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ORIGINAL ARTICLE

COMPARATIVE ANALYSIS OF OUTCOME OF MANAGEMENT OF PEDIATRIC CATARACT WITH AND WITHOUT PRIMARY POSTERIOR CAPSULOTOMY AND ANTERIOR VITRECTOMY

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ABSTRACT: AIM: To compare the outcome of management of Pediatric cataract with or without Primary Posterior Capsulotomy and Anterior Vitrectomy **MATERIAL & METHODS**: This prospective, randomized clinical study was undertaken in the institute. 30 eyes of 27 children in the age group of 4 to 14 yrs underwent cataract extraction. Phaco aspiration & IOL (Acrys of Foldable IOL) implantation was done. The patients were consecutively randomized into two groups. Group A included 15 children where primary posterior capsulotomy (PPC) and anterior vitrectomy with Intraocular Ocular Lens implantation was performed. Group B comprised 15 children in whom the posterior capsule was left intact. Postoperative visual acuity, visual axis opacification (VAO) and possible complications were analyzed. **RESULTS**: Visual acuity was better in the group with Posterior capsulotomy and Anterior vitrectomy as the difference in best corrected visual acuity between the two groups was statistically significant at 6weeks (p value =0.001) and highly significant at 6months (p=0.0001).Visual axis opacification as graded by posterior capsular opacity was significantly high in Group B as compared to Group A. The difference in the mean intraocular pressure postoperatively between the two groups was not statistically significant (p>0.5). **CONCLUSION:** Primary posterior capsulotomy and anterior vitrectomy with capsular bag in the bag implantation of IOL results in better visual acuity and significantly helps to maintain a clear visual axis in children with cataract.
KEYWORDS: Pediatric cataract, Primary Posterior Capsulotomy, Anterior Vitrectomy, Posterior capsular opacification

INTRODUCTION: Managing cataracts in children remains a challenge. Identification of the aetiology is the first essential step in the management of paediatric cataracts. [1] The main causes of pediatric cataract are genetic, trauma, metabolic disorders, prematurity and intrauterine infections.[2] The assessment of vision, examination of the eyes require time and experience on the part of the examiner.[3] A complete ocular examination including pupil reflex, optic disc, retina and macular status should also be assessed.[4] Reduced visual input from birth to 3 months leads to reduced connections between the cortical cells and the affected eye and a reduced number of binocularly driven cells.[5]

Patients with monocular cataracts have 2 predisposing factors for the development of amblyopia: binocular rivalry and visual deprivation.[6] To prevent otherwise irreversible amblyopia, patients with dense cataracts should have surgery and optical rehabilitation before the age of 17 weeks.[7] However, there are contradicting data concerning surgery within the first 4 weeks of life, with regard to a higher incidence of complications.[8]

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Ocular dimensions continue to grow until adolescence.[9,10] The sclera is thinner, more vascular and elastic in children with greater tendency for hemorrhage and collapse leading to high vitreous pressure during surgery.[11] The crystalline lens is smaller in children: the equatorial diameter measures approximately 6.5mms.[12] The anterior capsule is thinner and more elastic in children compared to adults which makes a continuous curvilinear capsulorrhexis more difficult.[13]

The iris is thicker, more vascular and tenacious in children resulting in more postoperative inflammation and fibrinous reaction.[14] Remnants of the anterior vitreous in children serve as a scaffold for fibrous membrane overgrowth and opacification.[15,16]

There is increasing evidence that IOL implantation is safe for patients under 2 years old.[17-19] Dahan et al have suggested under correcting biometry reading by 10% in children between 2 to 8 years.[20]Performing anterior continuous curvilinear capsulorrhexis (CCC) is always a surgical challenge to pediatric cataract surgeons as the capsule is much more elastic and is notoriously difficult to control.[21] With the introduction of tryphan-blue or indocyanine green (ICG) staining, anterior CCC has became more feasible even in white cataract.[22]

Anterior vitrectomy, by means of mechanized vitrector has also been advocated.[23] In-the bag IOL implantation could provide a good centration and reduce the chance of PCO.[24] A primary posterior CCC is recommended by some surgeons for IOL implantation for patients younger than 6 years old.[25]

MATERIALS AND METHODS: This study was conducted in our institute over a period of 20months from January 2012 to August 2013.

Type of study: Prospective comparative study

A total of 30 eyes of 27 pediatric patients admitted in the hospital, were included in this study. The procedures followed were in accordance with the ethical standards committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000. The patients included in the study were in the age group between 4 -14 years having unilateral or bilateral cataract. The patients excluded from the study were having IOP >21 mmHg, other concomitant ocular disorders e.g. Persistent hyperplastic posterior vitreous, strabismus, nystagmus, any active infection e.g. blepharitis, dacryocystitis, conjunctivitis or penetrating ocular trauma.

Patients with systemic diseases such as juvenile rheumatoid arthritis and diabetes mellitus were excluded from the study. Demographic details including age, sex, socioeconomic status etc were recorded. Detailed past and present history including medical history was taken. A detailed visual history was taken, in particular establishing near as well as distant vision, past history of eye disease, binocular function and amblyopia.

A complete ophthalmic examination was performed including measurement of visual acuity, Pupil examination, External eye examination including lids and lashes, measurement of intraocular pressure, slit lamp examination for classification of lens opacity, dilated examination of the cataract, fundus examination including optic disc, retina, macular status. Biometry was done when child was old enough to cooperate, if not, this was done under anesthesia. When the view of the fundus was obscured, B-scan ultrasonography was done to establish that the retina is attached and identify any intraocular masses.

In eyes with traumatic cataracts, Contact B-scan was done. In unilateral cases, IOL power was adjusted to avoid anisometropia >3 D based on the refractive error in the fellow eye. Under

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correction of biometry reading by 10% was done in children between 4 to 8years. The eyes of the subjects were randomly divided in two groups.

In Group A, Cataract extraction was done by Phacoaspiration followed by Primary posterior capsulotomy and anterior vitrectomy. In Group B only cataract extraction was done by Phacoaspiration.

The procedure and its risks were explained to the patient and appropriate consent obtained. Pre-operative topical antibiotics were instilled for at least 3 days. All operations were performed under general anesthesia. A limbal-based conjunctival flap was made and cautery was used to control bleeding from episcleral vessel. A clear corneal incision was given of length 2.8-3.2 mm. Anterior chamber was entered by 2.8mms wide keratome knife. Viscoelastic material was placed in the anterior chamber to maintain anterior chamber depth.

A bubble of air was injected in the anterior chamber. Trypan blue dye was used to stain the lens capsule for better visibility. The residual dye and air are irrigated and washed out of the eye using. Balanced salt solution and then replaced with viscoelastic to fill the anterior chamber before proceeding with the capsulorrhexis. Aspiration of the lenticular material was performed in patients with the irrigation–aspiration hand piece alone through the clear corneal incision. In Group A, PCCC was done by using a sharp cystotome or the barbed tip of a disposable needle to snag a small central flap in the posterior capsule.

After opening the posterior capsule by PCCC, the vitrector (Air cutter type) is inserted port down below the posterior capsule for the vitrectomy. An anterior vitrectomy was performed to remove an adequate core of vitreous from the visual axis. In Group B, the posterior capsule and the vitreous were left intact. The anterior chamber was filled with viscoelastic substance. Foldable acrylic IOL were implanted in all the patients. A 5.5 or 6mms diameter IOL was implanted through a ~2.8-3.0mms incision with the help of an injector. One or more interrupted 10-0 nylon sutures were required to close the paracentesis site.

After surgery, topical steroids and antibiotic drops were administered ten times a day. Postoperative examinations were carried out 1 day, 7 days, 14 days, 6 weeks, 3 months and 6 months after surgery. All patients were followed for at least 6 months. The refractive status, if unattainable in the clinical setting, can be evaluated at the same time. Amblyopia treatment started within a week postoperatively when the media was clear. Refractive errors were determined 2 weeks postoperatively and glasses were prescribed if needed.

Follow-up examinations included Best-corrected and uncorrected visual acuity (BCVA and UCVA), Slit lamp biomicroscopy, IOP measurement, Direct Ophthalmoscopy and Indirect Ophthalmoscopy

PCO grading was performed based on dilated slit lamp photographs as follows: grade 0 (no opacity), grade 1 (minimal opacity), grade 2 (mild opacity), grade 3 (moderate opacity) and grade 4 (severe opacity).

RESULTS: The age group included in the study ranged from 4-14 years. Out of 30 patients, 11(36%) were in age group 4-7 yrs, 17(57 %) were in age group 8-10 yrs, 2(7%) were in age group 11-14 yrs. The mean age was 7.9 years in Group A and 8.33 years in Group B. The p value was 0.462, indicating that there was no significant difference in age distribution in two groups. Above table shows that Male patients constituted 21(70 %) and Female patients were 9(30 %) in number. The p value was

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1.00 indicating that there was no significant difference in gender distribution in the two groups (Table 1).

The most common cause of the cataract operated in the study was developmental (Table 2) accounting for 20 cases (67 %), Other causes were metabolic constituting 4 cases(13%), traumatic for 5 (17%) cases & it was complicated in 1(3%) case (Figure 1).

Morphologically(Table 3), Lamellar cataract was found in the maximum no of patients accounting for 15 (50%) cases, followed by Posterior Subcapsular Cataract in 6(20%) cases, Total cataract in 5(17%) cases, Nuclear in 3(10 %) cases & Posterior Polar in 1(3%) case (Figure 2).

Mean Pre op Best Corrected Visual Acuity in log MAR of the two groups was 1.6967 for Group A and 1.7544 for Group B (Figure 3). The p value was 0.529, indicating that there was no significant difference in mean pre operative BCVA in both groups.

The mean 6 Months Post operative best corrected log MAR Visual Acuity of the two groups was 0.1893 for Group A and 0.7172 for Group B (Figure 4). The p value was 0.0001 indicating that there was significant difference in 6 months post op BCVA between the two groups (Table 4). The BCVA of the two groups over the follow up period of 6 months. Visual acuity improved in both groups. At follow up at 6 month, the mean log MAR BCVA in Group A was 0.1893 and the mean log MAR BCVA in Group B decreased to 0.7172 (Figure 5).

The mean Pre op Intra ocular Pressure (in mm Hg) of the two groups was 14.9 for Group A and 15.03 for Group B. The p value was 0.705 indicating that there was no significant difference in Pre op IOP in both groups. The mean 6 months Post op IOP (in mm Hg) of the two groups was 14.29 for Group A and 14.79 for Group B. The p value was 0.078 indicating that there was no significant difference in 6 months Post op IOP in both groups (Table 4).

The formation of Posterior Capsular Opacity between the two groups was compared according to the grading of Visual Axis Opacification which comes out to be 0.133 for Group A and 2.73 for Group B. The p value was 0.00 indicating that there was highly significant difference in Visual Axis opacification in both groups (Table 5).

DISCUSSION: In our study, the visual improvement was seen in both groups. At 1 week there is no significant difference between the BCVA of both groups (p value=0.127). After that, visual acuity decreased gradually in Group B. The difference in BCVA between the two groups was statistically significant at 6 weeks (p value=0.001) and highly significant at 6 months (p=0.0001). This concludes that posterior capsulotomy & anterior vitrectomy gives a better visual acuity in children

The mean 6months Post operative IOP (in mmHg) of the two groups was 14.29 for Group A and 14.79 for Group B. The difference in the visual acuity was not statistically significant (p = 0.78). This concludes that the Posterior capsulotomy and anterior vitrectomy has no significant effect on the IOP.

In our study, the formation of posterior capsular opacity between the two groups was compared according to the grading of Visual Axis Opacification which comes out to be 0.133 for Group A and 2.73 for Group B. The difference in the visual acuity was statistically significant ($p < 0.001$).

In the study by D D Koch et al they found that in all 5 eyes with intact posterior capsules and in the 4 eyes that underwent PCCC without vitrectomy and without posterior optic capture (i.e., the optic was left in the capsular bag). The optical axis remained clear in all 6 eyes that underwent PC IOL

implantation with vitrectomy (with or without posterior optic capture). Initially, all optic capture cases without vitrectomy also remained clear, but after 6 months 4 out of 5 developed opacification.

Thus they concluded that posterior capsulorrhexis with anterior vitrectomy was the only effective method of preventing or delaying secondary cataract formation in infants and children.[26]

Luo Y et al found that there were significant differences in the percentages of posterior capsule opacification (PCO) and rate of neodymium YAG (Nd:YAG) capsulotomy between the anterior vitrectomy group and cataract extraction group ($P < 0.01$). The anterior vitrectomy group was associated with less posterior capsular opacification (11.8%) than the cataract extraction group (76.9%). The YAG capsulotomy rate was 2.9% for the anterior vitrectomy group, and 57.7% for the cataract extraction group.[27]

Jenson AA et al found that PCO occurred in 40% of 30 eyes with intact posterior capsule. None of 24 eyes in which PPC with anterior vitrectomy was performed out of intraoperative necessity before primary PCIOL implantation had secondary opacification develop. No reduction in postoperative vision was attributable to PPC.[28]

In the study by Banu M Hosal et al, Seventy-two eyes (37.9%) developed secondary membrane a mean of 8.9 months postoperatively (range 3 weeks to 53 months). Membranes occurred in 78.6% of eyes with an intact posterior capsule, 42.9% with posterior capsulectomy, and 22.5% with combined posterior capsulectomy and anterior vitrectomy. Secondary membrane formation was associated with not performing a posterior capsulectomy with anterior vitrectomy ($P <.001$) and the presence of a primary IOL ($P <.001$). Younger age at surgery increased the chance of secondary membrane formation in patients who had posterior capsulectomy and anterior vitrectomy ($P <.01$).[29]

In the study by Jagat Ram MD et al, Postoperatively, 25 eyes in the intact capsule group and 5 in the PPC + AV group developed PCO; the difference between groups was significant ($P<.05$). Of eyes with an intact capsule, 12 with an acrylic IOL and 13 with a PMMA IOL developed PCO ($P>.05$). In the PPC + AV group, 2 eyes with an acrylic IOL and 3 with a PMMA IOL developed PCO ($P>.05$). Overall, 14 eyes with an acrylic lens and 16 eyes with a PMMA lens developed PCO ($P>.05$). After surgery, there was a significant short-term delay in the development of PCO in the acrylic group (14 eyes; mean 6.66 months ± 1.57 [SD]) compared to the PMMA group (16 eyes; mean 3.16 ± 0.83 months) ($P<.05$).[30]

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	Group A	**Group B**	**p value**
Age(years)	7.9+/-1.54	8.33+/-1.71	0.462
Gender(Male:Female)	11:4	10:5	
Unilateral	4	3	
Bilateral	11	12	

Table 1: Comparison of demographics in the two groups

	Group A	**Group B**	**Percentage (%)**
Developmental	10	10	67
Complicated	1	0	3
Metabolic	2	2	13
Traumatic	2	3	17

Table 2: Etiology of cataract operated

	Group A	**Group B**	**Percentage (%)**
Lamellar	8	7	50
Nuclear	3	0	10
PSC	2	4	20
Posterior polar	0	1	3
Total	**2**	**3**	**17**

Table 3: Morphology of cataracts operated under study

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	Group A	Group B	p value
Pre op BCVA(log MAR)	1.6969	1.7544	0.529
1 Wk Post op BCVA(log MAR)	0.298	0.398	0.127
6 Wk Post op BCVA(log MAR)	0.2226	0.398	0.001
6 Months Post op BCVA(log MAR)	0.1893	0.7172	.0001
Pre op IOP(mm Hg)	14.9	15.03	0.705
1 Wk Post op IOP(mm Hg)	15.406	14.907	0.254
6 Wk Post op IOP(mm Hg)	14.206	14.726	0.12
6 Months Post op IOP(mm Hg)	14.29	14.79	0.078

Table 4: Comparison of the changes in the variables under study

Group	Mean	N	Std. Deviation	Std. Error Mean	p value
A	.1333	15	.35187	.09085	0.00
B	2.7333	15	.79881	.20625	

Table 5: Visual Axis Opacification at 6 months: Group A vs Group B

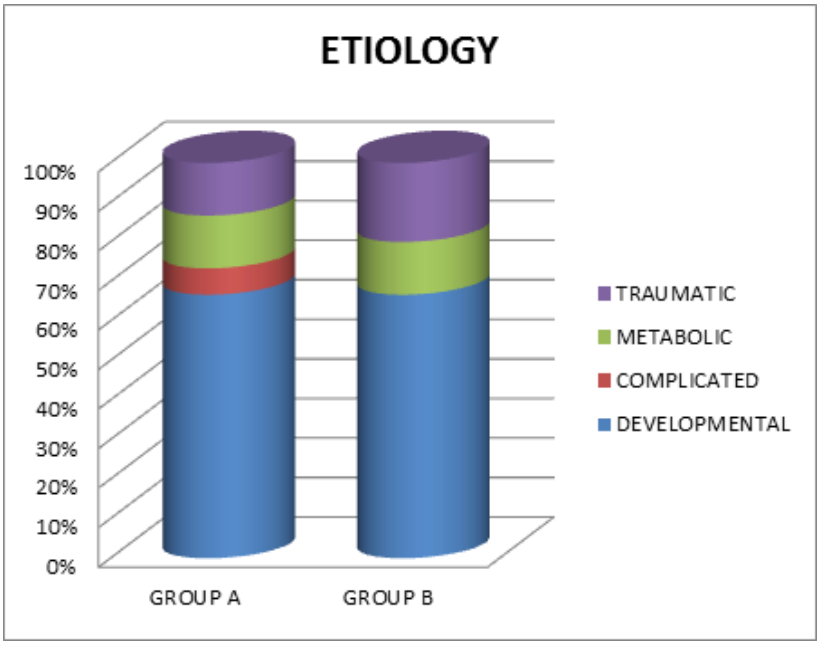

Figure 1: Etiology of Cataract in the 2 Groups

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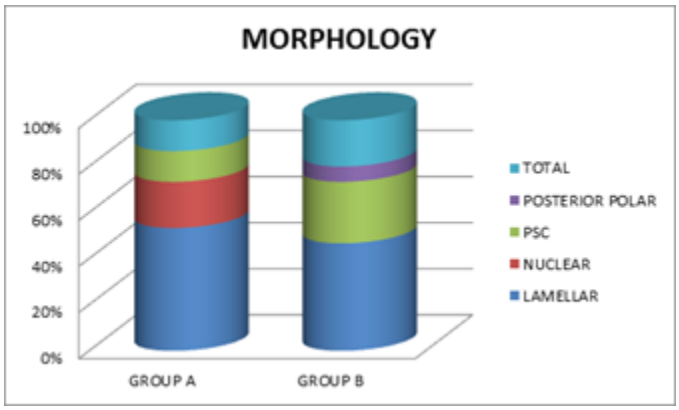

Figure 2: Morphology of Cataract in the Two Groups

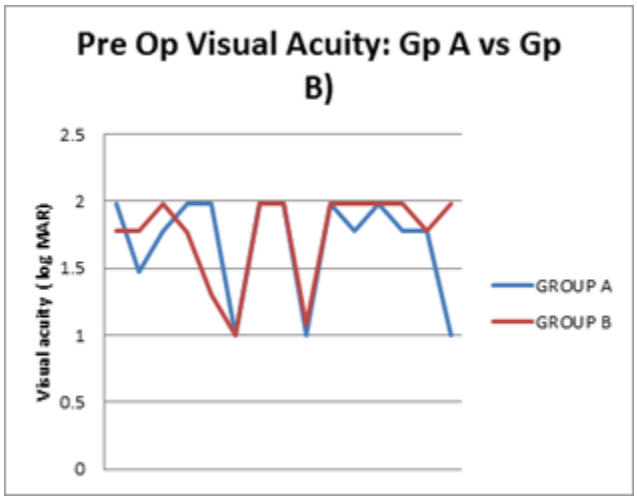

Figure 3: Comparison of Pre -op BCVA (log MAR) between the two groups

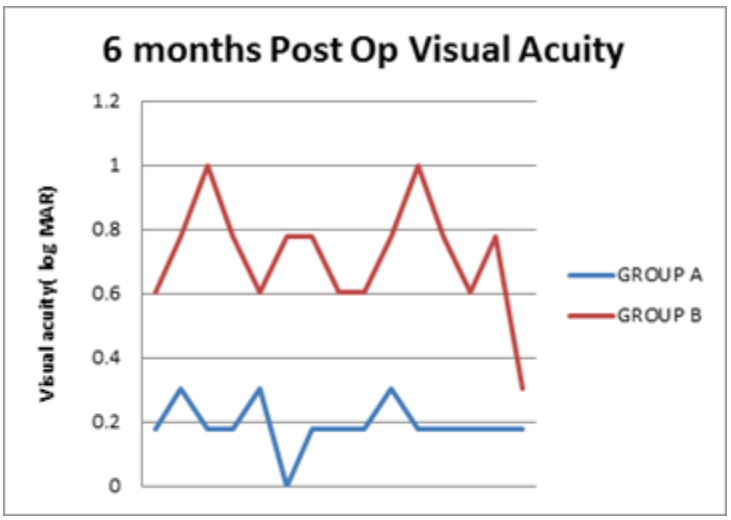

Figure 4: Comparison of 6 months Post -Op BCVA (log MAR) between the two groups

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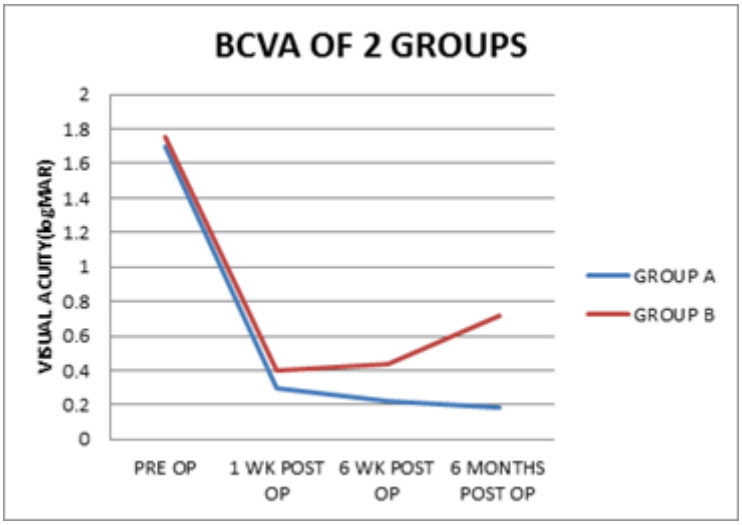

Figure 5: Comparison of gradual change of BCVA (log MAR) between the two groups

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