Original Article

Long Term Outcome of Primary Posterior Capsulectomy (PPC) and Anterior Vitrectomy (AVT) in Children with Bilateral Developmental Cataract

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ABSTRACT

Purpose: To evaluate the visual outcome and long term complications of PPC & AVT in children with bilateral developmental cataract.

Methods: A retrospective study was carried out on 48 eyes of 24 children who underwent cataract surgery under general anesthesia. Age range was 1 year to 8 years. Primary IOL implantation, PPC & AVT were done in all cases. All the cases were reviewed at 1 week, 1 month, 3 months and 6 months interval. All the cases who completed at least 6 months follow up were included on this study. After 6 months, best corrected visual acuity were recorded. IOP, anterior chamber angle, optic disc and peripheral retina were evaluated.

Results: Post operative best corrected VA were 6/6 in 10.4%, 6/9-6/18 in 56.3% and <6/18 in 33% eyes. IOP was found within normal limit (12 ± 2.09mm of Hg) in all cases. No abnormalities in AC angle were recorded in 44 eyes (91.7%). Peripheral retina and vitreous were normal in all cases. No significant Optic disc changes were noticed. The most common cause of decreased vision was amblyopia (79.2%) in the fellow eye due to delayed surgery.

Conclusion: Amblyopia is the main cause of decreased visual outcome in children following cataract surgery. Primary IOL implantation, PPC and AVT are safe methods for visual rehabilitation in children in appropriate time.

Keywords: Developmental Cataract, Primary Posterior Capsulectomy (PPC), Anterior Vitrectomy (AVT), Amblyopia.

Introduction

Childhood cataract is an avoidable cause of visual disability globally and is a priority for VISION 2020: The Right to Sight. Cataract is the major causes of childhood blindness, with a prevalence of 1.2 to 22.9 cases per 10,000 births[1]. Cataract in children may be congenital or acquired, unilateral or bilateral and in the majority of cases are treatable[2]. Advances in surgical techniques and intraocular lenses (IOLs) in recent years have significantly improved the visual prognosis in pediatric cataracts. Nonetheless, posterior capsule opacification (PCO) or visual axis opacification remain the most important complication following pediatric cataract surgery[3]. To prevent visual axis opacification following pediatric cataract surgery includes primary posterior capsulectomy with or without anterior vitrectomy and posterior capsulectomy with capture of the IOL optic without vitrectomy. With the advent of automated vitrectomy in the late 1970s, nearly all pediatric cataract surgeons began to routinely perform primary posterior Capsulectomy and anterior vitrectomy[4,5]. Creation of a large central opening in the posterior capsule and removal of a portion of the anterior vitreous proved to be an effective means of maintaining clear media in the long term. IOL implantation in the posterior chamber became an accepted option in the treatment of pediatric cataracts in the early 1990s, at least in children older than 2 years, management

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of the posterior lens capsule and anterior vitrectomy once again problematic[6]. Primary posterior Capsulectomy alone is not enough to eliminate posterior capsular opacification. This is because the dense structure of the young vitreous acts as a scaffold for the growth of cells even in the absence of a posterior capsule, thereby leading to closure of the primary posterior Capsulotomy[7-10]. To prevent this secondary opacification of the visual axis, primary posterior Capsulectomy along with anterior vitrectomy has been reported to provide good visual outcomes[11-14]. The visual outcome of cataract surgery in children has generally been poorer than in adults[15] as blindness in children with cataract is not only attributed to cataract, but also to visual deprivation from early onset and delayed surgery, duration of surgery between 2 eyes, complications of surgery and associated ocular abnormalities[16]. Hence the timely management is crucial to the visual development and successful rehabilitation otherwise it will lead to amblyopia and ultimately loss of sight. With the limited number of article regarding clinical outcomes or complications following pediatric cataract surgery with PPC and AVT, we present a retrospective study at a tertiary eye care center in Chattogram, Bangladesh.

Patients and Methods

This retrospective review was conducted in 24 children who were previously diagnosed as bilateral developmental cataract and surgeries were performed in Chittagong Eye infirmary & training complex (CEITC), Chattogram over 4 years period between June 2015 to June 2019. Data were included on age, gender, time interval of surgeries between two eyes. Exclusion criteria were associated ocular anomalies, systemic and mental disorders and follow up less than 6 months. All surgeries were performed by a single pediatric ophthalmologist and children were followed up according to a defined protocol. The range of follow up was 6 months to 48 months. IOP measurement, AC angle and Optic disc evaluation were done by Glaucoma consultant. Peripheral retina was examined by retinal surgeon. All cases that were included had their entire follow up at CEITC.

Pre-operative examination

The preoperative examination included Visual acuity, slit lamp biomicroscopy, direct and indirect ophthalmoscopy after full dilatation and B-scan ultrasonography. Intraocular lens (IOL) power calculations were made by using the SRK-II formula on the basis of axial length (A scan) and keratometric readings. IOL power was adjusted according to Dahans formula.

Preanesthetic checkup and anesthesia

All the patients underwent cataract surgeries under General Anesthesia (GA) with spontaneous ventilation. Investigations for GA like complete blood count (CBC), X-ray chest P/A view were done and pre-anesthetic checkup by anesthetist was ensured. Intubation was done with laryngeal Mask Airway (LMA) and sevoflurane used as inhalation agent during anesthesia.

Surgical technique

Pre-operatively pupils were dilated with phenyleprine and tropicamide eye drops. The ocular adnexa and skin surrounding the eye was cleaned with 5% povidone iodine, the surgical field draped with sterile towels and plastic materials. Scleral tunnels were done by crescent knife in small incision cataract surgery (SICS). Corneal tunnels were done by MVR blade in case of Automated Irrigation and Aspiration (I/A). Adrenalines was injected into anterior chamber to dilate the pupil. Tryptan blue was used to stain the anterior capsule of lens. An irrigating cystitome was inserted into the anterior chamber to create continuous curvilinear capsulorrhexis (CCC). Aspiration of lens was accomplished by using an automated I/A hand piece with Optikon 2000 S.P.A system (Model-PULSAR-2) in case of corneal tunnel. In case of SICS cortex was aspirated with simcoe cannula. After in bag implantation of soft foldable hydrophobic acrylic lenses (Alcon, MBI), primary posterior Capsulectomy (Vitrectorrhexis) and anterior vitrectomy were done in all cases by automated vitrectomy machine. Corneal tunnel were closed by 10-0 nylon. All patients received a sub-conjunctival injection of Gentamicine (5mg) and dexamethasone (2mg). The eye remain padded until the 1st post operative examination.

Post operative examination

Children were discharged from the hospital after one day of surgery and were reviewed after one week, one month, three months and at six months of interval. Atropine and antibiotics eye drops were continued up to one month. Steroid eye drop was reduced slowly over the following 8 weeks.

VA was measured by CSM method, crowding Kay Picture test (KPT), Lea symbol and snellen charts. The best corrected visual acuity was recorded according to subjective refraction in every visit. Refraction and spectacles prescription were given after 2 weeks. Part time occlusion (4 to 6 hours) and active vision therapy were given for amblyopic eyes.

AC angle, IOP, Optic disc changes and Peripheral retina were evaluated after 6 months.

Statistical Analysis

SPSS version 16 was used for analysis. Descriptive analysis and central tendency were used for analysis. Categorical variables were compared between age groups and sex using chi-square test. A value of P <0.05 was defined as statistically significant.

Results

A total 48 eyes of 24 patients with bilateral developmental cataract (18 Boys and 6 Girls) were included in this study. The mean age at diagnosis was 4.83 ± 2.09 years (range 1 year to 8 years). (Table-01)

Table-01: Age of the respondents

Age	Male (%)	Female (%)	Total Percentage
1-4	47.83	8.7	56.53
5-8	26.08	17.3	43.38
Total	73.91	26.09	100
Chi square= 15.12 (p>0.05); Phi and Cramer's V=0.794 (p>0.05)			

Time interval of surgeries between 2 eyes was 3.33 ± 3.07 months. The range of follow up was 6 months to 48 months with mean of 32.6 ± 2.12. Post operative VA of the respondents after 6 months is depicted in table 02.

Table-02: Post operative Visual Acuity of the respondents

Visual acuity	N	Percentage
6/6	5	10.4
6/9-6/18	27	56.3
<6/18-3/60	9	18.4
<3/60	1	2.1
CSM (+ve)	5	10.4
CSM(-ve)	1	2.1
Total	48	100

Post operatively, no refractive error was found in 6.2% cases and in case of refractive error, With the rule astigmatism was highest in number (70.8%). (Table-03)

Table-03: Refractive status of the respondents

Types of refractive error	N	Percentage
Emmetropia	3	6.2%
Hyperopia	3	6.2%
WTR astigmatism	34	70.8%
ATR astigmatism	2	4.2%
Oblique astigmatism	6	12.5%
Total	48	100

Among 48 eyes, 38 eyes were amblyopic and 10 eyes were normal. Here, 70.8% respondents have with the rule astigmatism & 4.2% have against the rule astigmatism. Amblyopic patients were given part time occlusion with active vision therapy. (Table-04)

Table-04: Status of Amblyopia

Amblyopia type	N	Percentage
Non - amblyopic	10	20.8%
Mild Amblyopia (6/9-6/12)	21	43.8%
Moderate Amblyopia(6/18-6/36)	13	27.1%
Deep amblyopia(>6/60)	4	8.3%
Total	48	100.0

Visual axis obscuration was noticed in one eye of a patient due to thick membrane & after 6 months surgical membranectomy was done with satisfactory outcome.

IOP was normal in all cases (12 ± 2.09 mm of Hg). Gonioscopy revealed Angle recession in one eye of one case whose CDR was 0.6:1 with healthy neuroretinal rim. Peripheral anterior synechiae were found in 3 cases (6.2%). All other cases showed wide open angle (91.7%). (Table-05)

Table-05: Presentation of Gonioscopic Findings

Gonioscopy findings	N	Percentage
Peripheral anterior synechiae	03	6.2%
Angle recession	01	2.1%
Wide open angle	44	91.7%
Total	48	100

No significant glaucomatous optic disc changes were noticed. Peripheral retina & vitreous were normal in all cases. Cup Disc Ratio (CDR) was 0.2:1 for both eyes in most cases (43.72%). Percentage distribution of CDR has been given in figure-01.

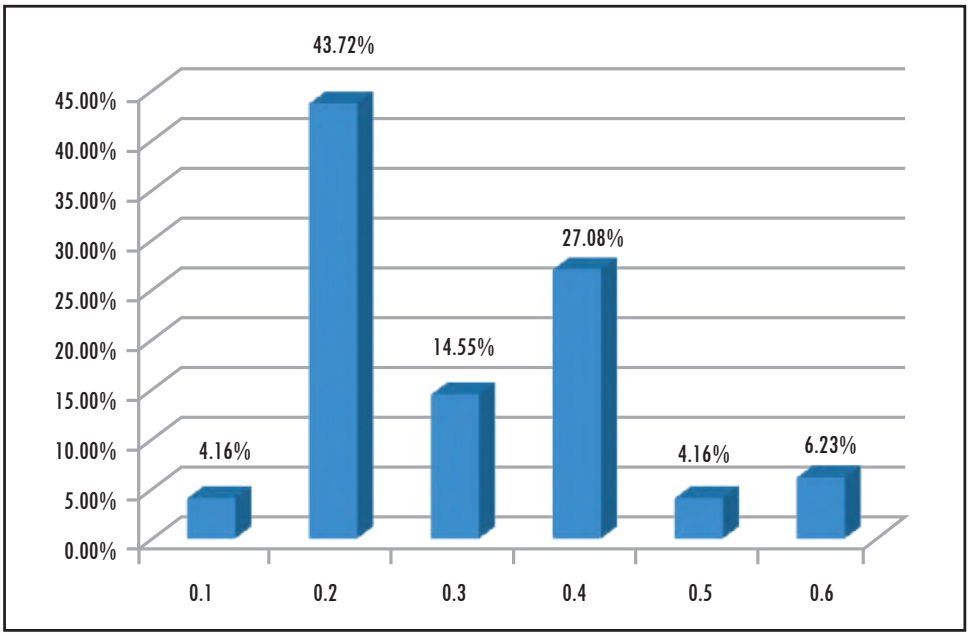

Figure-01: Percentage distribution of CDR of both eyes

Discussion

Current study aims to investigate visual outcome and long term complication of PPC & AVT in developmental cataract in children. Appropiate surgical timing and adequate rehabilitation are paramount to avoid irreversible visual damage[17]. Wright et al[18] emphasized the advantage of early surgery. So, visual outcome can be achieved before binocular interaction develops.

The surgical approach to cataract extraction and IOL implantation in younger children require careful consideration of posterior capsule management. The posterior capsule opacifies rapidly in children after cataract surgery which can present an amblyogenic hazard[19]. Strategies to maintain a clear visual axis are therefore necessary to achieve visual rehabilitation in such cases. Primary Posterior Capsulectomy is the preferred choice in children up to 6-8 years. The anterior vitreous face is more reactive in infants and young children. Inflammatory response in small children is severe and fibrous membrane may form on an intact vitreous face. This acts as a scaffold for lens epithelial cell migration and proliferation. Hence anterior vitrectomy along with posterior Capsulotomy is advocated in infants and young children[5].

In a study by Vasavada et al[20] on 5 to 12-year-old patients, opacification of the visual axis occurred in 70% of cases undergoing primary posterior continuous curvilinear capsulorrhexis (PPCCC) with optic capture but without anterior vitrectomy as compared to nil in eyes undergoing PPCCC and optic capture together with anterior vitrectomy. Therefore, they strongly recommended performing anterior vitrectomy in addition to PPCCC and IOL capture[3,20]. Nevertheless, Gimbel and coauthors[21] have expressed concern about the effect of vitreous removal on ocular development in young eyes. According to them; modern cataract surgery has made routine anterior vitrectomy unnecessary in children above 2 years. They did not report any case of visual axis opacification among 2.5 to 12-year-old patients who underwent PPCCC plus IOL capture without anterior vitrectomy.

In the bag IOL fixation is the most preferred site of IOL implantation in pediatric cataract surgery. Many surgeons perform optic captures as it is believed to maintain better IOL centration. However, studies have found those optic capture groups develop statistically significant increase in the mass of cell deposits on IOL and synechiae formation.

When compared with in the bag implantation, optic capture gives only marginal advantage. Hence, optic capture is not advocated by many surgeons[4, 8, 21].

David Taylor[22], Koch DD[23] and Vasavada. A et al[20] reported that CCC and in bag implantation and PPC with AVT were the effective method of preventing development of PCO in children. Similar to other studies, we agree to this idea that PPC with AVT provide the best chance of a long term clear visual axis. In our study, visual axis obscuration was noticed in only one eye of a patient due to thick membrane after 6 months and surgical membranectomy was done afterwards with satisfactory outcome.

In our study optic disc was evaluated by glaucoma consultant. Cup disc ratio was within normal limit and neuroretinal rim was healthy in all cases. In our study intraocular pressure was within normal limit in all cases. So, short term use of topical & systemic steroid did not influence the intraocular pressure in our cases. No steroid responder was found. Angle recession was found in one eye of one case whose CDR was 0.6:1. The exact cause of angle recession in this case could not be identified. Peripheral retina was evaluated by vitreoretinal consultant after full dilation & it was normal in all cases. No RD, Vitritis or degenerative change in vitreous was observed. So, precise and refined vitrectomy is safe in children.

In present study, the visual outcome of 56.3% eyes having post-operative visual acuity ≥6/18 is comparable to a study from central India that reported 16.4% having post-operative vision ≥ 6/18[24] and a series from Nepal that had 36.6% eyes having post-operative vision ≥ 6/18[25], but these series included some traumatic cataracts too. At the final follow up visit, majority of the patients of our study had post operative best corrected visual acuity of 6/9-6/18. The main causes of reduced vision were due to amblyopia in second eye because of delayed surgery causing competitive inhibition of vision. Other factors such as delay in bringing the child for treatment, compliance with occlusion therapy may hamper the child's possibility of developing good visual acuity even after a good surgical correction of cataract. Visual prognosis also depends on the degree of lens opacity, patient age and proper treatment maintained by parents and their child. Post operative management and minimum interval between surgeries of two eyes are very important to avoid amblyopia[26].

In bilateral cataract after operation in first eye, second eye may be operated within a week or two to prevent amblyopia. In our study majority post operative refractive errors were with the rule astigmatism (70.8%). So spectacle compliance & amblyopia treatment outcome were satisfactory. Limitations include smaller sample size and difficulty in actual quantification of visual acuity in preverbal children.

Cataract surgery in children is not a simple version of adult cataract surgery. Because pediatric eye differs from adult eye in terms of low scleral rigidity, high intralenticular pressure, unstable axial length, excessive inflammation & aggressive PCO which poses surgical procedure and overall outcome are troublesome and challenging. Despite good surgery sometimes vision doesn't improve due to amblyopia which needs occlusion therapy, regular follow up for long time and treatment compliance. Even after occlusion therapy for reasonable time and good compliance visual acuity may not improve and needs treatment with low vision aids. Pediatric eye needs to be operated under general anesthesia with some additional procedure like anterior vitrectomy with automated vitrectomy machine. Good surgical expertise and well functioning machinery supports are prerequisite for satisfactory surgical outcome. Recently IOL implantations before 2 years are gaining popularity for prompt visual rehabilitation & good binocular function. Aphakic management with heavy spectacle is difficult and binocular function can't be achieved. Later on it needs secondary implantation again under general anesthesia. During secondary implantation in bag placement may not be possible due to capsular fibrosis. So, in sulcus placement with hard lens remains only option which may cause a lot of complications. Hence primary in bag IOL implantation with PPC & AVT allows early restoration of vision & good comfortable visual rehabilitation.

Conclusion

Amblyopia is the main cause of decreased visual outcome in children following cataract surgery. This amblyopia can be avoided & good visual outcome can be achieved by doing surgery in the fellow eye within least reasonable time. Counseling regarding awareness of amblyopia & importance of regular follow up should be intensified. Primary IOL implantation, PPC and AVT are safe methods for visual rehabilitation in children in appropriate time.

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