Original Article

Visual Outcome of Pediatric Traumatic Cataract in Lumbini Eye Institute, Bhairahawa, Nepal

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Abstract

Introduction: There are not many studies of pediatric trauma in Nepal. Therefore, this study was conducted to find out the visual outcome of pediatric traumatic cataract and causes of poor visual acuity.

Materials and Methods: In this hospital based prospective study, all children visiting the pediatric department of Lumbini Eye Institute and Research Center with traumatic cataract and visual outcome after surgery from July 2018 to August 2019 were evaluated. A total of 136 children ranging from age (0 months to 15 years) with traumatic cataract were included in the study. Data on age of presentation, sex and diagnosis were collected from clinical charts and analyzed.

Results: The study enrolled 136 cases with traumatic cataract. 72.1% male and 27.9% female patients were involved with the average age being 9.46 years (SD 2.95). Final visual acuity was better than 20/60 in 73 percent of the children. Visual acuity was poor in 27 percent of children. In children with poor visual acuity 44 percent of the patients had corneal opacity, 23 percent had retinal detachment and 18 percent had vitreous opacification secondary to trauma. Closed globe injury was seen in 72 percent of children and 28 percent had open globe injury.

Conclusion: Male children were more prone to traumatic cataract than female children. Open globe injury with corneal laceration and opacity was the major cause of decreased visual acuity.

Key words: Traumatic, Cataract, Children, Visual acuity.

Introduction

Lumbini Eye Institute and Research Centre located in Bhairahawa, Nepal, is the tertiary eye care center for western Nepal and the northern Indian state of Uttar Pradesh (and to a lesser extent Bihar) with a pediatric ward, pediatric outpatient department and dedicated pediatric operating room as well as highly qualified pediatric ophthalmologists, nurses, and ophthalmic assistants specialized in pediatric care and visual rehabilitation (Thapa et al, 2015).

The World Health Organization's (WHO) global initiation for the elimination of avoidable blindness by the year 2020 has given prioritization to the control of childhood blindness (Thylefors et al, 1995). Currently cataract is one of the most important causes of avoidable blindness in children (Giles et al,

Financial Interest: Nil
Conflict of Interest: Nil
Received: 14.11.2019 Accepted: 30.12.2019

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2016). An estimated 19 million children are visually impaired and 1.5 million are living with blindness with 1 million children recorded in Asia and 300,000 in Africa (Chaudhary et al, 2017).

The prevalence of blindness in children is variable and has been related to the socioeconomic development status and infant mortality rates of the countries (Pascolini et al, 2012). Ocular injury is the leading cause of unilateral blindness in children (Jandeck et al, 2000). It is estimated that ocular injuries are avoidable in up to 90% of cases avoiding the mechanisms of damage to the ocular structures (Saxena et al, 2002; Santhiago et al, 2009; Abbott et al, 2013).

Traumatic cataract is defined as an opacification of the lens due to blunt or penetrating trauma to the eye. It can cause changes in anterior and posterior segment or appear as an isolated alteration a long time after the ocular trauma (Zimmermann A, Arieta et al, 2019).

The incidence rate of ocular trauma ranges from 0.746 to 9.9 per 10,00z0 children in the United States and other developed countries (Cao et al, 2013). In these countries, the estimated frequency of traumatic cataract in pediatrics is 30% of all cataracts in childhood and adolescence, and in the age group between 6 and 15 years it reaches 41% and is a significant cause of visual deficiency with social, emotional and psychological consequences to the child (Khokar et al, 2014; Kinori et al, 2013).

Very few studies have been done for ocular injuries in rural regions. The mechanism of ocular injury vary in rural and urban regions and need to be investigated. The knowledge regarding the etiology of injury is required to evaluate available means in the right direction to strategize the prevention of such injuries (Alfaro et al, 2005; Shah et al, 2008 and 2015).

Pediatric ocular trauma has poor prognosis; hence, it is a burden to society (Shah et al, 2008). This can be taken care of, to some extent, with the help of aforementioned knowledge of etiology of injury. Trauma to the eye is capable of giving rise to cataracts. There are no differences in the methods which are employed to assess the visual outcome. (Shah et al, 2008).

The standardization of ocular injury documentation was greatly facilitated following the introduction of Birmingham Eye Trauma Terminology System (BETTS) in regular practice (Kuhn et al, 2004; Shah et al, 2015). In this study, visual outcomes in eyes operated for cataracts after open and closed globe injury resulting from trauma were analyzed. The study will reveal the reasons of poor visual acuity after injury and the etiology of injuries.

Materials and Methods

All the children operated for traumatic cataract less than 15 years of age, attending Lumbini Eye Institute and Research Center, from July 2018 to August 2019, were included in the study. Obtaining guardian consent was the first and essential part before procedures. Demographic record, clinical history, general physical examination and detailed ophthalmological examination was carried out as per pro forma. Preoperative and postoperative visual acuity in each eye was measured using Snellen's visual acuity charts. In infants and preverbal children, visual acuity was measured based on fixation patterns. Teller acuity cards, Optokinetic Nystagmus (OKN) drum, Cardiff Acuity test, HOTV test were also used to test visual acuity in children. Detailed ocular examination was performed using slit lamp biomicroscope. For the preverbal children below 3 years of age portable slit lamp, torch light, optical visors were used. All the ocular injuries were classified according to Birmingham Eye Trauma Terminology System (BETTS).

Gross anterior segment examination from

the eyelid to the lens was done. All injuries including eyelid injuries, conjunctival laceration, corneal perforation, iris prolapse were evaluated. Trauma can partially displace the lens from its natural position (subluxated) or completely dislocate it.

Posterior segment of the eye was evaluated with the help of an indirect ophthalmoscope after dilating the pupil with topical tropicamide 1%. Ultrasound B scan was done in closed globe injury and few cases of open globe injury to rule out intraocular foreign body when fundus was not visible by indirect ophthalmoscopy.

Power of intra-ocular lens was estimated using SRK-II formula in co-operative children when keratometry was possible. In young and uncooperative children, the axial length of eye was measured preoperatively under general anesthesia (GA) on the operation table. A scan ultrasound biometry contact method was used for calculating axial length and IOL power was calculated using the Dahan Formula (Dahan and Drusedau, 1997).

Lens aspiration, primary posterior capsulotomy, anterior vitrectomy with intra-ocular L lens implantation was the major procedure done in patients below 8 years old under general anesthesia. In children above 10 years lens aspiration with intraocular lens implantation was performed under local anesthesia. In cases of open globe injury, cataract removal was performed as a second procedure. Patients without any capsular support were kept aphakic. Anterior vitrectomy (500 to 800 cuts per minute and vacuum of 150 mm Hg) was performed in children with posterior capsular tear and vitreous prolapse. Surgery was performed by two surgeons. At each follow up (first post-operative day, second week, sixth week), visual acuity was recorded. Final best corrected visual acuity (BCVA) was recorded on 3rd post-operative follow up visit which is after six weeks.

Visual outcome was considered improved if the Log MAR chart value was improved by 3 to 5 lines and not improved if the pre and post-operative value of visual acuity in LogMAR remained the same.

Data were prospectively collected in pediatric database for all eligible children. Data were gathered on standardized pre-operative, intra-operative and postoperative forms which included social and demographic information on parent's education, occupation and place of residence. Microsoft Excel spreadsheet 2013 and SPSS (Statistical Package for the Social Science) version 17.0 program were used for statistical analysis.

The research adhered to the guidelines of the declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Lumbini Eye Institute and Research Center that includes a research monitoring function.

Results

In our study, the total number of children with traumatic cataract were 136. Out of 136 children, 101 (74.26 %) were males and 35 (25.73 %) were females (Table 1). In 79 children with trauma (58.1%), right eye was involved and in 57 (41.9%) left eye was affected (Table 1). The lowest age of the children was 4 years and the highest age was 15 years with a mean age of 9.46 years (SD 2.951) (Table 2).

Ninety-eight children (72.1%) had improvement and 38 children (27.9%) had no improvement. Post-operative best corrected mean visual acuity at 2 weeks and 6 weeks were 0. 762 (SD 0.507) Log MAR and 0.596 (SD 0.556) Log MAR respectively (Table 2).

Closed globe injury was seen in 69 children (50.7%) and ppen globe injury in 67 (49.3%) (Table 1). In this study, the post-operative visual acuity after 2 weeks was better than the pre-operative visual acuity with mean Log MAR value 0.66 (SD 0.49) and was statistically

significant with P-value <0.001. The post-operative best corrected visual acuity after 6 weeks was better than pre-operative visual acuity with mean Log MAR value of 0.5356 (SD 0.045) and was statistically significant with P-value <0.001 (Table 3).

Mean post-op visual acuity in children who presented 1 month earlier was similar to those who presented in 2 years and 3 years. 38 out of 136 children i.e. 27.9% showed reduced vision (Table 4).

The most common mode of blunt injury was by stick (20.6%). Injury by pin was found to be the most common mode of sharp injury to the eye. Table 5 shows detailed illustration of the different modes of injury.

Table 1: Demographic profile of the patients

Parameters	Frequency	Percent
Gender		
Male	101	74.26
Female	35	25.73
Age		
<= 7	46	33.8
8-15	90	66.2
Laterality		
Right Eye	79	58.1
Left Eye	57	41.9
Outcome		
No Improvement	98	72.1
Improvement	38	27.9
Type of Injury		
Closed	69	50.7
Open	67	49.3

Table 2: Baseline and post-operative visual acuity (N=136)

	Minimum	Maximum	Mean	Std. Deviation
Age (years)	4	16	9.46	2.951
Pre-OP V/A	1	1.6	1.43	.169
Post OP V/A 2 weeks	.0	1.6	.762	.5073
Post OP BCVA 6 weeks	.0	1.6	.596	.5560

Table 3: Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-OP V/A - Post OP V/A 2 weeks	.6691	.4909	.0421	.5859	.7524	15.896	135	.000
Pre-OP V/A - Post OP BCVA 6 weeks	.8353	.5356	.0459	.7445	.9261	18.186	135	.000

Table 4: Relation of duration with visual acuity

Duration	Number of children	Mean pre-op. visual acuity (Log Mar)	Mean post-op visual acuity (Log Mar)
<= 1 month	56	1.36	0.5
2- 12 months	59	1.42	0.3
13- 24 months	7	1.4	0.5
24-36 months	9	1.43	0.8
37-48 months	2	1.4	1
49-60 months	1	1.6	0.1
61 -72 months	1	1.6	1.3

Table 5: Distribution of eyes by mode of injury

Blunt injury				Sharp		
Mode of injury	**Frequency**	**Percent**		Scissors	1	0.7
Rubber	7	5.1		Pin	6	4.4
Stick	28	20.6		Glass	2	1.5
Stone	22	16.2		Metal	1	0.7
Wood	14	10.3		Iron	5	3.7
Insect	1	0.7		Needle	5	3.7
Hand	4	2.9		Scale	1	0.7
Rice grain	1	0.7		Pencil	2	1.5
Firecracker	11	8.1		Pen	5	3.7
Fall	3	2.2		Spring	1	0.7
Wire	3	2.2		Arrow	1	0.7
Toy	2	1.5				
Broom	1	0.7				
Ball	1	0.7				
Chemical	1	0.7				
Plant	1	0.7				
Kitty	1	0.7				
Bamboo	2	1.5				
Door	1	0.7				

Discussion

Majority of patients included in the study were from low socioeconomic status and rural areas with male:female ratio of 2.75:1. Male dominance was recorded in this study. 74.26% males affected may be due to the male dominant society of the Terai belt of Nepal and Uttar Pradesh. Due to male dominance, all the sports, outdoor activities, field work, fire work, agricultural work are participated and performed by male. Worldwide, males are more involved in traumatic cataract (Singh et al, 2016). The result was similar to a study done in India where children involved were mostly from rural communities and from low socioeconomic status (Gogate et al, 2012).

In this study 66.2 % were above 7 years of age, similar to studies of Gogate et al (2012), Hyun et al (2009) and Eckstein et al (1998). Children older than seven years are primarily more involved in sports and recreation, be it at home,

school, park or sports center. These children may thus be more vulnerable to injuries than younger children (Adlina et al, 2014).

Open globe injury is the result of sharp objects and closed globe injury by blunt objects. 49.3% children in this study developed cataract due to open globe injury and 50% due to closed globe injury. Stick caused injury in 28 children (20.6%), stone in 22 children (16.2%), wood in 14 (10.3%) and firecracker in 11 children (8.1%). In rural areas the stick and arrow is sharpened to make swords and played by children, and firecrackers are part of festivities, more commonly during Dashera and Diwali season which leads to ocular injury (Gogate et al, 2012). Wood and sticks are used as firewood in the lower socioeconomic communities and children usually help their parents in collecting them. Also, agriculture is the major source of income and objects like stone, wood, stick, metal, iron, bamboo, plants, broom can lead to occupational ocular injuries. Objects like rubber, pen, pencil, scissors, ball, toy, scale, pin were also the cause of injury in our study, which explains that some school going children were also involved in the ocular trauma.

Visual acuity improved in 72%. The mean increase in visual acuity (BCVA) 6 weeks after cataract surgery compared to pre-operative visual acuity was Log MAR 0.8 (SD 0.5). 20 patients (14%) improved visual acuity from Log Mar 1 to better than 0.8. 17 children (12.5%) had visual acuity improvement to 0.6 from 0.9. Similarly, 20 (14.7%) and 22 children (16.17%) improved from Log Mar 0.8 and 0.7 respectively to 0.6. 11 children (8%) improved to 0.35 (25.7%), 24 (17.6%) to 0.2 and 6 children to 0.5. Patients whose visual acuity did not improve better than LogMar 0.6 had posterior capsular opacity and some were amblyopic due to delayed presentation. 38 children (26.4%) did not improve in visual acuity. Corneal scars, vitreous opacities due to vitritis and vitreous hemorrhage, retinal detachment and post-operative infections were the reasons for decreased vision. In this study, it was found that the duration of trauma and cataract surgery ranged from 5 days to 6 years.

No relation between duration and visual acuity was found in this study. Post-op visual acuity was related to the pre-operative visual acuity, mechanism of injury and mode of injury. In this study corneal opacity, vitreous opacity and retinal detachment caused by open globe injury had no improvement in visual acuity. This result which reported that initial visual acuity and modes of injury were predictors of final outcome was similar to Aldakaf et al (2006) and Sternberg et al (2014). Eyes with open globe injuries had decreased vision, as did eyes that needed multiple surgeries due to coexisting ocular morbidity, commonly corneal tears. Eyes that had postoperative uveitis and raised intra-ocular pressure had a poorer visual outcome. (Gogate et al, 2012)

Conclusion

In our study, male children had more traumatic cataract than females. Open globe injury with corneal opacity was the reason for decreased visual acuities with sharp ocular injury had poorer visual results. Household items, wood, sticks used as firewood were the major agent of ocular injuries.

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