

Golden Hour of Ocular Trauma: Need to Pay Heed

Dr Lubna Khan¹, Dr Abha Verma², Dr Rimpi Rana³, Dr Sapan Palod⁴

¹Professor, Dept of Ophthalmology, Sri Aurobindo Institute of Medical Sciences & Post graduate institute, Indore

²Asst. Professor, Dept of Ophthalmology, Sri Aurobindo Institute of Medical Sciences & Post graduate institute, Indore

³Resident 3rd year, Dept of Ophthalmology, Sri Aurobindo Institute of Medical Sciences & Post graduate institute, Indore

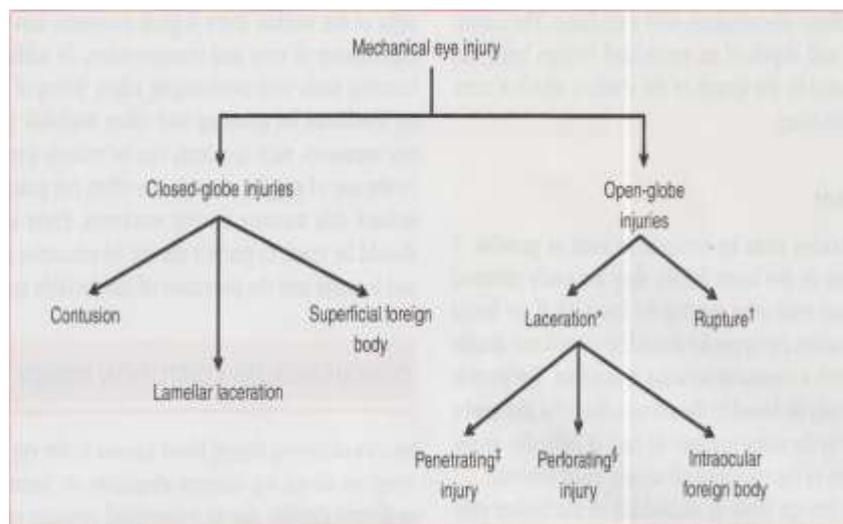
⁴Senior Resident, Dept of Ophthalmology, Sri Aurobindo Institute of Medical Sciences & Post graduate institute, Indore

I. Introduction

Ocular trauma is the leading cause of ocular morbidity in children and young adults. Ocular injuries can occur in almost any setting including recreational and sports activities, at workplace, at home, in rural agricultural settings, motor vehicle accidents and with intention of compensation. In addition to the visual concerns, ocular trauma leaves a tremendous financial penalty, in terms of both direct and indirect costs. Of the approximate 2.4 million ocular injuries annually, males are involved ~9 times more often than females, and most victims are younger than 40 years of age[1].

Trauma may range from trivial black eye to complete avulsion of the eye. Many forms of ocular trauma can be prevented with simple measures like wearing protective glasses. Education and common sense are two additional factors that can effectively reduce the number of ocular injuries. It is necessary to evaluate the damages caused by it and manage it with timely intervention to restore vision to the maximum possible, at the earliest.

This study has been undertaken to know the pattern, extent and severity of ocular injuries and to identify the factors leading to mechanical ocular trauma, the modes of clinical presentation, their management and the visual outcome in such cases. We have used the "Birmingham Eye Trauma Terminology" or "BETT" for the classification of the trauma developed by [Kuhn F](#) et al[2] (1996) which is recognized by "The Society of Ocular Trauma and The World Injury Registry" and other organizations.



Classification of ocular trauma.* Outside-in injury; inside-out injury; ^single break in eye wall; § through-and-through injury of globe, dual breaks or double perforation. (Adapted from Kuhn and associates) [3]

II. Aims And Objectives

To describe the pattern, extent and severity of mechanical ocular injury & to identify the factors leading to mechanical ocular trauma & its association with other injury in patients presenting at SAIMS Medical College and postgraduate Institute, Indore, in a span of two years(2012 to 2014).

The main objectives of our study are:

- 1.To know the visual outcome following management of ocular trauma
- 2.To know the modes of mechanical trauma and classify them in a systematic way.
- 3.To know the demographic distribution of mechanical ocular trauma in this part of Central India.

III. Material And Methods

Patients presenting with history of mechanical ocular trauma in one or both eyes were included from department of Ophthalmology and referred cases of mechanical ocular trauma from critical care unit (causality department) of Sri Aurobindo Medical College & Post Graduate Institute, Indore. 150 patients were included in this study in a time duration from 01-05-2012 to 30-04-2014. The time interval between injury and consultation in this hospital varied considerably. Earliest consultation was sought at 30 minutes after injury and longest consultation was done after 18 years of injury.

Inclusion Criteria

All patients who presented in the department of Ophthalmology having sustained mechanical ocular injuries with or without intraocular foreign bodies. All types of mechanical injuries including contusion, penetrating and perforating injuries. All patients in whom there was presence of ocular adnexal injury.

Exclusion Criteria

All chemical injuries and self inflicted wounds of eye. When a patient presented with history of ocular trauma, a detailed history regarding age, sex, occupation, duration since injury, direction of force, signs and symptoms occurring following ocular injury were noted.

Detail ocular examination was performed under torch light. Vision was recorded on Snellen's chart, Intraocular pressure, Direct ophthalmoscopy, Indirect ophthalmoscopy, Slit lamp examination, Gonioscopy. Patients with purely sub-conjunctival hemorrhage were called up once every fourth day. Patients who were discharged from the hospital were followed-up once a week, then in second week, fourth week, at two months and finally at six months. In cases where vitrectomy and/or secondary implantation were done, follow up was done upto even after six months.

Investigations:

X-ray Skull A-P view
Water's nose-chin position
Reese parieto-orbital oblique projection
B-scan ultrasonography
Ultra biomicroscopy (UBM)
MRI and CT Head with Orbital screening if required.

IV. Observations And Discussion

Types Of Ocular Injuries:

From the etiological point of view, ocular injuries are difficult to classify since they occur from innumerable causes in every circumstance of life.

Classification Of Blunt Injury

Duke – Elder [4] has classified injuries in following ways.

A. Etiological Classification:

1. Intrauterine Injuries
2. Birth Injuries
3. Domestic Injuries
4. Injuries due to Travel and Sports.
5. Agricultural Injuries.
6. Industrial Injuries.
7. War Injuries.

B. Classification II

(a) Mechanical Injuries

1. Blunt Concussion, Contusion
2. Penetrating; Perforating; Non-Perforating.

(b) Non Mechanical Injuries:

1. Thermal Injuries
2. Ultrasonic Injuries
3. Electrical Injuries
4. Radiational Injuries
5. Chemical Injuries
6. Stress Injuries.

The wounding capacity of an object depend upon the kinetic energy involved, thus, is related to mass and velocity of the object. According to Scott W.R et al [5].

Kinetic energy = Mass x Velocity/2g (g=Gravity)

According to Weidenthal DT and Schepens CL [6] injuries to anterior segment following blunt trauma arise from the momentary deformation occurring during impact under the effect of impinging forces which act antero-posteriorly and then expand the globe around the equator to the line of impact, relief being sought in circumferential lateral distension to compensate for the sudden antero-posterior compression. Injuries due to blunt trauma to the Eye

A.Blunt Injuries Affecting Anterior Segment

As the globe is deformed the mechanical energy is transformed into hydraulic pressure wave. These forces act on the anterior segment structures forcing their untethered ends posteriorly .While this is occurring, the tethered peripheral ends are directed more equatorially with the expansion of globe in this dimension and the combination of events creates shearing forces. This forceful expansion of tissue results in tears. Dante J Pieramici et al [7] stated that there are 7 rings of tissues that expand resulting in tears.

Sphincter pupillae.

Iris base to Ciliary body.

Anterior face of ciliary body.

Attachment of ciliary body to scleral spur

Trabecular mesh work.

Lens Zonule.

Attachment of vitreous and retina

B.Blunt Injuries Affecting Posterior Segment.

The pathogenesis of posterior segment involvement from blunt trauma includes coup injury, contrecoup injury and direct ocular compression as per Wolter JR[8].According to Elliott D. Robert L.A.[9] blunt injuries affecting posterior segment include blunt trauma applied directly to the eye in the setting of an intact globe and trauma to other part of the body that indirectly affects the eye.

Out of 150 patients :

30 patients (20.00 %) were in age group 0-15 years, 32 patients (21.34 %) were between 16-25 years, 36 patients (24%) were between 26-35 years of age, 33 patients (22%) between 36-45 years age, 8 patients (5.33%) were found in between 46-55 years of age and 11 patients more than 55 years of age .Incidence was found to be highest in age group 21-40 years of age (45.5%).Vats S,Murthy G V S et al[10] (2008)and Maurya R.P.et al [11] (2008) found peak incidence in age group 16-40 years and in 26-35 year age group (47.5%) and (43.4%) respectively which supports our study.

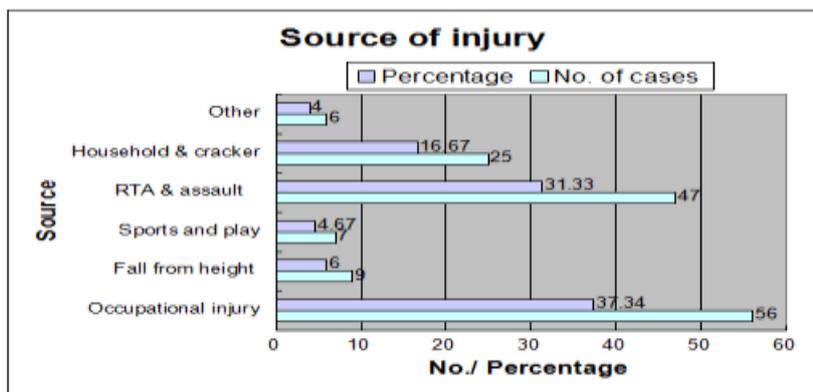
2. 124 were males (82.67%) and 26 were females (17.34%) since males are more involved in the outdoor work and majority females being housewives,we had higher rate of injury in males in our study.

This correlates with the study of Nadeem S and Fawad H [12] (ratio 5:1) and also of [Shukla IM](#), [Verma RN](#) [13] where it was found that incidence of ocular trauma in male was 83.5% and in female it was 12.5%.

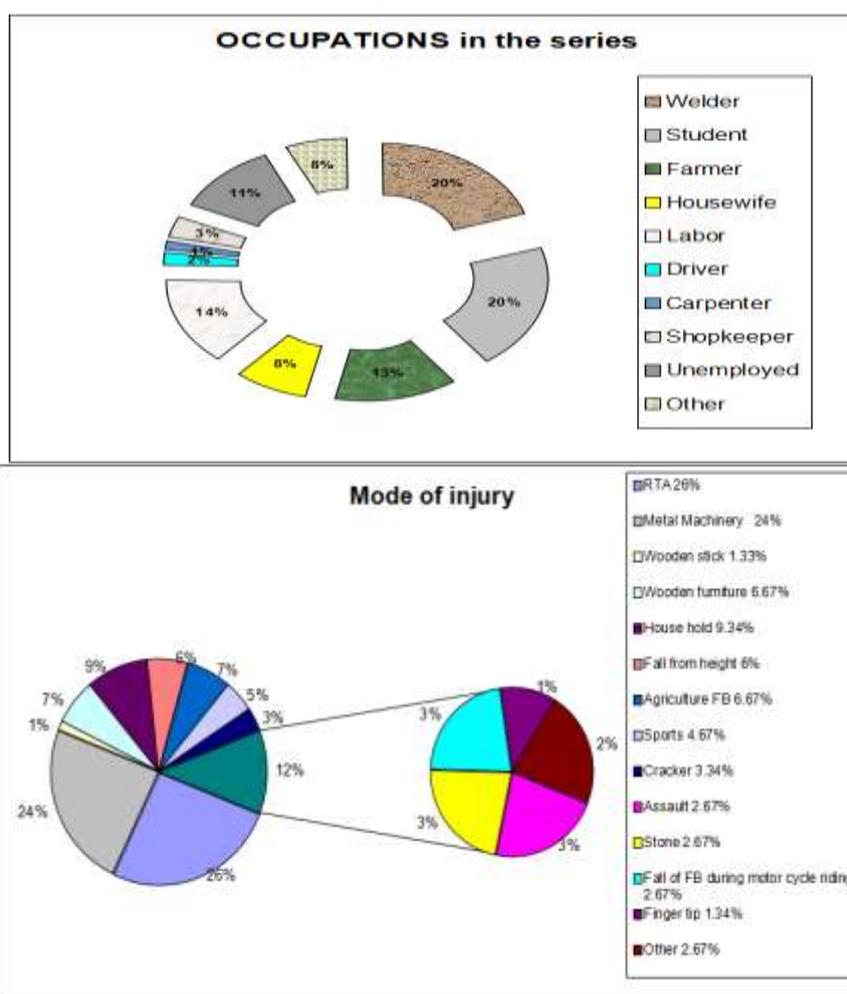
3. 63 were illiterate (42.00%), 28(18.67%) had primary education, 6 were graduates (17.34%), 19(12.67%) were educated till class 10th. 3 were upto class 12th, 11 were minors i.e. child below school going age group. Ocular trauma is sustained more by illiterates (42.0%) and undergraduates (31.0%), correlating with the study of D.V. Singh et al [14] which explains that education reduces the incidence of ocular injury.Incidence is also higher in school going children which may be because of their careless and notorious attitude

4. 94 patients (56%) had injury in right eye and 52 patients (41%) had injury in left eye, rest 3 % i.e. 4 patients had injury in both eyes. Incidence in our study was more in right eye , as reported by Arfat M.Y et al [15] (right eye-56.0%). Contrary to laterality result of present study, Maurya R.P et al[11] reported an incidence of 58.0% injuries sustained in left eye in their study, concluding thereby that any eye can be involved.

56 patients (37.34 %)sustained occupational injuries, 9 had fall from height (6.00%), 47(31.33%) sustained injuries due to road traffic accident and assault, household & cracker injuries were found in 25 patients 16.67%), 7(4.00%) patients had sports associated injuries and 6 (4.00%) had other injuries.



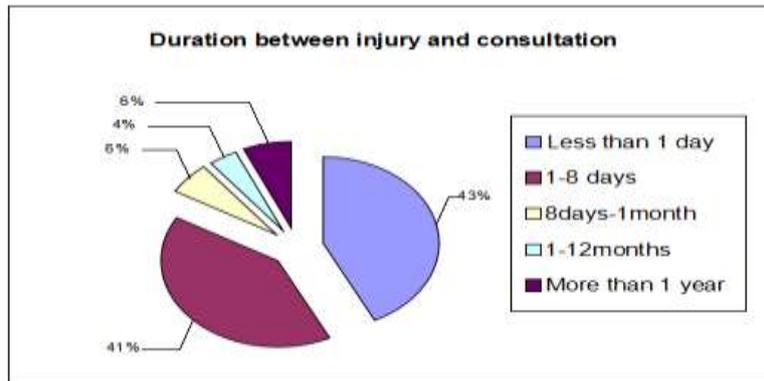
It was ascertained from the present study that highest incidence is among industrial workers, mainly welders, correlating with the study of Serinken M. et al [16]



6. 50 had contusion injury (33.34%), 11 had Lid and adnexal injuries (7.34%), 29 had penetrating injuries (19.34%), 10 had perforating injuries (6.67%), 37 patients had superficial corneal foreign body (24.60%), 7 had laceration (4.67%), 6 patients had rupture globe (4.00%). According to Boshoff and Jokand Favory and Sedan(1951) [17] the injuries can be soft tissue lacerations and occasionally fracture of orbit. Open globe injuries were 30.0% while closed globe injuries amounted to 62.6%.This correlates with the study of Maurya R.P et al [11].

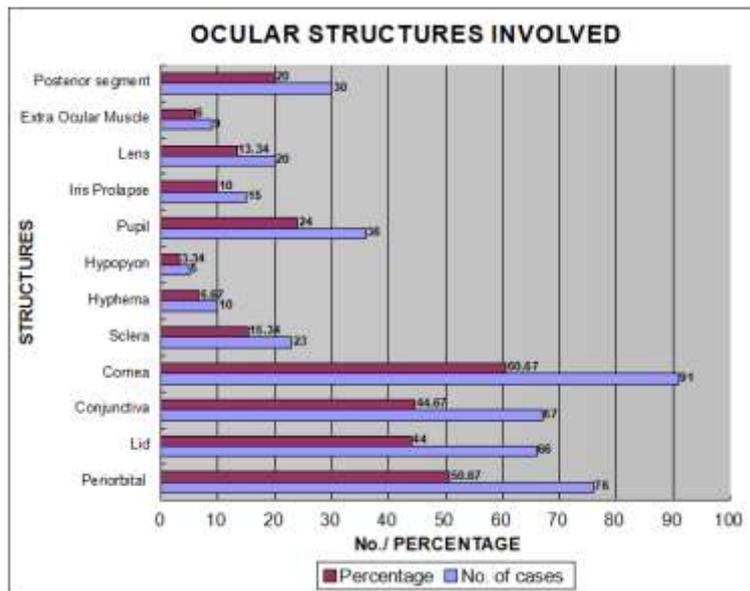
6. 64 patients (42.67%) consulted within 24 hour of trauma, 61 patients consulted within 8 days (40.67%), 9 patient consulted within 1 month (6%) , 6 patient consulted after 1 month of ocular injury (4%).10 patients

consulted after 1 year of ocular injury (6.66%). Had they presented earlier, visual prognosis would have been better.



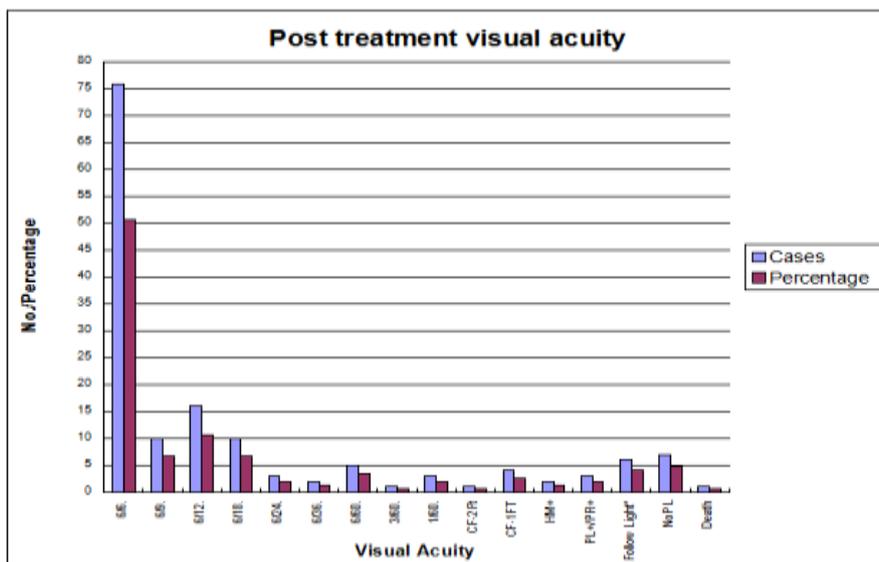
7. In 119 patients there was only anterior segment involvement (79.34%) . 8 had posterior segment involvement (5.32%), 23 patients had both anterior as well as posterior segment involvement (15.33%).

8. The no./percentage of patients having major involvement of ocular structures with clinical findings is given below :



9. The no. of cases with various involvement of posterior segment are given in the table :

	No. of cases	Percentage
VITREOUS		
Vitreous Haemorrhage	2	1.33
Vitreous prolapse	5	3.34
Endophthalmitis	2	1.33
RETINA		
Optic atrophy	1	0.67
Papilloedema	3	2.00
Berlin's edema/macular edema	3	2.00
Retinal FB	1	0.67
Retinal haemorrhage	2	1.33
Subretinal neovascularization	2	1.33
Retinal Detachment	6	4.00
MACULA		
Macular hole	1	0.67
CHOROID		
Choroidal detachment	1	0.67
Choroidal rupture	2	1.33
Total	31	



Clinical Findings In The Series:

Periorbital contusions or black eye was the most common clinical finding correlating with study of Macewan CJ [18] who stated 98.3% of all injuries involved periorbital or superficial ocular structures only. Damage to anterior segment of eye was seen in 119 cases (79.4%) and that in posterior segment was seen in 31 cases (20.7%). This correlates with the study of Maurya R. P. et al [11] which showed that anterior segment (30.2%) involvement is more common as compared to posterior segment (14.5%). Subconjunctival hemorrhage was seen in 57 cases (38.0%). 68 cases (45.5%) had corneal involvement in various forms ranging from superficial corneal foreign body (24.0%) to adherent leucoma (2.0%) which correlates with study of Nadeem S and Fawad H.[12] which stated corneal involvement in 50.0% cases. 79 cases had iris and pupillary involvement in various forms which is higher than that stated by of Canavan and Archar [19] in which 79 cases out of 205 had iris and pupillary injuries. 25 eyes had lenticular involvement. 21.0% cases had posterior segment involvement, of which vitreous hemorrhage was seen in 1.33%, 1.4% had Berlins edema, 4% cases had retinal detachment, 4% had macular edema and choroidal detachment was observed in 0.67%. There were 1.33% cases of choroidal rupture, both being crescentic and adjacent to the disc, located temporally.

To compare pre-treatment and post-treatment visual acuity and significance of our study we calculated the visual acuity in log MAR for which we used standard log MAR calculator. For data analysis in this study instead of finger counting (CF) 2.00 log MAR or hand movement (HM) 3.00 log MAR was used, instead of perception of light (PL) 3.10 log MAR was used, for following light we used 3.20 log MAR and instead of no perception of light (NPL) 3.30 log MAR was used, one patient died because of head injury. We find that inclusive of entire series, visual acuity log MAR pre-treatment mean was 1.17 while post-treatment mean was 0.67. Our p value is less than 0.0001 which is highly significant.

Visual acuity in log MAR	log MAR
Pre treat visual acuity (mean)	1.17
Post treatment visual acuity (mean)	0.67
P value	<0.0001

* Test Paired t-test, t-value=7.58, 95% confidence interval 0.3731 to 0.6331 Correlation coefficient-0.7456, result p-value -significant

We further divide the visual outcome of our study on basis of our classification of injury in closed globe and open globe injury. For closed globe injury p value for contusion injury was 0.00065 which is significant and for superficial corneal foreign body p value was <0.0001 which also highly significant, for laceration p value was 0.143 which is not significant.

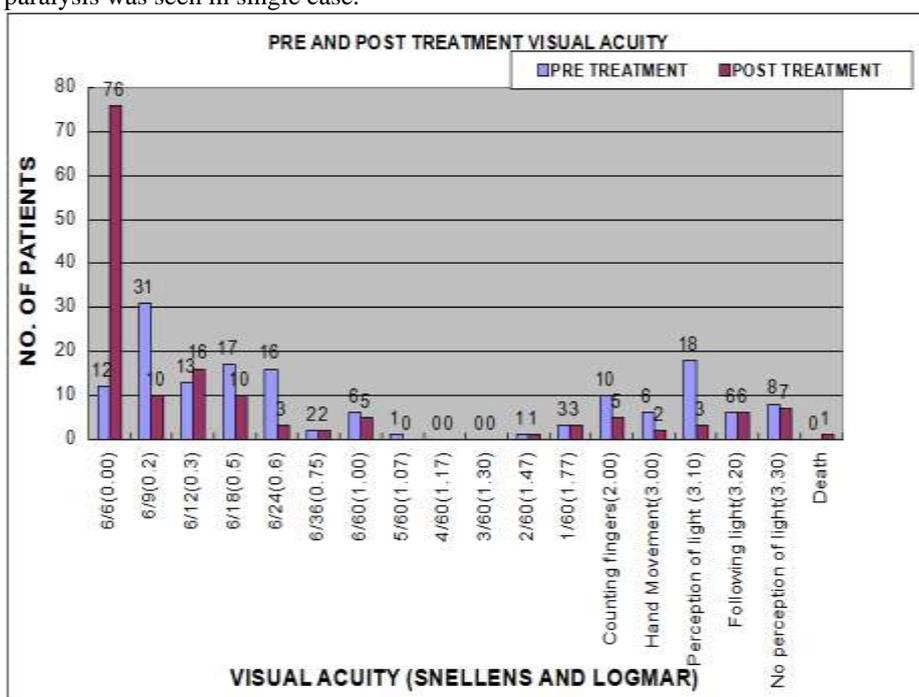
Visual acuity (log MAR)	Contusion injury	Superficial corneal FB	Laceration
Pre-treatment (Mean)	0.89	0.34	0.40
Post-treatment (Mean)	0.53	0.06	0.19
P value	0.00065	<0.0001	0.143

For open globe injury p value for penetrating injury was <0.0001 which is highly significant, for perforating injury p value was 0.049 which is not significant and for rupture globe injury p value was 0.684 which is not significant.

Visual Acuity (Log MAR)	Penetrating	Perforating	Rupture
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Pre-treatment (Mean)	2.50	2.99	0.83
Post-treatment (Mean)	1.30	2.19	0.73
P value	<0.0001	0.049	0.684

In most of the cases, patients who came to hospital within first few days of injury showed a lower IOP as compared to non traumatized eye. Only in a few of these cases, the non traumatized eye also showed a lower IOP simultaneously. In cases of traumatized hyphema, there was a marginal increase in IOP and in all these cases the IOP normalized soon. There were two cases of secondary glaucoma. One was an old case of blunt trauma with angle recession glaucoma and other had blunt trauma with angle recession and hyphema which later developed corneal blood staining and secondary glaucoma. There was no significant rise in IOP in cases with angle recession this is consistent with the study conducted by Canavan and Archer,[74] 35 eyes showed hypotony which was due to open globe injury including penetrating perforating and rupture globe. Traumatic optic neuropathy was seen in 2.0 % cases. All these cases were associated with relative afferent pupillary conduction defect(RAPD). Visual acuity ranged from counting finger to projection of rays. Fundus was normal in all the cases except six patients in whom there was associated retinal detachment. 6 % cases revealed nerve involvement ,one case of 3rd nerve paralysis was seen, 2 cases (1.3 %) of 4th nerve paralysis were seen, 3 cases (2.0%) of combined 3rd and 6th nerve paralysis and 2 case(1.3 %) of isolated 6th nerve paralysis were reported. Facial nerve paralysis was seen in single case.



V. Conclusion

It is clear from our study that ocular trauma is associated with varying degree of loss of vision and hampers means of livelihood. This is an area for further research. Additional investigation is also needed to develop and evaluate new methods for prevention and management of all types of ocular injuries. Interdisciplinary approaches and community based strategies will be important to make progress in this area of study to salvage vision. Children and young adults are more prone for mechanical ocular trauma. Occupational injuries and road traffic accidents constitute the main bulk of injuries (69%). Majority of patients having an injured eye with other injuries belonged to the RTA category (about 26%). Isolated ocular injuries due to sports were found very less in number (about 5%). Out of the total 150 patients, 112(74.66%) patients had visual acuity more than 6/18(log MAR = 0.5). These patients can contribute to the society and are productive for the nation. 28 patients out of total 150 had best corrected visual outcome less than 3/60 which ,according to WHO, is legal blindness. This was mainly because of the severity of trauma and longer duration of consultation. Many of the injuries could have been prevented, if the patients would have used safety measures during work or play. It is the temperament of an individual which makes him accident prone; hence prevention needs rectification in casual attitude. As we know that first sixty minutes are ‘Golden hour’ in ocular injuries, so early referral, prompt evaluation and treatment will prevent sight threatening complications. It is frequently noticed that our attitude for short distance travel by road in the city such as going to the office is more casual than long distance travel.

Any type of trauma including ocular trauma can occur anytime; hence it warrants development of habit for protective means on daily basis

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Phacocoele after trauma



Figure 1: Phacocoele after trauma: Subconjunctival position of the crystalline lens along with vitreous.

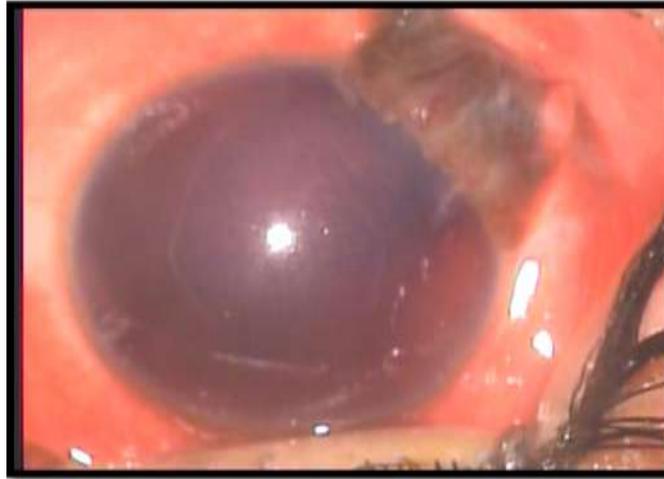


Figure 2: Corneal tear with iris prolapse



Figure 3: Intraocular foreign body, intra operative found in the angle and removed.

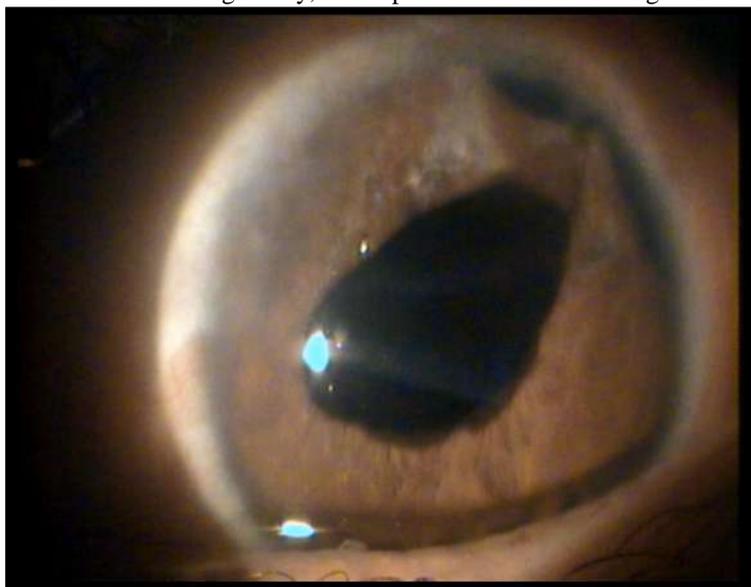


Figure 4 : Iridodialysis seen in the supero temporal part.