

A Clinical Study on Injuries of Eyeball

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ABSTRACT

The prospective study included total of 100 subjects in the final analysis. The mean age $\pm$ SD of the patients in the present study was 38.31 ± 17.21 years. There was predominance of males compared to females with 61.0%. The occupation of study subjects: 31% of the participants were students, followed by housewives, unemployed with 21% and 8% respectively. Both eyes were affected in 15% of patients while left eye and right eye were affected in 37% and 48% of participants. Subconjunctival hemorrhage, corneal abrasion and conjunctivalchemosis in the right eye were identified in 16%, 5% and 3% whereas subconjunctival hemorrhage, periorbital ecchymosis, conjunctivalchemosis and corneal abrasion in the left eye were observed with 14%, 5%, 4% and 4% respectively. The lid ecchymosis, edema, laceration, burns, ecchymosis with edema, abrasion and ecchymosis with laceration were observed in the present study with 17%, 8%, 5%, 2%, 2%, 1% and 1% respectively. The roof orbital fracture, floor, lateral wall and medial wall fractures in this study were identified with 4%, 7%, 3% and 0% respectively.

Keywords

Ocular injuries, Corneal abrasion, orbital fracture

INTRODUCTION

Eye injury is the second most common cause of visual impairment.¹ It consists of minor bruises, scratches, serious lacerations, fractures and burns. It is one of the major causes of morbidity and monocular blindness.^{2,3} About 40% of the monocular blindness is related with orbital trauma.⁴ In-home and work premises most common eye injuries occur. Young males are more predominant than females.⁵ The orbital wall fractures, periorbital swelling, hematoma, subconjunctival hemorrhage, ocular adnexal injuries, optic nerve injuries and penetrating globe injuries are the common eye injuries.⁶ Worldwide, one of the vital sources of blindness is ocular trauma. Orbital fractures can be related with muscle entrapment or soft tissue herniation, hematoma or emphysema. This can cause eyeball displacement or limited ocular morbidity.⁷ Radiography, ultrasound, magnetic resonance imaging and computerized tomography scan are the common modalities used for imaging the orbit and eyes.⁸ Around 3% of visits in the department of emergency accounts due to the traumatic injury.⁴ Road accidents, work-related and home-related activities mainly cause injury to the eyes. In India, use of ocular protective devices is very low.⁹ The use of protective eyewear can prevent eye injuries.¹⁰ The incidence of eye injuries is increasing; hence, public awareness should be made to decrease the incidence of eye injuries. Use of proper safety measures should be encouraged in public in order to avoid associated complications. The present study was conducted to determine the prevalence and clinical profile of eye ball injury.

Need for the study:

The incidence of morbidities and associated monocular blindness is increasing worldwide. In developing countries like India, the prevalence of eye injuries is comparatively high. work-related eye injuries and injuries related to road traffic accidents can be reduced through the use of protective measures. Hence studies should be conducted to increase the public awareness and thereby the increasing prevalence can be reduced.

MATERIALS AND METHODS

Study site: This study was conducted in the department of Ophthalmology in SreeBalaji Medical College and hospital

Study population: All patients with orbital injuries including ruptures, lacerations due to penetrating, perforating and intraocular foreign bodies, blunt trauma, contusions, burns and associated facial bone fractures reported to casualty and department of Ophthalmology in SreeBalaji Medical College and hospital were considered as the study population.

Study design: The current study was a prospective hospital-based study.

Sample size: Sample size was calculated assuming the proportion of patients showed improvement in vision after treatment as 76.8% as per the study by Mistra, A et al.¹⁶ The other parameters considered for sample size calculation were 9% absolute precision and 95% confidence level.

The required number of subjects as per the above- mentioned calculation was 85. To account for a non- participation rate of about 17% (15 subjects), it was decided to sample about 100 subjects in to the study.

Sampling method: All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size is reached.

Study duration: The data collection for the study was done between January 2017 to January 2018 for a period of 1 year.

Inclusion Criteria:

- Age of patient more than 11 years of age, both male and female.
- All patients with orbital injuries following a road traffic accident, domestic violence or ruptures, lacerations due to penetrating, perforating and intraocular foreign bodies, blunt trauma, contusions, burns and associated facial bone fractures presenting to the emergency department in SreeBalaji medical college and hospital.
- Consented individuals.

Exclusion criteria:

- Age of the patient for less than 10 years.
- Patients with previously known visual problems.
- Brought dead patients.
- Unconsented patients.

Methodology:

After obtaining an oral informed consent from the subject and maintaining confidentiality detailed history, clinical ocular examination including orbital margin palpation, neuro-ophthalmological examination, slit -lamp examination and fundus examination were done. Where the condition of the patient did not warrant the interview, the relatives or attendants were interviewed.

Radiographic evaluation was done by X-ray and computed tomography initially to determine the orbital fracture patterns, soft tissue injuries, localization of orbital foreign bodies and recognize abnormalities of the contents and integrity of the globe. The opinion of the oro- maxillofacial surgeon was obtained. The variables analyzed were patient's age, sex, occupation, mechanism of injury, fracture location, any other blunt, penetrating, open or closed ocular injuries and need for surgical management. Patients requiring acute surgical intervention were managed accordingly and referred to concerned specialists.

OBSERVATIONS AND RESULTS

RESULTS:

A total of 100 subjects were included in the final analysis.

Table1: Descriptive analysis of age in the study population (N=100)

Parameter	Mean $\pm$ SD	Median	Minimum	Maximum	95% C. I	
					Lower	Upper
Age	38.31 $\pm$ 17.21	35.50	13.00	80.00	34.90	41.72

The mean age was 38.31 $\pm$ 17.21 in the study population, ranged between 13 years to 80 years (95% CI 34.90 to 41.72). (Table 1)

Table 2: Descriptive analysis of gender in the study population (N=100)

Gender	Frequency	Percentages
Male	61	61.0%
Female	39	39.0%

Among the study population, 61 (61.0%) participants were males and remaining 39 (39%) participants were females.
(Table 2 & Figure 1)

Figure 1: Bar chart of gender in the study population (N=100)

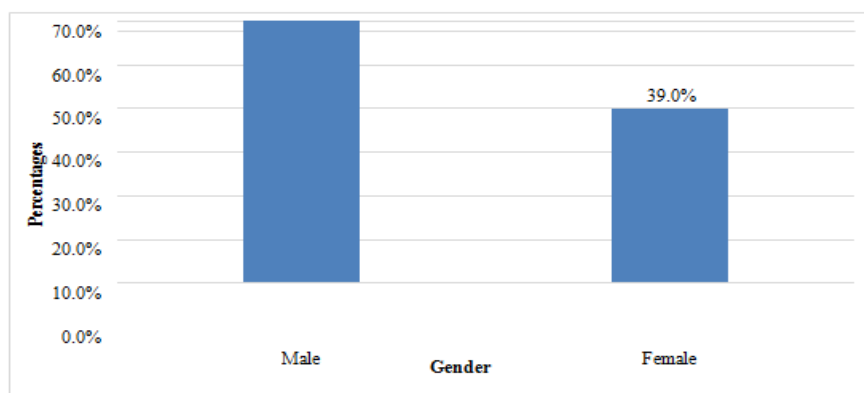


Table 3: Descriptive analysis of occupation in the study population (N=100)

Occupation	Frequency	Percentages
Student	31	31.0%
House wife	21	21.0%
Not working	8	8.0%
Driver	7	7.0%
It professional	6	6.0%
Teacher	4	4.0%
Security guard	3	3.0%
Clerk	2	2.0%
Plumber	2	2.0%
Sales manager	2	2.0%
Self employed	2	2.0%
Shopkeeper	2	2.0%
Gym trainer sch, fracture of floor of orbit	1	1.0%
Bank manager	1	1.0%
Carpenter	1	1.0%
Clerical job	1	1.0%
Eb officer	1	1.0%
Electrician	1	1.0%
Mechanic	1	1.0%
Physical trainer	1	1.0%
Salesman	1	1.0%
Shop keeper	1	1.0%

Majority of participants (31%) were students, followed by 21% participants were house wife, 8% participants were not working, 7% participants were drivers, 6% participants were IT professionals and 4% participants were teachers. (Table 3)

Table 4: Descriptive analysis of involved eye in the study population (N=100)

Involved Eye	Frequency	Percentages
Bilateral	15	15.0%
Left	37	37.0%
Right	48	48.0%

Among the study population, 15 (15%) participants had bilateral eye involvement, 37 (37%) participants had left eye and 48 (48%) participants right eye involvement.

Table 5: Descriptive analysis of the right eye in the study population (N=100)

Right eye	Frequency	Percentages
Normal	37	37.0%
SCH	16	16.0%
Corneal abrasion	5	5.0%
Conjunctivalchemosis	3	3.0%
Fracture of floor of orbit, chemosis	2	2.0%
Periorbital ecchymosis	2	2.0%
Periorbital ecchymosis, SCH	2	2.0%
Chemical burn (acid), congestion	1	1.0%
Chemical injury, congestion	1	1.0%
Circumcorneal congestion, SCH	1	1.0%
Circumcornealcongestion,SCH,acflare, cells++	1	1.0%
Displaced fracture of superior orbital rim	1	1.0%
Ecchymosis, SCH	1	1.0%
Foreign body removal, corneal abrasion	1	1.0%
Fractureoflateralwalloforbitandzygomatic arch	1	1.0%
Fractureoflateralwalloforbitandzygomatic arch, SCH	1	1.0%
Fracture of lateral wall of orbit, SCH	1	1.0%
Inferior orbital ecchymosis	1	1.0%
Inferior orbital wall fracture	1	1.0%
Laceration 2mm below eyebrow, SCH	1	1.0%
Laceration 3mm above upperlid margin	1	1.0%

There were 37(37%) normal right eye and 16(16%) were SCH followed by corneal abrasion with 5(5%) and conjunctivalchemosis 3(3%). (Table 5)

There were 48(48%) normal left eye and 14(14%) were SCH and periorbital ecchymosis with 5(5%) followed by conjunctivalchemosis, corneal abrasion and SCH, Ecchymosis with 4(4%) each.

Table 7: Descriptive analysis of lids in the study population (N=36)

Lids	Frequency	Percentages
Not involved	64	64.0%
Ecchymosis	17	17%
Edema	8	8%
Laceration	5	5%

Burns	2	2%
Ecchymosis, edema	2	2%
Abrasion	1	1%
Ecchymosis, laceration	1	1%

Majority of 17% participants had Ecchymosis, followed by Edema, Laceration was 8% and 5% respectively. Burns and Ecchymosis, edema was 2% for each respectively. (Table 7)

Table 8: Descriptive analysis of orbital bone fractures in the study population (N=100)

Orbital bone fractures	Frequency	Percentages
Not involved	86	86%
ROOF	4	4%
FLOOR	7	7%
LATERAL WALL	3	3%
MEDIAL WALL	0	0%

Among the people with orbital bone fracture, 4 (4%) participants were felling down by ROOF, 7 (7%) participants felling down by floor and 3 (3%) participants were felling down by lateral wall. (Table 8 & Figure 4)

Table 9: Descriptive analysis of cornea in the study population (N=14)

Cornea	Frequency	Percentages
Not involved	86	86%
Abrasion	13	92.9%
Opacity	1	7.1%

Among the people with cornea, 13 (92.9%) participants had abrasion and only 1 (7.1%) participants had opacity. (Table 9 & Figure5)

Figure 5: Pie chart of the cornea in the study population (N=14)

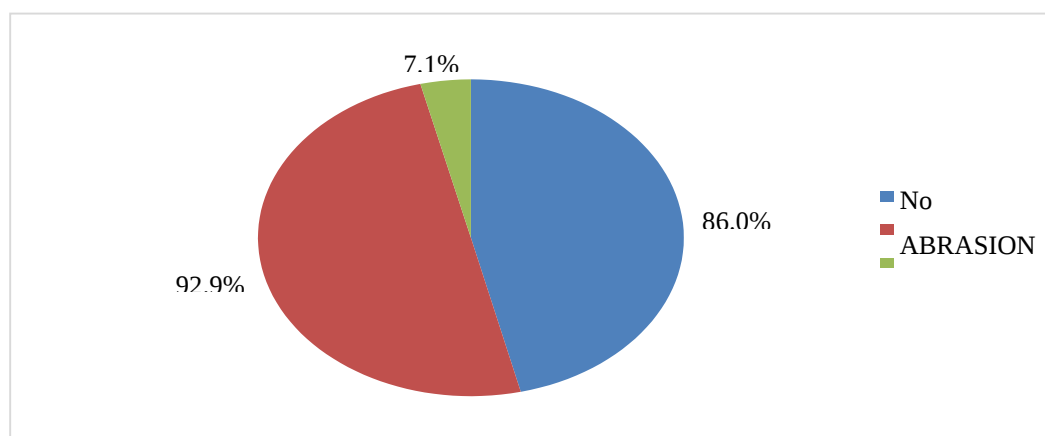


Table 10: Descriptive analysis of conjunctiva in the study population (N=73)

Conjunctiva	Frequency	Percentages
SCH	54	74.0%
Chemosis	9	12.3%
SCH, Chemosis	4	5.5%
Congestion	3	4.1%
SCH, Congestion	3	4.1%
Not involved	27	27%

Among the people with conjunctiva, 54 (74%) participants had SCH, 9 (12.4%) participants had chemosis, 4 (5.5%) participants had SCH, chemosis and 3 (4.1%) participants had congestion and SCH, congestion for each respectively. (Table 10)

Table 11: Descriptive analysis of anterior chamber in the study population (N=100)

Anterior Chamber	Frequency	Percentages
Not involved	98	98%
FLARE, CELLS++	1	1%
IRITIS	1	1%

Among the study population, only 1 (1%) participant had FLARE, CELLS++ and IRITIS for each respectively. (Table 11 & figure 7)

Figure 7: Pie chart of descriptive analysis of anterior chamber in the study population (N=100)

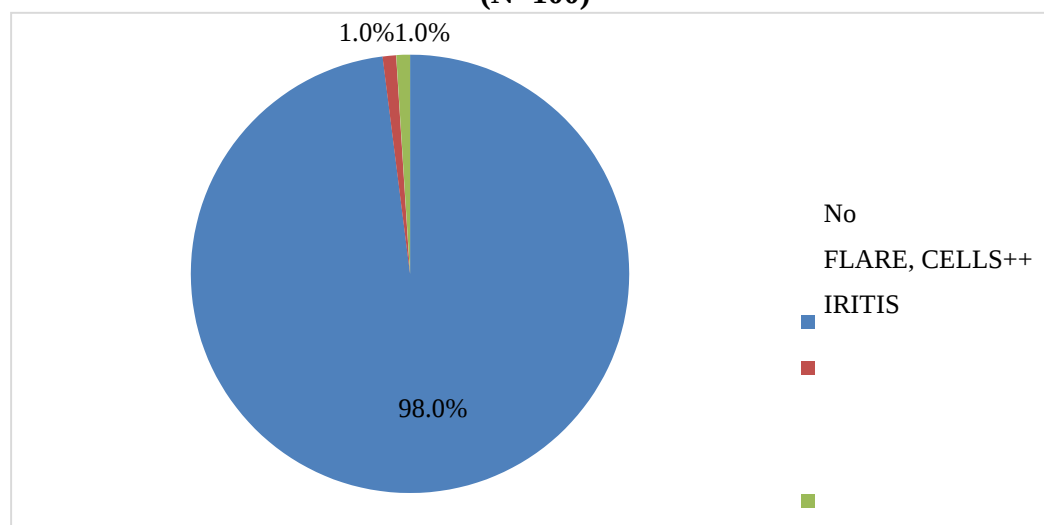


Table 12: Descriptive analysis of posterior segment in the study population (N=100)

Posterior Segment	Frequency	Percentages
Not Involved	96	96%
RETINAL DETACHMENT	2	2%
VITREOUS HEMORRHAGE	2	2%

Among the people with posterior segment, 2 (2%) participants had retinal detachment and vitreous haemorrhage for each respectively. (Table 12 & figure 8)

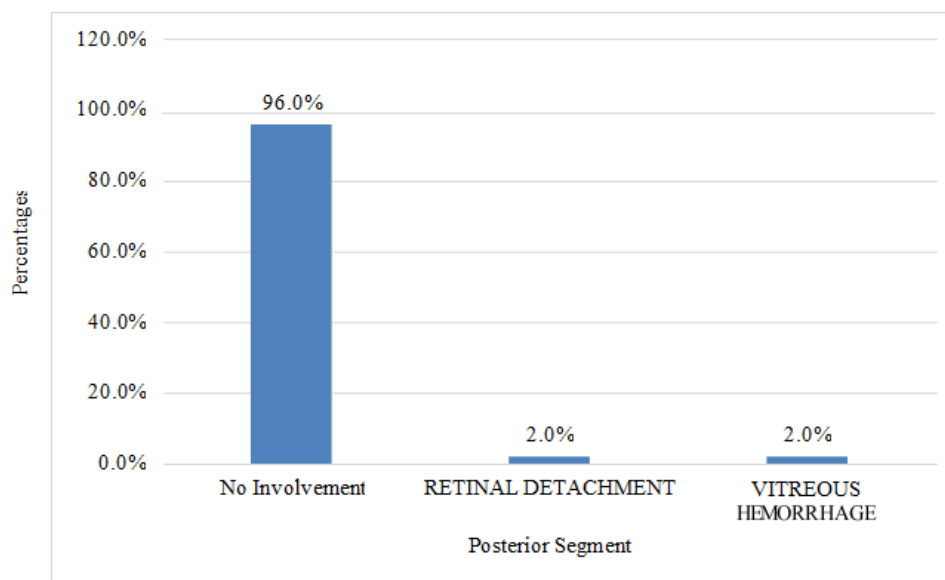


Figure 8: Bar chart of posterior segment in the study population (N=100)

Table 13: Descriptive analysis of v/a re in the study population (N=100)

V/A RE	Frequency	Percentages
6\9	29	29.0%
6\6	22	22.0%
6\18	12	12.0%
6\9P	8	8.0%
6\6P	7	7.0%
6\18NIP	3	3.0%
6\24	3	3.0%
NOT ASSESSED	3	3.0%
6\12	2	2.0%
6\18P	2	2.0%
6\24NIP	2	2.0%
HM +	2	2.0%
PL NEGATIVE	2	2.0%
2\60	1	1.0%
6\60	1	1.0%
6\9NIP	1	1.0%

Majority of the study population 29(29%) reported 6/9 and ,22(22%) reported 6/6 and followed by 12(12%) reported 6/18 and 8(8%) reported 6/9P in right eye. (Table 13)

Table 14: Descriptive analysis of v/a le in the study population (N=97)

V/A LE	Frequency	Percentages
6\6	34	35.1%
6\9	27	27.8%
6\9P	13	13.4%
6\18	8	8.2%
6\12	2	2.1%
6\18NIP	2	2.1%
6\18P	2	2.1%
6\36	2	2.1%
6/18 NIP	1	1.0%
6\24	1	1.0%
6\24NIP	1	1.0%
6\24P	1	1.0%
6\60	1	1.0%
6\6P	1	1.0%
6\9NIP	1	1.0%

Majority of the study population 34(34%) reported 6/6, 27(27%) reported 6/9 and followed by 13(13%) reported 6/9 P and 8(8%) reported 6/18 in left eye. (Table 14)

Table 15: Descriptive analysis of mode/type of injury in the study population (N=100)

Mode/Type of Injury	Frequency	Percentages
RTA (BLUNT TRAUMA)	30	30.0%
RTA(FRACTURE)	11	11.0%
CONTUSION	7	7.0%
FALL (BLUNT TRAUMA)	7	7.0%
INTRA OCULAR FOREIGNBODY	7	7.0%
PENETRATING INJURY	7	7.0%
DOMESTICVIOLENCE(BLUNTTRAUMA)	6	6.0%
LACERATION	6	6.0%
RTA (BLUNT TRAUMA)	5	5.0%
GLOBE RUPTURE	4	4.0%
BURNS INJURY	2	2.0%
CHEMICAL INJURY	2	2.0%
FALL (FRACTURE)	2	2.0%
PERFORATING INJURY	2	2.0%
PERFORATING	1	1.0%
RTA (FRACTURE)	1	1.0%

Majority of the study population 30(30%) reported RTA (Blunt trauma) as mode of injury followed by RTA (Fracture) with 11(11%) and contusion, Fall (Blunt trauma), Intra ocular foreign body, penetrating injury with 7(7%) each. (Table 15)

Table 16: Descriptive analysis of re v/a after treatment in the study population (N=100)

Re V/A After Treatment	Frequency	Percentages
Improved	75	75%
Not improved	25	25%

Among the study population, 75 (75%) participants were improved re V/A after treatment. (Table 16 & figure 9)

Figure 9: Pie chart of re v/a after treatment in the study population (N=100)

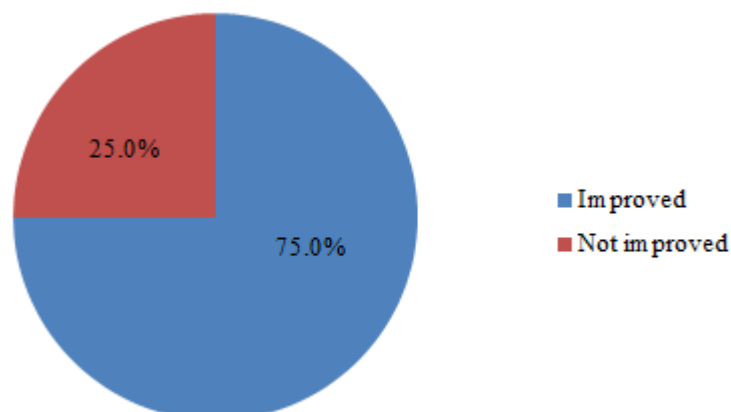


Table 17: Descriptive analysis of le v/a after treatment in the study population (N=100)

Le V/A After Treatment	Frequency	Percentages
Improved	83	83.0%
Not improved	17	17%

Among the study population, 83 (83%) participants were improved Le V/A after treatment. (Table 17 & figure 10)

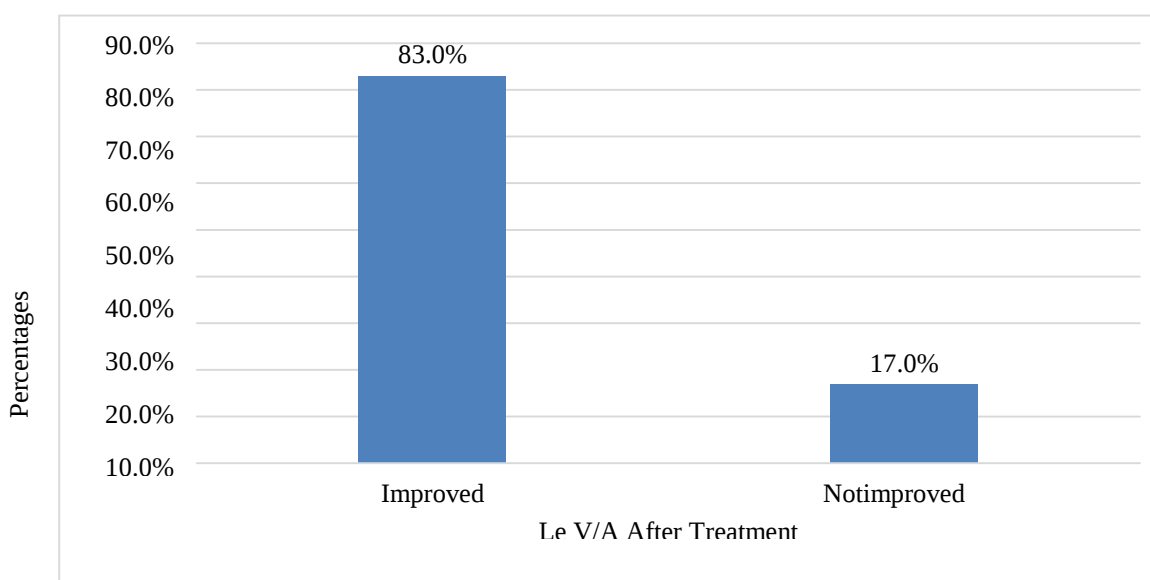


Figure 10: Bar chart of le v/a after treatment in the study population (N=100)

DISCUSSION

Worldwide one of the important causes of preventable visual impairment and blindness is ocular trauma. Based on age, geographical distribution, gender, and work pattern, the prevalence of ocular trauma can vary.¹¹ Due to the delegated nature of ocular tissue, eye injuries can result in permanent blindness. Awareness regarding the utilization of protective devices like goggles and protective shields can reduce the prevalence of eye injuries.¹² In developing and developed nations eye injuries are emerging as a major concern for the ophthalmologists.¹³ The present study was conducted to determine the prevalence, presentation, involvement of eyeball and visual outcome in patients with orbital injuries. A total of 100 subjects were enrolled in the final analysis.

The mean age $\pm$ SD of the patients in the present study was 38.31 ± 17.21 years. A retrospective study performed in a population of 5799 patients by Qi Y et al¹⁴, in which 35.5 ± 21.84 years was the mean age of the participants. Cao H et al¹⁵, conducted a retrospective study in 3559 patients in which the mean age of the patients was 29.0 ± 16.84 years. The mean age varies in studies due to the difference in sample size.

In the current study, the predominance of males was more as compared to females with 61.0%. Wang W et al¹⁶, carried out a retrospective study in a population of 2009 patients for a period of 5 years in which the majority of the patients were males with 84.4%. In another study conducted in Australia by Raymond S et al¹⁷ (2010), in which the number of males was more as compared to females with 64%. Majority of the patients affected with the eye injury in our study population were males leading to the loss of work and economic burden to their families as they were the potential earning group in most of the families.

Table 18: Comparison of the present study with other studies regarding gender distribution

Studies	Population	Percentage
Present study	100	61.0%
Mao CJ et al. ²⁰	162	Males (85.71%) Females (14.29%)
Kanoff, JM et al. ⁴⁰	146	Males (98%) Females (2%)
Shashikala, P et al. ⁵⁵	306	Males (75%) Females (25%)

In the present study, 31% of the participants were students, followed by housewives, unemployed with 21% and 8% respectively. Yumnam et al¹⁸, performed a descriptive study for a period of 2 years in which majority of the patients were workers with 34.46% followed by school going student, housewives, farmers, players, pre - school students and others with 18.11%, 9.95%, 8.84%, 6.15% and 8.84% respectively. In the current study, both eyes were affected in 15% of patients while left eye and right eye were affected in 37% and 48% of participants. A study was presented in 248 patients by Shtewi ME et al¹⁹, in which the right eye was affected in 42% of participants whereas left eye and both eyes were affected in 37.7% and 20.3% respectively. Based on the cause and severity, the involvement of the eye can vary.

Table 19: Comparison of the present study with other studies regarding the involvement of eyes

Studies	Population	Percentage
Present study	100	Right eye (48%) Left eye (37%) Both eyes (15%)
Puzari, B., et al. ²⁶	60	Right eye (52.1%) Left eye (29.42%) Both eyes (18.48%)
Shtewi, ME., et al. ²⁷	248	Right eye (42%) Left eye (37.7%) Both eyes (20.3%)

In the present study subconjunctival hemorrhage, corneal abrasion and conjunctival chemosis in the right eye were identified in 16%, 5% and 3% whereas subconjunctival hemorrhage, periorbital ecchymosis, conjunctival chemosis and corneal abrasion in the left eye were observed with 14%, 5%, 4% and 4% respectively.

The lid ecchymosis, edema, laceration, burns, ecchymosis with edema, abrasion and ecchymosis with laceration were observed in the present study with 17%, 8%, and 5%, 2%, 2%, 1% and 1% respectively. Gahlot A et al⁵⁹, conducted a prospective study in 114 patients in which the lid laceration and ecchymosis injuries were presented with 39.34% and 33.16% respectively. A study was performed by Swathi A et al²², in which 30% of patients was observed with lid edema whereas 25% with lid laceration. Menon C et al²³, presented a study in 832 patients in which lid laceration and ecchymosis with edema were identified in 48.2% and 68.6% of patients respectively.

Roof orbital fracture, floor, lateral wall and medial wall fractures in this study were identified with 4%, 7%, 3% and 0% respectively. Marudhamuthu E et al²⁴, performed a study on 150 cases in which out of 14 orbital fractures 57.14% were the lateral wall fracture followed by medial wall and floor fractures with 21.43% and 21.43% respectively.

Swathi A et al²², conducted a study in a population of 200 patients in which 29% of patients was identified with orbital fractures.

In this present study corneal abrasions and opacity were noted with 92.9% and 7% respectively. Shtewi ME et al¹⁹, performed a study in a population of 248 participants in which 30.4% of patients were identified with corneal abrasions. A cross sectional study conducted by Negussie D et al²⁵, in 26400 patients in which 16.5% of patients was observed with corneal abrasions.

Subconjunctival hemorrhage, chemosis, subconjunctival hemorrhage with chemosis, congestion and subconjunctival hemorrhage with congestion were observed in the present study with 74%, 12.3%, 5.5%, 4.1% and 4.1% respectively.

In a population of 114 patients Gahlot A et al²¹, performed a prospective study in which subconjunctival hemorrhage and chemosis were identified with 54.10% and 18.85% respectively. Swathi A et al²², conducted a study in a population of 200 participants in which 22.5% of patients were identified with subconjunctival hemorrhage. Maiya A et al²⁵, presented a prospective study in which 37.89% of the patients with the majority was identified with subconjunctival hemorrhage.

The anterior chamber of the eye was not affected in 98% of the patients in the current study. Iritis and flare cells were observed in 1% of the participants. Steroids and antibiotic eyedrops

were given in tapering doses until the eye were quiet in such patients. In this study, 2% of the population were involved in the chemical injury, and 2% of the people had an injury due to burns. For Acid burns, copious saline wash was given, followed by fluorescein staining of the cornea. Epithelium and stromal involvement were seen for which frequent topical instillation of lubricant and antibiotic eye drops were given. 4% Globe rupture was noted in this study. Globe exploration and repair with 10-0 nylon suture was done. No intraocular foreign body were seen during the surgery. The intraocular foreign body was noted in 7% of this study population. Foreign body removal under local anesthesia was done with repair and antibiotic and lubricant eye drops were given.

In the present study retinal detachment and vitreous hemorrhage in the posterior segment were noted with 2% each. Vitreous hemorrhage was diagnosed on B-scan and was self-resolving in one case and vitrectomy was done in the other case. In Retinal detachment, retinal reattachment and silicone oil injection was done in both cases but the visual outcome was poor.

CONCLUSION

A total of 100 patients were included in the present study. The predominance of males was high in the study population, with 61% with a mean age $\pm$ SD of 38.31 ± 17.21 years. Majority of the patients were students and housewives with 31% and 21% respectively. The involvement of the right eye was high, with 48% followed by left eye with 37%. The right eye was mostly identified with subconjunctival hemorrhage and corneal abrasion with 16% and 5% respectively. Whereas left eye with subconjunctival hemorrhage and periorbital ecchymosis with 14% and 5% respectively.

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Ethical approval: The study was approved by the Institutional Ethics Committee

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

- [1] McGwin G, Jr., Owsley C. Incidence of emergency department-treated eye injury in the United States. *Arch Ophthalmol.* 2005;123(5):662 -6.
- [2] Andreotti G, Lange JL, Brundage JF. The nature, incidence, and impact of eye injuries among US military personnel: implications for prevention. *Arch Ophthalmol.* 2001;119(11):1693 -7.
- [3] Shruti L. Evaluation of epidemiological aspects and prognostic factors determining final visual outcome in patients of blunt ocular trauma: a prospective study of 250 patients. *Indian J Appl Res.* 2019;9(6):65 -8.
- [4] Lin KY, Ngai P, Echegoyen JC, Tao JP. Imaging in orbital trauma. *Saudi J Ophthalmol.* 2012;26(4):427 - 32.

- [5] May DR, Kuhn FP, Morris RE, Witherspoon CD, Danis RP, Matthews GP, et al. The epidemiology of serious eye injuries from the United States Eye Injury Registry. *Graefes Arch ClinExpOphthalmol.* 2000;238(2):153-7.
- [6] Salama A, Elatif H, Ghoneim A, Dawoud M. The role of multidetector computed tomography in the diagnosis of traumatic orbital lesions in emergency settings. *Tanta Med J.* 2015;43(2):60 -5.
- [7] Gupta S, Kaur G, Gurunadh VS, Khan MA. Imaging Modalities in Ocular Trauma. *DOS Times.* 2015;20(8):51-7.
- [8] Padma M, Padma Prabha D. Role of radio imaging in ocular trauma. *MRIMS J Health Sci.* 2015;3(3):160 -3.
- [9] Naskar AK, Adhikari S, Bandopadhyay S, Mondal KK, Chakravorty A, Sen S. Epidemiology, types and clinical features of cases of ocular injuries attending a tertiary care teaching hospital of Eastern India. *IntSurg J.* 2018;5(3):1072 -8.
- [10] Pizzarello LD. Ocular trauma: time for action.
- [11] *Ophthalmic Epidemiol.* 1998;5(3):115 -6.
- [12] Imran S, Amin S, Daula MI-H. Imaging in ocular trauma optimizing the use of ultrasound and computerised tomography. *Pak J Ophthalmol.* 2011;27(3):146-51.
- [13] Dastevska-Djosevska E. Ultrasonography in ocular trauma. *Pril (MakedonAkadNaukUmet Odd Med Nauki).* 2013;34(2):105 -13.
- [14] Bauza AM, Emami P, Son JH, Langer P, Zarbin M, Bhagat N. Work-related open-globe injuries: demographics and clinical characteristics. *Eur J Ophthalmol.* 2013;23(2):242 -8.
- [15] IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
- [16] Lavaju P, Badhu BP, Shah S. Clinical Profile and Factors Determining the Final Visual Outcome of Patients Presenting with Ocular Trauma. *Delhi J Ophthalmol.* 2018;29(1):14 -9.
- [17] Misra S, Nandwani R, Gogri P, Misra N. Clinical profile and visual outcome of ocular injuries in a rural area of western India. *Australas Med J.* 2013;6(11):560-4.
- [18] Saini JS, Mukherjer AK, Dabral SM, Moraes O. A profile of penetrating eye injuries. *Indian J Ophthalmol.* 1985;33(2):95-7.
- [19] Shashikala P, Sadiqulla M, Shivakumar D, Prakash KH. Profile of ocular trauma in industries-related hospital. *Indian J Occup Environ Med.* 2013;17(2):66 - 70.
- [20] Yumnam C, Laishram U, Gahlot A, Thoudam R, Keisham S. Epidemiological profile of ocular trauma in a tertiary care facility in Imphal. *J Med Soc.* 2016;30(3):162-5.
- [21] Shtewi ME, Shishko MN, Purohit GK. Road traffic accidents and ocular trauma: experience at tripoli eye hospital, libya. *Community Eye Health.* 1999;12(29):11-2.
- [22] Puzari B, Das R, Pegu I. A study on ocular injuries following road traffic accidents. *Int J Res Med Sci.* 2017;5(2):627.
- [23] Gahlot A, Magdum R, Singh M, Kumari P. A study of ocular trauma profile and its visual outcome in road traffic accidents. *Nat J Med Res.* 2015;5(3): 211-5.
- [24] Swathi A, Matheen A, Charanya C, Sudhakar S. Prospective Study of Ocular

Manifestation of Road Traffic Accidents on East Coast Road Presenting to Tertiary Care Centre in Tamilnadu. *Int J Health Sci Res (IJHSR)*. 2016;6(8):84 -8.

- [25] Menon L, Mani S, Mathew A. The prevalence of ocular manifestations in road traffic accidents treated at a rural tertiary care hospital in south india: a cross sectional study. *Int J Res Med Sci*. 2017;5(10):4380 -4.
- [26] Marudhamuthu E, Sivakumar N, Kumaravel T. Study of ocular injuries in road traffic accident patients. *J Evolution Med Dent Sci*. 2017;6(41):3219 -22.
- [27] Shtewi ME, Shishko MN, Purohit GK. Road trafficaccidents and ocular trauma: experience at tripoli eyehospital, libya. *Community Eye Health*.1999;12(29):11-2.
- [28] Puzari B, Das R, Pegu I. A study on ocular injuriesfollowing road traffic accidents. *Int J Res Med Sci*.2017;5(2):627.