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Original Research Article

A Prospective Study on the Consequences of Blunt Ocular Trauma on Intraocular Pressure in a Tertiary Care Centre

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Abstract

Background: Ophthalmic injuries are the primary reason for blindness, visual impairment, and loss of vision in one eye among children worldwide. This represents a preventable public health problem. The present study was conducted to evaluate the clinical features, visual acuity, intraocular pressure changes, and visual outcomes following blunt trauma.

Methods: A total of n=100 patients (101 eyes) diagnosed with blunt ocular trauma were evaluated by taking a detailed history, vision by Snellen's visual acuity chart, slit lamp biomicroscopy, fundus examination under full drug mydriasis by indirect ophthalmoscopy and +90 D lens, gonioscopy with Goldmann four mirror gonio lens and IOP by Goldmann applanation tonometer. In cases with hazy media due to corneal edema or hyphema, gonioscopy was deferred in the first visit and B-Scan was performed to look for the posterior segment.

Results: In this study, out of 100 patients, 62% (n=62) patients presented to the hospital within 3 days of trauma. N=53 eyes (52.4%) eyes had angle recession and 44.5% (n=45) eyes had open angles. In this study, at the time of presentation 56.4% (n=57) eyes had normal IOP, 28.7% (n=29) eyes had raised IOP, and 14.8% (n=15) eyes had low IOP. By 12 weeks 98.0% (n=99) eyes had normal IOP and 0.9% (n=1) eyes each had raised and low IOP. Out of 101 eyes, 61.3% (n=62) eyes required only medical management, and 38.6%(n=39) eyes underwent surgical management. The majority 57.4% (n=58) eyes had circumcorneal congestion and 0.9%(n=1) eyes had RAPD. Out of n=29 eyes with raised IOP, 48.27% (n=14) eyes had a vision in the range of 1/60-PL positive, and only 3.4%(n=1) eyes had a vision of more ≥ 6/12. By 12 weeks majority 58.6% (n=17) eyes had ≥6/12 vision and only 3.4%(n=1) eyes had a vision of 1/60-PL positive.

Conclusion: This study highlights the epidemiology, clinical presentations, and consequences of blunt ocular trauma on intraocular pressure. As the angle structures can be severely injured following trauma, it emphasizes regular follow-up of such patients to prevent late-onset glaucoma. The public should be made aware of the risks of ocular trauma, and morbidity with a delayed presentation to the hospital.

Keywords: Ocular Injuries, Hyphema, Blunt Ocular Trauma, Intraocular Pressure, Best Corrected Visual Acuity, Closed Globe Injury.

Introduction

Ocular trauma is one of the leading causes of blindness worldwide. Eye trauma constitutes 7% of all bodily injuries and 10%–15% of all eye diseases. [1] About half a million people in the world are blind as a result of eye injuries. About 30-40% of monocular blindness is due to ocular trauma. [2] The global annual incidence of ocular trauma is around 55 million, of which 750,000 cases require hospitalization each year. [3] It has been estimated that 90% of all ocular injuries are preventable. [4] Ocular blunt trauma comprises all closed-globe injuries in which mechanical deformation and or direct energy delivery cause ocular damage. [5] These injuries can occur in almost any setting including recreational and sport-related, workplace, home, assault, agriculture, and road traffic accidents. [6] In India, the reported incidence of ocular trauma varies from 1% to 5%. [7] Ocular trauma constitutes a significant portion of emergencies presenting to an eye hospital. The clinical examination at the time of presentation is very important for determining the extent of the injury and for formulating the treatment plan. one crucial factor that has to be taken care of is intraocular pressure, particularly in an early period of trauma. Intraocular pressure elevation can occur for a variety of reasons including hyphema and inflammation. Traumatic tears extending into the face of the ciliary body are associated with a risk of glaucoma later in life, which if not monitored well can result in blindness. In contrast, the ciliary body may react to severe blunt trauma by temporary cessation of aqueous secretion (ciliary shock) resulting in hypotony. [8] The present study is therefore being conducted to evaluate the clinical features, visual acuity, intraocular pressure changes, and visual outcomes following blunt trauma.

Material and Methods

This prospective study was conducted in the Department of Ophthalmology at Sarojini Devi Eye Hospital and Gandhi Hospital. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language. Those willing to participate voluntarily were included in the study.

Inclusion Criteria

1. Patients with blunt ocular trauma.
2. All age groups.
3. Males and females.
4. Available for follow-up.
5. Willing to participate in the study voluntarily.

Exclusion criteria

1. Patients diagnosed with glaucoma.
2. Patients with open globe injury.
3. Patients with pre-existing ocular disorders.

A total of n=100 patients (101 eyes) diagnosed with blunt ocular trauma were evaluated by taking a detailed history, vision by Snellen's visual acuity chart, slit lamp biomicroscopy, fundus examination under full drug mydriasis by indirect ophthalmoscopy and +90 D lens, gonioscopy with Goldmann four mirror gonio lens and IOP by Goldmann applanation tonometer. In cases with hazy media due to corneal edema or hyphema, gonioscopy was deferred in the first visit and B-Scan was performed to look for a posterior segment. The patients were examined on a regular interval, first after one week and then after three and six weeks. The patients got a thorough ocular examination at each appointment, which included a slit-lamp examination and a vision evaluation using Snellen's chart. At each visit, changes, if any, were noted.

Statistical analysis: All the results obtained were uploaded on an MS Excel

spreadsheet and analyzed by SPSS version 21 in Windows format. Continuous variables were represented as mean, standard deviations, and percentages, and categorical variables were studied using t-test/fisher's exact test all the p values (<0.05) were considered as significant.

Results

In the present study, out of n=100 cases, the majority belonged to the age group of 21-30 years 22% followed by the 11-20 age group 21% the least belonged to the 61-70 age group 3% depicted in Table 1. Out of n=100 cases, 78% were males and 22% were females with male to female ratio of 3.5:1.

Table 1: Age-wise distribution of cases in the study.

Sl No	Age in Years	Frequency (N=100)
1	1-10	8
2	11-20	21
3	21-30	22
4	31-40	19
5	41-50	14
6	51-60	13
7	61-70	3
8	Total	100

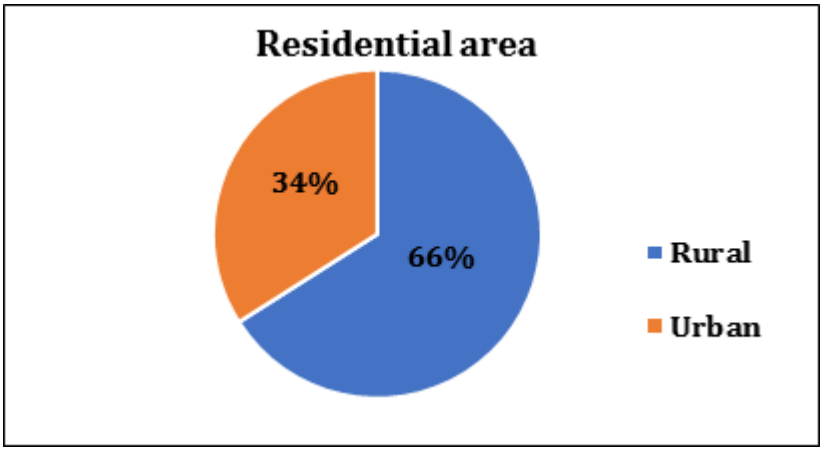

Figure 1: Showing the residential areas of cases included in the study.

In this study, most of the eye trauma occurred in students in 33% followed by 24% in farmers while working in the field. 16% of housewives endured ocular trauma and daily wage workers had ocular trauma in 10% of total cases. The detailed distribution of cases of ocular trauma with other categories of occupation has been depicted in Figure 2. The mode of injury was established in this study we found the most common cause of injury was stick injuries in 32% of cases, followed by ball in 15%, fist fight in 11% of cases, firecracker in 9% of results, stone injuries 5%, Belt injury 4%, bottle and rod injuries 3% each injury due to fall in 2% and other injuries in 16% of cases. In this study, out of 100 patients, 55% (n=55) right was affected, 44% (n=44) left eye was affected and 1% (n=1) of both eyes were affected. In the present study, 62% (n=62) of patients presented to the hospital within 3 days of trauma. In this study, the majority 57.4% (n=58) eyes had circumcorneal congestion and 0.9%(n=1) eyes had RAPD (Table 2).

Table 2: Anterior Segment Findings in the Cases of the Study

Anterior Segment Finding	Frequency
Lid edema	37
Lid ecchymosis	16
Lid laceration	8
Subconjunctival hemorrhage	21
Circumcorneal congestion	58
Corneal edema	47
Partial thickness corneal tear	4
Corneal epithelial defect	9
hyphema	45
AC cells and flare	10
Angle recession	53
RAPD	1
Sphincter tears	17
Traumatic mydriasis	30
Iridodialysis	7
Iridodonesis	8
Posterior synechiae	9
Traumatic cataract	42
Subluxated lens	18
phacodonesis	14
Vitreous in AC	12

In this study, based on the posterior segment findings we found 32.6%(n=33) eyes had a normal posterior segment, 25.7% (n=26) eyes had a vitreous hemorrhage and 0.9% (n=1) eyes had traumatic optic neuropathy (Table 3)

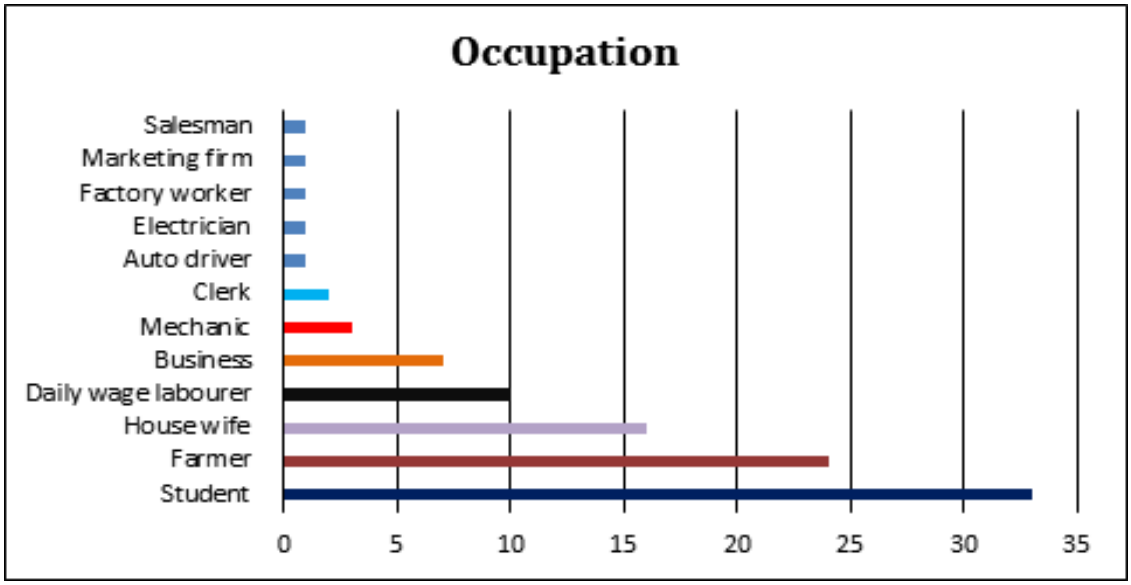

Figure 2: Distribution of cases of eye trauma based on occupation.

Table 3: Posterior Segment Findings in the Cases of the Study

Posterior segment findings	Frequency
Normal fundus	33
Vitreous hemorrhage	26
Belins Edema	8
Posterior Vitreous Detachment	7
The dislocated lens in the vitreous cavity	6
Subretinal hemorrhage	3
Choroidal Detachment	2
Retinal detachment	2
Traumatic optic neuropathy	1

In the present study, 52.4% (n=53) eyes had angle recession and 44.5% (n=45) eyes had open angles. In this study, at the time of presentation 56.4% (n=57) eyes had normal IOP, 28.7% (n=29) eyes had raised IOP, and 14.8% (n=15) eyes had low IOP. By 12 weeks 98.0% (n=99) eyes had normal IOP and 0.9% (n=1) eyes each had raised and low IOP. Out of n=101 eyes, 61.3% (n=62) eyes required only medical management, and 38.6%(n=39) eyes underwent surgical management (Table 4).

Table 4: Best corrected Visual acuity at different intervals

BCVA	BCVA at presentation	BCVA at 1 week	BCVA at 6 weeks	BCVA at 12 weeks
≥ 6/12	16	39	59	59
6/18 – 6/24	10	17	16	16
6/36 – 2/60	19	37	22	22
1/60 – PL Positive	55	7	3	3
PL Negative	1	1	1	1

Out of n=29 eyes with raised IOP, 48.27% (n=14) eyes had a vision in the range of 1/60-PL positive, and only 3.4%(n=1) eyes had a vision of more ≥6/12. By 12 weeks majority 58.6% (n=17) eyes had ≥6/12 vision and only 3.4%(n=1) eyes had a vision of 1/60-PL positive (table 5).

Table 5: Best corrected Visual acuity in eyes with raised IOP

BCVA (N=29 Eyes)	At Presentation	1-Week	6 Weeks	12 Weeks
≥ 6/12	1	11	17	17
6/18 – 6/24	5	4	6	6
6/36 – 2/60	9	12	5	5
1/60 – PL Positive	14	2	1	1

Discussion

In the current study out of n=100 patients, the age range was from 7-70 years. The Mean age of presentation was 32.19 ± 16.7 years. The Majority of patients 51(51%) were below 30 years. In a study conducted by Purvi R Bhagat et al 10 42.66% were below 30 years of age. In our study, out of n=100 patients, n=78(78%) of them were males and n=22(22%) were females which is similar to the study conducted by PR Bhagat et al., [9] where males were 81.55%. The male-to-female ratio was 3.5:1 which is similar to the study conducted by AS Maiya et al., [10] where male to female ratio was 4.5:1. In the

current study, out of n=100 patients, n=33(33%) were students, followed by farmers n=24(24%), housewives n=16(16%), daily wage laborers n=10(10%). In the study conducted by PR Bhagat et al., [9] 66.65% were students, laborers, or housewives. The students were more vulnerable because of their sports activities. The cause of injury in our study in majority n=32(32%) cases were injured with stick, n=15(15%) with ball, n=11(11%) with fist and n=9(9%) with firecrackers. Injury with a stick was common in people involved with agricultural work, injury with a ball was common in students, and fist injury was associated with the assault. In a study conducted by AS Maiya et al., [10] agricultural injuries stood out as the most common cause 48% and sports, playing, and recreational activities 14.7%. In this study, n=62(62%) patients presented to the hospital within three days of trauma. n=21(21%) patients presented on days 4-7, and n=17(17%) presented. after one week in the hospital. In a study conducted by AS Maiya et al., [10] 9 73% presented within 2 days of trauma, 2% presented within 2-7 days, and 6.3% after 7 days of injury. Blunt trauma can injure any ocular structure from anterior to posterior. Segment individually or combined. In our study of n=101 eyes, the most common clinical feature associated was circumcorneal congestion in n=58 eyes (57.4%). N=53 eyes (52.4%) had angle recession, n=47 eyes(46.5%) had corneal edema, n=45 eyes (44.5%) had hyphema, n=42 eyes(41.5%) had traumatic cataract, n=37 eyes(36.6%) had lid edema, n=30 eyes(29.7%) had traumatic mydriasis, n=21 eyes(20.7%) had subconjunctival haemorrhage, n=18 eyes(17.8%) had subluxated lens, n=17 eyes(16.8%) had sphincter tears among anterior segment findings. Out of n=45 eyes with hyphema, n=34 eyes (75.5%) presented with angle recession. Posterior segment findings in our study included n=33 eyes (32.6%) with fundus within normal limits, n=26 eyes (25.7%) had a vitreous hemorrhage, n=8 eyes (7.9%) had berlins edema, n=6 eyes (5.9%) had dislocated lens in the vitreous cavity, n=2 eyes (1.9%) had choroidal detachment and retinal detachment and n=1 eye (0.9%) had traumatic optic neuropathy. The clinical features described by PR Bhagat et al., [9] were similar to our study. In this study, at the time of presentation, n=57 eyes (56.4%) had normal IOP, n=29 eyes (28.7%) had raised IOP, and n=15 eyes (14.8%) had hypotony. Out of n=29 eyes with raised intraocular pressures, the causes were anterior subluxation of the lens (n=12 eyes), hyphema (n=9 eyes), traumatic iridocyclitis (n=9 eyes), dislocation of the lens into the vitreous cavity (n=3 eyes), lens matter in AC (n=1 eye). Angle recession was seen in n=12 eyes with raised IOP. The study conducted by Sihota R et al., [11] described that the relative risk of traumatic glaucoma was significantly higher with hyphema, elevated baseline IOP, angle recession of more than 180 degrees, lens displacement, and wider angles on UBM. The causes for hypotony at the time of presentation were ciliary shock (n=13 eyes), choroidal detachment (n=1 eye), and retinal detachment (n=1 eye). In the study by C Ding et al., [12] the rate of hypotony was 66.7% (n=2 out of n=3 eyes) in patients with ciliochoroidal detachment and 18.5 % (n=5 out of 27 eyes) in retinal detachment. At 1 week in n=92 (91.0%) eyes the IOP returned to normal, n=8 eyes (7.9%) had raised IOP and 1 eye (0.9%) had hypotony. At 6 weeks n=96 eyes (95.0%) had normal IOP, n=4 eyes (3.9%) had raised IOP and n=1 eyes (0.9%) had hypotony. At 12 weeks of follow-up, n=99 eyes (98.0%) have normal IOP, only n=1eye (0.9%) had raised IOP, and n=1eye (0.9%) had hypotony. Most of the eye pressures returned to normal due to surgical and medical management. N=1 eye with raised IOP had undergone surgical management for subluxated lens and developed glaucoma in aphakia. N=1 eye with hypotony had closed funnel retinal detachment. In our study, out of n=101

eyes, n=62 eyes (61.3%) underwent medical management with topical steroids, cycloplegics, and topical antibiotics. In n=39 eyes (38.6%) that underwent surgical management, the surgical procedure was small incision cataract surgery in n=33 eyes (84.6%) and vitreo retinal surgery in n=6 eyes (15.3%). Out of the n=29 eyes (28.7%) which had raised intraocular pressure, n=16 eyes (55.1%) underwent surgical management, and n=13 eyes (44.8%) underwent medical management with antiglaucoma medications in addition to topical steroids and cycloplegics. In our study of n=101 eyes, the majority n=55 eyes (54.4%) had the best corrected visual acuity at presentation in the range of 1/60-PL positive. N=19 Eyes (18.8%) were in the range of 6/36-2/60, n=16 eyes (15.8%) were ≥ 6/12,10 eyes (9.9%) were in 6/18 - 6/24 and n=1 eye (0.9%) was PL negative. The n=1 eye with PL negative at presentation was diagnosed with traumatic optic neuropathy. At 1 week, in the majority n=39 eyes (38.6%), the BCVA improved ≥ 6/12, n=37 eyes (36.6%) had the vision of 6/36-2/60, n=17 eyes (16.8%) had vision 6/18- 6/24, n=7 eyes (6.9%) had vision 1/60-PL positive and n=1 eye (0.9%) remained PL negative. The improvement in vision by 1 week was mainly due to the reduction of corneal edema, hyphema, and surgical management. In cases of subluxated and cataractous lenses. At 6 weeks and 12 weeks, BCVA in n=59 eyes (58.4%) were ≥ 6/12, n=22 eyes (21.7%) 6/36-2/60, n=16 eyes (15.8%) 6/18-6/24, n=3 eyes (2.9%) 1/60 - PL positive and n=1 eye (0.9%) PL negative. By the end of 12 weeks, the majority of the eyes had a good visual prognosis, this can be attributed to early presentation to the hospital and appropriate management. The causes for poor vision in the rest of the eyes could be due to late presentation to the hospital, poor visual acuity before trauma (Ex: refractive errors, senile cataracts, etc), poor compliance to treatment, and complications post-trauma. In n=29 eyes with raised IOP, at the time of presentation, n=14 eyes (48.27%) had BCVA in the range of 1/60-PL positive and n=1 eye had vision >6/12. By 12 weeks n=17 eyes (58.6%) had BCVA >6/12 and only n=1 eyes had vision in the range of 1/60-PL positive.

Limitations of the Study: The assumption that all patients had a vision of 6/6 before trauma was a source of bias in the results because refractive errors and senile cataracts would have been the reason for reduced vision at the time of presentation rather than ocular trauma. The follow-up duration of 12 weeks was short to study the causes of late-onset glaucoma following trauma.

Conclusion

This study highlights the epidemiology, clinical presentations, and consequences of blunt ocular trauma on intraocular pressure. As the angle structures can be severely injured following trauma, it emphasizes regular follow-up of such patients to prevent late-onset glaucoma. The public should be made aware of the risks of ocular trauma, morbidity with delayed presentation to the hospital, and the need to take safety measures in working place and on the playground.

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