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Clinical and Ultrasonographic Study of Ocular Manifestations of Blunt Trauma to the Eye

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ABSTRACT

Background: Ocular injury is a major health problem in India, blunt trauma being one of the leading causes of ocular morbidity and blindness. Worldwide, there are about 55 million incidents of ocular injuries annually, 750,000 of which require hospitalization. The objective of the study was to conduct a clinical and ultrasonographic study of ocular manifestations of blunt trauma to the eye.

Methods: Included in this study are 100 patients, examined from September 2016 to August 2018 at causality department of M.G.M. Medical College & L.S.K. Hospital, Kishanganj, Bihar, India.

Results: A detailed examination using a torch light was conducted. Snellen's chart was used to document vision. A Schiotz tonometer was used to measure intraocular pressure; however, in a few severely damaged globe cases, both intraocular pressure and vision could not be reliably recorded. In every instance, direct ophthalmoscopy was carried out. There were very few situations in which indirect ophthalmoscopy might be used. In the majority of instances, slit lamp examination was done. All patients underwent gonioscopy, except those who had only subconjunctival bleeding and were not gonioscopy. In some circumstances, gonioscopy was not possible. Patients with traumatic mydriasis, miosis, sphincter tears, subluxation, lens displacement, and iridodialysis who did not have media opacities underwent retinoscopy.

Conclusion: Blunt ocular trauma is more common in children and young adults, and the majority of injuries are caused by traffic accidents and occupational injuries. Stone injuries accounted for 20 cases (20%), followed by ball injuries (17%) and stick injuries (16%), all of which resulted in blunt eye trauma. In 70 cases (70%) of this investigation, the front section was more frequently afflicted. Had the patients worn safety glasses while working or playing, many of the injuries would have been avoided.

Key-words: Blindness, Blunt trauma, Ocular Manifestations, Ocular morbidity, Ultrasonographic

INTRODUCTION

Ocular blunt trauma (OBT) is the term used to describe any closed-globe injury in which ocular damage is caused by mechanical deformation and/or direct energy delivery [1].

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Ocular trauma is an avoidable public health concern on a global scale. It is one of the main causes of ocular morbidity and monocular blindness in the world [2].

Worldwide, there are about 55 million incidents of ocular injuries annually, 750,000 of which require hospitalization [3]. These injuries can occur in almost any situation, including homes, workplaces, places of recreation and sports, farms, attacks, and car accidents. Reports indicate that between 1% and 5% of Indians suffer from eye injuries [4]. OBT harms the eyes through the coup and contrecoup process or ocular compression.

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The concept of coup and contrecoup injury was first put forth by Courville [5] to characterize brain damage brought on by severe head trauma. Road traffic injuries (RTIs), physical assault, and explosive injuries are frequently the causes of severe bilateral ocular injuries [6]. Ocular trauma can have a significant psychological and financial impact on the affected individual, their family, and society as a whole [7]. Polytrauma is often associated with severe bilateral eye injuries sustained in motor vehicle accidents and physical assaults. Additionally, treating such significant bilateral eye injury is often difficult and complex, requiring strategic management and a multidisciplinary approach. Therefore, determining the epidemiology and risk factors of this kind of trauma is crucial. The study aimed to conduct a clinical and ultrasonographic study of ocular manifestations of blunt trauma to the eye.

MATERIALS AND METHODS

Research design- In addition to patients referred with blunt eye damage from the etiology department of M.G.M. Medical College & L.S.K. Hospital, Kishanganj, Bihar, India, patients having a history of blunt injury to one or both eyes were chosen from the ophthalmology department's outpatient and inpatient patients.

Methodology- One hundred patients, who were checked between September 2016 and August 2018, are part of this study. There were significant differences in the amount of time that passed between the injury and the consultation at these facilities. The longest injury consultation period is eleven years, while the earliest is two hours. A detailed history of the patient's age, sex, occupation, causative agents, length of injury, force direction, and any symptoms that followed the injury was obtained when the patient presented with a history of blunt trauma.

A detailed investigation was conducted using a torchlight. Snellen's chart contained information about vision. Schiotz tonometer was used to measure intraocular pressure; however, in some severely damaged globe cases, it was not possible to record intraocular pressure and vision reliably. Every time, a direct ophthalmoscopy was done. Only a few situations allowed for the use of indirect ophthalmoscopy. Most of the time, slit lamp inspection was used.

Inclusion criteria

- To understand the long-term effects and problems of blunt trauma, cases with both recent and old injuries were included in this study.

Exclusion criteria

- Except for those who had only subconjunctival hemorrhage and were not undergoing gonioscopy, all patients underwent gonioscopy.
- Some cases prevented gonioscopy from being conducted. Patients without media opacities who had traumatic mydriasis, miosis, sphincter tears, subluxation, lens displacement, and iridodialysis underwent retinoscopy.

Plain-X-ray- Anteroposterior skull X-rays were taken, together with measurements of the water's nose, chin, and reese parieto orbital oblique projection. In every medicolegal case, whenever necessary.

B scan- Patients suspected of having retinal detachment with or without media opacities or vitreous hemorrhage, underwent ultrasonography.

CT scan- Usually used for orbital fractures, traffic accidents, H/O falls, and medical malpractice instances involving severely wounded globes and adnexes.

Every four days, patients who had only subconjunctival hemorrhages were contacted for follow-up. Following their departure from the ward, patients were contacted for follow-up appointments once every week, twice a month, three times, and six times, as needed.

Statistical Analysis- Data was entered in Microsoft Excel and analysed using IBM SPSS version 23. Statistical tests were applied based on the type of variable and normality of the data.

Ethical Approval- The study was approved by the Institutional Ethics Committee.

RESULTS

As shown in Table 1, out of 100 patients, 61 cases (61%) are below the age of 35 years. Therefore, this number confirms that young people and those in the productive age group are the ones who sustain eye injuries the most frequently. Out of 100 patients, males were more involved in 73 cases (73%).

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Out of 100 patients, agricultural-related injuries were the most common, with 36 cases (36%). Out of 100 patients, farmers were the most affected with 36 cases (36%). Out of 100 patients, 31 cases (31%) had consulted after 5 days or more; if they had shown earlier, the visual prognosis could have been better.

Table 1: Distribution of patients according to Age, Sex, source of injury, Risk in occupation, and Time interval following blunt trauma

	Number of cases	**Percentage (%)**
Age group		
Birth to 15	16	16
16-25	16	16
26-35	29	29
36-45	22	22
46-55	11	11
Above 55	6	6
Total	100	100
Sex		
Male	73	73
Female	27	27
Total	100	100
Source of injury		
Agricultural	36	36
Occupational injuries	26	26
Sports & Play	22	22
Travel	11	11
Assault	05	05
Total	100	100
Occupation		
Farmer	36	36
Worker	27	27
Student	20	20
House wife	05	05
Others	12	12
Total	100	100
Time interval		
Less than 24 Hrs.	57	57
1 -5 days	12	12
5- days to 1 month	05	05
1 month to 12 months	18	18
More than 12 months	08	08
Total	100	100

Out of 100 patients, stone was the most common object causing blunt trauma in 20 incidents (20%) (Table 2).

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Table 2: Showing the objects causing blunt injury

Object	No. of cases	Percentage (%)
stone	20	20
Ball	17	17
Stick	16	16
RTA	14	14
Branch of tree	11	11
Iron rod	08	08
Fist	07	07
Fall	07	07
Total:	100	100

In Fig. 1, out of 100 patients, many patients had multiple involvements in the eyes involving more than one structure.

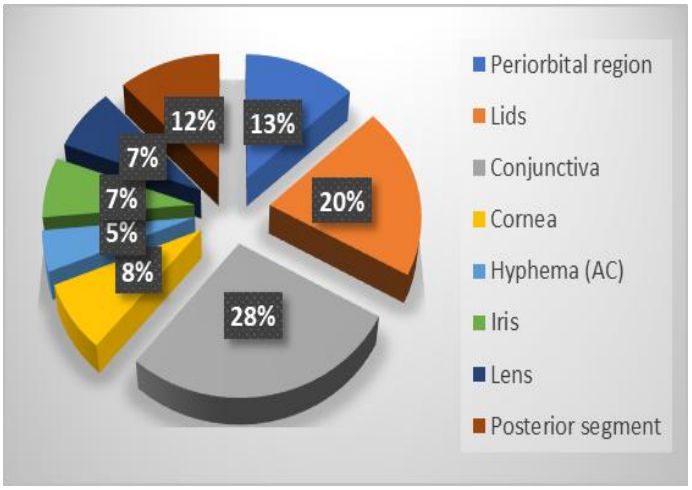

Fig. 1: Showing ocular structure involvement

In Fig. 2, out of 100 cases, the majority had anterior segment involvement with 70 cases (70%).

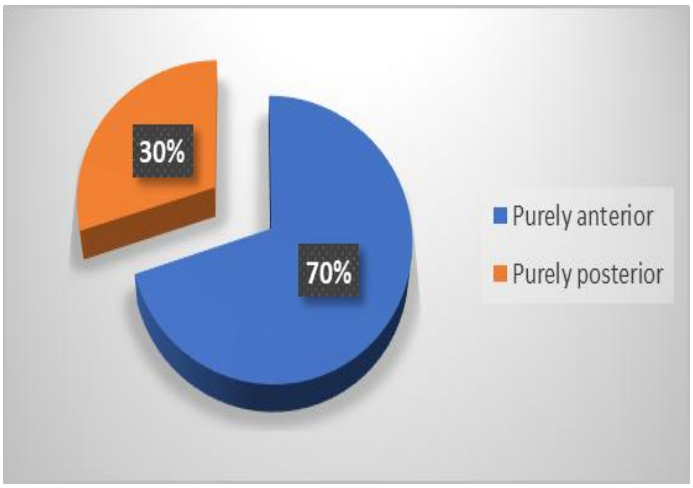

Fig. 2: Distribution of cases according to segment of the eye involved

In Fig. 3, out of 100 patients, 33 patients had periorbital lesions, out of which ecchymosis was the most common finding with 16 cases (16%). Out of 100 patients, lids were involved in 51 patients, out of which ecchymosis was a common result present in 21 cases (21%) (Fig. 4).

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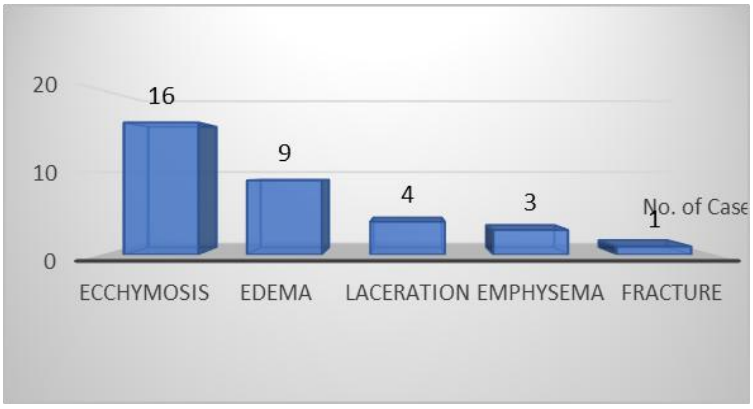

Fig. 3: Showing the distribution according to periorbital involvement

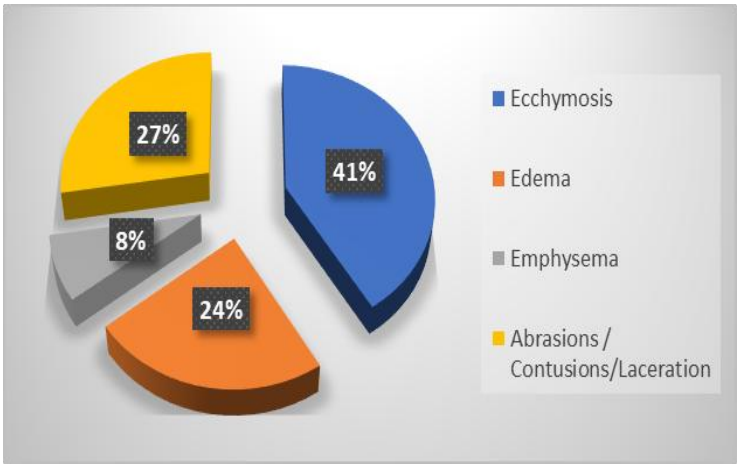

Fig. 4: Involvement of lids in blunt ocular trauma

Out of 100 cases, conjunctival lesions were seen in 70 cases, the majority had subconjunctival hemorrhage, with 32 cases (32%). 20 patients (20%) had corneal involvement, out of which corneal abrasions were a common finding in 04 cases (04%) (Table 3).

Table 3: Showing distribution of cases according to conjunctival and corneal involvement

	No. of cases	**Percentage (%)**
Conjunctiva		
Subconjunctival hemorrhage	32	32
Circum corneal ciliary congestion	10	10
Chemosis	22	22
Laceration	06	06
Total	70	70
Cornea		
Abrasion	04	04
Partial laceration	03	03
Complete laceration	03	03
Descemet's tear	01	01
Edema	05	05
Ulcer	02	02
Blood staining of cornea	02	02
Total	20	20

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Table 4, shows the comparison of the Grade of hyphema with a degree of angle recession, case no. 1, 8, 95, 97, 21, 50 and 64 (7 cases**)** had 25 to 50% of primary hyphema with 90-180° of angle recession, and case no. 23, 46, 76 (3 cases) had 25% of primary hyphema with **<**90° of angle recession, and case no. 28, 87 (2 cases) had 50 to 75 % of primary hyphema with angle recession of 90-180°.

Table 4: Comparison of the grade of hyphema with the grade of angle recession

Case Number	**Primary hyphema (AC)**	**Angle recession (Degrees)**	
1,08	25-50%	90-180	
23, 46, 76	25%	<90	
95, 97, 21	25-50%	90-180	
28	50-75%	>180	
50, 64	25-50%	90-180	
87	50-75	>180	
Angle recession (Degrees)	Case Numbers	No. of cases	Primary hyphema (%)
<90	23,46,76	3	25-50
90-180	1,8,95,97,21, 50,64	7	25
>180	28,87	2	50 - 75

Out of 100 cases, 18 cases (18%) had iris involvement majority being iridodonesis in 09 cases (09%) (Fig. 5). Out of 100 cases, 19 cases (19%) had iris involvement, out of which 08 patients (08%) had traumatic miosis and 08 cases (08%) had traumatic mydriasis (Fig. 6).

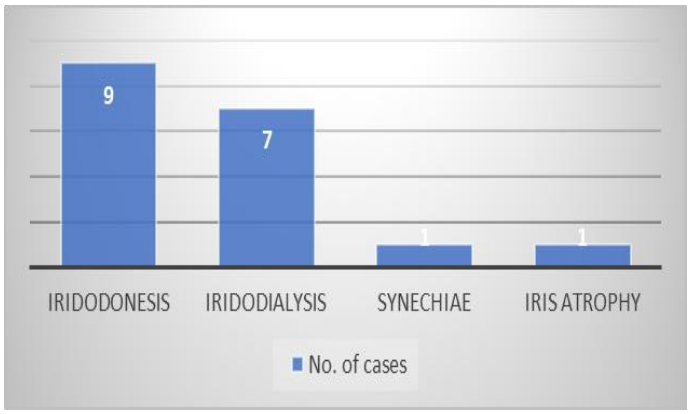

Fig. 5: Showing the division of cases according to iris connection

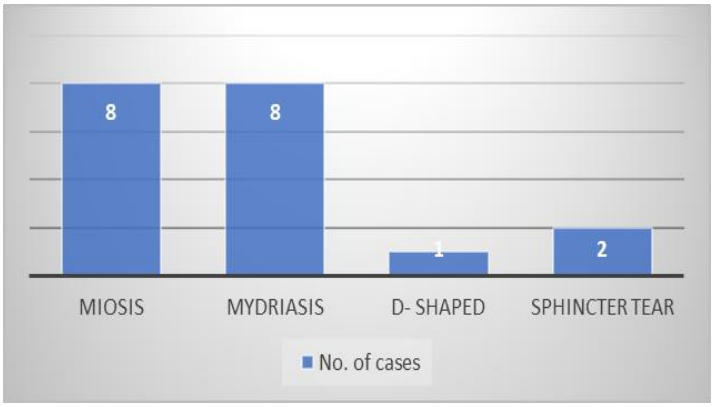

Fig. 6: Showing the distribution of cases according to pupil involvement

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Out of 100 patients, the lens was involved in 19 patients (19%), out of which the major finding was partial opacity seen in 07 cases (07%) (Fig. 7). Out of 100 patients, as per clinical findings of posterior segment damage, 30 patients (30%) (Table 5).

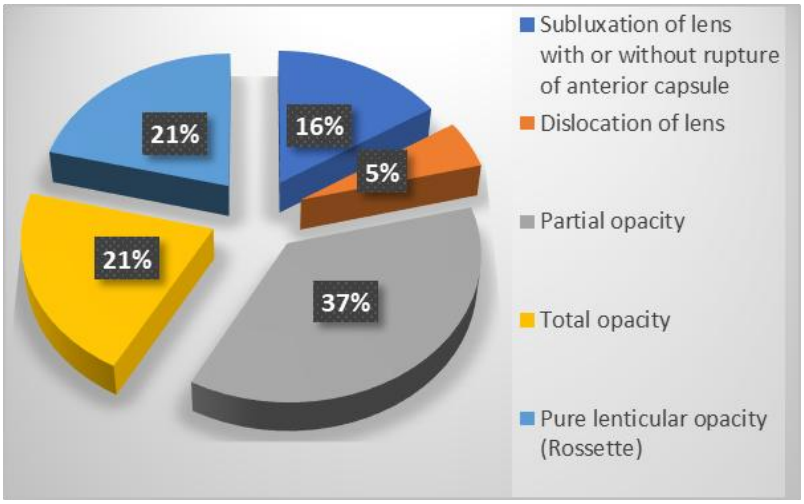

Fig. 7: Showing the pattern of lens involvement

Table 5: Showing the sharing of cases as per USG & clinical outcomes of posterior segment damage

Clinical findings	No. of cases	Percentage (%)
Vitreous		
Vitreous herniation into anterior chamber	03	03
Vitreous hemorrhage	05	05
Retina		
Berlin's edema	02	02
Retinal edema	03	03
Subretinal neovascularization	01	01
Retinal detachment	05	05
Macula		
Macular edema	05	05
Macular hole	02	02
Macular cyst	01	01
Choroid		
Choroidal hemorrhage	01	01
Choroidal rupture	02	02
Total	30	30

Out of 100 patients, cases 01, 14, and 53 (03%) had traumatic optic neuropathy. Cranial nerve injuries 02 cases (02%) had total 3rd nerve paralysis, 02 cases (02%) had 6 nerve paralysis, 03 cases (03%) had isolated 6th nerve paralysis, 04 cases (04%) had combined 3rd and 6th nerve paralysis, out of 100 patients. 03 cases (03%) had corneo scleral rupture (Table 6).

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Table 6: Showing cases with traumatic optic neuropathy, cranial nerve injuries, corneo scleral rupture

	No. of cases	Percentage (%)
Traumatic optic neuropathy		
Case No 1, 14, 53	03%	03
Cranial nerve injury		
Total 3rd nerve paralysis	2	2
4 nerve paralysis	2	2
6th nerve paralysis	3	3
Combined 3rd and 6th nerve paralysis	4	4
Corneo scleral rupture		
Case No 2,47,90	03%	03

Out of 100 cases, 40 cases (40%) had best modified visual acuity of 6/6, of remaining 60 cases, the visual acuity was 6/9 in 15 cases (15%), 6/12 in 12 cases (12%), 6/18 in 05 cases (05%), 6/24 in 04 cases (04%), 6/36 in 03 cases (03%), 04 cases (04%) had 6/60, 01 cases (01%) had Cf 5mt, 01 cases (1%) had Cf 4mt, 05 cases (05%) had Cf 1mt, 09 cases (09%) had PL^+ +PR^+ and 01 cases (01%) had no PL (Table 7).

Table 7: Showing final visual acuity percentage of final visual acuity

Visual acuity	No. of cases	Percentage (%)
6/6	40	40
6/9	15	15
6/12	12	12
6/18	05	05
6/24	04	04
6/36	03	03
6/60	04	04
Cf 5mt	01	01
Cf 4mt	01	01
Cf 1mt	05	05
$P1^+$+PR^+	09	09
No PL	01	01
Total	100	100

DISCUSSION

The age range of the 100 cases in this study ranged from 3 months to 80 years of age. The majority of cases (61%) occurred in children and young adults under the age of 35. Children and young adults are more vulnerable to injuries; this could be because they are more likely to sustain blunt injuries and because they are less aware of the risks associated with child injuries.

The highest prevalence of ocular injuries was observed in the 16–30 age range (63%) and in children under the age of 16 (23.2%), according to Jain BS et al. In this study, it is 61% because children are left to play unattended by their parents [8].

In this study, there were 73% men and 27% women. The male-to-female ratio was approximately 3:1, which is almost identical to the study by Razeghinejad *et al.*, which had a male-to-female ratio of 6.5:1 [9]. Incidence was 30.7% in females and 69.3% in males, per Wagh *et al.* [8]. According to this study, stones were the most frequent object that resulted in blunt injuries to the eye (20%), followed by balls (17%) and sticks (16%). In the study of Wagh *et al.* stones were the most common cause of injury [8].

The most common clinical finding in this study was a black eye or periorbital contusion, which occurred in 16 cases (16%) and involved ecchymosis to the eyelid and/or periorbital region. This is consistent with a study by Orlando and Doty, who evaluated 125 patients with

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ocular injuries sustained during sports and reported an incidence of 36% of lids of periorbital contusion injuries. Other findings included periorbital edema (09%), periorbital laceration (4 cases, 04%), crepitus (emphysema) (03%), lid abrasion (08%), and lid laceration (06%) [10].

32 patients had solely subconjunctival bleeding. It has been noted that the anterior portion of the eye was damaged in 70 cases (70%) more often than the posterior segment (30%). In a study of 5671 patients with ocular injuries, Abbott *et al.* discovered that superficial or periorbital ocular structures accounted for 98.3% of all injuries [11]. Out of 32 instances, it was the most prevalent clinical finding (32%). The subconjunctival hemorrhage was not graded according to RC Guptha's description due to different injury consultation intervals.

Twenty cases (20%) had corneal findings in this investigation; of these, four eyes had corneal abrasion, five eyes had corneal edema, and two cases had corneal blood staining. All five (5%) of the ocular edema cases were linked to hyphema. After a few days of treatment, the IOP in these patients returned to normal after initially being slightly elevated. There were four corneal abrasion cases (04%) observed. All recovered in a single day. Three patients had a partial thickness corneal tear that extended two to three millimetres in the superior temporal region, directly away from the limbus.

37 clinical findings involved the iris and pupil, with traumatic mydriasis being the most common, occurring in 8 instances (08%), followed by miosis in 8 eyes (08%), synechiae in 1 case (01%), and traumatic sphincter tear in 2 cases (0.2%). Our research differs from Miller *et al.* analysis of 205 patients, of which 79 suffered damage to the iris and pupil [12].

In this study, 12 cases (12%) had angle recession. Our study does not match with other studies Miller *et al.* noted 80.5% of angle recession [12] and Sihota *et al.* noted a 71% incidence of angle recession following blunt trauma [13]. This finding corresponds to the study conducted by Miller *et al.* [12].

In contrast to the 52 eyes out of 212 in a study by Miller *et al.*, 19 cases had lenticular involvement in the form of subluxation, dislocation, and lenticular opacities, with or without anterior capsule rupture [12].

02 cases of Berlin's edema (2%) out of 30 cases (30%) of post-segment injury were observed in this study, all of them cleared within 2-5 days, none of them included the macular area. Only 02 cases (02%) of macular holes were found in an old case of blunt injury with central scotoma and parafoveal fixation, whereas 09% of macular holes were attributable to trauma. There was an associated angle recession.

Out of 100 cases, 40 cases (40%) of had best corrected visual acuity of 6/6, of remaining 60 cases, the visual acuity was 6/9 in 15 cases (15%), 6/12 in 12 cases (12%), 6/18 in 05 cases (05%), 6/24 in 04 cases (04%), 6/36 in 03 cases (03%), 04 cases (04%) had 6/60, 01 cases (01%) had Cf 5mt, 01 cases (1%) had Cf 4mt, 05 cases (05%) had Cf 1mt, 09 cases (09%) had PL^+ +PR^+ and 01 cases (01%) had no PL.

Two instances of secondary glaucoma were reported. One example was blunt trauma with angle recession glaucoma that was quite old, while another involved blunt trauma with angle recession and hyphema that later developed secondary glaucoma and corneal blood staining. According to Miller *et al.* investigation, there was no discernible increase in IOP in cases of angle recession [12].

Three cases (3%) of corneoscleral rupture, which began at the cornea's extreme periphery and extended through the sclera, were linked to iris tissue prolapse. Following iris abscission/repositioning, 10.0 vicryl was used for suturing. This result nearly matches that of research by Kylstra *et al*. that found a 3.5% incidence of corneoscleral rupture [14].

CONCLUSIONS

This study and other epidemiological research over the last 15 years have made it abundantly evident that ocular damage is linked to varying degrees of vision and earning ability loss, which can have social and economic repercussions. This study suggests that blunt ocular trauma is more common in children and young adults and that the majority of injuries are caused by traffic accidents and occupational hazards. Stone injuries accounted for 20 cases (20%), followed by ball injuries (17%) and stick injuries (16%), all of which resulted in blunt eye trauma. The anterior segment was more frequently impacted in this study, in 70 cases (70%). Had the patients worn safety glasses while working or playing, many of the injuries could have been avoided. Males in rural areas are more likely to sustain ocular blunt trauma, which is primarily related to agriculture

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and involves multiple ocular structures in the same eye. Ocular consequences can vary from minor injuries to serious conditions that could cause blindness. To lower ocular morbidity, health education emphasizing early detection and timely treatment of ocular injuries is advised.

LIMITATIONS

More study is required in this field to create and assess novel therapies for the management and prevention of all kinds of eye injuries. To advance this field of study and preserve and salvage vision, interdisciplinary approaches and community-based tactics will be crucial. We must emphasize further how crucial it is to take preventative action to lower the frequency of these situations.

CONTRIBUTION OF AUTHORS

Research concept- Dr. Mohammed Yasser
Research design- Dr. Somnath Sarkar
Supervision- Dr. Ravi Prakash Pilania, Dr. Mohammed Yasser
Materials- Dr. Imran Azeem
Data collection- Dr. Mohammed Yasser
Data analysis and interpretation- Dr. Mohammed Yasser, Dr. Somnath Sarkar
Literature search- Dr. Mohammed Yasser
Writing article- Dr. Ravi Prakash Pilania, Dr. Mohammed Yasser
Critical review- Dr. Mohammed Yasser
Article editing- Dr. Mohammed Yasser
Final approval- Dr. Mohammed Yasser, Dr. Imran Azeem, Dr. Somnath Sarkar, Dr. Ravi Prakash Pilania

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