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ORIGINAL ARTICLE

Short Term Visual and Refractive Outcome following Surgical Intervention for Posterior Capsule Opacification (PCO) in Children in a Tertiary Eye Hospital

Résultats Visuels et Réfractifs à Court terme Après une Intervention Chirurgicale pour une Opacification de la Capsule Postérieure (OPC) chez des Enfants dans un Hôpital Ophtalmologique Tertiaire

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ABSTRACT

BACKGROUND: PCO occurs commonly postoperatively following cataract extraction in children, obscuring vision as did the initial cataract. It may require a second surgical procedure when it is dense. It is expected that this results in restoration of vision and it is important to ascertain that this is the case as well as to examine any significant changes in refraction thereafter.

METHODS: A retrospective observational study extracting demographic and clinical information from case notes of patients who had membranectomy and/or capsule polishing between October 2017 and September 2018.

RESULTS: 57 eyes of 51 patients were enrolled. There was a 2:1 male: female ratio. Mean age at cataract surgery was 6.33 ±3.59years whilst that for PCO surgery was 9.68 ±3.89years. Postoperative visual acuity (by WHO definition) was good (between 6/6 and 6/18) in 33.3%, compared to 8.8% preoperatively. Whereas presenting visual acuity was poor (<6/60) in 61.4% preoperatively, this reduced to 30% postoperatively. Visual outcome was influenced by age at cataract surgery, age at PCO surgery, interval between cataract and PCO surgery and type of cataract. Children >8 years of age at time of PCO surgery had a greater proportion of good post-operative best corrected visual acuity (BCVA) (52.6%), whilst 75% of children younger than 8years at time of surgery turned out with poor BCVA after surgery. Developmental cataracts proportionately had the best outcome of visual acuity. There was a range of refractive shift of +0.25D to –5.25D with a mean myopic shift of –1.51D following membranectomy.

CONCLUSION: There was a good proportion of children with significant improvement in visual acuity on the short term, and a mild myopic shift following membranectomy. **WAJM 2022; 39(11): 1174–1179.**

Keywords: Posterior Capsule Opacification, Cataract, Myopic shift, Visual outcome, Membranectomy.

RÉSUMÉ

CONTEXTE: Résultats visuels et réfractifs à court terme à la suite d'une intervention chirurgicale pour l'opacité de l'axe visuel (PCO) chez des enfants dans un hôpital ophtalmologique tertiaire.

METHODES: Une étude d'observation rétrospective extrayant des informations démographiques de cas de patients ayant subi une membranectomie et / ou un polissage de gélule entre octobre 2017 et septembre 2018.

RESULTATS: 57 yeux de 51 patients ont été inclus. Il y avait un ratio hommes / femmes de 2: 1. L'âge moyen à la chirurgie de la cataracte était de 5,9 ans alors que celui de la chirurgie du VAO était de 9,2 ans. L'acuité visuelle postopératoire était bonne (entre 6/6 et 6/18) dans 33,3% des cas, contre 8,8% en préopératoire. Alors que l'acuité visuelle était faible (<6/60) dans 61,4% des cas en préopératoire, elle était réduite à 30% en postopératoire. Les enfants de plus de 8 ans au moment de la chirurgie PCO présentaient une plus grande proportion de BCVA postopératoires satisfaisants (52,6%), tandis que 75% des enfants de moins de 8 ans au moment de la chirurgie avaient un BCVA médiocre après la chirurgie PCO. Les résultats visuels étaient influencés par l'âge au moment de la chirurgie de la cataracte et de la PCO, l'intervalle entre les chirurgies de la cataracte et de la PCO et le type de cataracte. Il y avait une plage de décalage de réfraction de +0,25 à -5,25 avec un décalage myopique moyen de 1,51D après la membranectomie. La cataracte développementale avait proportionnellement le meilleur résultat en acuité visuelle.

CONCLUSION: Il y avait une bonne proportion d'enfants présentant une amélioration significative de l'acuité visuelle à court terme malgré un léger déplacement de la myopie après une membranectomie. **WAJM 2022; 39(11): 1174–1179.**

Mots-clés: opacification de l'axe visuel, cataracte, changement myope, résultat visuel.

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Abbreviations: %, Percent; **>,** Greater than; **<,** Less than; **BCVA,** Best-corrected Visual Acuity; **D,** Dioptres; **IIEIH,** Ispahani Islamia Eye Institute and Hospital; **IOL,** Intra-ocular lens; **NdYAG,** Neodymiun Yttrium Aliminium Garnet; **PCO,** Posterior Capsule Opacification; **RD,** Retinal detachment; **WHO,** World Health Organisation.

INTRODUCTION

Posterior capsule opacification (PCO) occurs more frequently in children than adults following cataract surgery and it is amblyogenic.[1] It is the most common postoperative complication following extracapsular cataract extraction in children.[2] Its incidence varies widely, depending on the study cohort, from 39 to 100% when the posterior capsule is left intact.[3–7] There have been conflicting results of incidence of opacification when patients have had cataract extraction with IOL optic capture through the posterior capsulorrhexis without anterior vitrectomy, with some authors reporting the incidence of such opacifications of the visual axis as being virtually nil between 17 and 34 months of follow up[8–10] and as high as 70% incidence in others[11,12] Incidence falls to 0% to 11.5% in studies in which primary posterior capsulotomy and anterior vitrectomy was done.[11,13–16] Other factors which significantly influence the incidence following cataract surgery include age at surgery, type of cataract, postoperative phakic status, IOL position in pseudophakia, and associated ocular and systemic disorders.[1] Although NdYAG laser capsulotomy is widely accepted as a non-invasive treatment option for PCO, it may be ineffective in dense pearly or fibrotic opacification. Besides, fibrous membranes may encompass the IOL or incorporate the pupillary space anteriorly, necessitating surgical intervention to clear the visual axis. NdYAG capsulotomy is also not feasible for use in young uncooperative children, and in the presence of mental retardation[17,18] as well as in patients with nystagmus in whom steady focus for laser caspsulotomy will not be feasible.

Various surgical procedures have been used in the treatment of PCO, most often reported with a pars plana approach for capsulotomy or capsulectomy and anterior vitrectomy.[16,19–21] Very recently, Srinivasan and Koshy[19] described a procedure using pars plana capsulotomy with sutureless, trans-conjunctival 2-port micro-incision vitrectomy system with excellent visual recovery in 5 case reports involving adults. Similar successes have been reported by others. Lam and colleagues[20] reported pars plana membranectomy in 10 pseudophakic eyes of 6 children. Sharma and colleagues carried out surgical membranectomy in 10 out of 34 paediatric eyes with PCO following cataract surgery, although the specific approach was not mentioned.

The current study examines the profile of PCO requiring surgical membranectomy, all done with a limbal, retro-pseudophakic approach, and its visual and refractive outcome.

MATERIALS AND METHODS

A Retrospective observational study in which the case files of patients who had undergone surgical intervention for PCO at IIEIH following a prior cataract surgery were perused for information. These consisted of patients of the centre as well as referred patients who had the primary cataract surgery at other centres. Included in the study were patients who had membranectomy, posterior capsule polishing or both for posterior capsule opacification and/or membranes obscuring the visual axis over a 12-month period, from October 2017 to September 2018.

Information extracted from the case notes included age, sex, time interval between cataract surgery and surgery for PCO, aetiology of cataract which surgery was previously done for, presenting vision and best corrected visual acuity after PCO surgery, pre-operative and post-operative refraction result whenever available and associated ocular or systemic disorders and complications.

Surgical Technique

After routine cleaning and draping of patients under general anaesthesia, two microincisions were made in clear cornea to serve as main port and side port (Keratome and Lance blades respectively). Anterior chamber was filled with viscoelastic and deposits on the posterior capsule were cleaned with the use of a Simcoe irrigation aspiration cannula inserted by maneuvering around the edge of the intra-ocular lens (IOL) optic and placing the cannula behind the IOL. Then a posterior capsulotomy was done bimanually by inserting the vitrectomy probe of the phaco machine unit through the mainport and irrigation unit through side port. With appropriate vitrectomy settings, the cutter was used to create a capsulotomy of between 5mm and 6mm and anterior vitrectomy done.

Anterior membranes were gently teased off the iris and /or lens with a synechiolysis forceps and removed. Where this was not feasible due to density of the membrane, it was cut with intraocular scissors and removed. Ports were hydrated and stitched whenever necessary.

Steroid and antibiotic eyedrops and ointment were used for 4 to 6 weeks to achieve healing.

RESULTS

Fifty-seven eyes of 51 patients who had membranectomy and/or capsule polishing were included. There was a 2:1 male: female ratio. Mean age at cataract surgery was 6.33 ± 3.59 years whilst that for PCO surgery was 9.68 ±3.89 years. Table 1 shows the frequency distribution of the age groups. Mean follow up period was 4.9 months (range of 2 to 9 months). Cumulatively, it took less than three years to require surgery for PCO following cataract surgery in half the patients. More than half (52.6%) of eyes primarily had surgery for developmental cataracts whilst traumatic cataracts constituted 12.3% (Figure 1). Amongst all eyes, 82.5% had PCO only, whilst 12.3% had membranes obscuring the pupillary axis, either at the pupillary plane or encom-

Table 1: Age Distribution

Age (Years)	Number	Percentage (%)
2 – < 5	6	11.7
5 – < 8	11	21.6
8 – < 12	15	29.4
≥ 12	19	37.3
Total	**51**	**100.0**

Table 2: Type of Surgery for PCO

Surgical Procedure	Number of Eyes	%
Membranectomy	40	70.2
Capsule Polishing	15	26.3
Membranectomy + Capsule Polishing	2	3.5
Total	**57**	**100.0**

passing the IOL. In 5.2%, there was a combination of pupillary membranes with PCO. Posterior capsule polishing sufficed as treatment in 26.3%.

Associated ocular co-morbidities included nystagmus in 39.1%, corneal scars in 21.7%, strabismus in 17.4%, glaucoma in 13% and RD and micro-phthalmos in 4.3% each. Postoperative visual acuity (by WHO definition) was good (between 6/6 and 6/18) in 33.3%, compared to 8.8% preoperatively. Whereas presenting visual acuity was poor (<6/60) in 61.4% preoperatively, this reduced to 30% postoperatively (Table 3).

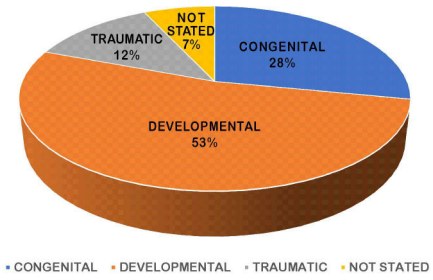

Fig. 1: Types of Cataracts

Children >8 years of age at time of surgery had a greater proportion of good post-operative BCVA (52.6%), whilst 75% of children younger than 8 years at time of surgery turned out with poor best corrected visual acuity (BCVA) after surgery. Following surgery for PCO, poor BCVA occurred in 71.4%, 56.2% and 6.7% of those whose initial surgery was for traumatic, congenital and developmental cataracts respectively. Developmental cataracts proportionately had the largest turnout of good BCVA (63.3%) following surgery for PCO. Seventeen point five percent (17.5%) of patients had more than a 5-line improvement in visual acuity postoperatively from preoperative levels, whilst 8.8% and 14% had 3-line and 2-line improvements respectively. There was less than 1-line improvement in 26.3% and no improvement in 7%. Following membranectomy, there was a myopic shift in refraction amongst 17 (85%) out of 20 patients whose refraction records were available. There was no change in 10% whilst 5% had a mild hypermetropic shift of 0.25D. The range

Table 3: Presenting and Post-Operative BCVA

	Presenting Visual Acuity		Post-Operative Bcva	
	Number of Eyes	%	Number of Eyes	%
Good (6/6–6/18)	6	10.5	21	36.8
Moderate (<6/18–6/60)	9	15.8	9	15.8
Poor (<6/60	32	56.1	17	29.8
Indeterminate	10	17.6	10	17.6
Total	**57**	**100.0**	**57**	**100.0**

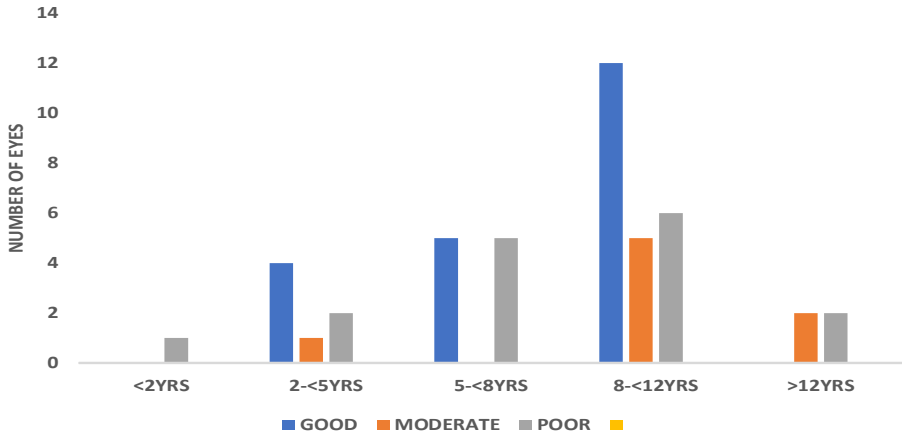

Fig. 2: Post-Operative Best Corrected Visual Acuity By Age At Surgery.

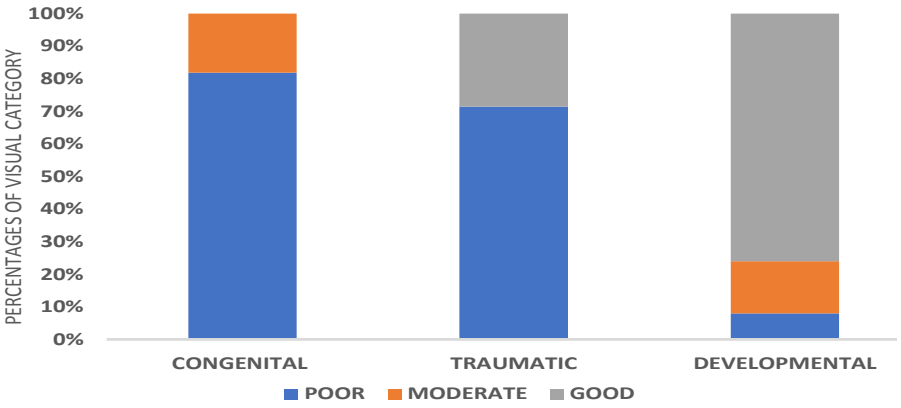

Fig. 3: Post-Operative Visual Acuity by Type of Cataract.

of refractive shift was +0.25 to –5.25D, with a mean of –1.51D. Less than 1D of shift occurred in 4 patients (20%), between 1 and <2D in 9 patients (45%) and 2 to <3D in 2 patients (10%).

DISCUSSION

PCO following paediatric cataract surgery is potentially amblyogenic, perhaps even more so than the initial cataract in some instances. Timely surgical intervention is important to restore clear media to forestall or treat amblyopia. Mild posterior capsule opacification is amenable to treatment by non-invasive means using NdYAG laser in cooperative children.[18] Otherwise however, surgical interventions such as with membranectomy and/or capsule polishing becomes essential to restore clear media. It is essential to understand factors which make PCO more likely

following cataract extraction and to characterize prognostic factors which determine or influence good visual outcome following surgical membranectomy. Several articles characterize the outcome following NDYag laser capsulotomy, but very few studies have examined outcome following membranectomy. This article takes a retrospective look at the short term refractive and visual outcome following surgical intervention for PCO in a tertiary eye centre in Dhaka, with high volume surgery and high number of referrals from other institutions.

Type of Cataract and Age at Initial Surgery

The aetiology of cataract for which the primary surgery was done significantly influenced visual outcome (P=0.001). In this study, 63.3% of developmental cataracts had good visual outcome after surgery for PCO, whilst only 28.5% of traumatic cataracts enjoyed good visual outcome. No patient who previously had surgery for congenital cataracts had a good outcome. Rather, outcome was poor in 56.2% of these. These patients were documented to have sensory nystagmus on presentation, an indicator of poor visual potential.[21] Shah and colleagues[23] also found aetiology of cataract to significantly influence visual outcome after cataract surgery with those in the traumatic group faring worse when compared to the non-traumatic group. Traumatic cataracts are prone to developing PCO postoperatively due to the increased amount of post-operative inflammation after trauma, which increases the likelihood of membrane formation, as well as inability to implant an intraocular lens primarily in many cases.[1] Visual prognosis is further worsened by the presence of trauma-induced co-morbidities like corneal scars and glaucoma. In this study, all cases whose primary surgery was for traumatic cataracts had co-morbidities- corneal scars in 71.4%, secondary glaucoma and retinal detachment in 14.3% each. However, Kora, *et al*[22] found opacifications to be earlier and more incident following surgery for congenital cataracts. Early intervention for congenital cataracts can avoid sensory amblyopia and more favourable eventual visual outcomes after surgery. In addition, aggressive amblyopia therapy with adequate refractive correction is essential.

Also, age at initial cataract extraction significantly affected the visual outcome following subsequent membranectomy/capsule polishing. Children who had cataract extraction at age of less than 8years constituted 70.6% of poor visual outcome following membranectomy, while those older than 8years of age at cataract surgery proportionately constituted 57.1% of good visual outcome (P=0.048). Younger children are more likely to develop sensory amblyopia from cataract or subsequent PCO compared to older ones in which visual maturity had occurred before the onset of cataract or occurrence of PCO. Several authors have reported higher occurrence of opacification of the anterior vitreous face following cataract surgery and posterior capsulotomy amongst relatively younger children. Alexanderkis et al[23] found that 6 out of 7 eyes which developed VAO after cataract surgery occurred in children less than 6 months old at the time of surgery. Hosal and Biglan's study gave a relative risk to be 4.7 times higher amongst younger children.[24] Other studies have also found more eyes in the younger age group to develop significant PCO requiring Laser capsulotomy to restore vision in 64% of eyes of children 1–6 years old, as opposed to 19% of those 6–13 years (P<0.05).[6] In the current study, 80.9% of good visual outcome occurred in children older than 8years at the time of having membranectomy. Half of poor visual outcomes was from children under 8 years. Although 50% of all poor outcomes occurred in children older than 8 years, 7 of the 8 such eyes (87.5%) were congenital cataracts whose mean age at cataract surgery was 2years with an average interval of 10years before membranectomy was done. Sensory amblyopia is likely to be dense in these patients due to the early onset of cataracts (in infancy) and the subsequent long duration of visual deprivation from PCO. One eye had surgery for traumatic cataract and had a resultant corneal scar, which will account for the poor outcome.

Duration of PCO

The interval between the primary cataract extraction and time of surgical intervention to clear PCO was a significant factor in this study. Amongst children older than 8years at the time of surgery, the average interval before membranectomy was 10years for those with poor visual outcome and 3.4years for those with good outcome. This was statistically significant (P=0.002). It is well-established that the longer the interval of visual obscuration (be it from a cataract or other media opacity such as PCO), the greater the occurrence of sensory amblyopia which contributes significantly to poor outcome post operatively.[1]

Phakic Status

Of those with poor visual outcome, the majority (82.3%) had received primary IOL implantation, whilst 5.9% had secondary IOL and 2 of the 17 eyes (11.8%) were aphakic. It is documented that opacification occurs with less frequency amongst aphakes compared to pseudophakes.[26] Lambert and colleagues[26] found 33.3% of their pseudophakic children needed membranectomy, as compared to none from the aphakic group. The intraocular lens is thought to act as a scaffold for the migration of the proliferating lens epithelial cells. Besides, the presence of the IOL does not allow for circumferential fusion between the peripheral sleeve of the anterior capsule and posterior capsule as it occurs in aphakes to form a physical barrier to migration of lens epithelial cells across the visual axis.[1] However although Ambroz, *et al* did find a difference between the phakic and aphakic group of patients in the incidence of PCO at 38.8% and 22.2% respectively, this was not statistically significant. The authors do admit that their small sample size is a limitation to establishing significance statistically. This study could not draw conclusions about the influence of phakic status on visual outcome due to the small number of aphakes in the study.

There was no documentation of the type of IOL implant in patient records for cases referred from other centres, a limitation of the retrospective nature of the study. A proper comparison for the significance of IOL type and position will

be better done in a prospective randomized study.

Change in Refraction and Visual Outcome

There was a mean myopic shift of 1.51D within a month following membranectomy. This is likely to be due to the anterior shift of the intraocular implant from its in-the-bag position to the ciliary sulcus in some patients with the limbal approach used in this centre. This is less likely to be the case with a *pars plana* approach which is less likely to alter the IOL position, although it has its drawbacks as well. Pars plana vitrectomy may be complicated by inadvertent suprachoroidal or subretinal effusion and there is an extra need for cauterization. Besides, endophthalmitis is also a possibility. Also, most pediatric ophthalmologists are not comfortable with utilizing the pars plana approach, preferring the limbal or corneal approach.[27] Ahmadieh[16] found no difference in the anatomic and visual outcome measures when he compared the limbal and pars plana approaches. However, unlike this study, lens implantation was done after capsulotomy and anterior vitrectomy.

Visual Outcome

There was good visual outcome in 63.1% and moderate visual outcome in 31.6% inspite of myopic shift following membranectomy. Mohan Amit, *et al*[28] did not report a shift in refraction, likely because in all patients, button-holing of the posterior optic was done through the central gap made in the membrane, both with pseudophakes and with concomitant secondary IOL implantation in aphakes. This ensured stability of the IOL with good centration, reducing chances of an IOL shift. This factor likely contributed to a four-line improvement in visual acuity compared to an average of 2.7 lines of Visual acuity improvement amongst those whose refraction results were available in this study, nineteen in all. Literature on visual outcome following membranectomy in children is sparse, forestalling further comparisons.

CONCLUSION

The short-term visual outcome following membranectomy is good and was most favourable with developmental cataracts. Those who were older than eight years of age at membranectomy and those with shorter duration of PCO before surgical intervention had better outcomes. Although age at the time of cataract development is a major determinant of outcome, this could not be definitely ascertained from information available. There was a mild myopic shift in refraction.

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