Cataract in Children - How Important is Age of Intervention in Non Traumatic Group?

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ABSTRACT

Purpose: To study the effect of age of intervention on visual outcome following treatment of pediatric patients with cataract.

Material and Methods: A study was done on a consecutive series of pediatric patients with congenital, developing and complicated cataracts who underwent surgery between January, 1999 and April, 2012 at our center. Patient demographics, cataract type, presenting symptoms, surgical intervention, postoperative visual acuity, and follow-up refractive changes were recorded.

Results: In total, 1305 eyes of 1047 children were included: unilateral cataracts were present in 786 (60.2%) eyes. Amongst total cases, 600 (46.7%) were traumatic and 705 (53.3%) non-traumatic. Age at the time of surgery ranged from 1 to 215 months. Eyes were grouped by the age at which surgical intervention (either by anterior route or pars plana route- with or without IOL implantation) was made. Group 1(</= 5 years) included 177 (25.1%) eyes, and Group 2(>5 years) had 528 (74.9%) eyes. The mean follow-up time was 117 days. Ultimately, 128 eyes (18.2%) in Group 1 and 213 eyes in (30.2%) Group achieved a visual acuity better than 20/80 ($P < 0.001$). Visual outcome was noticeably and significantly related to the age at which surgical intervention was done.

Conclusions: Age of intervention affects visual outcome significantly ($p<0.001$).

Key Words: Pediatric cataract; visual outcome; age of intervention.

INTRODUCTION

Childhood cataracts are responsible for 5-20% of blindness in children worldwide and for an even higher percentage of children have visual impairment in developing countries.[1-5]

The overall incidence of clinically significant cataracts (unilateral or bilateral) in childhood is unknown, but has been estimated to be as high as 0.4%.[6,7] The prevalence of childhood cataract varies from 1.2 to 6.0 cases per 10,000 infants. Pediatric cataracts are responsible for more than one million cases of childhood blindness in Asia. In developing countries, such as India, 7.4-15.3% of childhood blindness is due to cataracts.[8,9] Internationally, the incidence is unknown. Although the World Health Organization and other health organizations have made outstanding progress in vaccination and disease prevention, the rate of congenital cataracts remains much higher in underdeveloped countries.

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Geliş Tarihi - Received: 26.06.2014
Kabul Tarihi - Accepted: 22.09.2014
Glo-Kat 2015;10:182-188

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The visual results of cataract surgery in children have generally[10,13] been poorer than in adults.[1-3,6,12,13] This difference is due, in part, to the various types of amblyopia that develop in children with cataracts, the association of nystagmus with early onset cataracts, and the presence of other ocular abnormalities that adversely affect vision in eyes with developmental lens opacities. Since the introduction of the aspiration technique for cataract removal by Scheie in 1960, surgical procedures for the removal of the lens in childhood have improved[14-16] and earlier surgery for congenital cataracts has been encouraged.[17-19]

Any opacification of the lens and its capsule in children is defined as a pediatric cataract. Pediatric cataracts can be unilateral or bilateral. They can be subdivided based on morphology, as well as on aetiology. Morphologically, the most common type of pediatric cataract is the zonular cataract, characterized by opacification of a discrete region of the lens. This type includes nuclear, lamellar, sutural, and capsular cataracts.[6,10]

Polar cataracts are opacities of the subcapsular cortex in the polar regions of the lens. Almost all (90%) anterior polar cataracts are unilateral; bilateral anterior polar cataracts are commonly asymmetric and typically do not progress over time. Posterior polar cataracts are often small, but even a small posterior polar cataract can impair vision. A distinctive type of posterior polar cataract is the posterior lentiglobus or lenticonus, in which a protrusion of the posterior capsule is present. Membranous cataracts form when the lens, cortex, and nucleus are partially or completely reabsorbed, leaving a small amount of opacified lens material between the anterior and the posterior lens capsules.

Persistent hyper plastic primary vitreous (PHPV) is usually a unilateral ocular condition associated with a retro lenticular fibrovascular membrane. Although the lenses in most eyes with PHPV are initially clear, they often become opacified over time. Even when the lens remains clear, the retro lenticular membrane is usually sufficiently opaque to affect vision.

In terms of aetiology, pediatric cataracts occur due to genetic diseases, metabolic diseases, maternal infections, and trauma, and can also be idiopathic. The aetiology of cataracts can be established in up to half of the children with bilateral cataracts, but in only a small proportion of children with unilateral cataracts.

Congenital cataracts are one of the most common causes of treatable blindness in children, particularly in developing countries. [1] A recent report indicated that infants with bilateral congenital cataract who underwent early surgery (within 1 month of birth) and received appropriate optical rehabilitation could obtain visual acuity of better than 0.4 and could even achieve stereopsis.[2] However, because of typically relatively late detection and diagnosis, the nonavailability of facilities for infant anaesthesia, and poor compliance with long-term follow-up, the visual prognosis for infants with congenital cataract in developing countries differs markedly from that in industrialized countries. Visual loss is primarily attributable to amblyopia, most importantly, to "stimulus-form deprivation amblyopia," with the additional factor of ocular rivalry in unilateral disease. Thus, improved understanding of the critical periods of visual development has resulted in to surgical intervention for dense cataracts being deemed necessary within the first 3 months of life, possibly as early as the first 6 weeks in unilateral disease. Clinical factors believed to be important to visual outcome in children include age at diagnosis and surgery, type of refractive correction, type of cataract surgery, compliance with occlusion regimen, aetiology of the cataract, presence of non-ophthalmic disorders, development of capsular opacity or secondary membrane, and serious ocular postoperative complications.

Primary posterior capsulotomy and anterior vitrectomy are considered "routine surgical steps," especially in younger children. Previously, preparation for secondary intraocular lens (IOL) implantation at a later date was not considered. However, widespread acceptance of IOL implantation in children has caused this to be revised. Thus, management of the posterior capsule should eliminate or delay the formation of visual axis opacity and yet leave sufficient capsular support to achieve the desired "in-the-bag" (or ciliary sulcus) fixation of an IOL. Even when IOL implantation is not performed with the primary procedure, it is important to treat and prepare the eye in such a way that secondary implantation can be achieved subsequently.

MATERIALS AND METHODS

The study was approved by the hospital ethics committee. This was a prospective hospital-based study at a tertiary care eye hospital in western India over 20 years, from January, 1992 to April, 2012. All paediatric patients (0 to 18) with cataracts presenting to our department during this period were enrolled in the study.

Patient's primary details and history were documented using a pre-tested online format. Vision was checked according to the American Academy of

Paediatrics vision check protocol. Both eyes were assessed. Anterior segment examinations were conducted using a slit lamp bio-microscope. The pupils were dilated.

Ocular pressure was measured using a Perkin's handheld tonometer. If this was not possible, the pressure was measured under general anaesthesia. This procedure was omitted for eyes with open globe injuries. The posterior segment of the eye was evaluated with the help of an indirect ophthalmoscope and a +20 D lens and an ultrasound 'B' scan if the media were not clear.

The surgical technique was decided based on aetiology, cataract morphology, and the position of the lens. Surgery was done by the anterior or pars plana route. Anterior route surgeries were performed using a phacoemulcifier or manual suction. Membranectomies and lensectomies were performed using a pneumatic cutter. Intraocular lenses were not implanted in patients younger than 1.5 years. Children below this age underwent lensectomies/membranectomies; secondary implant placement conducted later. Patients were rehabilitated using glasses or contact lenses in-between. For IOL power calculations, we followed published guidelines.[20,21]

Postoperative follow-up was performed according to a pretested online format, including vision, anterior and posterior segment findings and intra ocular pressure, over an appropriate follow-up schedule. Glasses were prescribed when the media were clear and the final prescription was at 6 weeks post-operation. Patients underwent orthoptic evaluations and amblyopic patients were treated with appropriate patching. Aphakic patients were rehabilitated using glasses or contact lenses. Patients were evaluated for stereopsis and contrast sensitivity using a Titmus vision tester or a Titmus fly test.

Patients developing later cataracts underwent membranectomies and vitrectomies as required. For children operated on below the age of 1.5 years, secondary lens implantation was performed after they reached 2 years of age.

Data were analyzed using the SPSS software (ver. 19.0; SPSS Inc., Chicago, IL, USA). Univariate parametrical analyses were used. A P-value of <0.05 was considered to indicate statistical significance.

RESULTS

The enrolled patient group consisted of 1305 eyes in 1047 pediatric patients with cataracts. There were 432 (61.3%) males and 273 (38.7%) females (Table 1). The mean patient age was 9.1±4.9 years (range, 0-18). Of the cataracts, 600 (45.9%) were traumatic and 705 (54.1%) were congenital or developmental. Of the eyes, 1117 (85.6%; Table 2) had diminished vision and 188 (14.4%) presented with leukocoria. The follow-up period was 1-3084 days (mean, 117.4 days). We analyzed non traumatic cataract for current study. In the non-traumatic group, eyes were further subdivided into congenital (276), developmental (402), and secondary cataracts (27) Tables (2). According to the statistical analysis, the demographic factors including socioeconomic status (74.5% were of lower socioeconomic status) and residence (92% were from rural areas), had no significant relationship with the final visual acuity.

Table 1: *Age and sex distribution.*

Age (Years)	Sex		Total
	F	M	
</=1	19	25	44
1 TO 3	26	37	63
4 TO 5	28	49	77
6 TO 10	90	144	234
11 TO 18	110	177	287
Total	273	432	705

Table 2: *Comparision of visual outcome according to aetiology.*

Visual Acuity (Post Op)	Aetiology			Total
	Complicated	Congenital	Developmental	
Un Cooperative	0	5	3	8
<1/60	19	61	72	152
2/60 to 3/60	3	58	65	126
6/60 to 6/36	1	24	53	78
6/24 to 6/18	3	119	101	223
6/12 to 6/9	1	7	85	93
6/6 to 6/5	0	2	23	25
Total	27	276	402	705

Regarding patient entry, 9.2% of the patients had received primary treatment prior to reaching our center; this was not associated with a significant difference in the final visual outcome (P=0.2). Of the total patients enrolled, 26.4% entered via an outreach department, and 71% were self-referred.

A comparison of pre- and post-operative visual acuities showed that treatment significantly improved visual acuity (Table 3; P<0.001, Pearson's χ^2 test; P=0.001, ANOVA).

Final visual acuity following cataract surgery was >20/200 in 419 eyes (59.3%) and ≥20/40 in 118 eyes (16.7%) in the non-traumatic group. The follow-up period ranged from 1 day to 3084 days, with a mean of 117.4 days. We compared visual outcome according to age of intervention. It showed significant difference. Better results were achieved in age range between 6 to 18 (second group), (Table 4,5, p=0.000).

We have also compared outcomes of groups above and under 5 years of age. Amongst sub groups (Table 5,6) a significant difference was observed. Better results were achieved in which (</=5 group) early intervention was done. (Table 6 p<0.001),

Table 3: *Comparision of visual outcome according to pre operative visual acuity.*

Visual Acuity (Post Op)	Visual Acuity (Pre Operative)						Total
	Un Cooperative	<1/60	2/60 to 3/60	6/60 to 6/36	6/24 to 6/18	6/12 to 6/9	
Un Cooperative	1	7	0	0	0	0	8
<1/60	0	138	6	1	7	0	152
2/60 to 3/60	0	72	39	3	12	0	126
6/60 to 6/36	0	40	26	9	3	0	78
6/24 to 6/18	0	70	34	15	104	0	223
6/12 to 6/9	0	38	19	17	16	3	93
6/6 to 6/5	0	14	2	6	2	1	25
Total	1	379	126	51	144	4	705
P=0.000							

Table 4: *Comparision of visual outcome according to age of intervention.*

Visual Acuity (Post Op)	Age Category					Total
	</=1	1 TO 3	4 TO 5	6 TO 10	11 TO 18	
UN COOPERATIVE	0	1	0	7	0	8
<1/60	2	5	17	50	78	152
2/60 to 3/60	2	8	16	33	67	126
6/60 to 6/36	1	1	3	33	40	78
6/24 to 6/18	38	47	38	59	41	223
6/12 to 6/9	1	0	3	44	45	93
6/6 to 6/5	0	1	0	8	16	25
Total	44	63	77	234	287	705
P=0.000						

Table 5: *Comparision of visual outcome amongst i ntervention under and above 5 years.*

Visual Acuity (Post Op)	Age Category		Total
	<=5	>5	
UN COOPERATIVE	1	7	8
<1/60	24	128	152
2/60 to 3/60	26	100	126
6/60 to 6/36	5	73	78
6/24 to 6/18	123	100	223
6/12 to 6/9	4	89	93
6/6 to 6/5	1	24	25
Total	184	521	705
P=0.000			

Table 6: *Visiual outcome in non traumatic group under 5.*

Visual Acuity (Post Op)	Age Group		Total
	0 TO 2	3 TO 5	
Un cooperative	1	2	3
<1/60	1	20	21
1/60 to 3/60	1	18	19
6/60 to 6/36	0	3	3
6/24 to 6/18	75	55	130
6/12 to 6/9	0	0	0
6/6 to 6/5	0	1	1
Total	78	99	177
P=0.000			

The effect of laterality was also studied. Over all bilateral cases are doing well (p<0.001) but when we tried to study laterality in association with the age of intervention we found significant difference in bilateral cases in above 5 years of age (group 2, Table 7,8 p<0.001).

Intraocular lens was implanted in 692 (98.2%) eyes and was associated with significantly improved visual acuity (Table 9, P<0.001).

DISCUSSION

The enrolled patient group consisted of 1305 eyes of 1047 pediatric patients. The mean patient age was 9.1±4.9 years. The mean age in another report was 7.1.[22] Age at intervention had a significant effect on visual outcome (Table 4). Other investigators have reported similar findings.[23]

With regard to unilateral and bilateral cases, we found that bilateral cataracts fared better in above 5 year age group while it did not make significant difference in under 5 year age group, which again is similar to some other published reports[10] (Table 7).

A prospective study of the outcome of surgery for cataracts in the pediatric age group has several limitations. Although we believe that all patients included in the study had congenital, developmental, or traumatic lens opacities, not all patients were seen and followed by us from the time of birth. In particular, some patients with lamellar cataracts were not seen by us until they were several years old.

Regarding timing of intervention, our study suggests that visual outcome is affected by age of intervention, aetiology, and laterality. Patients in the non-traumatic group did well in the case of type 1 morphology if the intervention was early and in the case of type 2 morphology (partial opacity), even if the intervention was late. In case of unilateral cataracts, sooner the better policy was found advantageous. These findings were similar in the non-traumatic group.[10] On the other hand, their lens opacities were characteristic of congenital lamellar cataracts.[10]

The surgeries performed in our series of patients were not identical in all cases. For example, the posterior capsule was handled differently at different times during the study period. Additionally, the timing of surgery was not dictated by an established protocol, but was determined by age at the time of referral and by the visual status of individual patients. Finally, some observations that would have been useful for analysis were missing from the records because of loss to follow-up.

Nevertheless, we feel that some useful observations can be made on the basis of this review of patients. There seem to be two general categories of patients with congenital and developmental cataracts. One is characterized by extensive lens opacity and an early, obvious reduction in vision. These patients, who come for cataract surgery in the first year of life, often have smaller-than-normal corneal diameters, poorly

Table 7: *Visual outcome according laterality considering age category.*

Visual Acuity (Post Op)		Laterality		Total
		Unilateral	Bilateral	
<=5 POST OPERATIVE VISION	Un cooperative	0	1	1
	<1/60	6	18	24
	2/60 to 3/60	8	18	26
	6/60 to 6/36	0	5	5
	6/24 to 6/18	17	106	123
	6/12 to 6/9	1	3	4
	6/6 to 6/5	0	1	1
TOTAL		32	152	184
>5 POST OPERATIVE VISION	Un cooperative	2	5	7
	<1/60	69	59	128
	2/60 to 3/60	25	75	100
	6/60 to 6/36	11	62	73
	6/24 to 6/18	18	82	100
	6/12 to 6/9	16	73	89
	6/6 to 6/5	4	20	24
TOTAL		145	376	521
P=0.000, P=0.327				

Table 8: *Visual outcome according laterality considering age category.*

Age Category Post	Operative Visual Acuiety	Laterality		Total	P Value
		Unilateral	Bilateral		
</=1	<1/60	0	2	2	
	2/60 to 3/60	0	2	2	0.926
	6/60 to 6/36	0	1	1	
	6/24 to 6/18	5	33	38	
	6/12 to 6/9	0	1	1	
Total		5	39	44	
1 TO 3	UN COOPERATIVE	0	1	1	
	<1/60	1	4	5	0.916
	2/60 to 3/60	2	6	8	
	6/60 to 6/36	0	1	1	
	6/24 to 6/18	6	41	47	
	6/6 to 6/5	0	1	1	
Total		9	54	63	
4 TO 5	<1/60	5	12	17	
	2/60 to 3/60	6	10	16	0.351
	6/60 to 6/36	0	3	3	
	6/24 to 6/18	6	32	38	
	6/12 to 6/9	1	2	3	
Total		18	59	77	
6 TO 10	UN COOPERATIVE	2	5	7	
	<1/60	23	27	50	0.000
	2/60 to 3/60	9	24	33	
	6/60 to 6/36	4	29	33	
	6/24 to 6/18	10	49	59	
	6/12 to 6/9	4	40	44	
	6/6 to 6/5	1	7	8	
Total		53	181	234	
11 TO 18	<1/60	46	32	78	
	2/60 to 3/60	16	51	67	0.000
	6/60 to 6/36	7	33	40	
	6/24 to 6/18	8	33	41	
	6/12 to 6/9	12	33	45	
	6/6 to 6/5	3	13	16	
Total		92	195	287	

dilating pupils, and a vulnerability to delayed post-operative open-angle glaucoma. The other category includes patients with partial, often lamellar lens opacities, corneas of normal size, and a remarkably good visual prognosis. Lamellar cataract did significantly better when compared with other morphologies in the non-traumatic group, similar to other studies.[10] Of the patients in the first category, 222 (17%) developed nystagmus at 2-4 months of age, which was accompanied by a reduction in visual acuity despite a good anatomical result from surgery.

Our study suggesting various outcomes according to age (>5 and </=5) similar to study by Robb,[10] The visual prognosis in this group of patients, whose surgery is usually performed after 5 years of age, at a time when increasing visual needs begin to exceed the limits imposed by 528 Bilateral Congenital/Developmental Cataracts the lens opacities, is excellent. The only patients in this second general category who fell short of this high expectation were a few who also had the unfortunate combination of nystagmus and high myopia.

Table 9: *Visual outcome according intra ocular lens implantation.*

Visual Acuity	Intra Ocular Lens		Total
(Post Op)	IOL	NO IOL	IOL
UN COOPERATIVE	8	0	8
<1/60	141	11	152
2/60 to 3/60	112	14	126
6/60 to 6/36	71	7	78
6/24 to 6/18	179	44	223
6/12 to 6/9	93	0	93
6/6 to 6/5	25	0	25
Total	629	76	705

*IOL=INTRA OCULAR LENS, P=0.000.

Treatment of strabismic amblyopia following bilateral congenital cataract surgery is useful, although the ocular misalignment is sometimes hard to identify, and the amblyopia may be profound by the time it is recognized.[10]

Deprivational amblyopia due to asymmetry of cataracts from the outset is very difficult to reverse, similar to the situation in patients with monocular congenital cataracts.[24-27] An early start of treatment would seem to be the only hope -of success in these asymmetrical cases.[10]

Conclusion; Age of intervention affects visual outcome significantly and our conclusions out of this study are-

- Non traumatic group cataract morphology is type-1 early age intervention has better outcome (p=0.000).
- Over all visual outcome is better when age of intervention >5 and bilateral, if age is </=5 no significant difference in outcome with laterality.

WHAT WAS KNOWN: Age of intervention is important in pediatric cataracts for better visual outcome.

WHAT THIS PAPER ADDS: Age of intervention when considered with laterality provides clear idea about outcome.

Over all visual outcome is better when age of intervention >5 and bilateral, if age is </=5 no significant difference in outcome with laterality.

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