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A Study on Visual Outcome and Prognostic Factors in the Injuries of Anterior Segment of Eye

Dr. Balla Vidya Sagar, Dr. P.S.V. Saleem Basha, Dr. Nagarapu Anusha
Assistant Professor, Department of Ophthalmology, Kurnool Medical College, Kurnool, AP, India
Assistant Professor, Department of Ophthalmology, REH, Kurnool Medical College, Kurnool, AP, India
Postgraduate, Department of Ophthalmology, Kurnool Medical College, Kurnool, AP, India

Corresponding Author: Dr. P.S.V. Saleem Basha
Assistant Professor, Department of Ophthalmology, REH, Kurnool Medical College, Kurnool, AP, India

ABSTRACT

Aim: To study the various prognostic factors affecting the visual outcome in patients with ocular injuries at a tertiary referral eye care center. This study was undertaken at the Regional Eye Hospital, Kurnool, from December 2020 to November 2022.

Methodology: This study is a prospective analytical study with 100 patients who attended the outpatient department with anterior segment injuries were included in the current study. Patients fulfilling the inclusion criteria were included and patients with exclusion criteria were excluded. Detailed history regarding age, gender, occupation, source of injury, duration of injury, signs and symptoms following the injury were taken. A thorough general examination and ocular examination were done. A detailed torch light examination followed by a Slit lamp examination was done in most cases. The vision of all patients was recorded at the time of presentation by means of snellen's test type charts. OTS scoring was given for all cases. All cases were treated accordingly and followed up for 6 weeks. Final visual outcome and various prognostic factors were assessed. The data collected were entered into an MS excel sheet and appropriate statistical analysis was done.

Results: In the present study, the most common age group affected was 21-30 years of age (30%). Males were most commonly affected (84%). Preponderance of right eye involvement (50%) was seen. Most common source of injury was Occupational injuries (41%). Most of the patients were presented within 24 hours of injury. Most common injuries were seen are chemical injuries (22%). RAPD was present in 14% of the cases. Vision at presentation for majority of the patients (44%) was in the range of 20/200 — 20/50. OTS score at presentation for majority of the patients (40%) was 4. 56% of the cases were managed conservatively and 44% of the cases required surgical intervention. By the end of 6 weeks, the final visual acuity was ≥ 20/40 in 29% of the cases. By the end of 6 weeks, 62% of the cases were achieved OTS score of 4 or 5. Significant difference was seen betweenVA at presentation and VA at 6 weeks. Delayed presentation and final VA. Presence of RAPD and final VA. Associated ocular damage and final VA. Patient's age, immune status and final VA. Drug compliance and final VA.

Conclusion: This study makes it evident that different eye injuries are linked to variable degrees of visual loss, reduced earning potential, and socioeconomic implications.

Keywords: VA, RAPD, Drug Compliance, Immune status

INTRODUCTION

Ocular trauma is a common cause of visual impairment. Ocular trauma ranges from a minor abrasion to a serious sight-threatening injury such as a corneoscleral tear or a severe chemical injury.

In developing countries, eye injuries are the leading cause of disabling ocular morbidity. Trauma causes up to 5% of all bilateral blindness[1]. Globally, more than 55 million eye injuries occur each year, with approximately 1.6 million people blinded from ocular trauma, 2.3 million people visually impaired bilaterally, and 19 million people blinded or visually impaired unilaterally[1-3].

Ocular trauma can be a devastating injury in children, causing disability for a lifetime. In this age group, ocular trauma is a significant cause of morbidity and acquired unilateral blindness[4,5]. Pediatric eye injuries account for 8% to 14% of all child injuries[6]. Such patients need distinct therapeutic strategies than adults because they have different ocular injury patterns. Most handler-related injuries in children under 3 years of age include the fingernails of parents, caretakers, or siblings[7].

To achieve or retain functional vision, a number of prognostic criteria[8] must be taken into consideration, such as the severity of the initial trauma, the kind of injury, the involvement of the ocular structures, preoperative visual acuity, and quick diagnosis and treatment. A positive visual prognosis can be achieved through patient education regarding eye injuries and their early, specialized treatment. Significant ocular structure damage and poor visual outcomes occur from the delayed presentation. The factors that are most likely to influence the final visual acuity (VA) following an

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injury include the initial visual acuity, mechanism or type of injury, the area of injury, adnexal trauma, relative afferent pupillary defect (RAPD), retinal detachment, uveal or retinal tissue prolapse, vitreous hemorrhage, lens injury, hyphema, delay in surgery, and the number of operative procedures.

Careful assessment is crucial for proper management and also for prognosticating the visual result when utilized in accordance with the ocular trauma score (OTS). After reviewing over 2500 registered cases of ocular trauma, A more favorable prognosis is linked to higher OTS scores. As a result, the OTS can be used to help with patient counselling and to help identify serious ocular lesions with a poor prognosis for vision.

AIMS AND OBJECTIVES

- To study the various prognostic factors affecting the visual outcome in patients with ocular injuries at a tertiary referral eye care center.
- To assess the visual outcome in patients with anterior segment injuries.
- To grade the severity based on the international classification of ocular trauma.

PATIENTS AND METHODS

The current study is a prospective analytical study which was conducted on patients attending the Regional Eye Hospital / Government General Hospital, Kurnool with anterior segment trauma. Ethical approval for this study was obtained from the ethics review board of the hospital.

Source of data:

A total of 100 patients was studied who were attending Regional Eye Hospital, Kurnool in the period between December 2020 to November 2022 at Kurnool Medical College and Hospital were selected according to the inclusion criteria and exclusion criteria.

Inclusion criteria:

- All cases of mechanical ocular injuries involving the anterior segment.
- Age more than 5 years.

Exclusion criteria:

- Age less than 5 years.
- Prior history of intraocular surgery.
- Presence of intraocular foreign body at the time of presentation.
- Ocular injuries involving the posterior segment of the eye.

History: This was recorded in all cases presenting with ocular manifestations, detailed history regarding age, gender, occupation, causative agents, duration of injury, and signs and symptoms following the injury were taken.
A thorough general examination and ocular examination were done.

Ocular examination:

- Local examination of the eyes was carried out for the anterior segment of theeyes.
- A detailed torch light examination followed by slit lamp examination wascarried out in most cases.

Visual acuity:

- Each patient's vision was recorded at the time of presentation by means of snellen's test-type charts. OTS scoring was given for all cases.
- Fundus examination was performed in all cases.
- B-scan was performed in cases where it is necessary.
- CT & MRI Orbits was advised in RTA cases.

Treatment was given depending on the severity of injury. Surgery was performed in some cases where it is necessary. Cases were followed up on for 6weeks and the final VA was noted at the end of 6 weeks.OTS scoring was given.

The final visual outcome depends upon several prognostic factors such as,

- Time of arrival of the patient to the hospital.
- VA on the time of presentation.
- Time lag between presentation and intervention.
- Type of injury.

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- Size and location of the wound.
- Presence of RAPD.
- Associated ocular damage.
- Age and immune status of the patient.
- Compliance to the drugs.

STATISTICAL ANALYSIS:
Frequencies were expressed as percentages. Chi-square has been used to find the significance of the association between visual outcome and various prognostic factors in the injuries of the anterior segment of the eye.

STATISTICAL SOFTWARE:
The statistical software namely SPSS version 26 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables, etc.

OBSERVATIONS AND RESULTS
In this study, 100 patients who met the inclusion criteria were examined.

TABLE 1 – AGE DISTRIBUTION

AGE	FREQUENCY	PERCENTAGE
5 -10 yrs	5	5%
11 – 20 yrs	9	9%
21 – 30 yrs	30	30%
31 – 40 yrs	27	27%
41 – 50 yrs	16	16 %
51 – 60 yrs	5	5 %
> 60 yrs	8	8%
TOTAL	**100**	**100%**

In the current study, out of 100 patients, the majority (30%) belongs to the age groupof 21-30 years.

TABLE 2 – GENDER DISTRIBUTION

GENDER	NUMBER	PERCENTAGE
MEN	75	75%
WOMEN	15	15%
MALE CHILD	9	9%
FEMALE CHILD	1	1%
TOTAL	**100**	**100 %**

In the current study, out of 100 patients, most of them (75%) were men. Children comprises 10% out of these 100 patients.

TABLE 3 - LATERALITY

LATERALITY	NUMBER	PERCENTAGE
RE	50	50%
LE	38	38%
BE	12	12%
TOTAL	**100**	**100%**

In the current study, out of 100 patients, the right eye involvement (50%) is more than that of left eye involvement (38%) and both eyes were involved in 12% of cases

TABLE 4 – SOURCE OF INJURY

SOURCE	NUMBER	PERCENTAGE
RTA	13	13%
ASSAULT	14	14%
OCCUPATIONAL INJURIES	41	41%
SPORTS AND PLAY	20	20%
OTHERS	12	12%

The most frequent source of injury was occupational injuries which constitute 41% inthis study.

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TABLE 5 – TIME OF PRESENTATION

TIME OF PRESENTATION	NUMBER	PERCENTAGE
WITHIN 24 HOURS	84	84%
WITHIN 48 HOURS	8	8%
AFTER 48 HOURS	8	8%
TOTAL	100	100 %

Majority of the patients (84%) were presented within 24 hours of injury.

TABLE 6 – INJURY AT PRESENTATION

INJURY	NUMBER	PERCENTAGE
PARTIAL THICKNESS CORNEAL TEAR	6	6%
FULL THICKNESS CORNEAL TEAR	4	4%
CORNEAL TEAR WITH IRIS PROLAPSE	8	8%
CORNEAL FOREIGN BODY	11	11%
CORNEAL ABRASION	12	12%
CORNEAL ULCER	18	18%
CORNEAL PERFORATION	2	2%
CHEMICAL INJURY	22	22%
IRIDODIALYSIS	2	2%
HYPHEMA	6	6%
SUBLUXATION / DISLOCATION OF LENS	3	3%
TRAUMATIC CATARACT	6	6%
TOTAL	100	100%

Most frequent injury was chemical injury which constitute for 22%

TABLE 7 – RAPD

RAPD	FREQUENCY	PERCENTAGE
PRESENT	14	14%
ABSENT	86	86%
TOTAL	**100**	**100%**

RAPD was seen in 14% cases only.

TABLE 8 - GLAUCOMA

RAISED IOP	FREQUENCY	PERCENTAGE
PRESENT	6	6%
ABSENT	94	94%
TOTAL	**100**	**100%**

Raised IOP was noted in 6% of the cases during the follow-up period. It was more commonly seen in those patients with hyphema and cataractous lens.

Table 9– VISION AT PRESENTATION

VISION AT PRESENTATION	FREQUENCY	PERCENTAGE
No PL	3	3%
PL/HM	31	31%
1/200 to 19/200	9	9%
20/200 to 20/50	44	44%
≥ 20/40	13	13%
TOTAL	**100**	**100%**

Majority of the patients (44%) belongs to the group of 20/200 – 20/50.

TABLE 10 – DISTRIBUTION OF OTS AT PRESENTATION

OTS SCORE	FREQUENCY	PERCENTAGE
1	2	2%
2	7	7%
3	38	38%
4	40	40%
5	13	13%
TOTAL	**100**	**100%**

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Most of the patients (40%) have OTS score of 4 followed by 3 in 38% cases.

TABLE 11 - MANAGEMENT

MANAGEMENT	NUMBER	PERCENTAGE
MEDICAL	56	56%
SURGICAL	44	44%

In this study, 56% of the cases required medical management. 44% of thecases required surgical intervention.

TABLE 12 – VARIOUS MODALITIES OF MANAGEMENT

MODALITY	NUMBER	PERCENTAGE
CONSERVATIVE	56	56%
CORNEAL FB REMOVAL	11	11%
CORNEAL TEAR SUTURING	10	10%
CORNEAL TEAR AND IRIS TISSUE REPAIR	7	7%
EVISCERATION	2	2%
PARACENTESIS FOR HYPHEMA	2	2%
IRIDODIALYSIS REPAIR	1	1%
CATARACT EXTRACTION	7	7%
REFERRED TO HIGHER CENTRE	4	4%

TABLE 13 – DISTRIBUTION OF VISION AT THE END OF 6 WEEKS

CATEGORY	NUMBER	PERCENTAGE
No PL	4	4%
PL / HM	14	14%
1/200 – 19/200	3	3%
20/200 – 20/50	38	38%
≥ 20/40	29	29%
LOST TO FOLLOW UP	12	12%
TOTAL	100	100%

Majority of the patients (38%) have vision in the range of 20/200 – 20/50.

TABLE 14 – DISTRIBUTION OF OTS SCORE AT THE END OF 6 WEEKS

OTS SCORE	FREQUENCY	PERCENTAGE
1	**0**	**0%**
2	**5**	**5%**
3	**21**	**21%**
4	**34**	**34%**
5	**28**	**28%**
Lost to follow up	**12**	**12%**

Most of the patients (34%) have OTS score of 4 at the end of 6 weeks.

TABLE 15 – COMPARISON BETWEEN VA ON THE TIME OF PRESENTATIONAND AFTER 6 WEEKS

VA	AT PRESENTATION		AT 6 WEEKS	
	n	%	n	%
No PL	3	3	4	4
PL/HM	31	31	14	14
1/200 – 19/200	9	9	3	3
20/200 – 20/50	44	44	38	38
≥ 20/40	13	13	29	29
TOTAL	**100**	**100**	**88**	**88**

In our study, at presentation, the maximum group of patients (44%) had a VA in between 20/200 – 20/50. At 6 weeks, the maximum group of patients (38%) had a VA in between 20/200 – 20/50. There was a significant difference between VA at presentation and VA after 6 weeks.

TABLE 16- COMPARISON OF FINAL VA & TIME LAG BETWEENPRESENTATION AND INTERVENTION

		FVA > 20/200	FVA < 20/200

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TIME LAG	FREQUENCY	n	%	n	%
< 1 hour	52	40	76.9	7	13.4
< 6 hours	32	21	65.6	7	21.8
> 6 hours	16	4	25	9	56.2

P value = 0.0004.

In our study, Final VA >20/200 is seen in 76.9% patients in whom the intervention was taken within one hour of presentation. Final VA < 20/200 is seen in 56.2% of the patients in whom the intervention was taken after 6 hours of presentation.

There was a significant difference between time lag and final visual acuity.

TABLE 17 – EFFECT OF FINAL VA BASED ON TYPE OF INJURY

TYPE OF INJURY	FREQUENCY	FVA > 20/200		FVA <20/200	
		n	%	n	%
SHARP INJURY	12	7	58.3	5	41.6
BLUNT INJURY	18	7	38.8	11	61.1
STICK INJURY	20	12	60	8	40
CHEMICALINJURY	22	18	81.8	4	18.1

P value = 0.0512.

In the present study, Final VA > 20/200 is seen in maximum number of patients (81.8%) with chemical injury. Final VA <20/200 is seen in maximum number of patients (61.1%) with blunt injury. This table shows no significant difference between type of injury and final visual acuity.

TABLE 18 – EFFECT OF FINAL VA BASED ON SIZE AND LOCATION OF THEWOUND

)CATION OF THEWOUND	FREQUENCY	FVA > 20/200		FVA < 20/200	
		n	%	n	%
LARGE SIZE AND INVOLVING PUPILLARY AXIS	48	28	58.3	13	27
SMALL SIZE AND NOT INVOLVING PUPILLARY AXIS	52	40	76.9	7	13.4

P value = 0.0605.

This table shows no significant difference between Size, location of the wound andFinal VA.

TABLE 19 – EFFECT OF FINAL VA ON RAPD

RAPD	FREQUENCY	FVA > 20/200		FVA < 20/200	
		n	%	n	%
PRESENT	14	2	14.2	9	64.2
ABSENT	86	67	77.9	10	11.6

P value = 0.0001.

This table demonstrates a significant difference between RAPD and Final VA.

TABLE 20 – EFFECT OF FINAL VA ON ASSOCIATED OCULAR DAMAGE

ASSOCIATED OCULAR DAMAGE	FREQUENCY	FVA > 20/200		FVA < 20/200	
		n	%	n	%
PRESENT	24	8	33.3	11	45.8
ABSENT	76	60	78.9	9	11.8

P value = 0.0001.

This table shows that there is significant difference between Associated ocular damage and Final VA.

TABLE 21 – EFFECT OF FINAL VA ON AGE AND IMMUNE STATUS OF THEPATIENT

AGE AND IMMUNE STATUS	FREQUENCY	FVA > 20/200		FVA < 20/200	
		n	%	n	%
YOUNG AGE AND HEALTHY	83	63	75.9	11	20.7
OLD AGE AND IMMUNOCOMPROMISED	17	4	23.5	10	58.8

P value = 0.0001.

This table shows that there was significant difference between Age, immunestatus of the patient and Final VA.

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TABLE 22 – EFFECT OF FINAL VA ON DRUG COMPLIANCE

DRUG COMPLIANCE	FREQUENCY	FVA > 20/200		FVA < 20/200	
		n	%	n	%
BETTER	81	64	79	8	9.87
POOR	19	4	21	12	63.1

P value = 0.0001.

This table shows there was significant difference between Drug compliance andFinal VA.

DISCUSSION

AGE DISTRIBUTION

In the current study, patients of all age groups were included. The majority belonged to the age group of 21-30 years (30%). The maximum number of patients in the current study were of the adult age group. The most vulnerable were young adults of age group 21-30 years, and they accounted for 30 out of 100 (30%). The vulnerability of the young is because of the increased association with outdoor activities.

The current study is closely related to the study that was done by **Ajay M. Tammewar *et al*.**[8] Young adult males (21–40 years) were more vulnerable to blunt trauma, 56%. And also correlated with the study done by **S. Padmanaban**[9]. Here, the frequentage group affected by ocular blunt trauma ranged in between 26-40 years of age,48%.

GENDER DISTRIBUTION

In the current study, out of 100 patients, males were 84 (84%), and females were 16 (16%), which implies that majority of the patients were males. This is because young men are exposed to outdoor environments more frequently, and young people who are working age are more likely to be actively involved in sports and working without sufficient safety precautions. Males are more prone to head injuries because they are more frequently involved in outdoor activities than females. Thus, males are affected in greater numbers than females. Alcohol is an important contributing factor in men.

In a study done by **Sana Nadeem *et al***[10], male preponderance was seen with 69 (83.1%) male and 14 (16.9%) female patients where the ratio of male to female is 4.92:1. The current study shows a similarity with this study.

In a study done by **Mohammad Yasir Arfat *et al***[11]**,** the male to female ratio was 5.25:1, with 42 men (84%) predominating over 8 women (16%). Correlation exists between this study and the current study.

LATERALITY

In the current study, out of 100 patients, right eye involvement is seen in 50 patients, left eye involvement is seen in 38 patients and involvement of both eyes were seen in 12 patients.

In a study done by **Sana Nadeem *et al***[10], Right eye involvement occurred in 53 (63.9%) cases, left eye in 29 (34.9%) cases, and bilateral involvement occurred in1 (1.2%) case only.

SOURCE OF INJURY

However, because of the vast majority of the injuries are work-related injuries, it remains an important cause of avoidable and primarily monocular visual morbidity, because of the fact that the majority of injuries are due to not following proper safety precautions. Although the usage of safety precautions doesn't affect the final VA, safety measures were recommended for all the practical purposes as a means of preventing injuries, whether they may be ocular injuries or other injuries**.**

Common household injuries, such as those with curling irons, are usually mild with resolution of signs and symptoms within 1 to 2 weeks after onset with proper wound care, topical antibiotics, cycloplegics, and pressure patching.

In the current study, out of 100 patients, Occupational injuries constitute 41%.

Azusa Fujikawa *et al*[12] conducted a study, states that Work-related trauma (27 [45.8%] eyes) was the most common cause of the injury, which was followed by falls (19 [32.2%] eyes). The current study shows a correlation with this study.

Edita *et al*[13] conducted a study in which, Home was the leading place of eye injury (59.6%, n =98).

VISION ON THE TIME OF PRESENTATION

According to this study, out of 100 patients, most of them (44%) belongs tothe range of 6/60 — 6/18.

Muhammad Yasir Arfat *et al*[11] conducted a study in which most of the patients (18%) belong to the group PL and PR+, followed by 16% 0f the patients belonging to the group CF.

Dr. Arup Deuri *et al*[14] conducted a study in which, 25.6% of the patients belong to the group HM to PL+

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OTS SCORE AT PRESENTATION

In the present study, out of 100 patients, 40% of the patients belong to an OTS score of 4 and 38% of the patients belong to a score of 3.

Gomathi Nayagam *et al*[15] conducted a study in which, the maximum number of patients (35%) belong to an OTS score of 3.

In the present study, out of 100 patients, 56% were managed conservatively and 44% need surgical intervention.

Dr. Arup Deuri *et al*[14] conducted a study in which, 43.59% cases were managed conservatively and 56.41% required surgical intervention.

Sana Nadeem *et al*[10] conducted a study in which, 43.4% cases were managed conservatively and 56.6% cases required surgical intervention.

FINAL VISUAL OUTCOME

In the present study, out of 100 patients, at 6 weeks follow up, 29% of the patients had visual acuity ≥ 6/12. Maximum group of patients (34%) belongs to the OTS score of 4.

Ajay M. Tammewar *et al*[16] conducted a study in which, at 6 weeks follow-up, 81.25% of the patients had VA of ≥ 6/12. This study correlates with the present study.

Muhammad Yasir Arfat *et al*[11] conducted a study in which, post-operative VA of ≥ 6/12 was noted in 6% of cases.

In the present study, it shows that, no significant difference was found between the Type of injury and the Final VA (P value = 0.0512). And also, there was no significant difference between the Size, location of the wound, and Final VA (P value = 0.0605).

Azusa Fujikawa *et al*[17] conducted a study in which patients < 5 mm wounds had a better prognosis that is statistically significant than in patients with > 5 mm wounds (p = 0.0078).

In the present study, there was a significant difference between Early presentation and Final VA (P value = 0.0004).

CN Madhusudhana *et al*[18] conducted a study in which people presented within 24 hours had VA in the range of 6/6 – 6/12 with a p-value of < 0.005.

In the present study, only 2% of patients belong to the OTS category of 1, having a final VA of PL, whereas 53% of patients belong to OTS categories 4 and 5. Out of these, 29% of patients had a final VA of ≥ 20/40.

Another study by **Man and Steel[19]**, also suggested that OTS possibly had a predictive value of the final VA in open globe injury. OTS is of great importance both for patients and also for ophthalmologists.

Shah *et al*[20] also reported that OTS was a reliable indicator of the final vision of pediatric traumatic cataract. There was only one reference that mentioned the value in traumatic cataract in adults and children. Shah reported that OTS was found as a reliable tool to predict visual outcomes in traumatic cataracts 6 weeks post operatively[21].

Persons of lower educational status and lower socio-economic class are more likely to be injured. Ignorance and illiteracy among the poor people and rural folks contribute in a big way to ocular morbidity.

CONCLUSION

This study makes it evident that different eye injuries are linked to variable degrees of visual loss, reduced earning potential, and socioeconomic implications.

The injuries in this study were more likely to occur in children and young adults. Injury types that are most common (41%) are occupational ones.

Early referral, rapid assessment, and treatment will lessen the problems that could endanger vision or sight in many circumstances.

A stronger emphasis on health education at home, at school, and at workplace can also raise awareness.

Patients should be advised of the significance of safety precautions like helmets and protective eye wear and should be encouraged to use themwhether participating in sports or travelling.

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Conflict of Interest None

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REFERENCES

1. Mc Gwin G Jr, Hall TA, Xie A, Owsley C. Trends in eye injury in the United States, 1992-2001. Invest Ophthalmol Vis Sci. 2006;47(2):521-7.
2. Desai P, Mac Ewen CJ, Baines P, Minassian DC. Epidemiology and implications of ocular trauma admitted to hospital in Scotland. J Epidemiol Community Health. 1996;50(4):436-41.
3. Vats S, Murthy GV, Chandra M, Gupta SK, Vashist P, Gogoi M. Epidemiological study of ocular trauma in an urban slum population in Delhi, India. Indian J Ophthalmol. 2008;56(4):313-6.
4. MacEwen CJ, Baines PS, Desai P. Eye injuries in children: The current picture. Br J Ophthalmol1999;83:933-6.
5. Kaur A, Agrawal A. Pediatric ocular trauma. Curr Sc 2005;89:43-6.
6. Brophy M, Sinclair SA, Hostetler SG, Xiang H. Pediatric eye injury-related hospitalizations in the United States. Pediatrics 2006;117:e1263-71.
7. Burgueño Montañés C, Colunga Cueva M, González Fernández E, Cienfuegos García S, Díez-Lage Sánchez A, DiabSafaM. Eye injuries in childhood. An EspPediatr1998;48:625-30.
8. Ajay M. Tammewar, Pooja D. Waghmare, Anjali P. Kapase, Praful J. Chaudhary, Sheethal A. Divate. An observational assessment of visual outcome in blunt ocular trauma. DOI : 10.47009/jamp.2022.4.4.80.
9. S. Padmanaban "Original Research Article A Clinical Study Of Visual Outcome In Ocular Blunt Trauma" IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol.17, no.5, 2018, pp 11-18.
10. Visual outcome of ocular trauma. Sana Nadeem, Muhammad Ayub, Humaira Fawad. Pak J Ophthalmol 2013, Vol. 29 No.1.
11. Arfat MY, Butt HM. Visual outcome after anterior segment trauma of the eye. Pak J Ophthalmol. 2010; 26: 74-8.
12. Azusa Fujikawa, Visual outcomes and prognostic factors in open-globe injuries. Fujikawa *et al*. BMC Ophthalmology (2018) 18:138.
13. Clinical Characteristics, Visual Outcomes, and Prognostic Factors of Open Globe Injuries. Medicina 2021, 57, 1198. https://doi.org/10.3390/ medicina57111198.
14. Dr. Arup Deuri, Dr.Rheetuparna Borthakur. A Clinical Study on Anterior Segment Injury of Eye and its Visual Outcome. International Journal of Science and Research (IJSR) ISSN: 2319-7064.
15. Nayagam G, Raman M, Anuradha A, Sheela S, Chakravarthy N. Assessment of visual prognosis using Ocular Trauma Score in open globe injury at a tertiary care center. TNOA J Ophthalmic Sci Res 2020;58:9-13.
16. Ajay M. Tammewar, Pooja D. Waghmare, Anjali P. Kapase, Praful J. Chaudhary, Sheethal A. Divate. An observational assessment of visual outcome in blunt ocular trauma. DOI : 10.47009/jamp.2022.4.4.80.
17. Azusa Fujikawa, Visual outcomes and prognostic factors in open-globe injuries. Fujikawa *et al*. BMC Ophthalmology (2018) 18:138.
18. CN Madhusudhana, Apoorva N, Varna V Shet. Clinical profile and visual outcome of patients presenting with penetrating ocular trauma to a tertiary care hospital. Indian Journal of Clinical and Experimental Ophthalmology, 2017;3(3): 249-251.
19. C. Y. W. Man and D. Steel, "Visual outcome after open globe injury: a comparison of two prognostic models—the Ocular Trauma Score and the Classification and Regression Tree," Eye, vol. 24, no. 1, pp. 84–89, 2010
20. M. A. Shah, S. M. Shah, A. Applewar, C. Patel, and K. Patel, "Ocular Trauma Score as a predictor of final visual outcomes in traumatic cataract cases in pediatric patients," Journal of Cataract and Refractive Surgery, vol. 38, no. 6, pp. 959–965, 2012.
21. M. A. Shah, S. M. Shah, A. Applewar, C. Patel, S. Shah, and U. Patel, "Ocular trauma score: a useful predictor of visual outcome at six weeks in patients with traumatic cataract," Ophthalmology, vol. 119, no. 7, pp. 1336–1341, 2012.