ORIGINAL RESEARCH ARTICLE

VISUAL OUTCOME AND PROGNOSTIC FACTORS IN MECHANICAL INJURY OF ANTERIOR SEGMENT OF EYE

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Received: 21-09-2024 / Revised: 05-10-2024 / Accepted: 22-11-2024

ABSTRACT

INTRODUCTION

Trauma can result in wide spectrum of eye injury of the globe, optic nerve and adnexa ranging from superficial to vision threatening complication Timely intervention and surgical repair of anterior segment injury and subsequent visual rehabilitation with long term impact is a topic of great significance and challenges to the practicing ophthalmologists. Even though with the advent of new modalities and improved technology, the management of penetrating ocular injuries has changed. We need to prognosticate any patient with ocular trauma before and even after the repair of ocular injury.

OBJECTIVES

1. To assess the various factors affecting the final visual outcome in patients with mechanical ocular injury
2. To assess the severity of ocular trauma at the time of presentation

METHOD

This prospective study was conducted on minimum of 72 patients fulfilling the inclusion criteria in the department of Ophthalmology, R. L. Jalappa Hospital and Research centre, Kolar from August 2022 to December 2023, after obtaining ethical clearance from Institutional Ethical Committee of Sri Devaraj Urs Medical College and written informed consent from the subjects. All cases of mechanical ocular injuries involving the anterior segment of eye age more than 5 years were assessed by a detailed history regarding Time of onset an mode of injury, Mode of injury Clinical examination including Visual acuity, Color Vision, Slit lamp examination, fundus examination, X-ray orbit, B-Scan CT and MRI orbit if needed.

RESULTS

Among 72 eyes studied, patients' average age (years) was 31.82, and most were 11-30. Around 60% were males. The left eye was implicated among 45.8%, and 9.7% had bilateral eye involvement. Around one-fourth had trauma by RTA, followed by wooden pieces. At the

presentation time, 44.4% had Cf 1-meter to Cf 5-meter vision, and 30.6% had 6/60 to 6/24 visual acuity. At one week follow-up, 54.2% had a VA 6/60 to 6/24, 26.4% had 6/18 to 6/6, and 19.4% had Cf 1 meter to Cf 5 meter. At one month follow-up, 25% had a VA 6/60 to 6/24, 73.6% had 6/18 to 6/6, and 1.4% had Cf 1 meter to Cf 5 meter Corneal foreign body with epi defects was the most common complication, followed by Traumatic cataract (9.7%), IOP was high among 13.9% of the patients.11.1% of the patients had wounds involving the pupillary axis. 16.7% of the patients were immunocompromised. Most patients presented within 24 hours (75%), while 16.7% and 8.3% presented within 24-48 hours and >48 hours, respectively.

CONCLUSION
This study concluded, most had ocular injury by RTA, Corneal foreign body with epi defects is the common complications observed upon the presentation Three-fourths of those with ocular injury had good vision by follow-up. A significant association was found between visual acuity and wounds involving the pupillary axis, the immunocompromised status of the patients.

KEY WORDS: Ocular Trauma, Visual Acuity, RTA, Traumatic Cataract.

INTRODUCTION

Ocular morbidity and blindness are mostly caused by ocular trauma.[1] Globally, as per the World Health Organization (WHO), around 55 million traumatic etiology for eyes occur annually. Ocular trauma contributes to more than 10% of ophthalmology consultations.[2] Ocular trauma is the primary causative factor for vision loss in the low-middle-income countries. Ocular trauma is a leading etiology for blindness globally.[3]

It affects around 500,000 individuals, often necessitating surgery and placing a heavy strain on society.[4] Literature suggests that socioeconomic factors, including the individual's residence, are risk factors for ocular injuries.[5]

There are multiple ways in which injuries to the eye can damage the vision, leading to extreme ocular morbidity. Up to 6 million children worldwide suffer from ocular trauma each year, with a fifth of those cases necessitating hospitalization.[6] The etiological variables are very varied and directly affect the final visual result. Numerous issues will be covered, including the trauma's origin, severity, first visual acuity, timing of treatment initiation, need for numerous surgeries, correlation with endophthalmitis, counseling, and the management's realistic result. Over the past three decades, the achievement of the final visual outcome has been enhanced through progress in eye surgical tools and methods, alongside shifts in our understanding of the disease processes and treatment of eye injuries. The well-being of the patient, along with that of their loved ones and the broader community, is significantly impacted by injuries to the eye.[7]

Over the last 30 years, developments in equipment and ocular surgical methods and a better understanding of the modes of pathology and physiological mechanisms have aided in the effective therapy of vitreoretinal surgery for damaged eyes.[8] Several prognostic criteria, including the severity of the injury, the extent of anatomical degree, vision status at the time of presentation and initiation of therapy are necessary to achieve or retain usable vision.[8,9] Understanding the characteristics of eye injuries is crucial for implementing the right measures to prevent and treat long-term complications in severe eye cases. These injuries can significantly damage the eye's overall structure and lead to a loss of vision.

It is crucial to comprehend these characteristics in the local contexts since ocular trauma patients vary in their prognostic factors and visual acuity across the region. Thus, the current investigation has been started.

Need for the study

Trauma can result in wide spectrum of eye injury of the globe, optic nerve and adnexa ranging from superficial to vision threatening complication.[10]

Timely intervention and surgical repair of anterior segment injury and subsequent visual rehabilitation with long term impact is a topic of great significance and challenges to the practicing ophthalmologists. [10]

Even though with the advent of new modalities and improved technology, the management of penetrating ocular injuries has changed.[10]

We need to prognosticate any patient with ocular trauma before and even after the repair of ocular injury.[2]

The factors likely to predict outcome after ocular injury are: mode of injury, preinjury visual acuity, time lag between injury and surgery, site of the wound. [2]

MATERIALS AND METHODS:

Study Design

A prospective Study.

Source of Data:

This prospective study was conducted on minimum of. 72 eyes fulfilling the inclusion criteria in the department of Ophthalmology, R. L. Jalappa Hospital and Research centre, Kolar from August 2022 to December 2023, after obtaining ethical clearance from Institutional Ethical Committee **[NO. SDUMC/KLR/IEC/313/2022-23, Date: 20-07-2022]**of Sri Devaraj Urs Medical College and written informed consent from the subjects

STUDY DURATION: September 2022 to December 2023

Inclusion Criteria:

1. All cases of mechanical ocular injuries involving the anterior segment of eye age more than 5 years.

Exclusion Criteria:

1. Prior history of intra ocular surgery
2. Presence of intra ocular foreign body or endophthalmitis at the time of presentation
3. Chemical injuries of eye
4. Posterior segment of eye injury

Patients who are unconscious at the time of presentation

Method of Collection of Data

A total of 72 eyes fulfilling the inclusion criteria will be included in this study. After prior consent from the patient or guardian, a detailed history regarding: Time of onset of injury, Mode of injury Preliminary general examination of patient will be done with these investigations:

1. Visual acuity assessment by using Snellen chart for distant vision.

2. Near vision by using near vision charts.
3. Color Vision by Ishihara test
4. Slit lamp bio microscopy for evaluation of anterior segment.
5. Fundus examination by IDO
6. X-ray orbit
7. B-Scan
8. CT and MRI orbit if needed

Sample Size Estimation

Sample size was estimated by using the proportion of Hyphema in subjects who had Anterior Segment Trauma of the Eye was 22% from the study by Muhammad Yasir Arfat et al. using the formula

$$\text{Sample Size} = \frac{Z_{1-\alpha/2}^{2}\, P\,(1-P)}{d^2}$$

$Z_{1-\alpha/2}$ = is standard normal variate (at 5% type 1 error ($P<0.05$) it is 1.96 and at 1% type1 error($P<0.01$) it is 2.58).As in majority of studies P values are considered significant below 0.05 hence 1.96 is used in formula.

P= Expected proportion in population based on previous studies or pilot studies

d= Absolute error or precision

P = 22% or 0.22

q = 78% or 0.78

d = 10% or 0.10

Using the above values at 95% Confidence level a sample size of 66 subjects will be included in the study. Considering 10% Nonresponse a sample size of $66 + 6.7 \approx 72$ subjects will be included in the study.

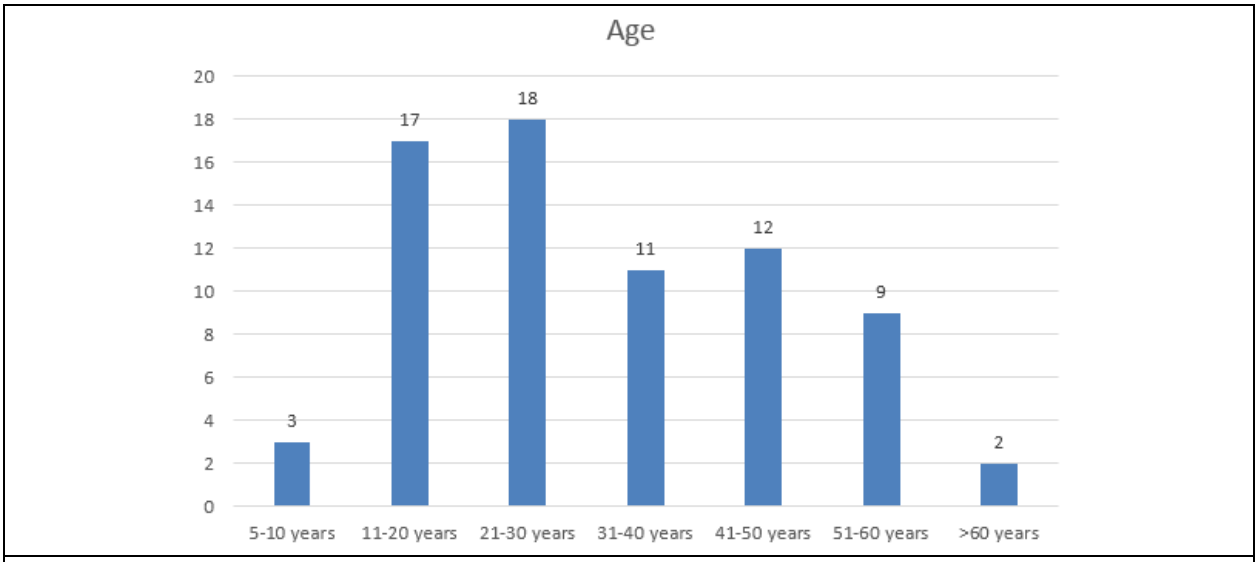
Statistical Methods used for this study

Data entered into Microsoft excel data sheet and analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

Chi-square used as test of significance. Continuous data represented as mean and standard deviation. Independent t test will be used as test of significance to identify the mean difference. P value <0.05 will be considered as statistically significant.

RESULTS

Majority of the patients were in the age group of 21-30 years (25%), while 23.6% were in age group 11-20 years.

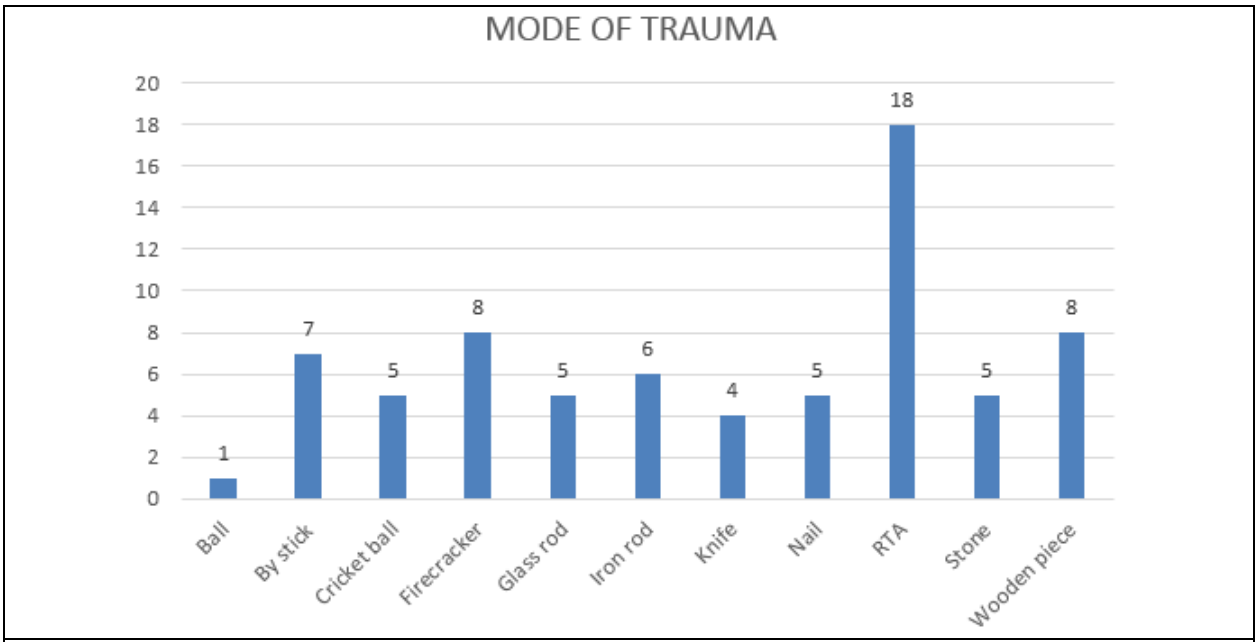


Graph 1: Age Distribution

Majority of the patients were males (59.7%), while 40.3% were females.

Left eye was involved among 45.8% of the patients, while right eye was involved among 44.4% of the patients. 9.7% of the patients had bilateral eye involvement.

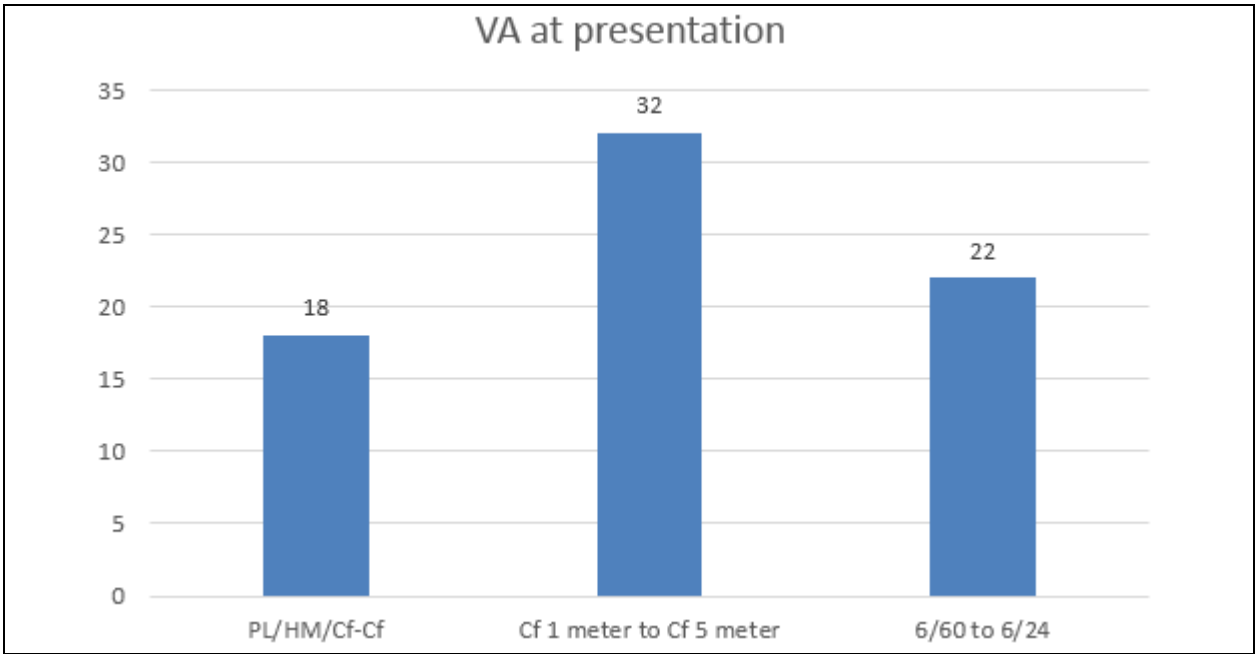
MODE OF TRAUMA



Graph 2: - Mode of Trauma

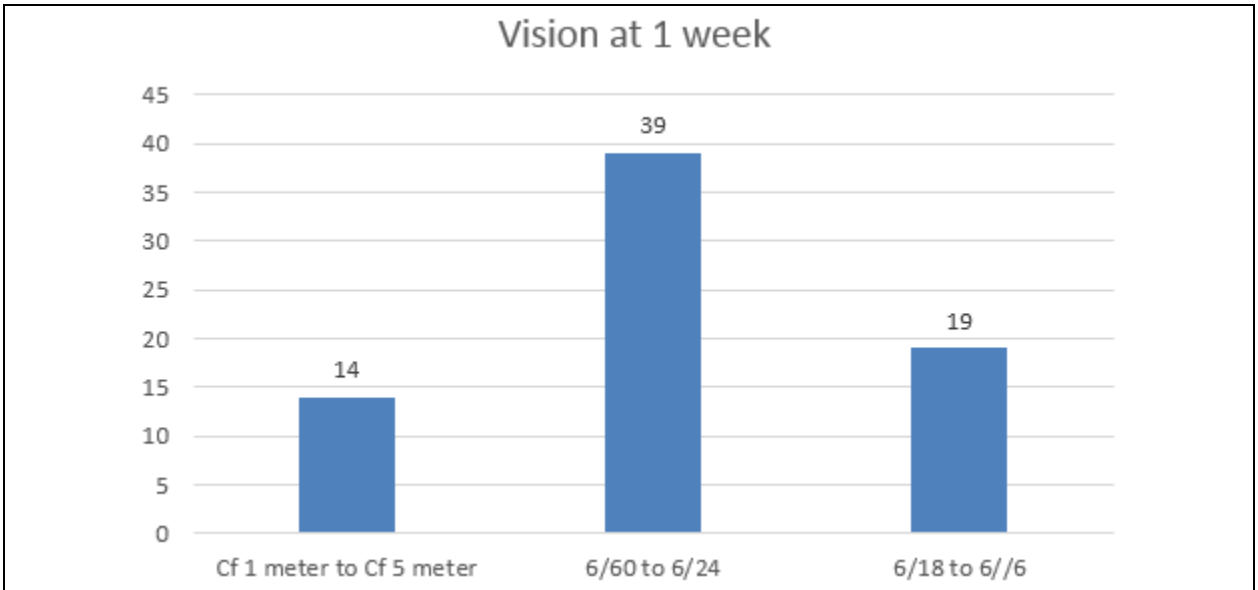
- Severity of ocular trauma at presentations
- Most had Cf 1 meter to Cf 5 meter at presentation (44.4%).

VA at presentation



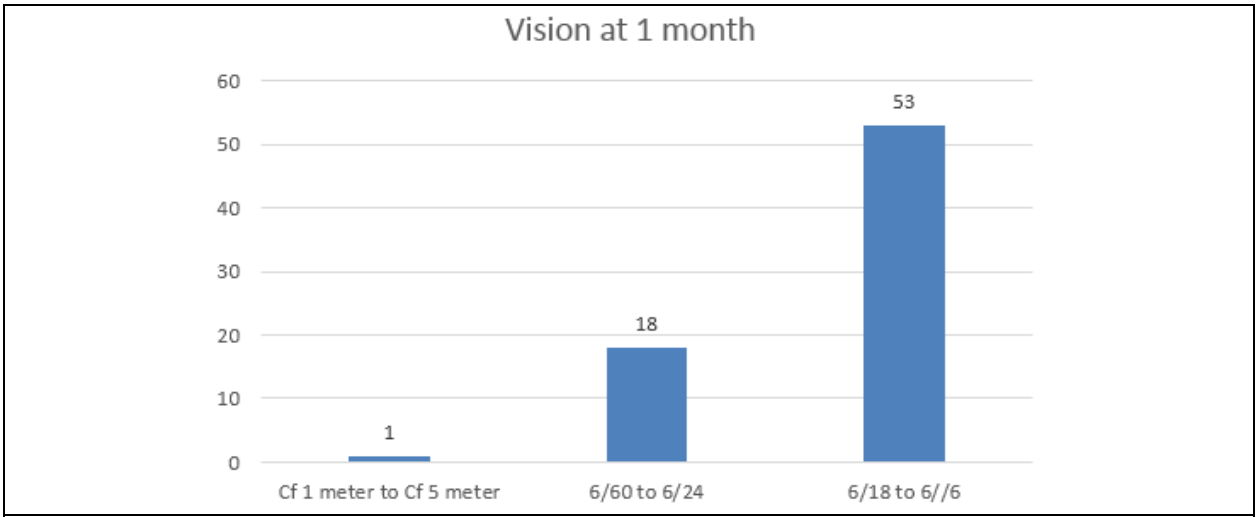
Graph 3: VA at Presentation

- Follow-up
- At one week follow-up, 54.2% had a VA 6/60 to 6/24, 26.4% had 6/18 to 6//6 and 19.4% had Cf 1 meter to Cf 5 meter.



Graph 4: Vision at 1 Week

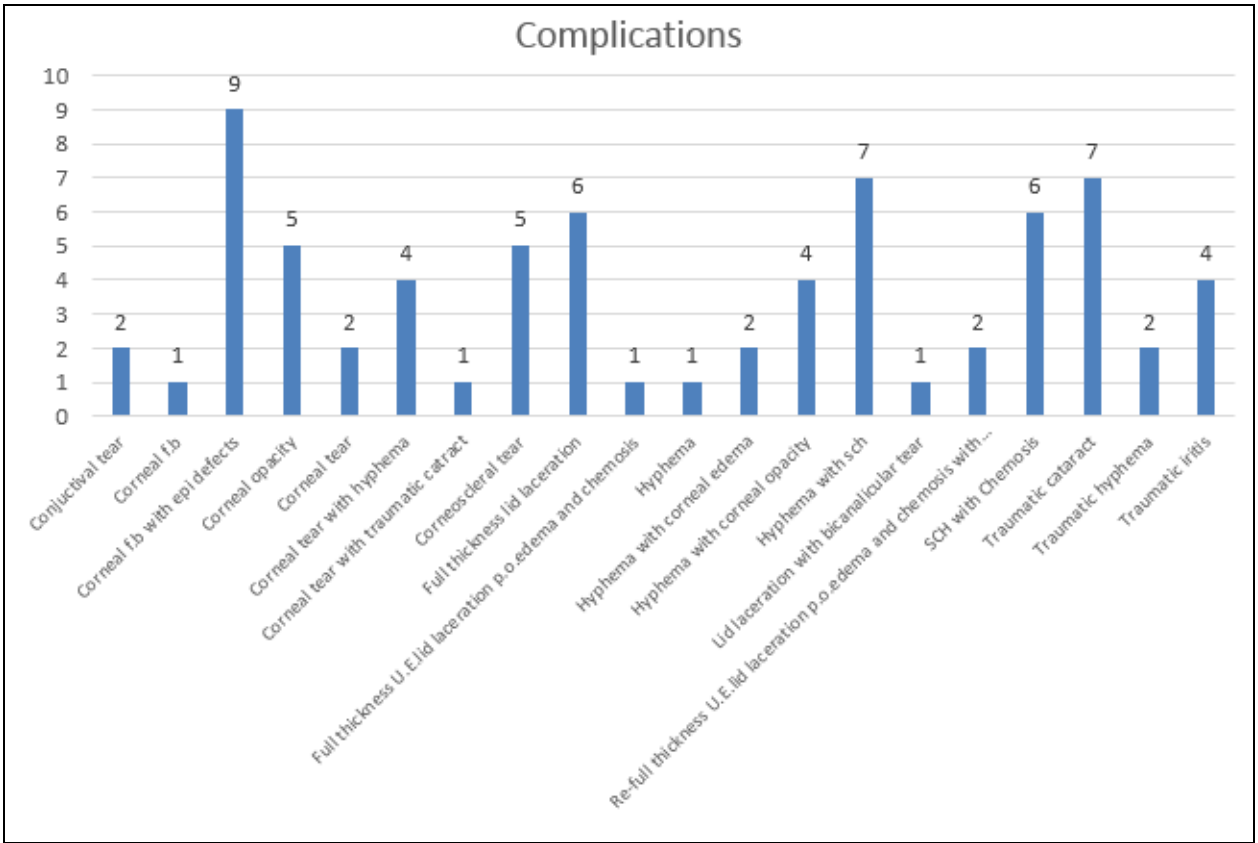
- At one month follow-up, 25% had a VA 6/60 to 6/24, 73.6% had 6/18 to 6//6 and 1.4% had Cf 1 meter to Cf 5 meter.



Graph 5: Vision at 1 Month

- Corneal foreign body with epi defects was the most common complication, followed by Traumatic cataract (9.7%), Hyphema with sch (9.7%), Full thickness lid laceration (8.3%), SCH with Chemosis (8.3%), Corneoscleral tear (6.9%), Corneal opacity (6.9%)

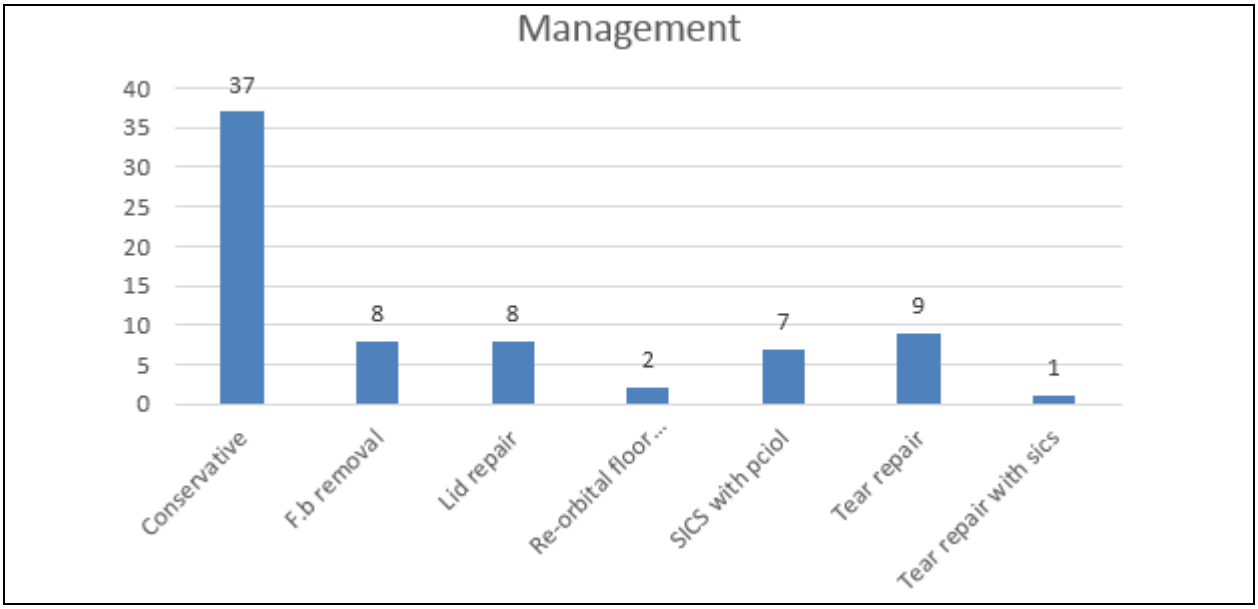
Complications



Graph 6: Complications

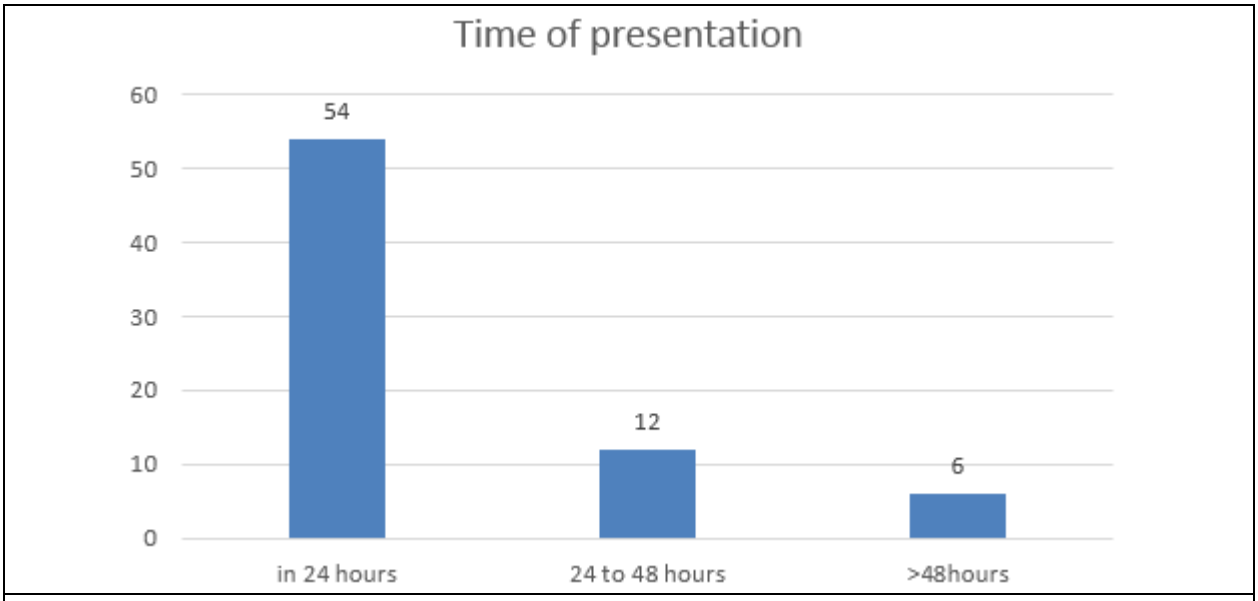
- More than half of the patients were managed conservatively (51.4%).

Management



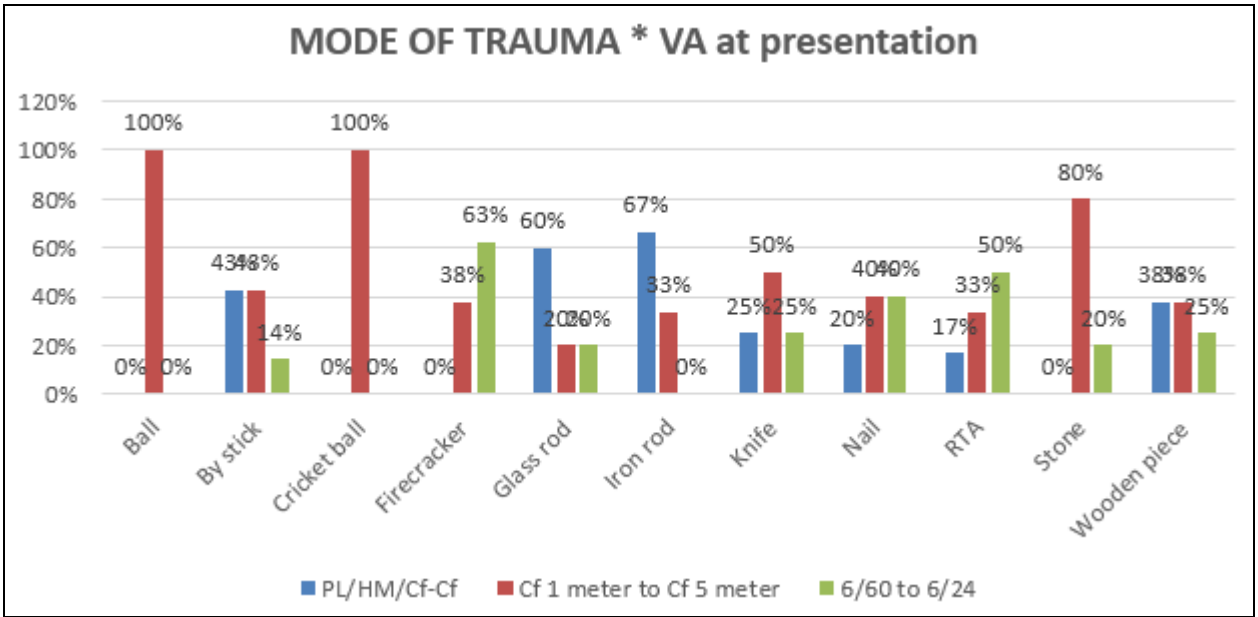
Graph 7: Management

- IOP was high among 13.9% of the patients.
- 11.1% of the patients had wound involving pupillary axis
- 16.7% of the patients were immunocompromised
- Majority of the patients presented within 24 hours (75%), while 16.7% and 8.3% patients presented 24-48 hours and >48 hours, respectively.



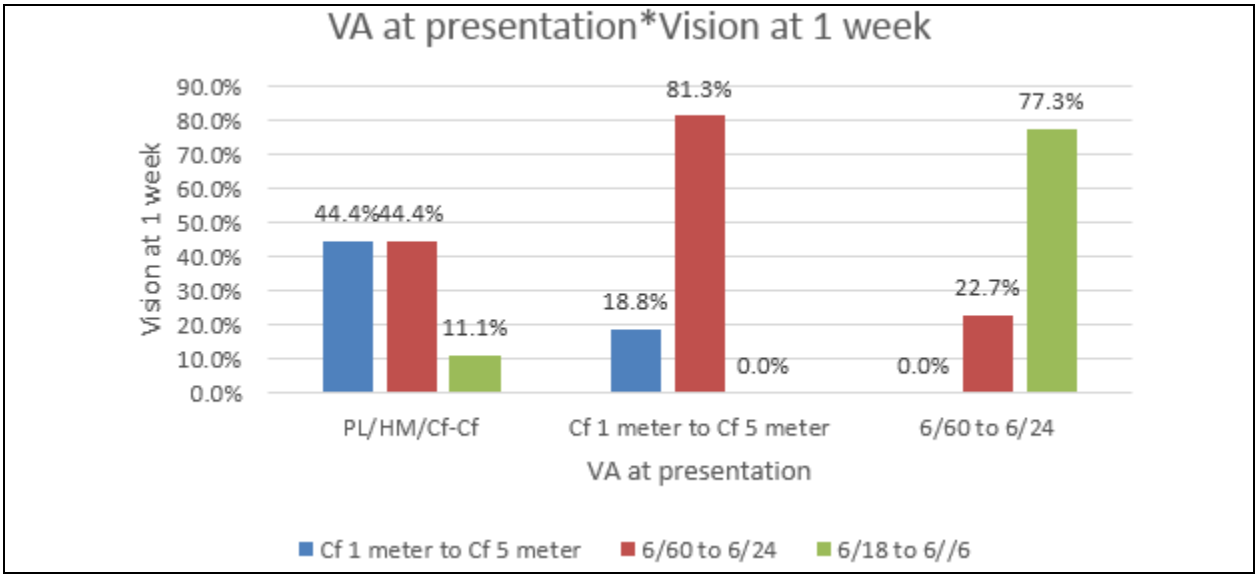
Graph 8: Time of Presentation

- Prevalence of glaucoma was 6.9%.
- Majority or all patients with stone, knife, stick and ball injuries had a vision of Cf 1 meter to Cf 5 meter at presentations. Most of the glass rod, iron rod and wooden piece injuries patients had a vision of PL/HM/Cf-Cf.



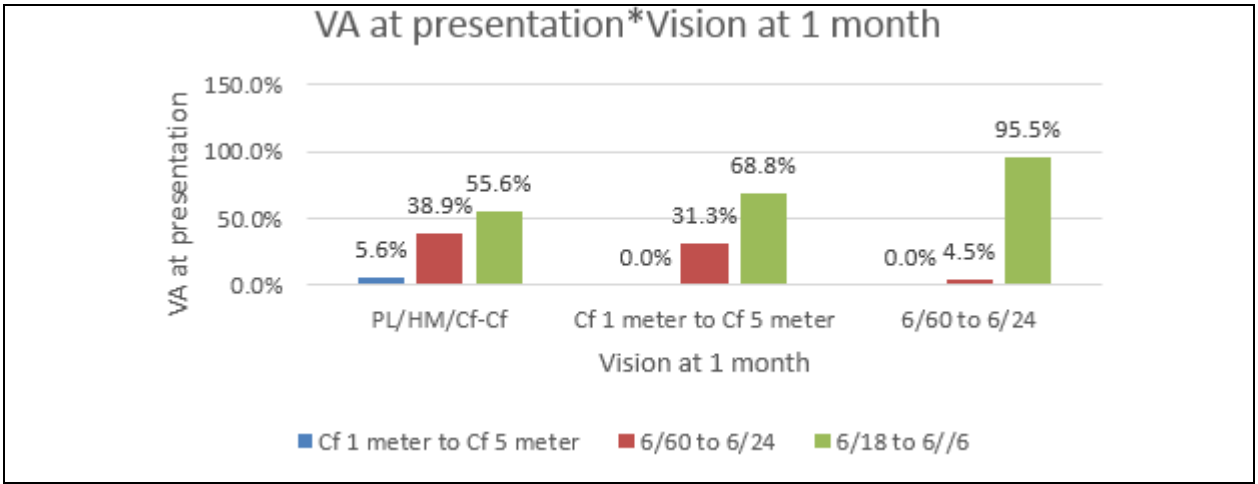
Graph 9: Mode of Trauma * VA at presentation

- All patients who had PL/HM/Cf-Cf at presentation showed improvement at 1 week after management, while 81.3% among the Cf 1 meter to Cf 5 meter and 77.3% among 6/60 to 6/24 patients showed improved VA.



Graph 10: VA at Presentation* Vision at 1 Week

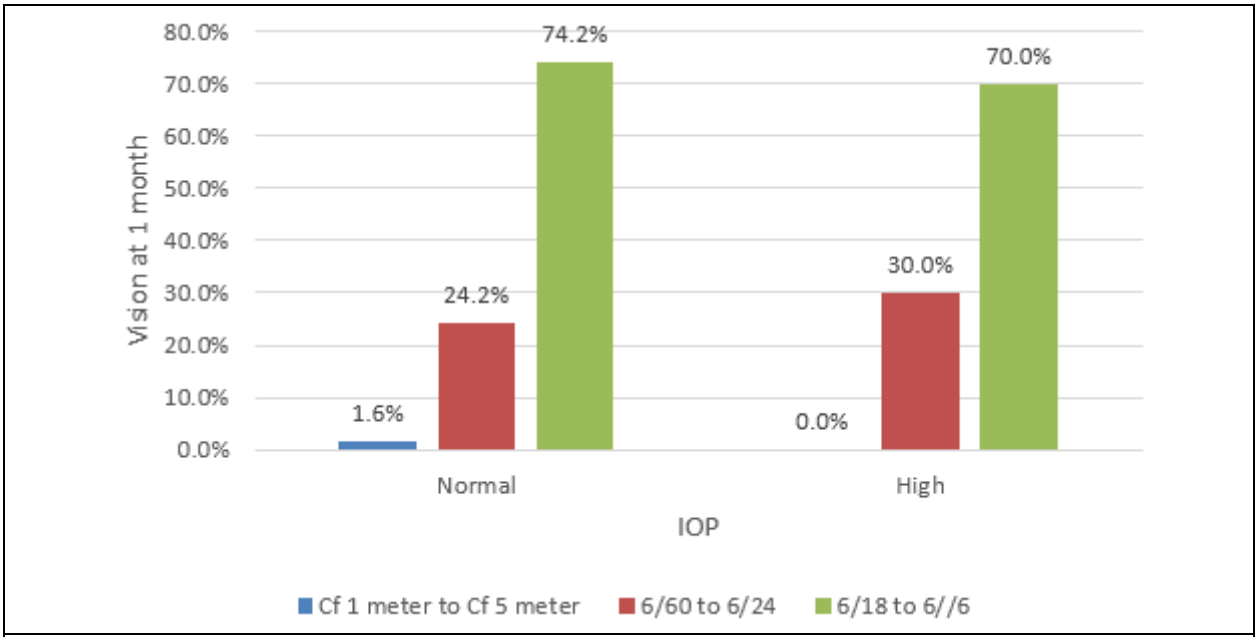
- All patients who had PL/HM/Cf-Cf and Cf 1 meter to Cf 5 meter at presentation showed improvement at 1 month after management, while 95.5% among the 6/60 to 6/24patients showed improved VA. None of the patients has their VA deteriorated at 1 week or 1 month.



Graph 11: VA at Presentation* Vision at 1 Month

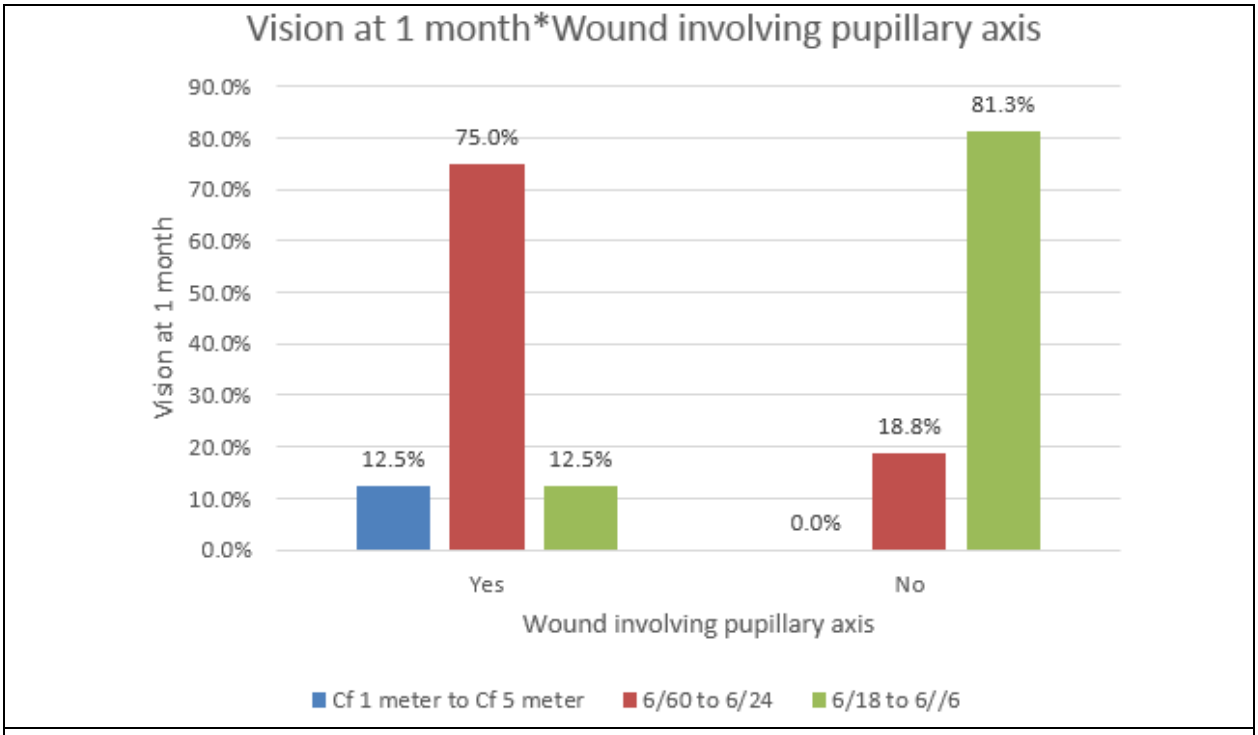
Factors affecting the final visual outcome in patients

- There was no association between IOP and vision at 1 month.



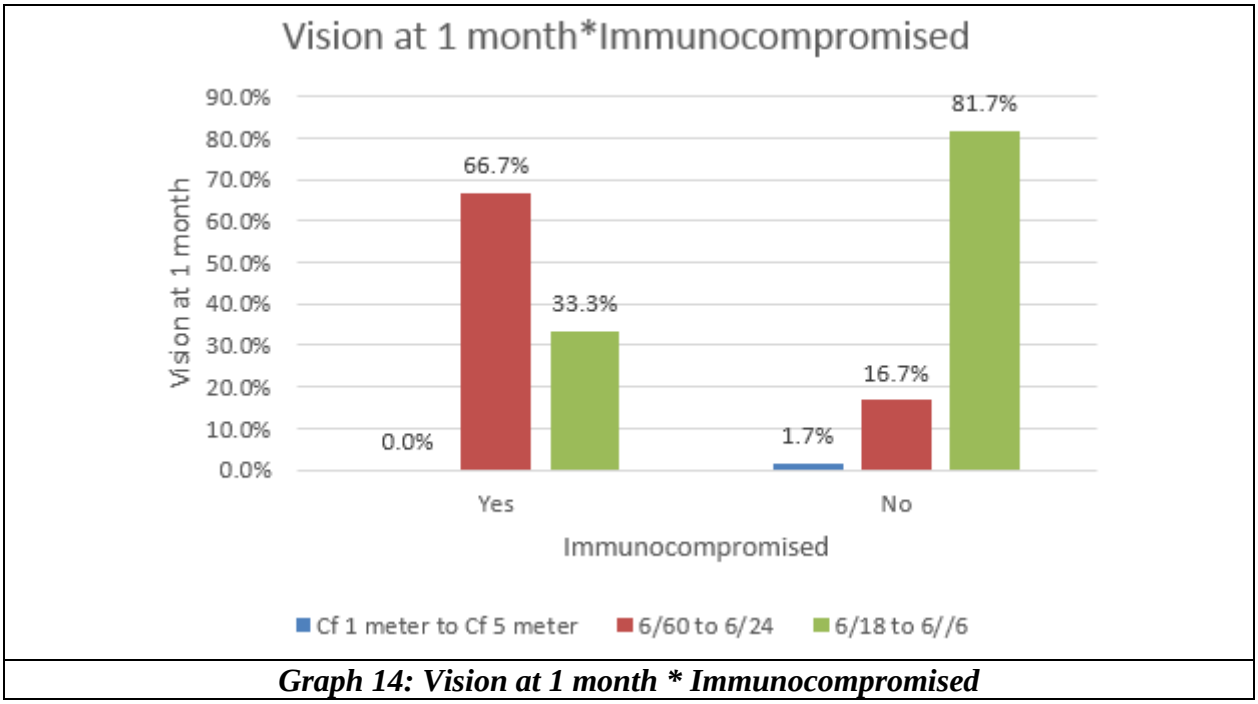
Graph 12: Association between IOP and Vision at 1 Month

- There was a significant association between Wound involving pupillary axis and poor visual outcomes.



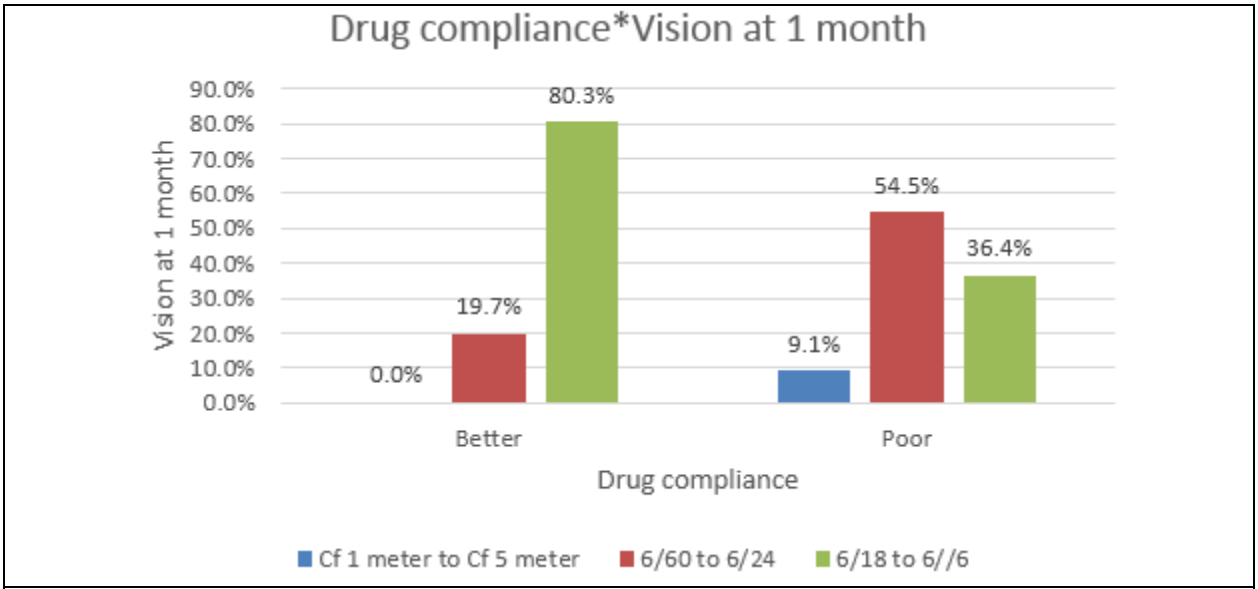
Graph 13: Vision at 1 month * Wound Involving Pupillary Axis

- There was a significant association between immunocompromised status and poor visual outcomes.



Graph 14: Vision at 1 month * Immunocompromised

- There was a significant association between better drug compliance and good visual outcomes.



Graph 15: Drug Compliance * Vision at 1 Month

DISCUSSION

Our prospective study assessed various elements influencing the final visual outcome among those with ocular injuries. We determined the grade of ocular trauma during admission. We included cases of mechanical ocular injuries involving the anterior segment among patients. We excluded those who had prior trauma or chemical injuries, foreign body in the eye, or endophthalmitis.

Demography

Among 72 eyes studied, patients' average age (years) was 31.82, and most were 11-30. Around 60% were males. The left eye was implicated among 45.8%, and 9.7% had bilateral eye involvement. Around one-fourth had trauma by RTA, followed by wooden pieces or firecrackers. At the presentation time, 44.4% had Cf 1-meter to Cf 5-meter vision, and 30.6% had 6/60 to 6/24 visual acuity. At one week follow-up, 54.2% had a VA 6/60 to 6/24, 26.4% had 6/18 to 6/6, and 19.4% had Cf 1 meter to Cf 5 meter. At one month follow-up, 25% had a VA 6/60 to 6/24, 73.6% had 6/18 to 6/6, and 1.4% had Cf 1 meter to Cf 5 meter.

In a prospective study conducted by Wagh et al.[11] ocular trauma study participants were followed up at one, three, and six weeks, while the present study followed up at one and four weeks. The majority (35%) were in the age group of 11-30 years, similar to the present study. The average age was 32.28 ± 16.7, while in the present study, it was observed as 31.82±15.76 years, which is comparable. Around 90% were males, which is higher than in the present study. 55% had an injury in the left eye, while in the present study, the left eye was involved among 45.8%. Three-fourths of the patients had RTA, which is higher than the present study (25%).

In the Jawade et al.[12] study, 20% of 103 patients were due to RTA, and two-thirds were males, similar to the present study. Patients were followed up at weeks 1 and months one and six, while the present study assessed the outcomes at 1 week and 1 month.

In Malawi, among the ocular injury cases reported by Zungu et al.,[13] 22.5% were the age group, followed by children under 11 (35%), similar to the present study. In terms of eye injury, male predominance was observed, which was similarly reported in our study. Most adult injuries were due to RTA (48%), higher than in the present study.

Complications and factors affecting visual outcomes:

Corneal foreign body with epi defects was the most common complication, followed by Traumatic cataract (9.7%), Hyphema (9.7%), Full-thickness lid laceration (8.3%), SCH with Chemosis (8.3%), Corneoscleral tear (6.9%), Corneal opacity (6.9%). More than half of the patients were managed conservatively (51.4%). IOP was high among 13.9% of the patients.

11.1% of the patients had wounds involving the pupillary axis. 16.7% of the patients were immunocompromised. Most patients presented within 24 hours (75%), while 16.7% and 8.3% presented within 24-48 hours and >48 hours, respectively. Glaucoma was present in 6.9%. Better compliance was seen in 85%.

There was no association between age, gender, IOP, presentation time, glaucoma, and vision at 1 month. There was a significant association between wounds involving the pupillary axis, immunocompromised status, better drug compliance, and poor visual outcomes.

In the Jawade et al. study, 83% had lid edema and conjunctival chemosis, 84% had a sub-conjunctival hemorrhage, 16% had corneal abrasion, 31% had hyphaema, 2% had traumatic optic neuropathy, 7 and 8% had angle recession glaucoma. However, in our study, hyphaema (10%) and chemosis (8%) were comparatively lower. At six months, 44% had a visual acuity 6/6, which is lower than in the present study.

The visual outcome in 6/18-6/6 improved from 61% at presentation to 63% in week one and 67% in six weeks in a similar prospective study. In the present study, 11% of PL/HM/Cf-Cf patients at presentation showed improvement at 1 week to 6/18 to 6/6 and 56% at one month. 77.3% of patients in 6/60 to 6/24 showed improved VA in one week, and 96% showed improvement in VA in one month. The improvement to 6/18-6/6 in our study was comparatively higher than the present study, probably because the RTA causes in our study were lesser (75% vs 25%).

In the Maiya et al. research, patients with blunt ocular trauma were enrolled. Among them, 44.2% were in 21–40 years. 48.4% agricultural injuries. 37.8% had subconjunctival bleeding, which was followed by traumatic uveitis (28%). In our study, a similar proportion of patients was in the 20-40 age group, and 8% had SCH, which was lower in comparison. The difference was probably due to the inclusion of only blunt injury patients in the Maiya et al. study.

Singh et al. included 103 patients with ocular injury. They observed that one-third of injuries were at home (32%), then by the workplace. In the present study, the majority had RTA. On follow-up, 50% of the patients had a good result (vision of > 6/60). There was an association between a good outcome and an early presentation in 57 percent of cases, while in our study, we observed no association with the presentation time of patients.

In the study by Jovanovic et al., 255 were included**,** and males were 222 (87.1 %). The average age (years) was 36.8, greater than the present study. 38% had injured lids, 55% had contusion, 8% had hyphaema, 12% had traumatic cataracts, 14% had lens subluxation, and 4%

had retinal detachment. The hyphaema proportion is comparable to the present study, and none of them in our study had lens subluxation or retinal detachment, which shows the severity might be comparatively lesser than in the comparison study. They observed a significant association for poor visual outcomes with age more than 36 years, lens subluxation, and macular hemorrhage, which was not significantly associated in the present study.

A fifth of the research participants had monocular blindness due to ocular injury in Zungu et al. While none of them were reported to have blindness as a complication in our study. The difference in blindness proportion might be due to higher RTA cases reported in the Zungu et al. study than ours.[13]

In the Duan et al.[14] study, the majority were males (5.3:1), similar to the present study. The average age was 39.5 ± 18.5 years, higher than the present study. In their two studied countries, the leading cause of eye injuries among the elderly was falls at home. This discrepancy may be linked to their population's work environment.

In the study results of Puodžiuvienė et al. Compared to females, boys were more likely to have eye injuries. Home accounted for 60.4 percent of eye injuries, with outdoor environments (31.7 percent), schools (5.2 percent), and sports facilities (2.2 percent). They observed that blunt trauma contributed 40% and sharp objects 29%. In addition, burns (9%), falls (7%), explosives (5%), fireworks (4%), bullets (2%), and traffic accidents (1%) were observed. In our study, the majority had RTA, which is higher in comparison, and none had explosive or bullet injuries.

Limitations

- The long term follow-up visual outcomes post one month was not assessed
- Since this was an observational study, the causal relationship between the type of trauma and visual outcomes were not assessed
- Since the study was conducted on single setting, the generalizability of findings across primary, secondary and referral settings is limited

CONCLUSION

In conclusion, most had ocular injury by RTA, followed by wooden pieces or firecrackers. Three-fourths of those with ocular injury had good vision by follow-up. We documented significant association between wounds involving the pupillary axis, the immunocompromised status of the patient, and better drug compliance with final visual outcomes. Corneal foreign body with epi defects, traumatic cataracts, and hyphaema were the common complications observed upon the presentation. We recommend that further studies be conducted to estimate the incidence of ocular trauma with the long-term visual outcomes of different types of ocular trauma.

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