

Ten-year review of paediatric cataract surgery outcomes at a tertiary referral centre

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ABSTRACT

Introduction: Paediatric cataract is a major cause of preventable childhood visual impairment, with surgical outcomes associated with several factors. This study aimed to investigate the post-operative visual outcomes, complications, and factors associated with poor visual outcomes in paediatric patients who underwent cataract surgery, one-year post-operation.

Materials and Methods: Retrospective study on paediatric patients who underwent cataract surgery in Hospital Raja Perempuan Zainab II, Malaysia from January 2014 until December 2023. The data was collected from medical records.

Results: 48 paediatric patients (65 eyes) were recruited. The mean age was 7.7 ±4.79 years. 32 (66.7%) males and 16 (33.3%) females. 17 patients had bilateral while 31 patients had unilateral cataract. 44 eyes (67.7%) had primary cataract, and 21 eyes (32.3%) had secondary cataract. Overall, 53.8% (35 eyes) achieved good visual outcomes of 6/12 or better, but outcome was better in primary cataracts with 56.8% achieved good vision compared to 47.6% in secondary cataracts. 52.4% (11 eyes) of the secondary cataracts was traumatic in nature, with male predominance (72.7%) and 72.7% (8 eyes) achieved good vision. Post-operative complication occurred in 18.5% (12 eyes), with posterior capsular opacification being the commonest. Overall, ocular and systemic comorbidities contributed to poor visual outcome. Specifically for traumatic cataracts, the factors leading to poor visual outcomes were significant corneal opacity and amblyopia. Implantation of posterior chamber IOL was significantly associated with good visual outcomes (60.7%).

Conclusion: Paediatric cataract surgery outcomes at our centre are comparable with previous studies, with posterior chamber IOL implantation give favourable results. Ocular and systemic comorbidities significantly elevate the risk of poor outcomes. Corneal scarring and amblyopia were common causes of poor vision in traumatic cataracts

KEYWORDS:

Malaysia; paediatric cataract; congenital cataract; lens aspiration; visual outcome

INTRODUCTION

Cataract is one of the leading causes of visual loss (22.3%) among paediatric population in Malaysia, aside from retinal disorders (20.8%).¹⁻³ Malaysia has one of the highest prevalence of paediatric cataract in Asia at 5.33 per 10,000 people, compared to its neighbours, Indonesia and Thailand, at 0.60 and 4.27 per 10,000 people, respectively.⁴ Paediatric cataracts have various aetiologies such as idiopathic, drug induced, metabolic disorders, traumatic, intrauterine infection, and association with systemic abnormalities.⁵ Acquired cataracts are also reported as relatively common in Asian children.^{6,7}

Surgery at young age in paediatric cataract is challenging and have variable outcomes due to several factors. Particular challenges include a more elastic lens capsule, a smaller eye that can preclude intraocular lens (IOL) implantation, and quickly changing axial length, which makes determining IOL power more challenging.⁸ There are several factors, including the laterality of cataracts, the presence of ocular and systemic comorbidities, the development of glaucoma after surgery, and the phakic condition of the eye, have been shown in prior research to influence the outcomes of patients after surgery.⁹ One local study by Chew et al concluded that eyes with longer axial length was significantly associated with good visual outcome.¹⁰ Some factors are preventable and addressing these will improve the patients' surgical outcome.

There are relatively few studies on paediatric cataract in Malaysia, and all published studies to date have been conducted at single centres.¹⁰⁻¹³ The present study was designed to add to the limited literature on paediatric cataract in Malaysia. We aim to describe the demographics, clinical features, post-operative visual outcomes, complications, and factors associated with poor visual outcomes in paediatric patients who underwent cataract surgery, one-year post-operation in our tertiary institution.

MATERIALS AND METHODS

This is a retrospective record review of paediatric patients aged below 18 years old who underwent cataract surgery in Raja Perempuan Zainab II Hospital, Kelantan, Malaysia from January 2014 to December 2023. Purposive sampling was used and data were extracted from the Cataract Registry of National Eye Database, a Ministry of Health of Malaysia's

This article was accepted: 26 February 2026

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website. The study obtained ethical approval from Medical Research and Ethics Committee of the Malaysian Ministry of Health (NMRR ID-24-00814-OLC (IIR)) and conducted in accordance with the Declaration of Helsinki.

The data included patients' socio-demographic characteristics, clinical characteristics, cataract surgery related information (including type of cataract surgery done, intraocular lens implantation, duration of surgery and complications), and visual outcomes. All data extracted were devoid of any patient identifier. Both digital and physical medical records were traced from the Ophthalmology Clinic to complete any missing data. Patients with incomplete data or missing medical records were excluded from this study. Good visual outcome is defined by visual acuity at one-year post operation of 6/12 or better and poor visual outcome is visual acuity worse than 6/12.

IBM Statistical Package for the Social Sciences (SPSS) software version 28.0 was used for further analysis of the data collected. The visual outcomes at one-year post-operation and the factors associated with poor visual outcomes were analysed using logistic regression.

RESULTS

A total of 117 eyes (94 patients) underwent cataract surgery over ten-year period from January 2014 until December 2023. Only 65 eyes were included as others were excluded due to incomplete medical records. The demographic data, clinical and operative characteristic of the patient cohort are outlined in Table I. The mean age of patient in our study is 7.7 years (± 4.79 years). Majority of the patients are male, 32 patients, 66.7% (41 eyes) are males and 16 patients, 33.3% (24 eyes) are females. This study was conducted at a hospital with significant majority of Malay community, thus 98.5% of the operated eyes belongs to this ethnic category. Thirty-one patients had unilateral cataract and 17 patients (34 eyes) had bilateral cataract. 44 eyes had primary cataract and 21 eyes had secondary cataract (11 eyes: traumatic cataract, five eyes: post vitrectomy cataract, five eyes: uveitic cataract). Most of the patients had no ocular comorbidities (72.3%) or systemic comorbidities (80%). The most common postoperative complication in this study is posterior capsule opacification, diagnosed in eight eyes (12.3%).

Table II shows the multiple logistic regression analysis done on the factors associated with poor visual outcome post paediatric cataract surgery. The presence of ocular and systemic comorbidities was shown to be significantly associated with poor postoperative visual outcomes. The odds of poor visual outcomes were 5.85 times greater for patients with ocular comorbidities and 4.78 times greater for those with systemic comorbidities compared patients with no comorbidities. In this study, thirteen patients have systemic comorbidities, including Down syndrome, congenital heart disease, global developmental delay and retroviral disease. All these findings were statistically adjusted for variables such as age, gender, cause of cataract, axial length of the eye, and duration of the surgical procedure.

Table III presents the demographic and clinical characteristics of paediatric patients with traumatic cataract ($n = 11$), including age distribution, gender, mechanisms of injury, and the location of the traumatic event, structural injuries associated with traumatic cataract, the timing of intraocular lens (IOL) implantation, the operation details and the visual outcomes. Among the 11 paediatric patients with traumatic cataract, the mean age was 9.1 years (± 4.13 years), with a predominance of boys (72.7%). Penetrating trauma was the most common mechanism of injury (72.7%), and the majority of injuries occurred at home (72.7%). While isolated lens injury was seen in only 18.2% of cases, the majority (81.8%) presented with multiple structural injuries, most commonly involving the lens, cornea, and iris together (36.3%). Primary IOL implantation during lens aspiration was performed in 63.6% of cases, whereas secondary implantation was required in 27.3%, and one patient remained aphakic. Notably, no patients underwent lens surgery within the first month post-injury; the timing was evenly distributed between 1–6 months and more than 6 months (45.5% each). At presentation, 90.9% of patients had a visual acuity worse than 6/60. By 1 year, 72.7% achieved a final visual acuity of 6/12 or better, while 18.2% remained worse than 6/60. The causes of poor postoperative visual outcomes included corneal scar with aphakia, amblyopia, and corneal scarring with exogenous endophthalmitis, each accounting for 9.1% of cases.

DISCUSSION

Primary cataracts (67.7%) were more common than secondary cataract (32.3%), which is consistent with previous studies.^{6,10,11} A study conducted by Song et al in 2014 in an Ophthalmology Department of Shengjing Hospital over 10-year period involved 367 patients, 296 patients (80.7%) were diagnosed with primary cataract.⁶ Among secondary cataracts, traumatic cases were predominant, 11 eyes, followed by post vitrectomy cataract (five eyes) and uveitic cataract (five eyes). Consistent with Song et al and Chew et al, traumatic cataract is the commonest cause of acquired cataract, which is preventable.^{6,10} Song et al reported 61 (85.9%) patients with acquired cataract were traumatic cataract and Muhd-Syafi et al reported 40% of the acquired cataract were traumatic cataract whereas in this study noted a comparable percentage of 52.4% patients with traumatic cataract.^{6,11}

Our study found a higher prevalence of male patients with paediatric cataract, 32 patients (66.7%), consistent with local and international studies.^{6,7,10,11,14} Interestingly, a 2020 study by Ramadhon et al from Indonesia, a neighbouring Southeast Asian country, reported a higher prevalence of female patients (58.5%) compared to male patients (41.5%).¹⁵ Besides that, in this study, majority patients have unilateral cataract, 31 patients (64.6%) and 17 patients (35.4%) have bilateral cataract, consistent with local study reported by Muhd-Syafi et al.¹¹ Muhd-Syafi et al reported majority of unilateral cataract of 68.2% of the patients.¹¹ Interestingly, two other studies by Song et al and Chew et al discovered that majority of patients have bilateral cataract with 65.9% and 69.2% respectively.^{6,10}

Table I: The demographic data, clinical and operative characteristics of paediatric patients who underwent cataract surgery

Variables	Total n (%)	BCVA group		p-value
		Good vision n (%)	Poor vision n (%)	
Age, mean (SD)	7.7 (+4.79 years)	8.4 (+4.32 years)	7.0 (+5.26 years)	0.243 ^c
Total	65 (100.0)	35 (53.8)	30 (46.2)	
Gender				0.579 ^a
Male	41 (63.1)	21 (51.2)	20 (48.8)	
Female	24 (36.9)	14 (58.3)	10 (41.7)	
Ethnic Group				1.000 ^b
Malay	64 (98.5)	34 (53.1)	30 (46.9)	
Indian	1 (1.5)	1 (100.0)	0 (0.0)	
Laterality				0.730 ^a
Unilateral	31 (47.7)	16 (51.6)	15 (48.4)	
Bilateral	34 (52.3)	19 (55.9)	15 (44.1)	
Cause of Cataract				0.487 ^a
Primary	44 (67.7)	25 (56.8)	19 (43.2)	
Secondary	21 (32.3)	10 (47.6)	11 (52.4)	
Axial Length				0.352 ^a
22mm-25mm	34 (52.3)	21 (61.8)	13 (38.2)	
<22mm & >25mm	28 (43.1)	14 (50.0)	14 (50.0)	
IOL Implantation				0.003 ^b
PCIOL	56 (86.2)	34 (60.7)	22 (39.3)	
Aphakia	7 (10.8)	0 (0.0)	7 (100.0)	
IOL in sulcus	2 (3.1)	1 (50.0)	1 (50.0)	
Ocular Comorbidity				0.002 ^a
No	47 (72.3)	31 (66.0)	16 (34.0)	
Yes	18 (27.7)	4 (22.2)	14 (77.8)	
Systemic Comorbidity				0.013 ^a
No	52 (80.0)	32 (61.5)	20 (38.5)	
Yes	13 (20.0)	3 (23.1)	10 (76.9)	
Duration of Operation (min)				0.349 ^a
0-60	53 (81.5)	30 (56.6)	23 (43.4)	
>60	12 (18.5)	5 (41.7)	7 (58.3)	
Post-operative Complication				0.010 ^b
No	53 (81.5)	33 (62.3)	20 (37.7)	
PCO	8 (12.3)	1 (12.5)	7 (87.5)	
Cornea Scar	1 (1.5)	0 (0)	1 (100)	
High refractive power	3 (4.6)	1 (33.3)	2 (66.7)	

^cChi-square test

^bFisher's exact test

^aIndependent t-test

BCVA= best corrected visual acuity, IOL=intraocular lens, PCIOL=Posterior chamber intraocular lens, PCO= Posterior Capsule Opacification

Table II: Factors associated with poor visual outcome post paediatric cataract surgery

	Simple logistic regression		Multiple logistic regression ^a	
	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age operation	0.94 (0.85, 1.04)	0.240		
Gender				
Male	1.33 (0.48, 3.69)	0.579		
Female	1			
Cause of Cataract				
Primary	1			
Secondary	1.45 (0.51, 4.11)	0.487		
Axial Length				
22mm-25mm	1			
<22mm & >25mm	1.62 (0.59, 4.45)	0.354		
Ocular Comorbidity				
No	1		1	
Yes	6.78 (1.92, 24.01)	0.003	5.85 (1.39, 24.68)	0.045
Systemic Comorbidity				
No	1		1	
Yes	5.33 (1.31, 21.76)	0.020	4.78 (1.04, 22.00)	0.016
Duration of Operation (min)				
0-60	1			
>60	1.83 (0.51, 6.50)	0.353		

^aBackward method was applied

^bNo multicollinearity and no interaction

^cHosmer and Lemeshow Test, p-value=0.311

Table III: Demographic data of paediatric patients with traumatic cataract (n = 11), the mechanisms of injury, locations of event, structural injuries, operation details and the visual outcomes

Characteristics	No. (%)
Age range (years)	
1-6	3 (27.2)
7-12	4 (36.4)
13-17	4 (36.4)
Mean (SD): 9.1 years (+ 4.13 years)	
Gender	
Boys	8 (72.7)
Girls	3 (27.3)
Mechanism of injury	
Penetrating Trauma	8 (72.7)
Blunt trauma	3 (27.3)
Location of event	
At home	8 (72.7)
Elsewhere	
Tailor shop	1 (9.1)
Outdoor playground	2 (18.2)
Lens injury only	
Multiple structural injuries	
Lens and cornea	2 (18.2)
Lens and iris	1 (9.1)
Lens, cornea and iris	4 (36.3)
Lens, cornea, iris and sclera	1 (9.1)
Lens, cornea, iris and choroid	1 (9.1)
IOL implantation setting	
Lens aspiration and primary IOL	7 (63.6)
Secondary IOL	3 (27.3)
Aphakic	1 (9.1)
Time to lens surgery (months)	
Less than 1	0 (0.0)
Between 1 to 6	5 (45.5)
More than 6	5 (45.5)
	* 1 aphakic
Visual acuity at presentation	
6/12 or better	0 (0.0)
6/15 – 6/60	1 (9.1)
Worse than 6/60	10 (90.9)
Visual acuity 1 year postoperatively	
6/12 and better	8 (72.7)
6/15 – 6/60	1 (9.1)
Worse than 6/60	2 (18.2)
Causes of poor visual outcome	
Cornea scar and aphakia	1 (9.1)
Amblyopia	1 (9.1)
Cornea scar with exogenous endophthalmitis	1 (9.1)

IOL=Intraocular lens

For primary cataract, 56.8% had good visual outcome whereas 43.2% had poor visual outcome as shown in Table I, comparable to local and international studies where 44.1% to 85.0% of the patients with primary cataract achieved good postoperative outcome of 6/12 or better.^{10,12,14} Chew et al reported that, at final review, 44.1% (49 out of 111) of subjects achieved a visual acuity of 0.3 LogMAR or better.¹⁰ Ting et al reported a greater proportion of eyes with good visual outcomes, with 25 (71.4%) obtained best corrected visual acuity (BCVA) of 6/12 and better at 6 months after IOL implantation.¹² Another study by Lekskul et al in Thailand likewise found that 85% of patients had a good visual outcome of 6/12 or better.¹⁴

In this study, the most common cause of poor post operative outcome is posterior capsule opacification (PCO) which is seen in eight patients (12.3%) as shown in Table I, consistent with previous local studies where the rate of PCO ranged from

17.1% to 30.8%.¹⁰⁻¹² Compared to adult eyes, paediatric eyes have more tendency for excessive post-surgical inflammation, which increases the rate of posterior capsule opacification (PCO) with high risk of amblyopia due to potential difficulties in compliance to visual rehabilitation post-operatively.⁸

Simple and multiple logistic regression showed that ocular and systemic comorbidity were significantly associated with poor visual outcome, with p-value of 0.016 and 0.045 respectively. This study concludes that patients with ocular comorbidity has 5.85 times more likely to develop poor vision. Patients with systemic comorbidity has 4.78 times more likely to develop poor vision post cataract surgery. There are no significant association of age, axial length, cause of cataract and duration of surgery with the poor visual outcome. The most commonly observed systemic comorbidity was Down syndrome, identified in four eyes, followed by

congenital heart disease and retroviral disease, each affecting two eyes. This finding is consistent with patterns observed in regional and international studies. A local study by Chew et al. conducted on the West Coast of Malaysia similarly highlighted Down syndrome as the most prevalent systemic comorbidity among paediatric patients with ocular conditions.¹⁰ A systematic review by Munoz-Ortiz et al. in 2022 reported that cataract is one of the most commonly associated conditions in Down Syndrome (10.9% of patients) 16. Similar study done in United Kingdom reports 5.4% of patients diagnosed with cataract were diagnosed with Down Syndrome with the majority (61.5%) diagnosed during the neonatal period, highlighting the early onset of lens opacities in this population.¹⁷ 18 (27.7%) eyes have ocular comorbidities, the commonest one being rhegmatogenous retinal detachment in six eyes (9.2%). This is consistent with a Japanese study done by Oshika et al. in 2023 involving 457 eyes where the visual outcomes were influenced by systemic and ocular comorbidities, the laterality of the cataract, and the patient's age at surgery.⁹

In contrast to previous studies, this current study found no association between shorter or longer axial length with the visual outcome. The axial length in this study ranges from 15.37mm to 27.62 mm with a mean of 22.53mm +2.40mm. 34 eyes (52.3%) have normal axial length, and 28 eyes (43.1%) have short or long axial length. In a study done at Hospital Kuala Lumpur, Malaysia, Chew et al. found that eyes with longer axial lengths being associated with better visual outcomes at one-year post operation.¹⁰ In the study, most of the subjects (61.3%, 68/111) were aged one year and below, and the mean age at surgery was 33.14 months (± 33.47 months). A possible explanation to relate the longer axial length with better visual outcome is, longer eyeballs are nearing its adult length, with less degree of lengthening compared to shorter eyeballs when reviewed at one year post operation. This association could possibly change if the paediatric patients were to be followed up for a longer duration, as most of the patients are aged below one year old at the time of operation with more potential for eyeball growth.¹⁸ Similar findings were found in another study by Zhou X. et al. in 2022, who investigate the effect of pre-operative axial length on myopic shift three years following primary IOL implantation, concluded eyes with longer axial length has slower myopic shift.¹⁹ Our cohort, being older with a mean age of 7.7 years, may have had more stable axial lengths, reducing the confounding effect of myopic shift. Additionally, the relatively smaller sample size in this study may have limited statistical power to detect subtle associations.

Traumatic cataract

Traumatic cataract was the commonest cause of acquired cataract in this study. Similar to other studies, there is male preponderance of traumatic cataract.^{13,20-21} The majority (72.7%) of the patients with traumatic cataract achieved good visual outcome of 6/12 or better at 1 year post-operation (Table V), comparable to studies in other countries, where 50.0%–80.0% of the patients had a good postoperative visual outcome of 6/12 or better.²²⁻²⁴ A similar study done at another local centre only had 34.5% of patients with good outcome, and this was mainly attributed to significant corneal opacity and amblyopia, similar to this current study.²⁰

Other studies have also shown that cornea scarring and amblyopia are common causes of poor outcome, contributing to 7.7% - 100% and 11.0% - 100% of poor visual outcome, respectively.²²⁻²⁴ The outcome of traumatic cataract is unpredictable as it depends on the structures involved. Similar to other studies, penetrating injuries (72.7%) were more common than blunt injuries in this study, which tends to involve the cornea and cause scarring (Table IV).²¹⁻²⁵ The majority of injuries occurred at home (72.7%), highlighting the critical need for improved supervision and the creation of safer environments for children within the household.

There are several limitations in this study. Firstly, it was a retrospective study and conducted in a tertiary centre with mostly referred and complicated cases, which may affect final visual outcomes. Secondly, sample exclusion due to the missing or incomplete data led to a relatively smaller sample size in this study, which may affect the statistical analysis result. Future multicentre studies with bigger sample size produce a more robust study.

CONCLUSION

Our paediatric cataract surgery outcomes align with previous reports, with posterior chamber IOL implantation associated with better vision. Ocular and systemic comorbidities markedly increased the risk of poor outcomes, while corneal scarring and amblyopia were frequent causes of visual impairment in traumatic cases. The high rate of home-related injuries and delayed surgeries highlights the need for caregiver education and improved access to care. Future priorities include multicentre studies to enhance generalisability, along with long-term follow-up to track amblyopia progression, sustained visual outcomes, and refractive changes particularly in growing paediatric eyes.

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