A Clinical Study of Ocular Trauma in Paediatric patients attending Tertiary Care Centre

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ABSTRACT

Aims: To study demographic parameters, modes of injury, its impact and relation to visual outcomes in paediatric ocular trauma. **Methods**: A prospective observational study was done at a tertiary centrefor 120 eyes of 117 patients over a period of 2 years. **Results**: Mean age of patients in this study was, 7.97 ± 3.919 years with males being predominance. No severe injuries were noted in children whose parents had college-level education. Mean distancebetween the place of injury and our centrehad no significant correlation with final BCVA but it significantly correlated with delay in presentation. Wooden Stickand household itemswere the most common agents of injury, followedby iron wire/rod/nailand Chemical/Thermal agents. Most common pathology was Corneal tear followed by corneoscleral tear and Chemical / Thermal injuries. Posterior segment involvement was seen in 27.5 %of cases. Traumatic cataract was noted in 13 eyes. Open globe injuriesexceededclosed globe ones. Prognostically closed globe injuries had better visual outcome and achieved higher BCVA than closed globe ones irrespective of mode of management being surgical/ nonsurgical. **Conclusion**: This study showed a demographic snapshot for the patients of ocular trauma, withthe male child between the age group of 6-8 years most commonly affected. BCVA was relatednot to socioeconomic status, but educational status of the patients. Mode and type of injury strongly correlated withvisual acuity. Final BCVA correlated to BCVA at presentation, and not to the treatment factors, thusmaking primary prevention of trauma of paramount importance.

Keywords: Ocular Trauma, Corneoscleral Tear, Paediatric Open Globe Injury

INTRODUCTION

Ocular trauma is the most common cause of acquired mono-ocular blindness in paediatric age group. Worldwide, as many as 6 million children annually sustain some form of ocular trauma[1]. It is estimated that 30% of all ocular trauma still occurs in childhood[2] and accounts for approximately 8-14% of total injuries in children[3]. Childhood trauma is more devastating than that suffered in adulthood as children are yet to complete their physical, mental, emotional and socioeconomic development. It can have a detrimental psychological impact on patients and substantial socio-economic consequences for patients, their families and public health in terms of medical care utilization, including rehabilitation and productivity loss, due to an immense increase in DALE (Disability adjusted life years). Children as it is are at greater risk of ocular trauma because of immature motor skills, careless activities and inability to identify dangerous and harmful objects[4]. However, children in developing countries are more susceptible to trauma because of unavailability of proper play area, lack of regulated use of fireworks, living in remote rural areas without adequate medical services and poor parental supervision. Thus, the developing countries carry the heaviest burden of ocular trauma, while being the least capable of affording the

costs. An estimated 90% of this trauma is relatively preventable by simple measures[2]. Also most common emergencies are due to open-globe injuries and require immediate interventions. Patient and social education regarding eye injuries and its early specialized treatment can give good visual prognosis. Delayed presentation and treatment due to lack of awareness of the need for immediate medical attention, inadequate medical infrastructure, and lack of transport to the health centre when such infrastructure exists, leads toa relatively high frequency of associated complications and visual disability[5].Currently there is a lack of representative data on the magnitude and profile of ocular trauma in paediatric population, especially in western India. In order to develop targeted strategies to create better awareness and effective protocols for prevention and management of ocular trauma, it is first necessary to understand current trends in nature and presentation of ocular injuries. The aim of this hospital based prospective observational study conducted at M&J Western Regional Institute of Ophthalmology,Civil Hospital, Ahmedabad from October 2018 to October 2020, for a period of 2 years is to document the clinical profile, etiology and outcome of paediatric ocular trauma presenting at a tertiary eye care centre of western region of India, as a means to identifying methods of prevention of the trauma and factors influencing the outcome. Presenting cases were classified into mechanical and non-mechanical mode of injury and further classified as per The Ocular Trauma Classification Group. Chemical / Thermal Ocular Surface Injuries were classified based on Duas Classification of ocular surface burns.

MATERIAL AND METHODS

This was a hospital based prospective observational study carried out at theophthalmology department of a government medical college in western India.The study was approved by the local ethics committee and followed the tenets of the Declaration of Helsinki. Informed consent was obtained from parents of all participating children before the procedure. 120 eyes of 117 patients were evaluated over period of 2 years. All patients presenting to the Institution up to the age of 14 years with any kind ofocular trauma were eligible for inclusion. Once written informed consent was obtained from the parent/guardian of each patient, a detailed history was obtained and recorded on a pre-designed proforma. History as to the cause and mode of the injury, whether it occurred under parental supervision or not was and any associated systemic injury was noted. Demographic profiles of all patients in terms of age, sex, residential area (urbanor rural), distance of the place of injury from the institution, date and time of injury, date and time of presentation and if or not any treatment was received in theinterim were noted. Socio Economic Status was classified based on Modified Prasad's Classification[6] taking into consideration educational status of the primary decision maker. The distance of place of injury from the tertiary centre was calculatedwith the help of Google Maps. Essentially the patients underwent testing for visual acuity with correction on Snellen's chart for age above 5 years, E chart or Picture chart for age less than 5 years. Foryounger and uncooperative patients, ability to count fingers and follow light, or a toyat a distance was recorded. Anterior segment evaluation on Slit Lamp Biomicroscopy (or torch light for younger patients not cooperative for SLE). IOP evaluation using Goldman Applanation tonometry or Non-Contact Tonometry as applicable forcooperative patients after ruling out the cases of open globe injury[7]. Dilatation and fundus examination of the other eye and of the affected eye if possible, using directand indirect ophthalmoscopy. USG was performed if fundus examination was notpossible. Radiological investigations like X-Ray, CT scan, MRI etc wereperformed when necessary. Ultrasound Biomicroscopy was done for cooperativepatients when indicated.Patients were followed and assessed at the end of 1 week and one month toassess visual outcome and development of complications. On each visit, thebest-corrected visual acuity, slit-lamp examination, intraocular pressure, andfundus examination were performed. Patients with minimum follow-ups of 1month were included in the study group.Enumerating surgical as well as nonsurgicaltreatment protocols applied is out of the scope of this document and thus has beenexcluded.

Statistical Analysis

The data was entered in an Excel® sheet Microsoft Office Excel 2007(12.0.4518.1014) MSO (12.0.4518.1014) and statistical analysis was performedwith SPSS. Visual acuity was converted to Log MAR unit for the statistical analysis.Data wasanalysed with appropriate statistical indices: mean, standard deviation, relative risk, Chi-square test, P value, and linear regression analysis.

RESULTS

The Study included 120 eyes of 117 patients. The mean of the study population was 7.97 ± 3.919 years. Most of the children fell between 6-8 years of age. Males (n=84) were significantly more affected than females(n=36). No significant difference was found between presentation from Rural and Urban Areas. Between 0-2 years of age both males and females are almost equally affected, however with increase in age, male population is affected more than females. But his difference was not found to be statistically significant.

Table 1 Age wise distribution

Age Group	Male	Female	Number Of Children	Percentage
0-2 years	5	4	9	7.50%
3-5 years	18	12	30	25.00%
6-8 years	22	9	31	25.83%
9-11 years	14	6	20	16.67%
12-14 years	25	5	30	25.00%
GRAND TOTAL	84	36	120	100%

As this study was conducted in a Government Hospital, most of the patients belonged to Lower and Lower Middle Class Groups. While most of the patients presented from within a radius of 100 Km, being a Western Zonal Institute of India, our Institute received several cases from farther away, the farthest being, as far as 819 Km. Based on mode of injury Wooden Stick 17.5 % (n=21) and household items 17.5 % (n=21) were the most common agents of injury, followed by closely by iron wire/rod/nail15.8 % (n= 19) and Chemical/Thermal agents 15.8 % (n=19). Wooden stick injuries were sustained mostly during play. They were also incurred during agricultural activities and cutting firewood in some cases. Of 19 eyes with chemical injuries, 5 eyes of 3 patients were involved in fire cracker injuries 3.6 %. Other agents associated with chemical injuries were acid and lime injuries. Stone injuries were seen in 10 % population, RTA in 4% and animal bites accounted for 3.3 % (n=4), of total injuries. Household items were the commonest cause in children up to 2 years of age. For rest of the age groups both household articles and wooden stick play a near equal role. Most of the fire cracker injuries were seen between 12-14 years of age. Mean time of presentation was 59 ±107.56 Hours (corresponding to approximately 1±1.7 days). While most of the patients presented within first 6 hours of injury, a significant chunk of patients presented later, with the second peak being between 1-3 days. Majority of the patients within a radius of 100 km presented within first 6 hours. As the distance from the center increases, so does the delay in presentation. This was found to be statistically significant ($p < 0.05$) Patients belonging to rural area are more likely to present later than those from urban area. (p=0.00). Most of the patients from the urban regions, presented within a day, whereas most of the patients presenting after first 24 hours, were likely to be from rural regions. 40 % (n= 49) patients presented directly to the tertiary centre, whereas 59% (n=71) patients first sought treatment at least one primary centre. Fewer patients underwent 2, 3 or 4 referrals. Most common pathology found was Corneal tear 38.33% (n=46) followed by corneoscleral tear 13.33% (n=16), Chemical / Thermal injuries 12.50% (n=15), Lid tears 8 % (n=10), out of which, 40 % (n= 4) i.e. 3.33 % of total, were associated with canalicular tear. Conjunctival tear was seen in 6% (n=7), isolated subconjunctival

haemorrhage in 3 % (n=4) Scleral tear was seen only in 2.5% of patients (n=3). Only 23 patients were treated by purely medical means. 97 Patients went through some sort of surgical intervention. BCVA at the end of 1 month was found to be a little better than the BCVA at presentation. Final Visual Acuity at 1 month strongly correlated with Visual acuity at presentation (p=0.00). A regression analysis performed, keeping Visual acuity at Presentation as Independent Variable and Visual acuities at 1 week and 1 month as Dependent Variables an R value of 0.910 (R>0.5) which is highly significant. The p value for the above analysis was p=0.00. A series of regression analyses were performed to further assess the data: 1) Regression analysis keeping visual acuity at presentation as independent variable and vision improved or not as dependent variable gave an R value of R= 0.453 which suggests a partial negative correlation. (p=0.00) 2) Regression analysis with visual acuity at 1 week as independent variable and vision improved or not as dependent variable gave an R value of R= 0.514 which suggests a partial positive correlation. (p=0.00) 3) Regression analysis with visual acuity at 1 month as independent variable and vision improved or not as dependent variable gave an R value of R= 0.625 which suggests a partial positive correlation.(p=0.00) This rising trend in R values may suggest that though the visual prognosis is strongly dependent on vision at presentation, it becomes less so with time and after intervention in form of treatment is given. One might expect better visual outcomes given more time. Only 7.81 % of patients with open Globe Injury regained BCVA of 6/18 or better, as compared to 57.14% of those with closed globe injuries. Only about 9% of patients with closed globe injuries suffered a visual acuity < 1/60 as compared to 35 % of patients with open globe injuries. (p=0.00) Patients with parents having lower educational status are likely to have worse prognosis. (p=0.00) Injuries occurring in settings without parental supervision are likely to have worse prognosis. (p=0.059) (>90% confidence Interval). Involvement of Posterior Segment is associated with worse prognosis. (p=0.00)

Ocular Involvement	BCVA At 1 Month					
	1/60-NOPL	5/60-1/60	6/24-6/60	6/6-6/18	NA	Grand Total
Corneal Tear	12	11	17	4	2	46
Corneoscleral Tear	7	6	1	1	1	16
Chemical/Thermal Injury	1	5	1	8	0	5
Conjunctival Tear	0	0	0	6	1	7
Echymosis,Lid Edema, SCH	1	0	10	0	1	3
Lid Tear	0	0	0	10	0	10
Other	4	1	4	4	3	16
SCH	0	0	0	4	0	4
Scleral Tear	3	0	0	0	0	3
Grand Total	28	23	24	37	8	120

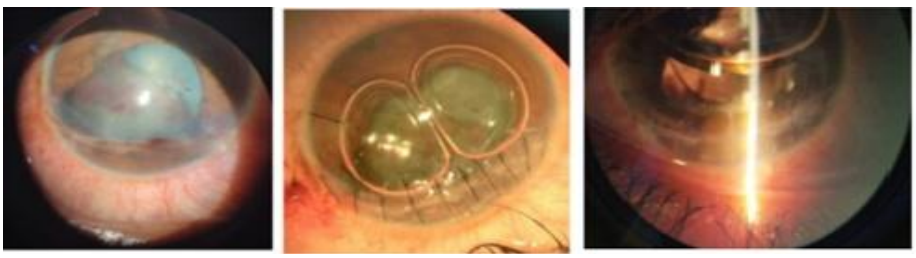

Figure I (A) Corneal tear with traumatic Cataract in a 12 year old male due to wooden stick injury. BCVA at presentation was HM+PL+PR4+ (B) Same patient after primary closure. BCVA improved to 4/60 (C) Same patient after Cataract Extraction surgery. Final BCVA improved to 6/12.

DISCUSSION

In our study the mean age of patients in this study was, 7.97 ± 3.919 years (range 0-14 years) similar to other studies carried out in Indian population[8,9,10,11]. Males were more commonly affected 70%(n=84) as compared to females 30%(n=36), thus giving a relative risk ratio of 2.33 similar to other studies[9,10,12]. But below the age of 3 years, males and females are almost equally affected. As the age increases, so does the difference in distribution between male and female population. Several reasons could be responsible for male preponderance. Males are likely to be more involved in outdoor play activities, be more active and are given more freedom without adult supervision whereas females have more restrictions imposed on them. Also they are likely to be involved in farming or other domestic chores like wood cutting, which may make them more likely to suffer injury. Another reason could be the higher importance given to the 'Male Child' in Indian Culture where parents are more likely to seek treatment for male patients. Such under reporting of cases of female trauma may be responsible for the male bias. Considering both age and sex, most common population group involved was male child, between 12-14 years of age. In present study, 51 % (n=61) of patients were from rural population while 49% (n=59) belonged to urban regions. Patients from rural areas might be less likely to present because of lack of education, lack of availability of money and transport mechanism. Of all the patients included in our study, 33% (n=39) were Illiterate, 49 % (n=59) had completed Primary Education and only 18% (n=22) were graduate. No post Graduate parents presented to our hospital[13]. In our study, educational status was significantly associated with visual prognosis. In conclusions of various studies related to paediatric ocular trauma it is mentioned that parental education can be instrumental in prevention and better prognosis of ocular trauma, however surprisingly very few studies exist in literature which take educational status of parents and geographical location of the place of injury and its distance from the place of definitive treatment into consideration. On plotting a spot map of the patients based on their geographical location, it was observed that most of the cases are centred on Ahmedabad (n=45, 37.5%), and other surrounding districts, like Gandhinagar, Banaskantha, Kheda, Mehsana, Nadiad and Anand (total n=24, 20%). However, 17 (14.2 %) cases presented from the Saurashtra region more so from southern Saurashtra, among which 7 (5.8 %) presented from Amreli district. While the data in itself is not enough to draw conclusions, it may justify need for conducting further studies to evaluate adequacy and quality of ophthalmic health care facilities in Saurashtra region of Gujarat. Similarly, while 103 cases belonged to Gujarat and 4 cases were from Madhya Pradesh as many as 13(10.8 %) cases were from all over Rajasthan, which might not be adequately explained by proximity of our centre to some areas of the state. This again warrants further evaluation into health facilities especially those of tertiary level in Rajasthan and may as well strengthen the role of our institute as a western regional zonal center. Katiyar V et al[9]studied the location of patients of trauma around Lucknow and noted that almost one-fourth (26.7%) of paediatric patients were from the same district, 46.2% cases from adjoining six districts and 27.1% patients from far off 12 districts. The mean distance measured in kilometres between the place of injury and our centre was 144.72 kilometres, with a median of 88 km standard deviation of 157.92 kilometres. Q1 is 8.75 km and Q3 is 264 km. No significant correlation of distance was found with final Best Corrected Visual Acuity (BCVA). However, it significantly correlated with delay in presentation, as would be expected. Average time of presentation at the tertiary centre was 58.63 hours (2.44 days) with median time of 18 hrs and standard deviation of 107.56 hours. Q1 is 4hrs and Q2 is 53.75hrs. Most of the patients who presented within first 6 hours, came directly to the tertiary centre. Those who had gone through multiple referrals presented late (p=0.00). 72 Wooden Stick 17.5 % (n=21) and household items 17.5 % (n=21) were the most common agents of injury, followed by closely by iron wire/rod/nail15.8 % (n= 19) and Chemical/Thermal agents 15.8 % (n=19). Wooden stick injuries were sustained mostly during play. They were also incurred during agricultural activities and cutting firewood in some cases[9,10,11]. Of 19 eyes with chemical injuries, 5 eyes of 3 patients were involved in fire cracker injuries, 3.6 %. Other agents associated with chemical injuries were acid and

lime injuries. Stone injuries were seen in 10 % population, RTA in 4% and animal bites accounted for 3.3 % (n=4), of total injuries[9,10,11].Most common pathology found was Corneal tear 38.33% (n=46) followed by corneoscleral tear 13.33% (n=16), Chemical / Thermal injuries 12.50%(n=15), Lid tears 8 % (n=10), out of which, 40 % (n= 4) i.e. 3.33 % of total, were associated with canalicular tear. Conjunctival tear was seen in 6% (n=7), isolated subconjunctival haemorrhage in 3 % (n=4) Scleral tear was seen only in 2.5% of patients (n=3). Posterior segment involvement was seen in 27.5 % (n=33) of cases. Adenexal structures were involved in about 21 % (n=25) of cases. Conjunctiva was involved in 38.3 % (n= 46) of cases. Corneal involvement was seen in, 61.7% (n=74) of cases. Traumatic cataract was seen in 27.5% (n=33) of cases[14]. In the present study, open globe injuries 53.3 % (n=64) to the eye exceeded the closed globe ones 46.7 % (n= 56)[11,15,16,17]. Open globe injuries present more potential for poor vision than the closed globe injuries[8,10,12,18,19,20]. In our study, only 7.81 % of patients with open Globe Injury regained BCVA of 6/18 or better, as compared to 57.14% of those with closed globe injuries. Only about 9% of patients with closed globe injuries suffered a visual acuity < 1/60 as compared to 35 % of patients with open globe injuries. (p=0.00).81 % of the total injuries underwent surgical management. Of closed globe injuries, only 40 % were treated non-surgically, whereas 60 % underwent some kind of surgical management. All open globe injuries underwent immediate surgical intervention except one case. 74 Final BCVA was assessed at the end of 1 month. Only 30.83 % of patients achieved final BCVA of 6/18 or better. About 20 % of patients had BCVA between 6/24-6/60, 19.17 % of patients had BCVA between 5/60-1/60. 23.33 % of the patients had vision worse than 1/60 causing monocular blindness. Visual Acuity could not be reliably assessed in about 6.67 % of patients. In our study, Posterior segment involvement was seen in 27.5% of cases. 57.58 % of patients without posterior segment involvement gained final BCVA of >6/18 as compared to only 14.94% of patients with posterior segment involvement[21]. Out of 120, 71 patients presented to our institute after undergoing 1 or more referrals, however only 28 (39.4%) of them received proper emergency care from the referral centre. One case was of lime injury where patient presented to us after >24 hours after being referred from primary centre without even receiving a proper wash. However, administration of appropriate emergency care was not found to have any statistically significant relation to final BCVA Though in various studies, delay in presentation has been strongly linked to worse visual outcomes, such relation was not found to be significant in our study. This might be explained by the fact that a lot of cases with severe injuries and poor prognosis were received where even timely management could not make a major difference. In conclusion this study showed a demographic snapshot for the patients of ocular trauma, with the male child between the age group of 6-8 years was affected. BCVA was related not to socioeconomic status, but educational status of the patients. Posterior segment findings strongly correlated with a worse visual acuity. Final BCVA most strongly correlated to BCVA at presentation, and not to the treatment factors, thus making primary prevention of trauma of paramount importance.

CONCLUSION

This study showed a demographic snapshot for the patients of ocular trauma, withthe male child between the age group of 6-8 years most commonly affected. BCVA was relatednot to socioeconomic status, but educational status of the patients. Mode and type of injury strongly correlated withvisual acuity. Open global injuries were more common than closed global injuries and were associated with worst visual outcome.Final BCVA correlated to BCVA at presentation, and not to the treatment factors, thusmaking primary prevention of trauma of paramount importance.

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