



Outcome of pediatric cataract surgery at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

By: Dr. Maranatha Mengistu (Ophthalmology Resident)

Addis Ababa, Ethiopia

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Outcome of pediatric cataract surgery in patients who visited pediatric ophthalmology clinic, St. Paul's Hospital Millennium Medical College

By: Dr. Maranatha Mengistu (Ophthalmology resident)

Advisors: Dr. Mandefro Sintayehu (MD, Pediatrics ophthalmology and strabismus
subspecialist)

Dr. Bezawit Tadegagne (MD, Pediatrics ophthalmology and strabismus
subspecialist)

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Address of the investigator	Tel:
	Cell phone: 0912350775
	Fax:
	PO box:
	E mail: mame.mm00@gmail.com
Name of the advisors	Dr. Mandefro Sintayehu Dr. Bezawit Tadeagne

Abstract

Aim

- To assess outcome of pediatric cataract surgery at St Paul's Hospital Millennium Medical College, Addis Ababa.

Methods

- The medical records of children aged below 16 years who underwent cataract surgery between January 2020 and December 2022 were reviewed for preoperative, surgical and postoperative data.

Results

- 152 eyes of 114 children, with mean age 6.05 ± 4.14 and 67.1% male who had cataract surgery were included. Children that presented with bilateral non-traumatic cataract were 32.5%, bilateral traumatic cataract 0.9%, unilateral non-traumatic 22.8% and unilateral traumatic cataract were 43.9%. At presentation majority (67.1%) complained decreased vision. At presentation, 76.2% of cases had visual acuity < 1.0 LogMAR, 27.6% presented with strabismus and 15.8% with nystagmus. The mean post-operative visual acuity at 6 months was significantly improved, ranging from 0.0 LogMAR to LP with 90.7 % achieving ≤ 1.00 LogMAR visual acuity. Post-operative complication that were encountered were PCO (18.7%), fibrous inflammatory membrane (7.3%), high IOP (4.9%) and RRD in (3.3%) of cases.

Conclusion

- With treatment from a qualified pediatric ophthalmologist, pediatric cataract can result in good visual outcomes, especially when supported by consistent follow-up care and dedication from the parents.

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Acronyms and Abbreviations

AC- Anterior chamber

AV- Anterior vitrectomy

BCVA- Best corrected visual acuity

CSM- Central, Steady, and Maintained

DC- Data collector

IOL- Intraocular lens

IOP- Intraocular pressure

IRB-Institutional Review Board

LA- Lens aspiration

PCO- Posterior capsular opacity

PI-Principal investigator

POC- Pediatric ophthalmology clinic

PPC- Primary posterior capsulectomy

SPHMMC - St. Paul's Hospital Millennium Medical College

UCVA-Uncorrected visual acuity

VA- Visual acuity

WHO- World Health Organization

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Introduction

1.1 background

Cataracts are opacities of the crystalline lens. They are a major issue in pediatric ophthalmology because they commonly impede on normal visual development(1). Cataracts in children can be isolated, or they can be associated with a number of conditions, including chromosomal abnormalities, systemic syndromes and diseases, infection, trauma, and radiation exposure(2).

Pediatric cataracts can be congenital or acquired. Congenital cataract, refers to a cataract that was present at birth, but it may or may not have been visibly apparent(2). A more practical definition considers whether the visual axis was clear from birth until 12 months of age. Most congenital cataracts are idiopathic. In acquired cataracts, ocular trauma is the commonest cause(3). Cataracts that develop earlier are more amblyogenic, particularly in unilateral cases. Significantly visible lens opacities before 2–3 months of age are the most likely to be detrimental to vision. Cataracts are responsible for nearly 10% of all vision loss in children worldwide(2).

The commonest presentations are with leukocoria or strabismus(4). The presence of poor tracking, strabismus, or nystagmus in the setting of bilateral or unilateral cataracts is a late sign, and evidence that deprivation amblyopia is already present. Dense congenital cataracts, whether unilateral or bilateral, may produce irreversible amblyopia if surgery is not performed in the early months of life(5).

Cataract can significantly impact the neurobiological development of a child. Treatment depends on the type, whether in one or both eyes, and the severity of the cataracts. Most children need surgery to remove them and appropriate refractive correction is needed to create clear image on the retina(2).

The aim of pediatric cataract surgery is not just to clear visual axis but also to maintain clear visual axis for a long time. Cataract surgery in children poses greater surgical challenge as compared to adults due to difference in anatomy and higher risk of complications. Special considerations and meticulous surgical technique for primary surgery can help in achieving optimal outcome(6).

Early surgical complications include sequelae of the increased inflammatory reaction in the young eye, and late complications include glaucoma, secondary opacities, or retinal detachment(5).

1.2. Statement of the problem

Cataract is a significant cause of visual disability in the pediatric population worldwide(7). The overall prevalence of childhood cataract and congenital cataract was in the range from 0.32 to 22.9/10,000 children (median=1.03) and 0.63 to 9.74/10,000 (median=1.71), respectively. The incidence ranged from 1.8 to 3.6/10,000 per year. The prevalence of childhood cataract in low-income economies was found to be 0.63 to 13.6/10,000 compared with 0.42 to 2.05/10,000 in high-income economies(8).

In Africa, cataract is the leading cause of childhood blindness replacing vitamin A deficiency and measles secondary to successful immunization program. Population based surveys suggest that 15–35% of childhood blindness is due to congenital or developmental cataract. There may be up to 82,000 children with non-traumatic cataract in Africa, with approximately 19,000 new cases each year(3).

In a survey done in Sekoru district South West of Ethiopia, prevalence of childhood blindness was about 0.062% and cataract was the commonest cause of blindness accounting for one third of the cases(9).

In a study done in Denmark, early surgery has been shown to be a risk factor for the occurrence of glaucoma among children undergoing surgery ≤ 6 months of age (35% of eyes). The postoperative visual outcome in the glaucoma cases was poorer, all with a Snellen visual acuity ≤ 0.3 (10).

In Africa, presentation is very late, visual outcome is poor and patients have inadequate post-operative follow up(11).

In a retrospective study done in East Africa, the results of cataract surgery were poor, partly because of inadequate correction of aphakia and amblyopia, which was identified as a leading cause of poor visual outcome. Eyes operated after the age of 2 years were more likely to obtain a

vision of 6/18 or better and fibrinous uveitis was the most frequent complication which occurred in 30.5% eyes(12).

Following pediatric cataract surgery, visual axis opacification continues to be the most frequent complication. Visual outcome after a successful cataract surgery in children finally depends on the timely management of amblyopia(7).

The functional and anatomic outcomes of pediatric cataract surgeries have significantly improved in recent years thanks to advancements in surgical procedures and optical rehabilitation approaches. Individualized treatment plans and skilled collaboration are essential for the effective management of pediatric cataracts(7).

1.3 Significance of the study

Pediatric cataract being one of the commonest cause of blindness and visual impairment in children worldwide, appropriate and timely management is key for improved visual outcomes.

There are different studies done on outcomes of pediatric cataract surgery worldwide, but literatures are scarce in Ethiopia and East Africa in general. Previously done studies were conducted in Northwest and Southern part of Ethiopia making this research the first of its kind in that there is no published data on the outcome of pediatric cataract surgery at SPHMMC and Addis Ababa city in general.

This research gives basic information about the outcomes of the surgeries done on pediatric patients with cataract and can serve as a standing point for future planning to improve management and follow up of pediatric patients. Additionally, this research will serve as a foundation for future researches.

2. Literature review

Cataract is one of the commonest cause of treatable childhood blindness globally and remains an important public health issue(13). Children with untreated cataracts place a great emotional, financial, and social burden on themselves, their families, and society. Favorable outcomes depend not only on effective surgery, but also on meticulous postoperative care and visual rehabilitation(14).

A retrospective study from Switzerland shows, bilateral cataracts (72.3%) predominate in patients who underwent cataract surgery and patients presented with leukocoria (62.8%), strabismus (22.3%), or nystagmus (9.6%). When surgery was done, the median patient age was of 22.2 months (1.6–50.9 months). During the follow-up period, 52 eyes (55.3%) developed complications. PCO (30.9%) was the most common post-operative complication which was observed more often in the IOL group. BCVA was documented to be greater than or equal to 0.4 decimal Snellen equivalent in 36.2% of eyes for distance and in 38.3% of eyes for near VA was better in bilateral cataract cases, especially if the procedure was done at a later age. Pediatric cataract surgery results are influenced by the timing of the procedure(15).

In a cohort study done in India, unilateral cataracts were evaluated. Most of the patients were boys and presented with a mean patient age of 2.5 ± 0.73 years. Eyes were grouped in to traumatic (66.4%) and non-traumatic groups of which congenital cataract (23.4%) predominates. A total of 106 (82.8%) patients presented with diminished vision and 22 (17.2%) presented with leukocoria. In both categories, treatment significantly improved visual outcome which was better in patients with non-traumatic cataract ($>6/60$ in 22 eyes (51.1%)). Other factors that influenced visual outcome were, age range 0-1 year, an anterior approach in cataract surgery and lamellar cataracts(16).

In a prospective study done in Nepal, the mean age of presentation was 3.84 ± 3.14 years and reduced vision (53.3%) and leukocoria (46.7%) were the main complaints. At presentation 80% were bilateral cataract, 43.3% had nystagmus and 20% had strabismus. Postoperatively, 70% of patients had VA $>6/60$ and only 13.3% patients were blind. Visual improvement was seen in 68.6% eyes following surgery. Visual axis opacification 29 (39%) was the most common postoperative complication which showed a strong link between PPC and absence of visual axis

opacification. Other complications were fibrinous uveitis in 2 cases (3.9%), optic capture and decentered IOL was seen in 1 case (1.95%). Early age of presentation, presence of nystagmus and poor preoperative visual acuity were found to be significantly associated with poor visual outcome (17).

In a prospective study conducted in Tanzania, mean age at presentation was 41.1 months and 78% of patients presented with bilateral cataract. Nystagmus appeared after surgery in 13/96 (13.5%) children. Children who were preoperatively blind had a decreased chance of improving their nystagmus. Acute fibrinous uveitis occurred in 41 (12%) eyes. Younger age at surgery and multi piece IOL fixation were associated with post-operative fibrinous uveitis. Children with corneal incisions were more likely to have postoperative astigmatism than those with scleral at 1 year. Surgery at <24 months of age predicted poor visual outcome. The majority (54%) of children with bilateral cataracts and 33% of children with unilateral cataract achieved visual outcome of at least 0.48 log MAR. Preoperative blindness, nystagmus/strabismus and aphakia were predictors of poor visual outcome in bilateral cases (18).

In a research done in Nigeria, the mean age of a patient was 6.88 ± 7.97 years (range, 0-13 years). At presentation, 78% of the eyes were blind. Statistically speaking, patients with congenital cataracts presented younger than those with developmental cataracts. The postoperative visual prognosis was impacted by a delayed diagnosis. Amblyopia, nystagmus and strabismus were the most frequent ocular comorbidities accounting for 50.3%, 36.5%, and 35.4% of patients, respectively. Intraoperative complications recorded include: miosis in five eyes, posterior capsule rupture with vitreous loss in two eyes and hyphema in one eye. Corneal edema was the most common complication on the first postoperative day. Other complications included PCO, fibrinoid reaction in the AC and shallow AC. Complications at 1 week postoperatively included, PCO, conjunctivitis, and uveitis. Four and 12 weeks postoperatively, PCO accounted for the majority of complications. At 12 week post-surgery, 71.2% of eyes had moderate vision (19).

In a retrospective study in Congo, the mean age was 5.7 ± 4.3 years and males were predominant (64.9%). Most of children were living mainly in urban poorest areas (96.3%). Strabismus, nystagmus and micro cornea were encountered in 20.1%, 25.1% and 8.7% of children

respectively. Most of patients were blind preoperatively. The most common type of cataract was total lens opacity (71.1%). Post-operative complications include secondary cataracts (5.8%), retinal detachment (1.2%), IOL decentration (1.2%), and secondary glaucoma (1.5%). Hyphema was found in 4 patients which resolved within 1 week. A transient corneal edema was found in 1 eye. The mean post-operative IOP was 18 ± 8 mmHg (min. 6 mmHg – max. 56 mmHg). Glasses were prescribed after refraction with a mean of $+ 0.5 \pm 1.5$ diopters (min. - 9 diopters, max. + 5 diopters). Visual outcome in at least one eye with VA 6/18 or better was found in 24.2%, VA 6/60 or better in 40.4% and severe visual impairment was found in 25.4% of eyes (20).

In a retrospective consecutive case series conducted in southern Ethiopia, unilateral cataract cases predominate and cataract etiology was primarily congenital, followed by traumatic. UCVA ranged from 6/60 to light perception. All patients with cataract secondary to trauma were unilateral and were generally older in age. The mean postoperative VA was significantly improved with 82% of patients achieving ambulatory vision (better than hand motion). 11% of eyes achieved VA 6/18 or better and VA that ranged from 6/18 to 6/60 was documented in 25.3% of eyes. Following surgery, several complications were noted: IOL dislocation, secondary visual axis opacities, anterior chamber reaction with a fibrinous membrane covering the IOL, transient raise in IOP, and choroidal effusion. There was no significant difference in VA results between unilateral congenital and traumatic cases. Patients diagnosed with nystagmus preoperatively had reduced VA results compared to patients without nystagmus. Following cataract surgery, ambulatory vision improved significantly, especially if an IOL was implanted (21).

In another study conducted at the University of Gondar, 25% of children had bilateral cataracts, 13% had unilateral non-traumatic and 63% had unilateral traumatic cataracts. Age at operation was 7.9 years on average. The 35 children who had bilateral cataracts before surgery, 58% of these eyes were blind (VA < 3/60). Nystagmus was present in 35% and strabismus in 19% of eyes. In unilateral non-traumatic cataract before surgery, 94% of operated eyes were blind. Strabismus was present in seven eyes (39%) and nystagmus in 1 eye. There was a significant delay in presentation particularly in non-traumatic. The proportion with a VA 6/6-6/18 or FF increased following surgery in all types of cataract, with better outcomes in bilateral cases compared with the other types (58% bilateral; 40% traumatic; 33% unilateral non-traumatic).

Poorer results in patients with bilateral cataracts were linked to nystagmus/strabismus prior to surgery. In traumatic cases, worse outcomes were associated with the preoperative trauma-related complications(22).

In a survey conducted in Ethiopia, nine ophthalmologists known to perform cataract surgery in young children were included. These doctors operated on patients whose ages ranged from 0 to 18 (the majority were under 15). A unilateral cataract affected 83% of eyes, mostly as a result of trauma, while 17% of people had bilateral cataracts. The majority of the factors that hindered the success of surgery for children with bilateral cataracts, according to all nine surgeons, was the delay in the procedure(23).

3. Objectives

3.1. General objective

- To determine outcomes of pediatric cataract surgery done at pediatric ophthalmology clinic of SPHMMC from January 2020- December 2022, Addis Ababa, Ethiopia.

3.2 Specific objective

- To assess primary and secondary outcome measures.
- To determine factors associated with good and poor outcomes.
- To describe complications encountered.

4. Methods and materials

4.1. Study area

The study was conducted at pediatric ophthalmology clinic of SPHMMC in Addis Ababa, Ethiopia. St Paul's Hospital Millennium Medical College was opened in 2007, the new millennium era of the Ethiopian calendar. It is intended to alleviate the severe shortage of medical doctors in the country. The school was established by the Ethiopian Ministry of Health together with Gordon Williams of the department of urology at the Hammersmith Hospital in London as the first dean.

The ophthalmology center is organized into different clinics: retina, glaucoma, pediatric, anterior segment, oculoplastic, general OPD and optometry clinics. It provides outpatient service to more than 40,000 patients and some inpatient services per year. The center's regular treatment modalities for patients include medical, optical, laser, and surgical care.

The center is a well-known college that offers ophthalmology residency training in Addis Ababa, the nation's capital. The center is also involved in various charity works by providing free medical and surgical services.

Pediatric ophthalmology clinic is run by pediatric ophthalmology and strabismus sub-specialist. The clinic provides surgical and rehabilitative services for pediatric cataract patients.

4.2. Study Design and period

A hospital based retrospective study design was conducted using secondary data from medical records. The study was conducted from January 01, 2023 to August 30, 2024.

4.3. Population

4.3.1. Source of Population

All medical records of patients who underwent surgery at the pediatric ophthalmology clinic of SPHMMC from January 2020 to December 2022 are considered as source population.

4.3.2. Study Population

All selected medical record of patients who underwent Cataract surgery at the POC of SPHMMC during the specified period and fulfilled the inclusion criteria.

4.4. Inclusion and exclusion criteria

Inclusion Criteria:

All medical record of children aged 0–15 years who underwent cataract surgery from January 2020- December 2022.

Exclusion criteria

Incomplete medical charts

Diagnosis of glaucoma prior to surgery

4.5 Sampling Technique and Sample Size Determination

All medical records of patients who underwent cataract surgery at POC of SPHMMC and who fulfilled the inclusion criteria were included.

4.5.1 Sample size calculation

Sample size was calculated by using single population proportion formula. 95% level of confidence interval and 5% of margin of error, $Z=1.96$ was assumed. The sample size was calculated using the formula

$$n = Z^2 p(1-p) / d^2$$

- n = is sample size
- Z = the value of the standard normal curve score corresponding to the given 95% CI= 1.96
- $P = 11\%$, (21)
- d = margin of error = 5%
- Non response rate=10%
- With this formula, the sample size calculated is 166.

4.6 Data Collection tool and Procedures

Children aged less than 16 years who underwent cataract surgery between Jan 2020 to Dec 2022 were identified from the operating theatre logbook and their medical records were reviewed for demographic, preoperative, intra-operative and postoperative information by ophthalmology resident at the department after he/she was oriented about the data collection format.

The preoperative data comprised socio-demographic information, presenting visual acuity, cataract type, any ocular or systemic comorbidities, and ocular ultrasound results. Intra-operative data included the surgical techniques employed, intraocular lens placement, and any intraoperative complications. Postoperative data encompassed primary and secondary outcome measures, categorized by the patient's age, and the presence of amblyopia, nystagmus, or strabismus prior to surgery. Additionally, the number of follow-up visits, postoperative complications, and interventions were documented.

Data was collected using a structured data collection form which encompassed all essential variables.

4.7 Data quality control

Data collectors were oriented on the data collection form prior to data collection and close supervision was made during the data collection process. The data collection form was pretested and daily regular supervision and checking for completeness and accuracy was be done by principal investigator.

4.8. Data Analysis

The collected data, after coding was done, entry and analysis was done using SPSS version 27.0. Uni-variate analysis and multi-variable logistic regression analysis was undertaken to determine predictors of postoperative outcomes. A P value of less than 0.05 was used to declare significance of the association.

4.9 Variables of the study

Dependent variables

- Clarity of visual axis
- Visual acuity
- Pupillary size and shape
- Degree of inflammation
- IOL positioning

Independent variables

- Age
- Sex
- Residency
- Type of cataract
- Presence of strabismus before surgery
- Presence of nystagmus before surgery
- Presence of amblyopia
- Uveitis before surgery

Visual acuity and clarity of the visual axis were used as primary outcome measures. For school-age children, visual acuity was measured using Snellen charts, while for preschool children, clarity of the visual axis served as the primary outcome measure.

4.10 Operational Definition

- VA will be categorized according to the World Health Organization classification
 - Blindness- visual acuity less than 3/60
 - Severe- VA worse than 6/60 to 3/60
 - Moderate- VA worse than 6/18 to 6/60
 - Mild- VA worse than 6/12 to 6/18

Mono ocular visual impairment- is not a WHO definition. It was derived to represent participants who had normal or near-normal vision in the better eye (VA of at least 6/18) and visual impairment in the other eye (VA from 6/18 up to 3/60 for low vision and less than 3/60 for blindness)

- Fixation and following - observed as the child's attention is directed to the examiner's face or to a small toy in the examiner's hand.
- CSM (central, steady and maintained)
 - Central refers to foveal fixation, performed monocularly.
 - Steady refers to the absence of nystagmus and other motor disruptions of fixation, performed monocularly.
 - Maintained refers to fixation that is held after the opposite eye is uncovered.

- Sensory strabismus- inward or outward deviation of eye in a patient with unilateral vision loss.
- Pupillary shape- central, round and regular circular opening.
- IOL dislocation- may present as simple decentration with in the bag or in the sulcus or complete dislocation of lens within or outside the bag.
- Congenital cataract- lens opacity which is diagnosed in the 1st year of life.
- Developmental cataract- lens opacity which is present after 1st year of life.
- Clear visual axis- absence of any significant media opacity with in the central 3 mm diameter.
- Adequate PC opening- 3-3.5 mm diameter central round opening.
- A/C inflammation grading:
Mild to moderate- clears with medical treatment
Sever- needs secondary surgical intervention
- School-age children- children who are in school or are of an age that would typically put them in school.
- LA+IOL- it is a procedure sparing the posterior capsule with no vitrectomy.

4.11 Plan for dissemination of findings

The finding of this study will be disseminated to SPHMMC, department of ophthalmology and will be submitted to school of medicine. The findings of the study will be used to improve clinical care and the research findings. It will also be presented on a relevant national conference and submitted to a peer-reviewed journal for publication.

4.12 Ethical Considerations

Ethical clearance was taken from the IRB of SPHMMC before starting data collection. Medical record number was used for the data collection and the identity of the study subjects was kept confidential throughout the study. Data collected will be used only for research purpose. The research was conducted after the approval of the proposal by ophthalmology department.

5. Results

One hundred fifty-two eyes with pediatric cataracts, which were operated on during the study period and fulfilled the inclusion criteria, were studied. Of the patients, 67.1% were male and 32.9% were female. The mean age at diagnosis was 6.05 ± 4.14 years, ranging from 0.2-15.

Developmental cataracts were the most common type, accounting for 78 eyes (51.3%), followed by traumatic cataracts with 52 eyes (34.2%) and congenital cataracts with 22 eyes (14.5%). Patients who presented with unilateral cataract were 76 (66.7%) and bilateral were 38 (33.3%).

Traumatic cataracts were found frequently in older children, with the majority presenting unilaterally ($p = 0.001$), and the frequency increased with age ($p = 0.013$). There was also a significant gender disparity when it comes to trauma cases, with males representing 80.77% of traumatic cataract cases compared to 19.2% in females ($p = 0.01$).

Table 1: Demographic characteristics of children who underwent cataract surgery from January 2020- December 2022.

	≤ 1 year	(1-3] years	(3-5] years	(5-8] years	(8-12] years	12+ years	Total
Sex							
Male	15	16	16	25	22	8	102
Female	7	8	14	8	11	2	50
Total	22	24	30	33	33	10	
Residence							
Urban	18	9	25	20	10	4	86
Rural	4	15	5	13	23	6	66
Total	22	24	30	33	33	10	152

Of the 152 eyes, 84 had preoperative visual acuity recorded using the Snellen chart. Among these, 64 eyes had a presenting visual acuity of >1.0 log MAR, while 20 eyes had a visual acuity <1.0 log MAR. Fixation pattern was assessed in 64 patients, and preoperative visual acuity was not recorded for 4 patients.

On motility and external eye examination, strabismus was observed in 42 eyes (27.6%) and nystagmus in 24 eyes (15.8%). Nystagmus was more commonly found in patients with bilateral cataracts compared to those with unilateral cataracts ($p = 0.001$). Slit lamp examination data indicated that total white cataracts made up 44.4% of the 126 eyes with documented morphology.

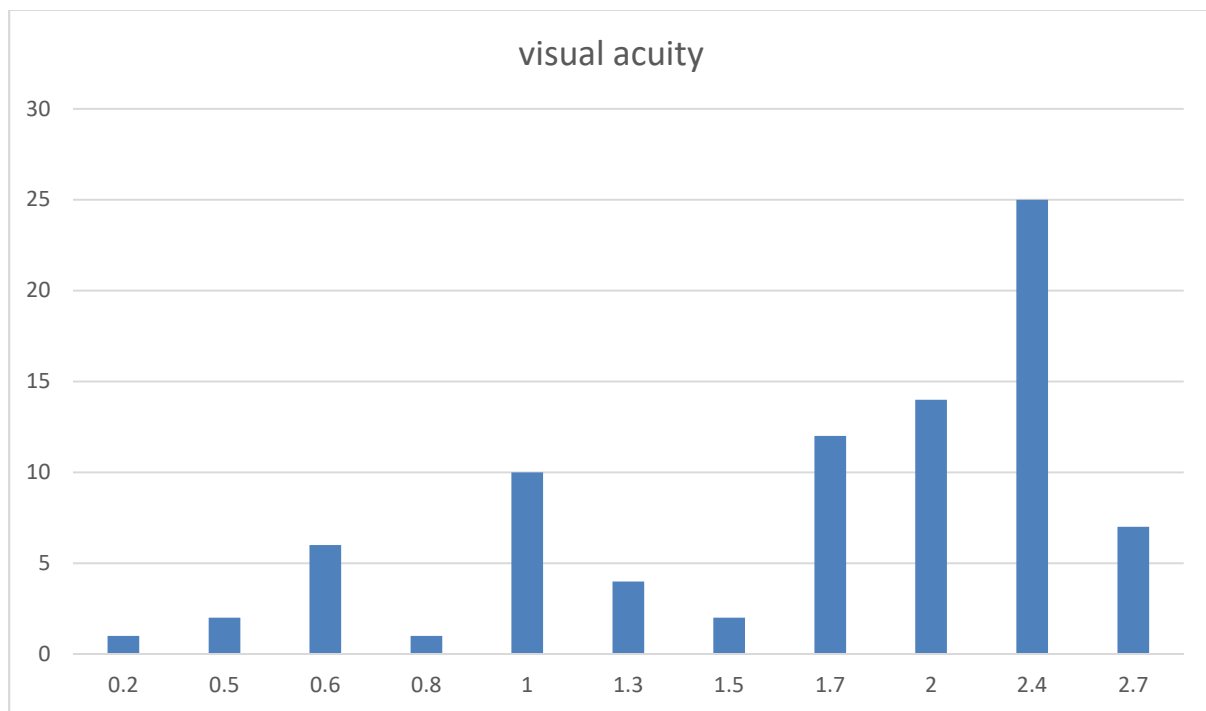


Figure 1: Visual acuity at presentation using LogMAR for school age children who underwent cataract surgery from January 2020- December 2022.

Table 2: Ocular comorbidity, surgical procedure and follow up visits of children who underwent cataract surgery from January 2020- December 2022.

	Preschool children	School age children
Amblyopia	15	8
Nanophthalmos	2	0
Strabismus	19	23
Nystagmus	18	6
Corneal opacity	1	8
Anterior/posterior synechiae	3	18
Ruptured lens	2	12
Subluxated lens	0	3
Retinal detachment	0	2
Surgical procedures		
LA+PPC + AV+ PCIOL	36	52
LA+PPC+AV	23	3
LA	1	-
LA+PCIOL	-	36
Lensectomy + AV	1	-
Type of IOL		
Foldable	19	20
Rigid	17	68

No IOL	25	3
Number of follow up visits		
1 st post op day	61	91
1 st post op month	61	88
3 rd post op month	42	86
6 th post op month	33	86

Table 3: Morphology of cataract at the time of presentation in children who underwent cataract surgery from January 2020- December 2022.

	Type	frequency	Percent
Morphology of cataract	Total	56	44.4%
	Nuclear	25	19.8%
	Lamellar	11	8.7%
	PSC	12	9.5%
	Posterior polar	10	7.9%
	Anterior polar	4	3.2%
	Cortical	3	2.4%
	Membranous	3	2.4%
	Sutural	2	1.6%
Total		126	

Surgery was performed at a median age of 6.1 years (range: 0.4–15). Lens aspiration with primary posterior capsulectomy and anterior vitrectomy was carried out in 75% (114/152) of cases. Among these, 39 (34.2%) received a foldable IOL, 49 (43%) received a rigid IOL, and 26 (22.8%) were left aphakic. Lens aspiration was performed in 24.3% (37/152) of eyes and rigid IOL was implanted in 97.3%.

5.1 School age children

At 6 months post-surgery, the uncorrected visual acuity for school-age children showed that 47.7% of eyes achieved $VA \leq 0.5$ LogMAR. 78 (90.7%) eyes had a visual acuity ranging from 0.0 to 1.0 (95% CI: 82.5%- 95.9%), while 8 (9.3%) eyes had a visual acuity between 1.0 and 2.7. Children with bilateral involvement tended to have a visual acuity better than 1.0 LogMAR compared to those with unilateral involvement ($p = 0.021$).

In univariate analysis, increased presenting visual acuity and male sex were associated with having a visual acuity better than 1.0 LogMAR. But on multivariable logistic regression, no association was found. The presence of a subluxated lens was significantly associated with visual acuity less than 1.0 LogMAR ($p = 0.022$).

On anterior segment evaluation, 72.1% (62/86) of cases had a clear visual axis at 6 months post-operation, while posterior capsule opacification (PCO) developed in 25.6% (22/86). LA+IOL was found to have a significant association with opacification of the visual axis at 6 months ($p = 0.028$).

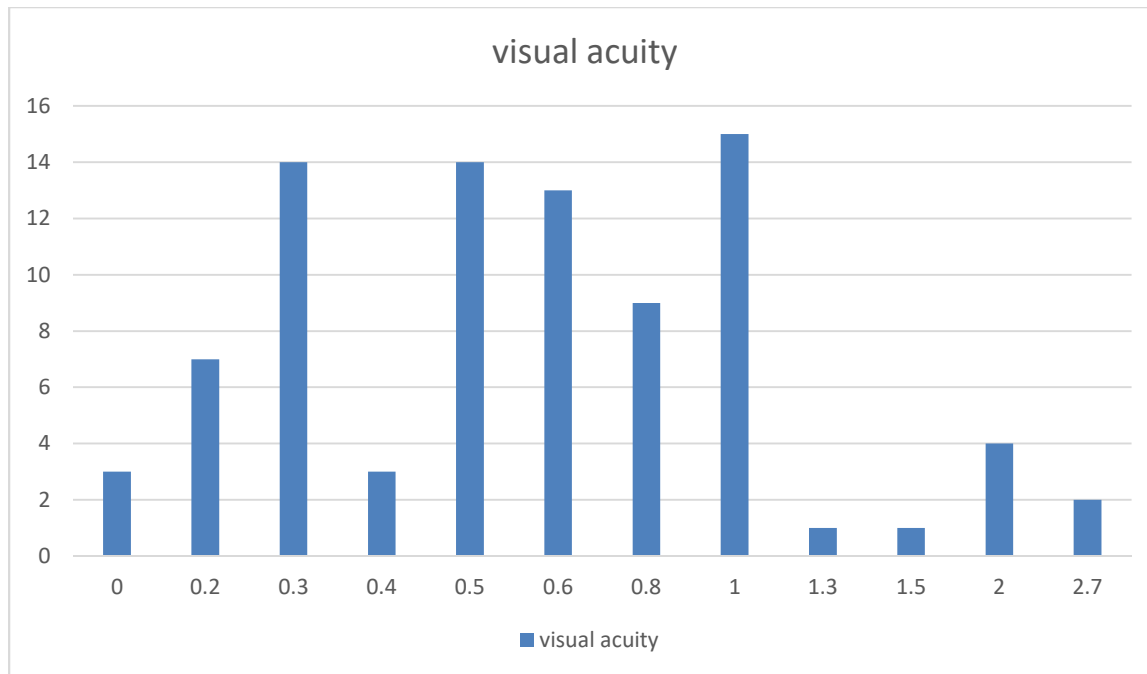


Figure 2: Visual acuity at 6 months post-operatively, measured using LogMAR, in children who underwent cataract surgery between January 2020 and December 2022.

Table 4: Pre-operative vs. post-operative visual acuity in children who underwent cataract surgery between January 2020 and December 2022.

Snellen/LogMAR	Pre-op VA	VA at 6 th month post op
$\geq 6/12$ (0.3)	2	24
6/12-6/18 (0.3-0.5)	2	17
6/18-6/60 (0.5-1.0)	16	37
6/60-3/60 (1.0-1.3)	4	1
$< 3/60$ (1.3)	60	7

Table 5: Binary and multivariable logistic regression analysis of factors associated with visual outcome at 6th month in children who underwent cataract surgery from January 2020- December 2022.

Variables	Crude Odds ratio (COR) (95% CI)	Adjusted Odds ratio (AOR) (95% CI)	P-value
Presenting VA	1.289(0.774,17.020)	6.940(1.120,43.012)	0.037
Sex			
Male	0.417(0.097,1.786)	0.23(0.047,1.119)	0.069
Female	xx	xx	

xx reference variable

5.2 Pre-school children

Clarity of the visual axis was used as the main outcome measure in preschool-aged children following cataract surgery. Post-surgical assessments of 61 eyes revealed that all cases had a clear visual axis on the first postoperative day. However, during follow-up, 4.9% eyes developed opacification of the posterior capsule affecting the central 3 mm of the visual axis.

Statistical analysis found no significant correlation between the type of surgery or the type of intraocular lens used and the development of PCO, with p-values of 0.98 and 0.65, respectively. These results indicate that neither the surgical approach nor the IOL choice had a significant impact on the formation of PCO in this group of children.

Table 6: Postoperative complications in cases of pediatric cataract surgery performed from January 2020- December 2022.

	Preschool children	School age children
Early post op complications		
Shallow anterior chamber(A/C)	-	1
A/C reaction	3	10
Acute fibrinous uveitis	5	16
Late post op complications		
High IOP	3	3
RRD	3	1
PCO	3	22
Dislocated lens		1
Pupillary capture of IOL	2	-

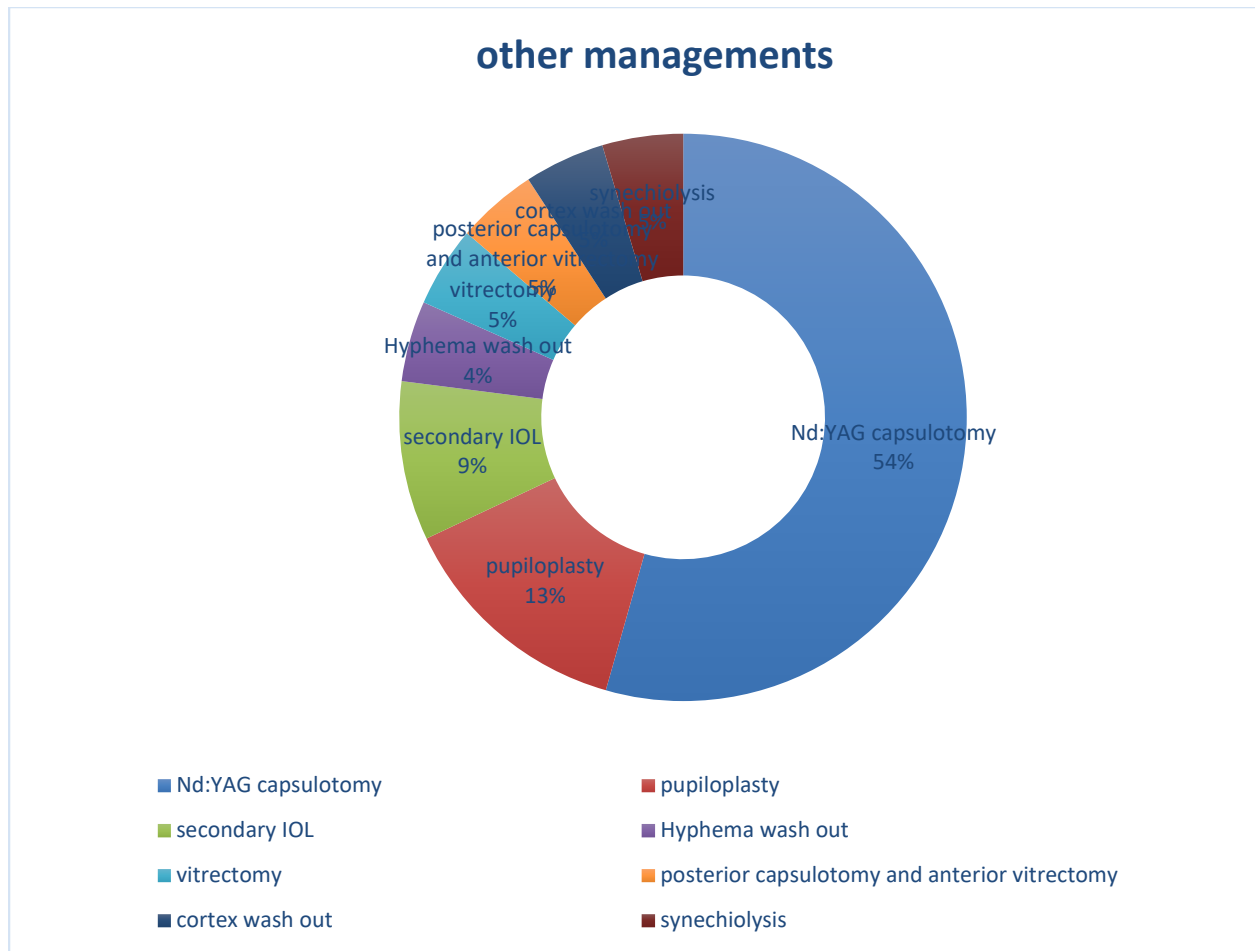


Figure 3: Additional surgical procedures performed in pediatric cataract surgery cases done from January 2020- December 2022.

A total of 12 out of 152 eyes (7.9%) required Nd:YAG capsulotomy for visually significant posterior capsule opacification . Amblyopia management with patching was implemented in 23 cases. Refraction was performed, and corrective glasses were provided for cases with a significant discrepancy from the target refractive error.

6. Discussion

In this study, 152 eyes of 114 patients were evaluated, with 67.1% of the patients being male and a mean age at diagnosis of 6.05 ± 4.14 . These findings are consistent with previous studies conducted in Southern Ethiopia(21), Gondar (22), Congo (20) and Nigeria (19).

Compared to the study in Gondar, there was a higher proportion of non-traumatic bilateral cataracts and a lower proportion of unilateral traumatic cataracts (22). Boys represented majority of traumatic cataract cases, similar to the 71% reported in the Gondar study (22), indicating a higher incidence of traumatic cataracts in males. A study from southern Ethiopia found that all traumatic cataracts were unilateral and generally occurred in older children, which aligns with our findings where the frequency of traumatic cataracts increased with age (21). This trend is likely due to children in developing regions frequently playing outdoors, often using wooden sticks, which increases the risk of trauma(16).

In school age children where visual acuity was assessed using logMAR, 76.2% eyes presented with a visual acuity of >1.0 logMAR. This is comparable to a studies in Southern Ethiopia where UCVA ranged from 1.0 logMAR to LP (21), Gondar 92%(22), Nigeria 78%(19) and study in Congo in which most of the cases were blind preoperatively (20). The difference that is seen could be attributable to the lack of recorded Snellen visual acuity for young children in our study.

On examination strabismus was present in 27% of cases and nystagmus in 15.8 %, which is comparable to a study done in Switzerland (22.3%, 9.6%) (15). The prevalence of strabismus was close with findings from studies in Tanzania, Nigeria, Congo, and Nepal. However, a higher incidence of nystagmus was reported in studies from Nigeria and Tanzania, likely due to a greater number of congenital cases, while studies in Nepal (17)and Congo had higher rates of bilateral cases compared to our study.

The average age at the time of surgery was similar to the study in Gondar (7.9years) (22), showing no significant difference from the average presenting age. Age was recorded in years, making it difficult to assess the exact lag time from presentation to treatment in our study.

Post-surgical uncorrected visual acuity ≤ 1.0 log MAR at 6 months for school age children was 90.7%, higher than studies conducted in India, Nepal, Nigeria, Congo and Southern Ethiopia.

This could be attributed to the fact that all surgeries were performed by trained pediatric ophthalmologists. All bilateral cataract cases had a recorded visual acuity ≤ 1.0 logMAR, while deprivational amblyopia may explain the presence of visual acuity >1.0 logMAR in unilateral cataract cases.

From the total cases, 47.7% were able to gain ≤ 0.5 log MAR vision which is comparable to study done in Switzerland (36.2%) and higher than the study done in Southern part of Ethiopia (11%). Traumatic cataract cases had a higher rate of good vision (45.5%) compared to non-traumatic cases (16.7%), possibly due to the older age at diagnosis in traumatic cases, which reduces the risk of amblyopia. As the presenting visual acuity increased, the odds of having a visual acuity better than 1.0 logMAR increased, a finding also observed in a study done in Tanzania.

This study focuses on the clarity of the visual axis as the primary outcome measure for preschool children following cataract surgery, with clear visual axis observed in 95.1% of cases. The clarity of the visual axis directly reflects the structural integrity of the visual pathway, free from opacities like PCO, making it a crucial indicator of surgical success. By concentrating on visual axis clarity, this study provides a more accurate assessment of cataract surgery outcomes, particularly for younger children who may not be able to cooperate with functional visual tests.

A clear visual axis is vital for preventing long-term visual impairment and supporting the development of binocular vision and depth perception. Timely restoration of visual clarity helps prevent amblyopia, which is essential for optimal visual development. Thus, this study contributes to a more comprehensive understanding of pediatric cataract surgery outcomes and underscores the importance of clarity of the visual axis in ensuring normal visual development.

From postoperative complications that were recorded, PCO was the most common. This is consistent with studies in Nepal, Nigeria, and Congo.

Due to the retrospective nature of this study, limitations included lost medical charts, incomplete data, inconsistent documentation and poor documentation of relevant details. Uncorrected visual acuity was used to assess the visual outcome, implying that refraction may not have been undertaken at every visit. Additionally, follow-up after cataract surgery was inadequate due to a

high number of cases which were lost to follow up, limiting the assessment of long term outcomes.

7. Conclusion

This research is the first to use clarity of the visual axis as the primary outcome measure for preschool children undergoing cataract surgery. In contrast to studies that often merge children capable of fixation with school-aged children, this study ensures a more realistic understanding of surgical success in younger children.

Visual acuity showed significant improvement after surgery; however, insufficient follow-up prevented the collection of postoperative data on long-term outcomes. This underscores the importance of regular follow-up care to assess ongoing visual outcome and address any potential issues. Surgery for pediatric cataract should be performed by a qualified pediatric ophthalmologist in a fully equipped facility, supported by trained staff. Before surgery parents should be counseled that surgery is the 1st step in managing this children and appropriate medical application, follow up, amblyopia management, refraction correction are also crucial in rehabilitation of this children.

8. Recommendation

For MOH and SPHMMC: since pediatric cataract is the leading cause of blindness further initiative should be made to avail resources and treatment in different parts of the country.

Strengthening follow up and parental education by providing counseling on post op care, amblyopia therapy, and the need for regular check-ups.

Further detailed studies are required on factors that affect the outcome of pediatric cataract surgery that are missing from this study, like discrepancy from target refractive error and amblyopia diagnosis and management.

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9. Annexes

Questionnaire

Part I: Socio-demographic Characteristics

Card number.....

Phone number.....

1. Age in years: _____

2. Sex

Male

Female

3. Residence

Urban

Rural

Part II: preoperative evaluation

1. What is the patient's main complaint?

More than one can be chosen

☐ Decrement of vision

☐ Leukocoria

☐ Strabismus

☐ Nystagmus

☐ Other.....

2. Any history of ocular trauma

☐ Yes

☐ No

3. Visual acuity OD..... OS.....

4. IOP OD..... OS.....

5. Is there any finding on EEE?

If yes, ...

6. Is there any finding on alignment and motility?

If yes, ...

7. Is there any finding on anterior segment examination?

If yes.....

8. Morphology of cataract

☐ Type

9. Involved eye

☐ OD

☐ OS

Part III. Investigation and management

1. Was ocular ultrasound done? If yes, finding

☐ Retinal detachment

☐ Vitreous opacities

☐ Vitreous hemorrhage

☐ Intraocular foreign body

☐ Other.....

2. Age when operation is done (in years).....

▪ Method used

☐ LA+ PPC + AV

☐ MSIC

☐ Other.....

▪ IOL type

☐ Foldable

☐ Rigid

☐ Other.....

▪ Intraoperative complication

☐ vitreous loss

☐ PC tear

☐ subluxation/ dislocation of IOL

☐ hyphema

☐ Other.....

3. Post-operative follow up

- Primary and secondary outcome measures for preschool children

SN	Primary outcome measure	1 st post op day	1 month	3month	6 month
1.	Clarity of visual axis				
	Secondary outcome measure				
2.	VA				
3.	Degree of AC inflammation				
4.	Pupillary size and shape				
5.	IOL positioning				
6.	Discrepancy from the target refractive error				
7.	Other findings				

- Primary and secondary outcome measures for school age children

SN	Primary outcome measure	1 st post op day	1 month	3month	6 month
1.	VA				
	Secondary outcome measure				
2.	Clarity of visual axis				
3.	Degree of AC				

	inflammation				
4.	Pupillary size and shape				
5.	IOL positioning				
6.	Discrepancy from the target refractive error				
7.	Other findings				

4. Other managements

- Further surgery
 - ☐ Yes, type.....
 - ☐ No
- Amblyopia therapy
 - ☐ Yes
 - ☐ No

Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the resident: Dr. MaranathaMengistu

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: Dr. MandefroSintayehu

Signature:

Date:

Approval of the Co-Advisor

Name of the Co - advisor: Dr. BezawitTadegagne

Signature:

Date:.....