



An analytical study of visual outcome in paediatric cataract surgery

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Abstract:

Introduction: Cataract is one of the most important causes of childhood blindness. Early intervention is necessary for good visual prognosis as this age group is prone for deprivation amblyopia. AIM: To study the morphological pattern and presentation of patients with congenital and developmental cataract and to study the visual outcome after cataract surgery in this group. To study the post-operative complications and the visual outcome after Yttrium Aluminium Garnet (YAG) laser capsulotomy and surgical capsulotomy in patients with posterior capsular opacification (PCO). **Materials and Methods:** Fifty children who presented with developmental cataract in the age group of two to twelve to the tertiary eye centre were included and followed up for one year. Extracapsular cataract extraction (ECCE) with primary Intraocular Lens (IOL) implantation with primary posterior capsulotomy (PPC) with anterior vitrectomy was planned for children aged less than six years and ECCE with primary IOL alone was planned for children aged greater than six years. Post operatively children were reviewed at regular intervals for the first year. Patients who developed PCO underwent either YAG laser capsulotomy or surgical capsulotomy. **Results:** Commonest type of cataract was total cataract followed by lamellar cataract and 92% were bilateral cataract. There was good visual gain after cataract surgery with post-operative vision greater than 6/24 in 44.3% at the end of one year. PCO was thick enough to require capsulotomy in sixteen eyes. Other than PCO, uveitis, pupillary capture, IOL decentration and glaucoma were the complication that was noted. **Conclusion:** This study shows a good visual outcome in paediatric cataract following IOL implantation and also PPC with anterior vitrectomy. Hence there is a need for early intervention for good visual prognosis in childhood cataract..

Key words: congenital cataract, ECCE, primary posterior capsulotomy, vitrectomy, PCO

Introduction:

Paediatric blindness presents an enormous problem to developing countries in terms of human

morbidity, economic loss and social burden. One of the common causes of paediatric blindness is paediatric cataract [1]. Managing cataracts in

children remains a challenge: presentation is often delayed, diagnosis and assessment requires multitude of investigations, and treatment is often difficult, tedious and requires a dedicated team effort. Post-operative complications continue to be a major concern. The risk of post-operative complications is higher due to greater inflammatory response after paediatric intra ocular surgery [2]. To assure the best long term outcome for cataract blind children, appropriate paediatric surgical techniques need to be applied and children have to be monitored and managed by a team comprising paediatric ophthalmologist, orthoptists, optometrists, skilled teachers, social workers and more importantly aware and patient parents.

Aim:

To study the morphological pattern and presentation of patients with congenital and developmental cataract and the visual outcome after cataract surgery in paediatric age group.

To study the visual outcome after YAG laser capsulotomy and surgical capsulotomy in patients with posterior capsular opacification.

Materials and Methods:

Fifty children who presented with developmental cataract in the age group of two to twelve years to the Regional Institute of Ophthalmology and Government Ophthalmic Hospital during two years period were included in this study after getting written consent from their parents. Institutional ethical committee approval was obtained.

Inclusion criteria:

Children with congenital and developmental cataract in the age group two to twelve years

Exclusion criteria

1. Children with traumatic cataract.
2. Children with complicated cataract.
3. Children aged less than two years and more than twelve years.
4. Mentally retarded children.

All children received complete ophthalmic evaluation. Visual acuity in children less than five years was assessed using picture charts and Teller acuity cards. Snellen chart was used to record visual acuity in children more than five years of age. Anterior segment evaluation of cornea, iris, anterior chamber and lens was carried using slit lamp biomicroscopy. Fundus examination was done using direct or indirect ophthalmoscopy.

In children less than five years, examination was done under sedation or general anaesthesia.

Examination under anaesthesia included corneal diameter measurement, intra ocular tension and fundus examination.

Subjects who had poor fundus view and unilateral cases were subjected to B scan ocular ultrasonography. Serological screening for congenital infections was done in selected cases.

Presence of nystagmus and ocular deviation was noted. Children with strabismus underwent detailed orthoptic evaluation including prism bar cover test, tests for the presence of binocular single vision (BSV) and stereopsis was tested in cooperative children. It was noted if the child could alternate fixation between the two eyes. Cycloplegic refraction was done in possible cases. Any associated anomalies were noted.

As the study involved children greater than two years of age, IOL was planned in all children except for four children who had microphthalmos. ECCE with primary IOL implantation with primary posterior capsulotomy, with anterior vitrectomy was planned for children aged less than six years and ECCE with primary IOL was alone planned for children aged greater than six years.

After obtaining written informed consent from the parent or the guardian, for the surgery and placement of IOL, children were operated under inhalational general anaesthesia.

Two hours prior to surgery, pupil was dilated with tropicamide 1% and cyclopentolate 1% applied three times at 15 min intervals in each case. Fornix based conjunctival flap was raised. Wet field cautery was done to cauterise the bleeding vessels. Scleral tunnel was performed superiorly. After entering the anterior chamber with keratome, the chamber was filled visco elastic. Manual curvilinear capsulorhexis (CCC) was performed. After hydrodissection, thorough cortical aspiration was done manually with irrigation aspiration cannula. Posterior CCC smaller in size than the optic diameter was done, followed with anterior vitrectomy was performed in less than six years of age. Posterior capsule was left intact in children above six years. Poly methyl methacrylate (PMMA) IOL was placed in the bag.

All children received topical 1% prednisolone acetate eye drops every four hours and 2% homatropine eye drops twice a day. Topical steroids were continued and tapered off in four to twelve weeks and cycloplegics were discontinued after two weeks.

Children were reviewed every day for first three days and then every week for first month and

every three months for the first year. Visual outcome was assessed using Snellen chart for near and distance vision, with and without correction during each visit.

Anterior segment examination was done with slit lamp and fundus was examined with direct or indirect ophthalmoscope under full dilatation. Retinoscopic refraction was done and refractive errors were corrected, children were prescribed bifocal spectacles.

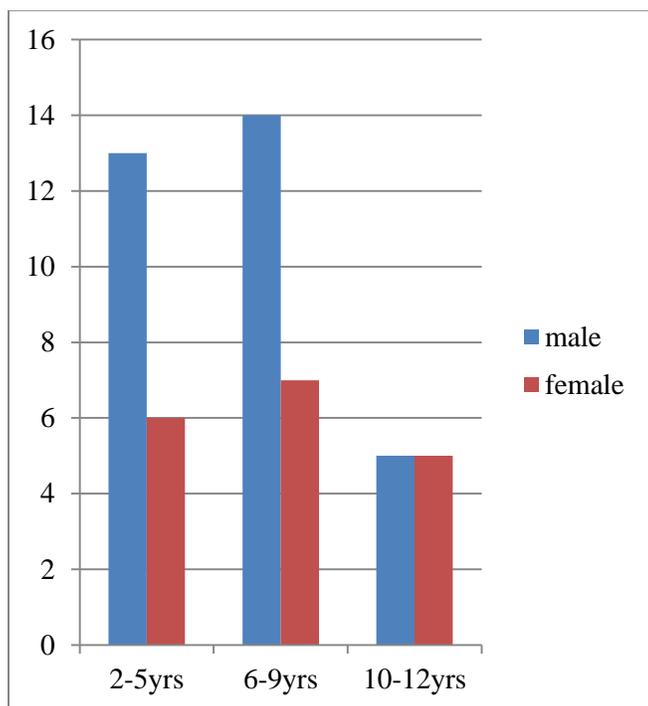
PCO which caused visual obscuration were detected and taken up for either YAG laser or surgical capsulotomy. The eyes were well dilated before the procedure. Using a minimum energy of one to two millijoules, a sufficient opening was made in the centre of the posterior capsule. 1 % prednisolone acetate eye drops, 2 % homatropine eye drops, 0.5% timolol maleate eye drops were prescribed for a week after the procedure. The seven unilateral divergent squint cases received occlusion therapy as a part of amblyopia treatment.

Results

Age and sex incidence:

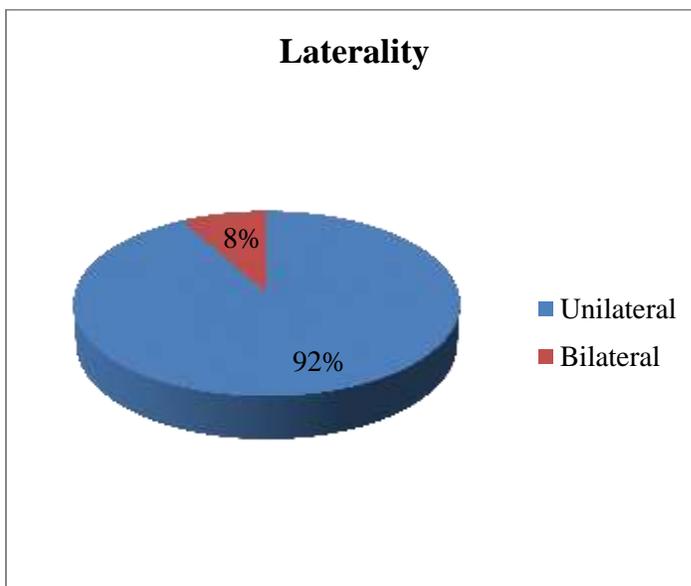
Majority of the patients were between two to nine years (40%, 6-9 years and 38% in 2-5 years). In this study boys outnumbered girls, 32(64%) were males, 18 (36%) were females as seen in figure 1.

Figure 1: Age and Sex distribution



Laterality:

As seen in figure 2, 46(92%) patients had bilateral cataract and four (8%) patients had unilateral cataract
Figure 2: laterality



Morphological Pattern and Presentation:

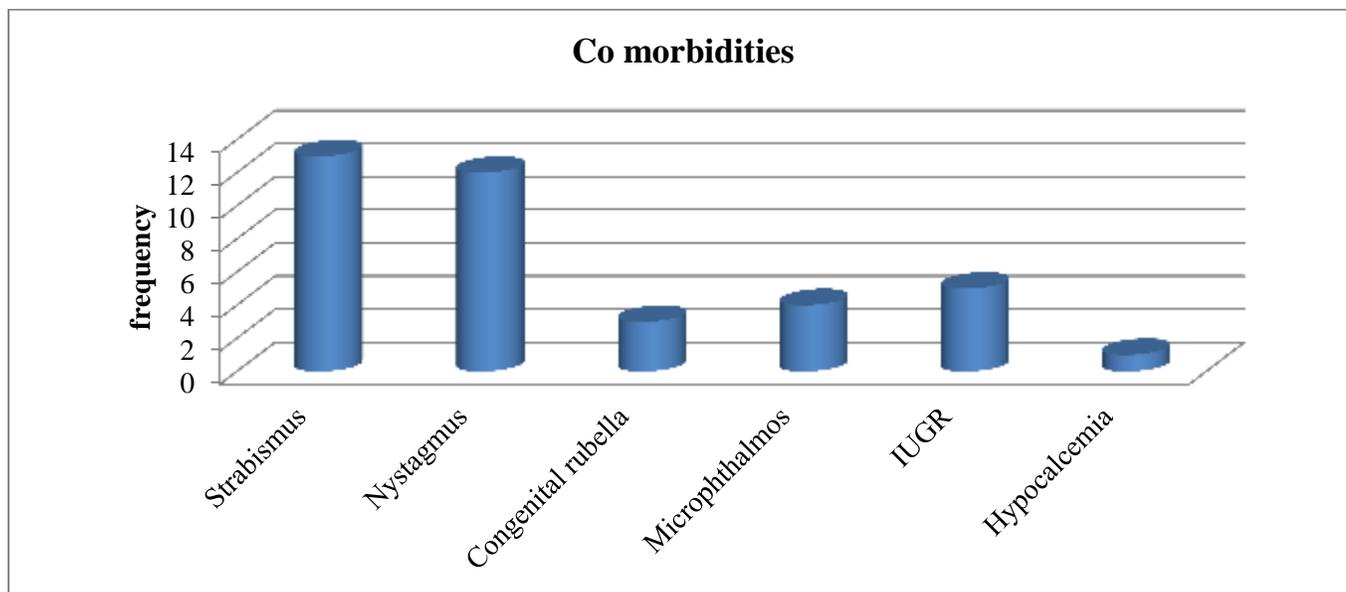
The Commonest type of cataract was found to be total cataract, which was seen in 26 patients (52%), followed by lamellar cataract in 40% of cases. The morphological distribution is shown in table 1.

Table 1: Morphological distribution

Type	No. of Patients	Percentage
Total	26	52
Lamellar	20	40
Sutural	1	2
Blue dot	1	2
Posterior subcapsular	1	2
Floriform	1	2

13 patients had associated strabismus, of which seven had unilateral divergent squint due to visual deprivation. Three patients had alternate convergent squint and three patients had alternate divergent squint. Nystagmus was seen in 12(24%) of the children. IgG rubella was positive in three (6%) of the children. Microphthalmos was seen in four (8%).One case had hypocalcaemia associated with umbilical hernia. In this study 5 out of 50 patients (10%) were low birth weight babies [figure 3].

Figure 3: Associated ocular and systemic anomalies



Preoperative Vision

Table 2: Vision at the time of presentation.

Age in yrs	<6/60 (No. of eyes) (N)	Percentage (%)	<6/24 (No. of eyes) (N)	Percentage (%)	≥6/24 (No. of eyes) (N)	Percentage (%)
2-5	20	20.8	16	16.66	0	0
6-9	24	25	13	13.54	4	4.2
10-12	9	9.4	6	6.25	4	4.2

As seen in the table 2, pre - operative vision of ≤ 6/60 was seen in, 53(55.2%) eyes and eight (8.33%) eyes had vision better or equal to 6/24. Surgery for four children who had vision equal to or greater than 6/24 was postponed keeping in mind the probability of post -operative complications. There were five dropouts. Hence Only 79 eyes out of 96 were operated. 73(92.10%) eyes received primary IOL implantation. Four children with microphthalmos were left aphakic.

Table 3: Post- operative visual outcome

Vision	At one month (N)	Percentage (%)	At six months (N)	Percentage (%)	At 12 months (N)	Percentage (%)
<6/60	18	22.78	21	26.58	17	21.51
<6/24	17	21.51	26	32.91	27	34.14
≥6/24	44	55.69	32	40.50	35	44.30

After one month postoperatively, vision greater than 6/24 was seen in 55.69%. Vision within

this category was seen in 44.30% at the end of 12 months. Number of eyes with greater or equal to 6/24

reduced after one year due to complications like PCO. Vision less than 6/24 was seen in 21.51% at the end of one month, which increased to 34.14% in twelve months. Only 22.78% had vision less than 6/60 in the first post-operative month, which was nearly the same at the end of 12 months. There was poor visual outcome (less than 6/60) in 21.51% of patients at the end of one year [table 3].

Postoperative complications:

The causes for poor visual outcome were post-operative uveitis in 9% and IOL decentration due to PCO or membrane formation. PCO was seen in 24.05%. Post-operative uveitis was seen in 8.86%. Pupillary capture, IOL decentration was also responsible for decreased vision in 6.6% [table 4].

Table 4: Post- operative complications.

Post- operative complications	Number	Percentage
Posterior capsular opacification	19	24.05
Uveitis	7	8.86
IOL decentration	5	6.6
Glaucoma	2	2.53
Hyphema	1	1.26

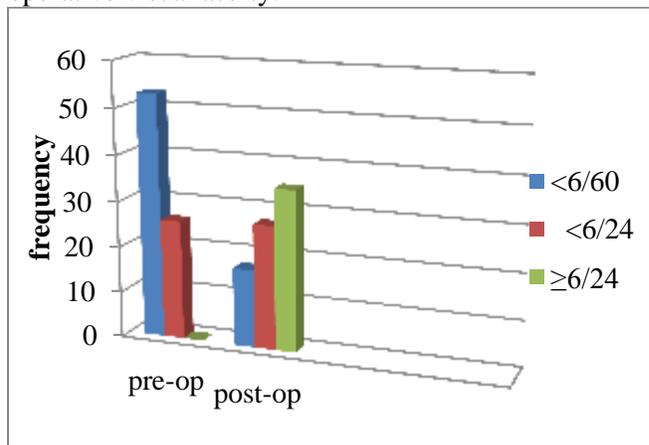
Post YAG/ surgical capsulotomy visual outcome

PCO was thick enough to require capsulotomy in 16 eyes. YAG capsulotomy was done in 9 eyes (47.36%) out of 16. Surgical capsulotomy was done in 7 eyes (59.63%). Of the 16 eyes, 13(68.42%) eyes improved by two Snellen lines, three(26.31%) had the same vision and one(5.26%) eye developed uveitis. 70% of patients had improvement in the visual function after YAG/ surgical capsulotomy.

Comparison of pre operative and post operative visual acuity:

The following figure 5 shows the drastic improvement in visual acuity post operatively. There is increased number of children having visual acuity of equal to or greater than 6/24 post cataract surgery, favouring the need for early intervention for paediatric cataracts.

Figure 5: Comparison of pre -operative and post-operative visual acuity.



Discussion:

As per recent WHO statistics there are 1.4 million children with severe visual impairment or blindness in the world. The proportion of blindness in children due to cataract is estimated to be 14% or 1,90,000 children[1]. Cataract is one of the most treatable causes of blindness in children. This is a priority in all blindness control program for children, as loss of vision in children influences their education, employment and social life.

Restoring sight in a child who is blind from cataract depends on four stages,

- Early detection of blind children within households and communities.
- Eye examination of blind children and referral of children with cataract.
- Good quality cataract surgery and optical correction.
- Follow up care: regular and long term.

Only a small minority of paediatric cataracts present clinically with subjective complaints relating to vision. Often the first sign is a white or partially white pupil noted by parents.

In our study, boys outnumbered girls. Bilateral cataract was present in 92%. Congenital cataracts occur in a variety of morphologic configurations, including lamellar, polar, sutural, coronary, blue dot, nuclear, capsular, total and membranous. The commonest type of cataract was found to be total cataract, followed by lamellar cataract. This could account for the increased incidence of bilaterality in our study.

Bilateral cataracts are often inherited, may be associated with systemic diseases like, galactosemia, Wilson disease, hypocalcemia and diabetes. Intrauterine infections including rubella, herpes

simplex, toxoplasmosis, varicella and syphilis are another cause. Unilateral cataracts are often due to local dysgenesis and as a rule, are not associated with a systemic disease and are not inherited. They are often associated with a small cornea and microphthalmos. Jugnoo S.Rahi et al [3] in their study, report the incidence to be 48% females (equal sex distribution) and more incidence of bilateral congenital cases(65%).

Of the associated ocular and systemic anomalies, strabismus was the most common. This was due to stimulus deprivation amblyopia. Deprivation amblyopia may occur when the visual axis is obstructed. The most common cause is a congenital or early acquired cataract. Deprivation amblyopia is the least common but most damaging and difficult to treat of the various forms of amblyopia [4]. Amblyopic vision loss resulting from a unilateral occlusion of the visual axis tends to be worse than that produced by bilateral deprivation of similar degree because interocular effects add to the direct developmental impact of severe image degradation. Even in bilateral cases, however, acuity can be 6/60 or worse. Hence, in children younger than six years, dense congenital cataracts that occupy the central 3 mm or more of the lens must be considered capable of causing severe amblyopia.

Dense cataracts also may lead to the development of sensory nystagmus, which has been found to be second most commonly associated anomaly in our study. Early cataract surgery may minimize the development of deprivation amblyopia as seen in the study by Birch EE et al [5].

There is significant association between low birth weight and the incidence of congenital cataract, in this study. This increased incidence of congenital cataract in the low birth weight babies has also been noted by John Paul et al in their study, Infantile Cataract in the collaborative perinatal project [6].

Of the 79 eyes that were operated, 73 eyes received primary IOL implantation. We found that implantation of IOL during cataract surgery seemed to be a practical option, while other methods of visual rehabilitation (aphakic glasses and contact lens) are less suitable in the developing countries.

In order to minimize the need to exchange IOLs later in life when a large myopic shift occurs, it has been advised to under correct children with IOLs, so that they can grow in to emmetropia or mild myopia in adult life. Wilson et al [7] in their study, paediatric cataract blindness in the developing world: surgical techniques and intraocular lens in the millennium, recommended that an IOL power should

be selected for each eye that is likely to give a post-operative refraction of no more than 4D of myopia, after full eye growth. This strategy will require leaving a moderate amount of hyperopia in children less than three years and mild amount up to six years.

The four unilateral cataract patients also underwent IOL implantation. Early cataract surgery and aggressive optical rehabilitation and occlusion therapy is very essential to prevent amblyopia. This was advocated by David et al [8] also in his study. According to Greewald et al [9], PCIOL appears to provide significantly better BSV in unilateral childhood cataract even though there is no substantial increase in visual acuity. Binocular vision in good percentage of cases could be attained if the patient is taken up for surgery at an earlier date. This is supported by the study by Lesueur et al in their study named visual outcome after paediatric cataract surgery from Purpan University hospital, France [10].

Patients in this study were implanted with PMMA lens. Children less than six years had undergone primary posterior capsulotomy with anterior vitrectomy, as children above six years were found to be mature enough to cooperate for YAG capsulotomy if needed. It was similarly reported by Jenson et al [11] in their study, where they did a retrospective study of children who underwent IOL surgery and concluded that PPC is advisable in children less than six years of age and preservation of posterior capsule is appropriate for older children. Kugelberg et al in his study has also reported decreased incidence of PCO when children less than seven years underwent anterior vitrectomy [12].

Good visual outcome could be attained in 76% of patients (6/60 and more) due to adoption of secure incisions, multi quadrant hydrodissection, PPC, and anterior vitrectomy in our study. Vasavada et al has shown that multiquadrant cortical-cleaving hydrodissection decreases lens substance removal time, lessens fluid volume used for lens substance removal, and facilitates lens substance removal in pediatric cataract surgery [13].

The reduction in the mean Snellen acuity in 13% of patients is due to pigment dispersion and development of PCO. This incidence could be further reduced if acrylic lenses with square edge design are used. The study by Wilson et al [7] has shown cell deposits and synechiae to be significantly less with acrylic lenses.

The incidence of PCO is relatively less due to adoption of procedures like primary posterior capsulotomy and anterior vitrectomy. This is

supported by Koch DD et al, who compared the effect of performing cataract surgery with and without posterior capsulotomy and with anterior vitrectomy in his retrospective study [14]. It was found that performing posterior capsulotomy with anterior vitrectomy was very effective in preventing or delaying the development of PCO.

Atropine was found to reduce the incidence of fibrin reaction in the post-operative period. Though 68.42% of the eyes showed improvement with capsulotomy, this still has to be given some thought, as it requires another episode of general anaesthesia, which has its own complications. Most of these patients had developed thick membranous PCO and decentered IOLs as complications. Following capsulotomy, there was a significant improvement in the visual acuity in these patients. This is supported by Namrata sharma, in her study of post-operative complications in paediatric cataract surgery, where she reported 87.2% of PCO [15]. Following YAG/ surgical capsulotomy, 55.88% achieved 6/18 and better vision in this group.

YAG laser delivery needs patient cooperation which cannot be expected in very young children and they also need very high pulse for effective posterior capsulotomy. That is also the reason why PPC is preferred in the younger age group as this is the group which is more prone for PCO. YAG/surgical capsulotomy play a significant role in visual rehabilitation of paediatric patients.

Conclusion:

Childhood cataract is an important cause of blindness in children and imposes a huge socio economic burden on society. There was male predominance in this study. Total cataract and lamellar cataract were the common type of cataract, which led to significant reduction in visual function. Most of the children brought, were less than or equal to six years of age, even if their cataract was not visually significant, showing the awareness amongst parents, teachers and paediatricians.

Strabismus due to visual deprivation in this study stresses the need for early intervention, especially in unilateral cases.

Children less than six years of age who underwent PPC with anterior vitrectomy showed good visual outcome, supporting the role of PPC and anterior vitrectomy.

PCO is the commonest complication and a major cause for visual obscuration following surgery, though the incidence of PCO has been brought down with modified surgical techniques and newer IOL

designs. The incidence of pupillary capture and IOL decentration was less probably due to the, in the bag fixation of the IOL, made possible by CCC. Children who needed YAG laser/ surgical capsulotomy had significant visual gain by showing improvement by more than two Snellen lines.

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