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ORIGINAL RESEARCH ARTICLE

VISUAL OUTCOME OF CATARACT SURGERY WITH IOL IMPLANTATION IN TRAUMATIC CATARACT AMONG 189 CHILDREN: THE LAHAN EXPERIENCE

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ABSTRACT

Trauma is an important cause of monocular blindness in the developing world. This study aims to determine the demographic profile and visual outcome of cataract surgery among the children with traumatic cataract. It was a prospective and longitudinal study of 189 consecutive children below 16 years who underwent cataract surgery with intra ocular lens(IOL) implantation for traumatic cataract at Sagarmatha Choudhary Eye Hospital, Lahan, Nepal from October 2012 to March 2014. Assessment included visual acuity measurement in the Snellen's chart or the Cardiff card, anterior segment examination with slit lamp, dilated fundus examination with the help of +20D lens in indirect ophthalmoscope, B-scan ultrasonography of posterior segment and objective and subjective refraction. Follow up was scheduled at first post-operative day, at discharge, one month and three months. Cause and type of trauma, demographic factors, surgical intervention, complications, and visual acuity was recorded. Among 189, majority of them were males (73%) and the average age was 8.8±3.6 years. The time of presentation ranged from 3 days to 8 years (median age two months). Wooden stick was the most common cause of injury (34.4%). The average preoperative visual acuity in logMAR scale was 1.6. The average postoperative visual acuity in logMAR scale was 0.8. Eye injuries with traumatic cataract are associated with significant visual impairment. Cataract surgery with intraocular lens implantation restores vision significantly.

Key words: *Children, Complications, Intra ocular lens, Traumatic Cataract, Visual Outcome.*

INTRODUCTION

Ocular injuries are the most common causes of acquired monocular blindness in children.[1] Ocular trauma in children is mainly accidental and has an age-specific pattern. It is well known that infants and children less than 3 years of age sustain fewer injuries due to close parental supervision.[2] However, they generally suffer handler-related injuries like from the fingernail of siblings, mother or caretaker, sewing and knitting needles, as well as scissors and knives. A marked preponderance of injuries is seen in the 6-10 years age group as children in this age group are relatively immature and exposed to varying surroundings making them more vulnerable to injuries. Male children are affected more due to their adventurous and aggressive nature.[3, 4]

Cataract is by far the commonest complication causing loss of vision following any type of ocular injury.[5] Traumatic cataracts present with other ocular morbidities like corneal tears, iris injury, vitreous haemorrhage, and retinal tears; and are preventable to some extent.[6] The methods used to evaluate the visual outcome in eyes managed for traumatic cataracts and senile cataracts are similar, but the damage to other ocular tissues due to trauma may compromise the visual gain in eyes operated on for traumatic cataracts.[7] The greatest concern in children with cataract is irreversible visual loss. This is compounded in unilateral cataracts because, even after surgical removal, there still exists anisometropia, aniseikonia, and intraocular complications that is often very difficult to treat. The presence of strabismus or nystagmus is a poor prognostic sign, and once nystagmus is present, it rarely resolves after cataract removal. The posterior capsule tends to opacify quickly in children and should be removed along with the anterior vitreous surface during surgery. Peripheral lens fibers in children use the capsule and anterior vitreous as scaffolding and quickly grow across and reopacify the opening. This process can result in marked delay in visual rehabilitation. Amblyopia is another entity to be considered in long standing cases and young children. So, the ideal way of management would be early removal of cataract, accurate optical correction and patching of the sound eye to prevent amblyopia. Parental cooperation is an essential part of the management program. Surgery is only the first step and it must be ensured that the optical correction remains appropriate and parents are complying strictly with the occlusion therapy throughout this long and tedious program to obtain useful vision.[8] This study aims at evaluating the demographic profile of ocular trauma causing cataract and the visual outcome of children undergoing cataract surgery following trauma to the eyes, in a tertiary hospital located in eastern Nepal.

MATERIALS AND METHODS

Study design and sample size

This was a prospective and longitudinal study of 189 consecutive subjects who underwent cataract surgery with IOL implantation for traumatic cataract at Sagarmatha Choudhary Eye Hospital, Lahan, Nepal from october 2012 to march 2014. All the children of 15 years or below were included. The subjects having lesion in the posterior segments were excluded from the study. An Informed consent was received from accompanying parents or guardians after delivering detailed explanation of the procedures involved in the study.

Intervention

A superior or supero-temporal scleral incision of 5.5mm to 6.0mm was made, 2mm behind the limbus after a fornix based conjunctival peritomy. The capsulorhexis was performed and lens matters were removed using bimanual irrigation-aspiration only. In grossly subluxated lens, intracapsular cataract extraction was performed. Then, intra-ocular lens

(IOL) was implanted in cases where capsular or ciliary sulcus support was evident intraoperatively. The cases, not ideal for IOL implantation were excluded from the study. A single piece of PMMA 5.50mm optical diameter PCIOL was implanted in the bag or ciliary sulcus. The IOL power was deducted by 20% from the biometry reading for the children less than two years of age, and by 10% from the biometric reading for the children two to eight years of age. A primary posterior capsulotomy was performed followed by anterior vitrectomy in all subjects having PCIOL implantation. The scleral incision was sutured with 2- 10-0 nylon sutures. Conjunctiva was closed with 8-0 vicryl sutures. The Intracameral Cefuroxime (1mg/0.1ml) and the subconjunctival injection of Kenacort 10mg/0.5 ml was injected in all subjects. Any intraoperative complications, events and accompanying surgical procedure were recorded.

Assessment

Visual acuity was assessed on the Snellen's chart or the Cardiff card according to their applicability. An approximate Visual acuity for Infants, and uncooperative children were recorded by the central steady maintained (CSM) fixation. Anterior segment was examined using the slit lamp. Intraocular pressure was measured using a non-contact tonometer.

Based on lenticular opacity, the cataracts were classified into total, membranous, white soft and rosette types. Cataract was considered as total if no clear lens matter was observed between the capsule and the nucleus. When the capsule and organized matter was fused and formed a membrane of varying density, it was considered as a membranous cataract. When loose cortical material was found in the anterior chamber together with a ruptured lens capsule, the cataract was considered as white soft. A lens with a rosette pattern of opacity was considered as rosette-type cataract. Trauma was classified as blunt or sharp based on the type of objects sustaining the injury. It was also classified as open or closed globe injury based on BETT'S classification of ocular trauma.

Posterior segment evaluation was performed using indirect ophthalmoscopy with +20D lens in partially opaque lens and with B-Scan ultrasonography where media was not clear.

Postoperative period

On the first post-operative day, uncorrected visual acuity was recorded and the slit lamp examination was performed to observe for any complications. Topical antibiotic-steroid combination and cycloplegics were prescribed routinely. Additional medications were prescribed for various post-operative complications when required. Retinoscopy was performed and readings were recorded on the day of discharge. A Spherical equivalent (spherical power+ half of the cylindrical power) was prescribed for distant vision accompanied by addition of +3.00DS for near vision as a bifocal glasses. For infants and toddlers, a monofocal power of distance correction on top of +1.50DS addition was prescribed. Occlusion therapy was advised to those in whom amblyopia was suspected.

Follow-up

All subjects were reviewed after one month and three months. An Uncorrected and the best corrected visual acuity were noted. Any persistent ocular complication or associated ocular morbidity was recorded. An attempt was made to find out the cause of poor visual outcome if it is present. Spectacles were prescribed on every visit based on retinoscopic findings and subjective refraction wherever possible.

RESULTS

Among 189 subjects, ocular injury was commonly noted in children of age group 11-15 years (48.7%), males (73%) and left eye (56.1%). The children who sustained ocular injury presented mostly from India (86.8%). The most of the children (74.6%) presented from seven days to 6 months. The mean age of presentation was 8.8 years with standard deviation of 3.6 years (range 1- 15 years). The median age of presentation was 2 months (range 3 days to 8 years). The commonest cause of ocular trauma was noted to be wooden stick or wooden piece in 65 subjects (34.4%). The blunt injury was most commonly reported in 120 subjects (63.5%). The most common injury was close globe injury in 131 subjects (69.3%).

Table1: Characteristics of subjects with ocular trauma

Characteristics		Number (%)
Age (years)	≤5	28 (14.8)
	6-10	69 (36.5)
	11-15	92 (48.7)
Gender	Males	138 (73.0)
	Females	51 (27.0)
Location	Nepal	25 (13.2)
	India	164 (86.8)
Laterality	Right eye	83 (43.9)
	Left eye	106 (56.1)
Time of presentation (days)	≤7	7 (3.7)
	8-30	66 (34.9)
	31-180	75 (39.7)
	>180	37 (19.5)
	Unknown	4 (2.1)
Agent of Injury	Wooden stick/piece	65 (34.4)
	Firecracker burst	13 (6.9)
	Stone	12 (6.4)
	Needle/wire	15 (7.9)
	Metal/Sickle	11 (5.8)
	Cricket ball	4 (2.1)
	Fall on ground	4 (2.1)
	Others	32 (16.9)
	Unavailable	33 (17.5)
Cause of injury	Blunt injury	120 (63.5)
	Sharp Injury	58 (30.7)
	Unknown	11 (5.8)
Type of injury	Close globe injury	131 (69.3)
	Open globe injury	47 (24.9)
	Unknown	11 (5.8)
Total		189 (100)

The most commonly noted cataract was total cataract in 114 subjects (60.3%). A list of intra-operative events was noted. Among them, the most common three intra-operative events were ruptured anterior capsule (29.1%), posterior capsule plaque (14.3%) and IOL implanted in sulcus (10.6%).

Table 2: The morphology of the cataracts and intra-operative events

Category		Number
Cataract morphology	Total	114 (60.3)
	White soft	55 (29.2)
	Membranous	12 (6.3)
	Rosette	8 (4.2)
Intra-operative findings/ complications/ events	Ruptured anterior capsule	55 (29.1)
	Anterior capsule plaque	10 (5.3)
	Posterior capsule plaque	27 (14.3)
	Pre-existing hole in posterior capsule	19 (10.0)
	Iridodialysis	2 (1.1)
	Synechialysis done	6 (3.2)
	Optical iridectomy done	6 (3.2)
	Subluxated lens	8 (4.2)
	IOL implanted in sulcus	20 (10.6)
	Primary corneal repair done	4 (2.1)
	Corneal suture removal done	11 (5.8)
	ICCE done	3 (1.6)
	None	18 (9.5)

Table 3 represents visual status at the time of presentation in traumatic eye and post operative visual status. Visual acuity can't be assessed properly in 16 children and infants (8.5%) due to uncooperation. The CSM method was employed among them and they were not considered for further analysis. At the time of presentation, majority of the subjects (95.4%) had poor visual acuity (<6/60). Visual acuity was improved to good level (6/6-6/18) in one subject (0.6%) during the first post operative day and in 82 subjects (47.4%) during the time of discharge. On first post operative day, 58 subjects (30.7%) manifested various complications. They were corneal edema in 31 subjects (53.4%), Non-fibrinous anterior chamber reaction in 10 subjects (10.6%), fibrinous anterior chamber reaction in eight subjects (13.8%), hyphema in three subjects (5.2%), decentered IOL in two subjects (3.4%) and each case of uveitis, vitreous prolapsed, vitreous haemorrhage and ocular hypotony. Only 55 subjects (31.8%) had poor visual acuity at the time of discharge. The causes of poor vision at the time of discharge were noted to be amblyopia in 26 subjects (47.3%), corneal opacity in 12 subjects (21.8%), vitreous opacity in eight subjects (14.5%), persistent uveitis in four subjects (7.3%), hyphema in two subjects (3.6%), vitreous haemorrahge in two subjects (3.6%) and macular edema in one subject (1.8%). After one month, 57 subjects (32.9%) visited for follow up examination. Among them, 39 subjects (68.4%) had good visual acuity. The causes of poor visual acuity (<6/60) were amblyopia in four subjects, corneal opacity in five subjects, vitreous hemorrhage in one subject and macular scar in one subjects. After three months, only six subjects visited for follow up examination. Among them, four subjects (66.6%) had good visual acuity.

Table 3: Visual status at presentation and at post operative examination in traumatic eye among children undergoing surgery for traumatic cataract

Visual acuity	Preoperative day	1st day post operative day	Time of discharge	After one month	After three months
Good (6/6-6/18)	0	1 (0.6)	82 (47.4)	39 (68.4)	4 (66.6)
Borderline (6/24-6/60)	8 (4.6)	57 (32.9)	36 (20.8)	7 (12.3)	1 (16.7)
Poor (<6/60)	165 (95.4)	115 (66.5)	55 (31.8)	11 (19.3)	1 (16.7)
Total	173 (100)	173 (100)	173 (100)	57 (100)	6 (100)

Table 4 represents visual outcome at the time of discharge. The good level of visual acuity was attained by 82 children (47.4%) aged above 5 years. The good level of visual acuity was noted in males (51.6%) than females (36.2%), close globe injury (51.2%0 than open globe Injury (30.9%), presentation 30 days earlier than 30 days later and rosette cataract (85.7%). However, these findings were statistically significant for age and gender only.

Table 4: Visual outcome at the time of discharge

Category		Good (6/6-6/18) No (%)	Moderate (6/24-6/60) No (%)	Poor (<6/60) No (%)	P (χ^2 df)
Age (years)	≤5	0	3 (25)	9 (75)	0.00 (χ^2=24.9, df=4)
	6-10	25 (36.2)	20 (29.0)	24 (34.8)	
	11-15	57 (62.0)	13 (14.1)	22 (23.9)	
Sex	Males	65 (51.6)	27 (21.4)	34 (27.0)	0.07 (χ^2=5.2, df=2)
	Females	17 (36.2)	9 (19.1)	21 (44.7)	
Type of injury	Close globe injury	63 (51.2)	22 (17.9)	38 (30.9)	0.07 (χ^2=5.4, df=2)
	Open globe injury	13 (30.9)	12 (28.6)	17 (40.5)	
Time of presentation (days)	≤7	4 (57.1)	3 (42.9)	0	0.30 (χ^2=9.5, df=8)
	8-30	34 (55.7)	10 (16.4)	17 (27.9)	
	31-180	30 (44.1)	13 (19.1)	25 (36.8)	
	>180	13 (37.1)	9 (25.8)	13 (37.1)	
	Unknown	1 (50)	1 (50)	0	
Morphology of cataract	Total	46 (44.2)	22 (21.2)	36 (34.6)	0.49 (χ^2=5.4, df=6)
	White soft	25 (49.0)	12 (23.5)	14 (27.5)	
	Membranous	5 (45.4)	2 (18.2)	4 (36.4)	
	Rosette	6 (85.7)	0	1 (14.3)	

Table 5 presents refractive error in traumatic eye among children undergoing surgery for traumatic cataract. The retinoscopy and subjective refraction was performed in 149 subjects at first postoperative examination and the time of discharge. The refraction couldn't be performed in remaining 39 subjects due to poor fundus glow and lack of proper co-operation. The spherical power ranged from 0 to +8.00 DS with an average of +3.8±2.2 DS in first post-operative examination. The cylindrical power ranged from -0.5 to -12.0 DC with an average of -5.2±2.8 DC. The cylindrical axes were oriented within 20˚ and 160˚ in 80% of the cases. The spherical equivalent which ranged from -3.0DS to +5.75 DS with an average of +1.2±1.9 DS, was prescribed at the time of discharge. The spherical power ranged from -1.00 DS to +6.00 DS with an average of +1.75±2.1 DS. The cylindrical power ranged from 0 to -4.5 DC with an average of -1.62±0.84 DC. The cylindrical axes were oriented within 20˚ and 160˚ in 13.5%, within 70˚ and 110˚ in 59.6% and in oblique axes in 26.9% of the cases. The average spherical equivalent at one month follow up was +0.95±2.2 DS. The spherical power ranged from +2.0 DS to +3.50 DS and the average spherical power was +2.7±0.5 DS. The cylindrical power ranged from -1.0 DC to -2.0 DC and the average cylindrical power was -1.6±0.4 DC.

Table 5: Refractive error in traumatic eye among children undergoing surgery for traumatic cataract

Refractive error	1st Post-operative day	At the time of discharge	One month
Spherical error	+3.8±2.2 DS (range 0.00 to +8.00)	+1.75±2.1 DS (range 1.00 to +6.00)	+2.7±0.5 DS (+2.0 to +3.50 DS)
Cylindrical error	-	-5.2±2.8 DC (range -0.5 to -12.0)	-1.6±0.84 DC (range 0 to -4.5)
Major axis	20˚ to 160˚	70˚ to 110˚	80˚ to 100˚
Spherical equivalent	1.6±0.4 DS (-1.0 to -2.0)	+1.2±1.9DS (range -3.0 to +5.75)	+0.95±2.2DS (range +2.0 to +3.50)

DISCUSSION

The present study has presented the demographic profile, type of cataract, cause of trauma and visual outcome in children with traumatic cataract.

In the study, males (73%) were affected with traumatic cataract more commonly than the females. In Adhikari et al study (2010), 57% male children sustained ocular trauma in Rapti zone of Midwestern region of Nepal.[10] The Gogate et al study (2012) in Sangli district of Maharastra, India reported 61.7% children sustained ocular injury were boys.[11] But a large study reporting traumatic cataracts from tribal regions of India had young adults with traumatic cataracts equally common in both the genders.[12] In our study, the possibility of outdoor activities, playing rough, playing contact and projectile sports could be some of the reasons commonly observed among boys.

There is a huge variation in presentation time that ranged from within seven days of injury (3.7%) to as long as eight years with median time of presentation of six months (table 1). However, most of them visited after one month (61.3%). This finding apparently depicts a deficit of awareness regarding emergency in treatment of ocular injuries. The similar kind of finding was also noted in the rural districts of western India that noted a delay between trauma and presentation to hospital from same day to 12 years with a median of 4 days .[11]

The most common cause of injury was wooden stick, followed by wooden piece, firecracker burst, stone, needle, metallic piece in order of frequency. Injury with cow tail, bird beak and mango are observed. They are more likely to be participated in some kind of agricultural activities and playing more outdoor sports. A study in mid-western Nepal and rural area of western India also reported that the wooden stick was the most common agent of injury .[10]

Blunt injury (63.5%) and close globe injury (69.3%) were the most common cause and type of injury noted in our study. Blunt injury was also reported in the MacEwen et al study (1999) and the Gogate et al (2012) study (48.8%).[9,11] However sharp object injury was commonly noted in the Kaur and Agrawal (2005) study (73.7%) and the Krishnan and Sreenivasan (1988) study (69.2%).[1,13]

Visual acuity of less than 3/60 was noted in 87.3% subjects and less than 6/60 in 95.4% before performing surgery. On the first post-operative day, visual acuity of less than 6/60 and 3/60 or less was reduced to 66.5% and 45% respectively. At the time of discharge with best correction, 43.4% subjects attained normal vision while 31.3% subjects had visual acuity 3/60 or less and 31.8% subjects had visual acuity less than 6/60 (Table 3). The pre-operative average visual acuity in logMAR scale was 1.6 which improved to 0.8 in (which time of follow up). After 1 month, 57 subjects visited for follow-up (30.2% follow-up rate). Of 57 subjects, 39 subjects (68.4%) had visual acuity 6/18 or better in the operated eye. The result of our finding is quite similar to the Gogate et al (2012) study[11] that visual acuity better than 6/18 after traumatic cataract surgery was reported in 46.3% subjects. In the Shah et al (2011) study, 43.5% subjects of all age group gained visual acuity of >6/18.[12] In the Gradin and Yorston (2001) study, 64.7% of the eyes operated for traumatic cataract in children attained visual acuity of 6/18 or better.[14]

The visual outcome appears to vary between males and females in our study. Visual acuity of 6/18 or better was achieved in 47.1% of the males as compared to 33.3% in females. The average visual acuity in logMAR scale was 0.80 and 1.05 in males and females respectively post-operatively that were significantly different between them ($p=0.023$). Gogate et al (2012) also found poor visual outcome in girls compared to boys[11] The visual outcome also appears to vary among various age groups in our study. We found that older children attained better visual outcome as compared to the younger ones. Visual acuity better than 6/18 was attained by 62.0% subjects of age group 11-15 years, 36.2% subjects of 5 to <10 years. The average visual acuity in logMAR scale of <5 years age group was 1.62, that of 5 to 10 years age group was 0.90 and that of 11 to 15 years age group was 0.69. These difference in visual outcomes were significantly different (p=0.03). A reason for the finding on visual acuity may be related to difficulty in assessing visual acuity due to their apprehension and lack of cooperation. Another reason for poor visual outcome could be related to likelihood of developing amblyopia in young children.

In the study, visual outcome appears to be non-significantly better in the subjects who sustained closed globe injury than the subjects who sustained open globe injury. Visual outcome of 6/18 or better were achieved in 51.2% of cases having closed globe injury as compared to 30.9% having open globe injury. The average visual acuity in logMAR scale was 0.83 and 1.01 for closed and open globe injuries respectively. This may be due to the presence of associated ocular comorbidity like corneal tears and subsequent scarring in cases of open globe injury.[11]

In the study, 31.8% subjects had poor visual outcome (<6/60) at the time of discharge. The most common causes were amblyopia, corneal opacity, vitreous opacity and persistent uveitis. Gradin and Yorston (2001) reported amblyopia and retinal detachment were the most common cause of poor visual outcome after surgery for traumatic cataract in children.[14]

The cylindrical power ranged from -0.5 to -12.0 DC with an average of -5.2±2.8 DC at the time of discharge. The cylindrical axes were oriented within 20˚ and 160˚ in 80% of the cases. The 2 sutures applied to close the scleral tunnel induced a with-the-rule astigmatism. However, after 1 month the cylindrical power ranged from 0 to -4.5 DC with an average of -1.62±0.84DC. The cylindrical axes were oriented within 20˚ and 160˚ in 13.5%, within 70˚ and 110˚ in 59.6% and in oblique axes in 26.9% of the cases. So, there is a reduction in surgically induced astigmatism by about -3.58 DC after one month of follow up. After 3 months The cylindrical power ranged from -1.0 DC to -2.0 DC and the average cylindrical power was -1.6±0.4(SD) DC. The average cylindrical power appears to have stabilized by this time as compared to that after one month. Spierer and Nahum (2002) found mean astigmatism was 5.8 ± 3.6 D (range 3–14 D) one week after surgery. The mean astigmatism declined to 2.8 ± 1.4 D (range 1.25–5 D) at 3 months post-operatively, and to 2.1 ± 1.3 D (range 1–4 D) at 5 months post-operatively. No significant further decline was recorded 1 year after surgery.[15]

Eye injuries with traumatic cataract are associated with significant visual impairment. If managed properly, satisfactory visual outcome can be achieved

.Cataract surgery with intraocular lens implantation is a preferred method for visual rehabilitation in these children.

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