Long-Term visual outcome of paediatric cataract surgery at Kitwe Teaching Eye Hospital, Kitwe, Zambia

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ABSTRACT

Aims: To determine the long-term visual outcome of paediatric cataract surgery performed at Kitwe Teaching Eye Hospital, Zambia
Study design: Cross sectional study
Place and Duration of Study: Kitwe Teaching Eye Hospital between January 2018 and December 2019.
Methodology: study population included all children aged between five and fifteen operated on. Participants underwent visual acuity and refraction re-assessment two years post-Operatively. Continuous variables were summarized using the median and interquartile ranges. Stuart-Maxwell test for paired data and Univariate and multivariable logistic regression analysis was used for data analysis.
Results: A total of 117 children participated in the study. About 29% of the children had complications after cataract surgery, and anterior segment complications were the most common experienced complications 18 (15.4%) after surgery. Only one (0.9%) child out of hundred and seventeen had good visual acuity before surgery (6/18 and better) while 24 (24.4%) had good visual acuity outcome six weeks after surgery, and at two years after surgery, 41(41.8%) had attained good visual outcome. The visual acuity outcome at six weeks after surgery significantly differed from the visual acuity outcome after two years with the proportion of good visual outcome increasing after two years. Pre-operatively, posterior segment accessibility (AOR 0.13; 95% CI: 0.03 – 0.69), developmental cataracts (AOR 3.09; 95% CI: 1.17 – 8.14) and refraction done at six weeks, were all associated with good visual outcome at two years after surgery. Poor outcomes were associated with delayed refraction, done after six weeks (AOR 0.22; 95% CI: 0.08 – 0.58), increased number of anterior segment complications (AOR 0.14; 95% CI: 0.03 – 0.72) and posterior segment complications (AOR 0.09; 95% CI: 0.01 – 0.83).

Conclusion: Children's vision significantly improved with time after cataract surgery. Long-term visual outcome follow-up (beyond six weeks) post-surgery is important as it increases the proportion of children attaining good visual outcome after surgery and helps correct uncorrected refractive errors hence optimizing the best visual acuity a child can attain. Significant improvement was seen more in children who were initially borderline from 24.4% with good sight at six weeks post-operatively to 41.8% two years later.

Keywords: paediatric cataracts, long-term, visual outcome

1. INTRODUCTION

Cataract refers to opacification of a crystalline lens and paediatric cataracts are cataracts occurring in children from birth to a day before their fifteenth birthday (1). A blind child, has to overcome a lifetime of social, emotional and economic difficulties and this affects not only the child, but the family and the society at large. Families with children blind from cataracts face enormous burden of caring for them, as these children face a lifetime of blindness ahead of them and also affects academic development and performance at school. (1,2,11).

An estimated 200,000 children are blind from cataracts worldwide, with higher prevalence being in developing countries at 1-4 per 10,000 as compared to 0.1-0.4 per 10,000 children in developed countries (3). Lower prevalence in the developed countries has been attributed to better cataract services as compared to the poorer countries (4,5). In developing countries, childhood blindness due to cataracts presents an enormous problem in terms of social burden, human morbidity, and economic losses. Financial challenges arise as caregivers are burdened with the expenses of caring for a blind child, inform of costs of visual aids, home modification and rehabilitation, services (3,6).

Surgery remains the mainstay of treatment and some studies have shown that these children are routinely followed up only for six weeks post-operatively in the absence of any clinical indication for further follow-ups (7,8) .Outcomes of paediatric cataracts plays a vital role on of determining how well the surgery was performed and assessing the subsequent long-term visual acuity outcomes. The assessment is done using WHO guidelines of (Good Visual acuity 6/6 to 6/18, borderline <6/18 to 6/60 and poor <6/60) (1). study done on paediatric cataract surgery outcome in the Copperbelt, Zambia, where children were followed up only up to six weeks post-operatively, found that only 29.7% of the children who had had cataract surgery were reported to have VA of 6/18 or better which was quite low by (9). Similarly another study on outcome of congenital and developmental cataracts done in South-Africa where children were followed for 3months,found the highest number of patients (46.3%) had a poor final visual outcome (10), while Sukhija in India who followed up children on a longer-term, showed that the final best-corrected visual acuity was 6/18 or better in 24/26 (92%) of eyes after eight years of follow-up (11). Although cataract surgeries are the most common surgeries that are performed at Kitwe Teaching Eye Hospital (KTEH), the only government institute carrying out these surgeries, receiving referrals from all over Zambia, yet information on follow up beyond six weeks is sparse and the long-term visual outcome of paediatric cataract surgeries at KTEH is unknown. This study was to establish what the long-term visual outcome of paediatric cataract surgery beyond six weeks of children operated on at KTEH. It is aimed to build onto the body of knowledge of previous studies conducted and provide the baseline for future comparisons and appropriate recommendations on the subject.

2. MATERIAL AND METHODS

117 participants with consenting parents/guardians were enrolled. The details of all records of consented parents/guardians meeting the inclusion criteria were entered into a data collection tool (study tool) by the principal investigator. Inclusion criteria included all patients aged between 5 to ≤15 years, who underwent cataract surgery between January 2018 to December 2019 with parents/guardians' consents. Exclusion criteria included history of traumatic cataracts prior to surgery, incomplete or missing information from the files and any patients who underwent combined surgeries due to other ocular comorbidities. Demographic data (Age and sex), date of surgery, baseline/ preoperative assessment, visual acuity, refractive status, and ocular comorbidities were included in the data collection sheet. Classification of type of cataract whether congenital or developmental as per record in the file, as recorded by the clinician was recorded. Intra-operative information such as type of

surgery, lens implanted or not and complications was included. Post-operative data such as Visual acuity at first post-operative day, at one week, and at six weeks follow up was recorded

The study adhered to the tenets of the Helsinki declaration. All participants were directed to the nearest eye health facilities for re-assessment of current visual acuity (VA) post-operatively. The participants in other parts of Zambia who could not travel to Kitwe were assessed through the help of trained research assistants located in designated Eye health facilities around Zambia. Visual acuity was assessed for distance, unaided and with pinhole, and near using the Snellen's and tumbling E charts. Objective refraction was performed using an autorefractor, taking an average of two readings. Subjective refraction was done using trial lenses.
Data collected was sort and cleaned before analysis. Collected data was entered in Microsoft Excel 2019 and was transferred to statistical package STATA version 15. Continuous variables were summarised using the median and interquartile ranges because the data did not meet the normality assumptions. Results for categorical variables were summarised using frequencies and percentages and presented through tables and graphs. The Stuart-Maxwell test for paired data was used to establish the difference in the distribution of visual acuity outcome at six weeks post-surgery and two years post-surgery. Univariate and multivariable logistic regression analysis was performed to identify factors associated with good visual acuity. A dummy variable coded 1 if the category is good visual acuity outcome and 0 otherwise was created. The level of significance was set at 5% with a confidence level of 95%. Therefore, a P-value < 0.05 was considered statistically significant.

3. RESULTS

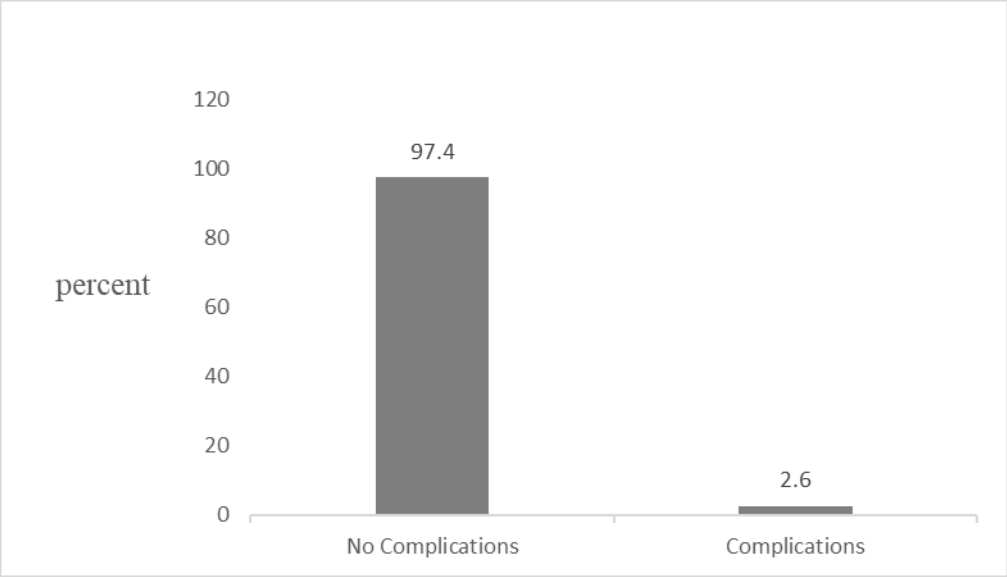
The study involved 117 children in total. The median age of the children was 13 years (IQR 10 – 15 years) and most children were aged between 11 and 15 years 60 (51.3%). The majority of children 67 (57.3%) were males and 50 (42.7%) were females. One hundred and twelve (95.7%) had no associated systemic conditions. Sixty-four (54.7%) had right eye cataracts and 53(45.3%) were left eyes. None of the 117 children (100%) who participated in the study had other associated ocular problems. The posterior segment was accessible preoperatively in 15 of 117 children (12.8%). This was due to their cataracts being immature or less dense compared to the rest and all 15 children had normal posterior segment findings. Among the 117 children, developmental cataract was the most common type 69 (59.0%) than congenital cataracts 48(41%) (Table 1).
Figure 1 and 2 shows the type of intraoperative and post-operative complications of paediatric cataract surgery encountered (2.6%) and (29.1%) respectively. Table 2 shows factors associated with good visual acuity outcome two years after cataract surgery and Table 3 compares visual acuity outcome at six weeks and those at two years following cataract surgery. Of the 117 children enrolled, 19 children were lost to follow up at six weeks, hence n=98.However, they were all traced and followed up two years later.

Table 1. Individual and clinical characteristics of children, N = 117

Variable	Frequency	Percentage (%)
Median Age (interquartile range)	13 (10 – 15)	
Age group		
6 – 10 years	40	34.2
11 – 15 years	60	51.3
16 – 19 years	17	14.5
Total	117	100.0
Sex		
Male	67	57.3
Female	50	42.7
Total	117	100.0
Associated systemic conditions		
DM (Diabetes)	2	1.7
None	112	95.7
HIV (+)	3	2.6
Total	117	100.0
Eye affected		
Right eye	64	54.7
Left eye	53	45.3
Total	117	100.0
Other associated ocular problems		
None	117	100.0
Total	117	100.0
Posterior segment accessible		
Yes	15	12.8
No	102	87.2
Total	117	100.0
Posterior segment findings		
Normal	15	100.0
Total	15	100.0
Type of cataract		
Congenital	48	41.0
Developmental	69	59.0
Total	117	100.0

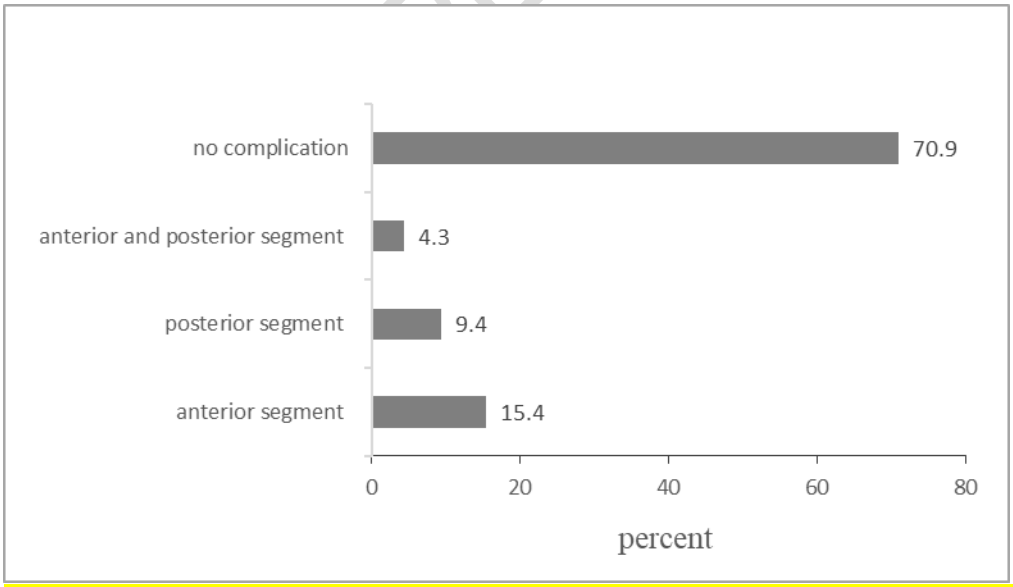
NB: 16-19 years enrolled participants who were 12-15 at the time of operation 2-4 years ago.

Figure 1. Intra-operative complications



Key: Complications: (Iris tear/trauma, hypheama and displaced IOL).

Figure 2. Post-operative complications



Key: Anterior segment: (Cornea edema, fibrin membranes, PCO, Iris prolapse, shallow A/C, hyphema, endophthalmitis, decentered IOL
Posterior segment (Amblyopia, Retina Detachment).

Table 2. Univariate and Multivariable analysis of factors associated with good visual acuity two years after cataract surgery

Variable	Univariate analysis		Multivariable analysis	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Age group				
6 – 10 years	Ref			
11 – 15 years	1.78 (0.76 – 4.16)	0.180		
16 – 19 years	2.07 (0.64 – 6.67)	0.221		
Sex				
Male	Ref			
Female	1.22 (0.58 – 2.57	0.608		
Eye affected				
Right	Ref			
Left	1.82 (0.86 – 3.87)	0.115		
Posterior segment accessibility				
Yes	Ref		Ref	
No	0.13 (0.03 – 0.47)	0.002	0.15 (0.03 – 0.69)	0.015
Type of cataract				
Congenital	Ref		Ref	
Developmental	2.91 (1.30 – 6.52)	0.009	3.09 (1.17 – 8.14)	0.002
Time of refraction				
At six weeks	Ref		Ref	
More than six weeks	0.30 (0.14 – 0.67)	0.003	0.22 (0.08 – 0.58)	0.002
Post-operative complication				
No complication	Ref		Ref	
Anterior complication	0.12 (0.03 – 0.56)	0.007	0.14 (0.03 – 0.72)	0.018
Posterior complication	0.10 (0.01 – 0.80)	0.03	0.09 (0.01 – 0.83)	0.034
Anterior and posterior complication	0.24 (0.03 – 2.28)	0.216		

NB: 16-19 years age group, indicates children who were 12-15years at the time of surgery, reassessed 2 to 4 years later.

Table 3. Visual acuity outcomes in children at six weeks and two years after surgery, n = 98.

Visual acuity outcome at 6 weeks	Visual acuity outcome after two years			Total	P value
	Good	Borderline	Poor		
Good	24	0	0	24 (24.4%)	0.0001
Borderline	15	22	0	37 (37.8%)	
Poor	2	5	30	37 (37.8%)	
Total	41 (41.8%)	27 (27.6%)	30 (30.6%)	98 (100%)	

4. DISCUSSION

The study found that intraoperative complications in children undergoing cataract surgery were very rare three (2.6%) and complications included iris tear/trauma, hypheama and displaced IOL. This is similar to a study from Turkey that found that no intraoperative complications were observed during cataract surgery (13) whereas a study by Ongore (2018) from Kenya found that three out of one hundred and twenty eight (2.3%) eyes experienced intraoperative complications with hypheama occurring in two eyes, which resolved with no implication on the visual acuity (14,15). As for postoperative complications, this study found that they were less post-operative complications (29.1%) with anterior segment being the most common complications (15.4%), followed by posterior segment (9.4%) and a combination of both anterior and posterior segment (4.3%) respectively. Duke (16) also had less post-operative complication of only nine out of hundred and thirty-two participants (6.8%). According to these results, there is less likelihood of children achieving good visual outcomes after surgery if they encountered complications, intraoperatively or postoperatively. Hence it is necessary to take action to recognise, address, and prevent these issues earlier for better visual outcomes.

The univariate analysis results showed factors such as posterior segment accessibility, type of cataract and time of refraction, were associated with good visual acuity outcome two years post-surgery. According to this study, children whose posterior segment was inaccessible were less likely to have a good visual acuity outcome than those with an accessible posterior segment. This finding is most likely due to the profound visual implication a denser cataract has on a child developing vision if no early intervention of cataract surgery is done. The study also suggests that the visual outcomes also differ depending on the type of cataract. Children who had developmental cataracts were 3.09 times more likely to have good visual outcome than children who had congenital cataracts.

This is consistent with findings from other studies (5, 13,15). Duke on the other hand, reported that congenital cataract was the most common type of cataract in his study (16). Furthermore, this study established that children's visual outcome was associated with the timing of refraction. Children who had their refraction done after six weeks were 0.22 times less likely to have good visual acuity than those that had their refraction done at six weeks. Refraction is required at six weeks post-operatively to achieve the best corrected visual acuity. The results also highlight the significance of performing the refraction early given its vital role on the final visual outcome. Given that the majority of the children in this study underwent refraction after six weeks, it is essential to address the reasons behind delayed refraction in children in order to maximise their achievement of good visual outcome. Early refraction and a good refraction follow-up plan is necessary as it forms an essential predictor of a good visual functional outcome (17).

When the visual acuity of children was compared at six weeks and two years later, it was found that those who had good visual acuity at six weeks maintained it. When compared to the results at six weeks and two years, there was a significant change in visual acuity (P-value 0.0001), with the greatest change after two years observed in those who had borderline visual acuity six weeks after surgery. At six weeks following surgery, a quarter (24.4%) of the children had good visual acuity outcome. At two years follow up period, this number increased to almost double (41.8%), the good visual acuity outcome after refraction (BCVA). The increase in the number of children with good visual acuity was due to children who had a borderline visual acuity result at six weeks improving to a good visual acuity outcome at two years. Although there was a significant improvement in visual acuity after surgery, less than half achieved good vision two years after surgery. In Kenya, a study found that 13/24 (46.4%) had a good visual outcome at one year of follow-up, which is consistent with the findings of this study (14). A higher proportion of good visual outcomes has been reported in other studies. For instance, Sukhija in India showed that the final best-corrected visual acuity was 6/18 or better in 24/26 (92%) of eyes after eight years of follow-up (12,15). The study confirms that visual acuity outcome improves over time and a longer term follow up could be beneficial for better visual outcome of these children.

5. CONCLUSION

Following paediatric cataract surgery, good visual outcomes are possible and the visual acuity improves over time after surgery. Intraoperative complications were very rare among children undergoing cataract surgery but postoperative complications were common, with anterior segment complications being the most common complication. The study found that

the number of children with good visual acuity outcome increased with time. A significant number of children who were initially borderline increased from (24.4%) with good visual acuity at six weeks post-operatively to (41.8%) two years later. This therefore demonstrates that long-term follow-up (beyond six weeks) post-surgery is important as it increases the proportion of children attaining good visual outcome after surgery and helps correct uncorrected refractive errors hence optimizing the best visual acuity a child can attain.

CONSENT

As per international standards, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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