%), traumatic PVR+concussion changes at the macula (5%), and Berlin 'edema with macular hemorrhage in 4% cases (Table-3). Lesions of the choroid were seen only in 19 cases. The choroidal rupture was the most common choroidal lesion seen in 11(58%) cases, followed by choroidal hemorrhage in 4(21%), traumatic choroiditis, and choroidal detachment in 10.5% cases each (Table 3). Optic atrophy constituted a lesion of the optic nerve which was present in 13(4%) cases. Orbital injury in the form of blow-out fracture was seen in 13(4%) cases. Blunt ocular trauma affected IOP in 67 patients of which, traumatic glaucoma accounted for 44(66%) and hypotony in 23(34%) cases.

TABLE 3: POSTERIOR SEGMENT FINDINGS.

1	VITREOUS	VITREOUS HAEMORRHAGE (71%)	VITREOUS HAEMORRHAGE & PVD (11%)
2	RETINA	BERLINS EDEMA (57%)	RETINAL HEMORRHAGES (21%)
3	CHOROID	CHOROIDAL RUPTURE (58%)	CHOROIDAL HEMORRHAGE (22%)

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Most of the patients were managed by medical mode of management (67%); which consists of analgesics, antibiotics, vitamin C, systemic steroids, topical steroids, cycloplegics, and anti-glaucomatous drugs whenever required. Surgical management was required only in 33% of cases. Surgical management was required for 105 patients. Lens extraction was performed in 33(31%) cases, lid repair was done in 22(21%) cases, corneal injury repair done in 18(17%) cases, iridodialysis repair was done in 13(12%) patients and vitrectomy was required in 7(7%) cases (Table-4). 36 patients out of 319 suffered from refractive errors, among which 27(75%) were myopic & 9 (25%) were hypermetropic.

TABLE 4: DIFFERENT MODES OF SURGICAL MANAGEMENT.

SL. NO	MODES OF SURGICAL MANAGEMENT	NUMBER	PERCENTAGE
1	LID REPAIR	22	21%
2	PARACENTESIS	9	9%
3	LENS EXTRACTION	33	31%
4	IRIDODIALYSIS REPAIR	13	12%
5	VITRECTOMY	7	7%
6	REPAIR OF SCLERAL TEAR	3	3%
7	REPAIR OF CORNEAL TEAR	18	17%
8	TOTAL	105	100%

In the present study, the most common BCVA at presentation was 6/60-6/18(33.2%), followed by 6/18-6/6(27%). But at 6months follow up most common BCVA was 6/18-6/6(49.5%), followed by 6/60-6/18(38.6%). 11(3.45%) patients had no perception of light at presentation, which was reduced to only 3 cases (0.94%) at 6 months follow-up (Table-5). This study found that the most common visual impairment was of moderate category at initial presentation. But at 6 months follow-up patients mainly presented with mild visual impairment**.** B-scan was done only in 75 cases and the most common findings were vitreous hemorrhage 25(32%), traumatic cataract 14(19%), lens subluxation 10(13%), PVD 7(9%), RD 6(8%), lens dislocation 5(7%) (Table-6).

TABLE 5: EFFECT ON VISUAL ACUITY.

SL. NO	VISUAL ACUITY	BCVA AT PRESENTATION	BCVA AT 6 MONTHS FOLLOW-UP
1.	PL-ve	11(3.45%)	3(0.94%)
2.	PL+ve-CFCR	17(5.3%)	5(1.57%)
3.	CFCR-3/60	29(9.1%)	9(2.8%)
4.	3/60-6/60	69(21.6%)	21(6.6%)
5.	6/60-6/18	106(33.2%)	123(38.6%)
6.	6/18-6/6	87(27%)	158(49.5%)
7	TOTAL	319	319(100%)

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TABLE 6: B- SCAN FINDINGS.

SL. NO	B SCAN FINDINGS	NO OF CASES	PERCENTAGE
1	TRAUMATIC CATARACT	14	19%
2	POSTERIOR CAPSULE RUPTURE	6	8%
3	LENS SUBLUXATION	10	13%
4	LENS DISLOCATION	5	7%
5	POSTERIOR VITREOUS DETACHMENT	7	9%
6	RETINAL DETACHMENT	6	8%
7	CHOROIDAL DETACHMENT	1	2%
8	VITREOUS HAEMORRHAGE	25	32%
9	VITREOUS DEGENERATION	1	2%
10	TOTAL	75	100%

DISCUSSION.

In the present study, the incidence of trauma was 0.87% and that of blunt ocular trauma was 0.24% of the total OPD patients. According to WHO, 97% of the eye injuries occur due to blunt trauma [7]. Chua D et al reported ocular trauma in 5.1% of the study population, of which in about 40% the object that caused the trauma was blunt [8]. In a study by Pai et al, around 30% of eye injuries occur due to blunt objects the objects generally reported for blunt trauma are baseballs, rocks, and fists [9]. Pandita et al study showed an incidence rate of 20.5 per 1,00,000 and the rates of ocular injuries requiring hospital admission range from 8-57 per 1,00,000 population [10].

In the study, the range of the age group was 21 to 30 years. Prevalence of trauma was higher in the younger age group, because younger people are more active and energetic, hence more prone to injuries. In the present study, 29 (9.2%) of total cases belong to the pediatric age group. whereas in the study conducted by Takvam JA et al pediatric population was involved in around 14% of cases [11]. Tielsch J M et al stated that injuries were maximum in the age group of 21 to 30 years and more than 75 years [12].

The higher male preponderance (70.2%) in the study may be because the participants of the study were exposed to such dangers due to their occupation and hobbies, increased alcohol intake& high-risk-taking attitude. Pandita et al found that males account for 63.8% of all ocular injuries [10]. Danenberg et al reported that in their study 95% of the patients were males [13]. Ligget et al has 82% and 18 % of males and females respectively [14] a similar study by Laishram et al found that 69% of sufferers of blunt trauma were males [15].

Laborers and agricultural workers accounted for more than half of the present study population. Most of the patients (60.2 %) were below the poverty line and from rural (63.6 %) populations. Because of a lack of education, and awareness, limited access to healthcare facilities, and more exposure to hazardous objects, these groups of populations are more prone to injuries. Agricultural, workplace-related injuries and assault were the main causes of blunt ocular trauma and sticks were the most common object causing blunt ocular trauma in 71 (22.2) % patients followed by fists (17.8%), vehicles (14.1%), and wood log (9%). Most of the patients were laborers or agricultural workers, so stick was the common object for them. Shashikala P et al reported that 50.7% of blunt ocular trauma cases were workplace-related [16]. Misra S et al that such injuries were common among patients who had agriculture as their occupation [17]. A study by Laishram et al found that the resident hospitals in urban areas reported more such incidences than those in rural areas [15]. The prevalence of ocular trauma is contradictory in terms of rural and urban areas as reported by the Ocular Trauma Society of India [18].

More than 50% of the patients had injuries in the right eye. Danenberg p et al reported similar findings where the injury of the right eye was 50% and that of the left and both eyes were as low as 0.4% [13]. Whereas Ligget et al found the right eye to be involved in 43%, the left eye in 41%, and both eyes in 11% of patients [14]. There were more injuries in the anterior region than that in the posterior region. In studies by Pai et al, the most

commonly involved ocular structure was conjunctiva (84.3%) [9]. Bruce M Zagelbaum and Eric D. Donenfeld have reported that corneal injuries as the most common injuries, whereas in the present study, epithelial defect was the most common finding, followed by corneal edema [19]. Optic atrophy and blowout fracture were seen only in 13 cases each.

Blunt trauma had affected IOP in 67 cases; of which glaucoma occurred in 44(66%) cases and hypotony in 23(34%) cases. 36 patients suffered trauma-induced refractive error, 3/4th of which were myopic. Alam M et al studied injuries of blast victims [20]. Around 48% of the patients had abrasion of the cornea, 38% had a hemorrhage in the vitreous chamber, and traumatic cataract in 30.55%) The study also shows significant vitreous involvement with vitreous hemorrhage being the most common finding. In the study by Movahedinejad et al, 74.5%required surgical intervention, and 25% required medical management where surgical repair of corneal laceration (18%) and blepharoplasty (13%) were among the most frequently done surgeries [21].

Alam M et al studied the type and severity of ocular injuries in blast victims of which final best corrected visual acuity (BCVA) improved in 51.85% of eyes, remained unchanged in 45.37% of eyes, and worsened in 2.77% of eyes [20]. Pandita et al reported final BCVA greater than and equal to 6/12 was found in 590 eyes, 6/12-6/60 in 143 eyes, and greater than and equal to 6/60 in 88 eyes [10]. In those with poor outcomes (final vision <6/60), late presentation beyond 48 hours was seen in 41.2% of cases.

In this study, 75 patients underwent B-scan USG. The most common findings on B-scan USG were vitreous hemorrhage (32%) followed by traumatic cataracts (19%) and lens subluxation (13%). Choroidal detachment was found in 2% of cases. Lens lesions were detected only in 14 cases on B-scan, vitreous lesions were accurately diagnosed by B-scan USG in 33 cases and Retinal detachment was diagnosed by B-scan USG in 6 cases. B-scan USG accurately diagnosed 6 posterior lens capsule ruptures, 7 posterior vitreous detachments, and 1 choroidal detachment which were not evident clinically. In the study B scan USG was a better diagnostic tool in identifying posterior segment lesions than anterior segment lesions. Thus, it is suggested B-scan USG be performed in every patient with blunt ocular injury suspicious of having posterior segment pathology. A study by Singh and Mutreja et al documented vitreous hemorrhage and retinal detachment in 20 and 16 patients respectively [22]. Yusuf et al study observed that the most common finding was traumatic cataract (57, 78.1%), followed by vitreous hemorrhage (7, 9.6%), and retinal detachment (4, 5.5%) [23].

GENERALIZABILITY.

The study provides insights into blunt ocular trauma epidemiology, with 0.87% overall incidence and 0.24% specifically for blunt trauma. The predominance of younger male laborers/agricultural workers aligns with previous studies. Anterior segment injuries, refractive errors, and right eye involvement are common, warranting tailored diagnostic and treatment approaches. B-scan ultrasonography proves useful for detecting posterior segment lesions. Generalizability requires consideration of regional differences in cultural, occupational, and healthcare contexts, urging collaborative research efforts for a comprehensive understanding of ocular trauma management.

CONCLUSION.

Young male, laborers from rural populations are more prone to blunt ocular trauma. Agricultural and workplace-related injuries were the most common cause; sticks being the most common object of blunt ocular trauma. Traumatic cataract, subconjunctival hemorrhage, and hyphaema were the predominant anterior segment findings whereas vitreous hemorrhage and Berlin's edema were predominant posterior segment findings. Most patients were medically managed. Lens extraction was the most commonly performed surgery. Vitreous hemorrhage was the most common B-scan finding.

B-scan ultrasonography is recommended while investigating these injuries this aids in the proper preparation of the surgery with an accurate understanding of the injury.

LIMITATION.

The study was conducted in a specific location so the findings can be based on the occupation of the patients in that location. Such multicenter studies are required to confirm the findings of the study.

RECOMMENDATION.

Educating people, and creating awareness to adopt protective measures in the workplace can prevent the occurrence of blunt ocular trauma, and at the same time rapid diagnosis, early referral, accurate investigations, and appropriate management can prevent complications following ocular trauma.

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LIST OF ABBREVIATION.

BCVA: Best Corrected Visual Acuity
VA: Visual Acuity
RD: Retinal detachment
BETT: Birmingham eye trauma terminology

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This study was not funded by any authority or agency.

CONFLICT OF INTEREST.

There was no conflict of interest.

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