Lensectomy and PCIOL Implantation with versus without Posterior Capsulotomy and Anterior Vitrectomy for Pediatric Cataracts

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Purpose: To compare the visual outcomes and complications of lensectomy and posterior chamber intraocular lens (PCIOL) implantation with or without posterior capsulotomy and anterior vitrectomy in older subjects with pediatric cataracts.
Methods: Seventeen eyes of 12 children aged 10 to 15 years with congenital or developmental cataracts were randomly divided to two groups. Lensectomy and PCIOL (Alcon Acrysof MA60 AC) implantation was performed with (8 eyes) or without (9 eyes) posterior capsulotomy and anterior vitrectomy.
Results: Mean age at the time of surgery was 12.3±1.5 (range 10-15) years and mean follow-up period was 18.7±11.2 (range 6-36) months. Posterior capsule opacification developed in three eyes in the non-vitrectomy group; however, media opacification was mild and capsulotomy was not required in any case. All eyes in the vitrectomy group had a clear visual axis at final follow-up (P=0.2). No significant difference was observed between the two groups in term of visual acuity (P=0.3) or complications.
Conclusion: Although posterior capsulotomy and anterior vitrectomy seems to be safe in pediatric cataract surgery, it may not be necessary as a routine procedure in older children.

J Ophthalmic Vis Res 2008; 3 (1): 37-41.

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INTRODUCTION

Cataracts are the most common cause of visual impairment and blindness in children.[1,2] 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 complications following pediatric cataract surgery. The most significant factor contributing to the development of PCO is age, such that up to 100% of patients less than one year of age without posterior capsulotomy develop PCO postoperatively.[3,4]

Preventive measures for visual axis opacification following pediatric cataract surgery include primary posterior capsulectomy with or without anterior vitrectomy and posterior capsulectomy with capture of the IOL optic without vitrectomy. A range of strategies have been described to manage visual axis opaci-

fication such as Nd:YAG laser capsulotomy or membranotomy and pars plana capsulectomy or membranectomy with anterior vitrectomy.[5-7]

Disadvantages of primary posterior capsulectomy and anterior vitrectomy include prolongation of surgical time, need for greater surgical skill and experience, vitreous loss through the surgical wound, IOL dislocation into the vitreous cavity and the increased risk of cystoid macular edema (CME) and retinal detachment (RD). Drawbacks to cataract surgery without primary capsulotomy include reliance on laser machines, limited cooperation of children for laser treatment, failure of laser treatment in some cases, laser induced IOL damage, need for repeat anesthesia and the complications related to pars plana surgery. Disadvantages inherent to either surgical strategy have led to disagreement among authorities regarding the age cut-off for primary capsulotomy and anterior vitrectomy which has been reported from 6 to 16 years of age.[5-7]

Based on a 10-year experience of the authors at Labbafinejad Medical Center which is a referral center for pediatric cataract surgery in Iran, posterior capsulotomy and anterior vitrectomy are currently performed for children under 10 years of age. Considering the high incidence of PCO requiring Nd:YAG laser capsulotomy or reoperation following lensectomy and implantation of polymethylmethacrylate (PMMA) IOLs in children aged 10 to 15 years at our center,[8] we performed this study to compare anterior lensectomy and implantation of hydrophobic acrylic IOLs, which are known to be more tissue compatible, with or without posterior capsulotomy and anterior vitrectomy in the same age group.

METHODS

This randomized controlled trial was performed on children aged 10 to 15 years with congenital or developmental cataracts who were referred to Labbafinejad Medical Center from 2002 to 2005. All patients underwent a comprehensive ophthalmologic examination including visual acuity, refraction, measurement of ocular deviation, classification of lens opacity, fundus examination and intraocular pressure (IOP) measurement. Eyes with traumatic cataracts, IOP >21 mmHg, anterior segment or other concomitant ocular disorders and patients with systemic diseases such as juvenile rheumatoid arthritis and diabetes mellitus were excluded from the study. Contact A-scan echography and manual keratometry were performed for IOL power calculation using a single apparatus and the SRKII formula; the goal was to achieve emmetropia postoperatively. In unilateral cases, IOL power was adjusted to avoid anisometropia >3 D based on the refractive error in the fellow eye. All operations were performed under general anesthesia and the same type of hydrophobic acrylic PCIOL (Alcon Acrysof MA60 AC) was implanted in all cases.

Patients were randomized to two groups; the vitrectomy group underwent lensectomy together with primary posterior capsulotomy, anterior vitrectomy and PCIOL implantation within the capsular bag. The non-vitrectomy group underwent lensectomy alone. The rest of the procedures and the follow-up protocol were the same for both groups. Anterior capsulorrhexis 5-5.5 mm and posterior capsulotomy 4-5 mm in diameter were performed using capsular forceps. The operations were performed by two skilled anterior segment specialists and follow-up examinations were undertaken by one of the authors. Postoperative examinations were carried out 1, 2, 4 and 6 days and 3, 6, 12 and 18 months after surgery. All patients were followed for at least 6 months. The postoperative regimen included betamethasone drops (every 2 hours), chloramphenicol drops (every 6 hours) and oral prednisolone (1mg/kg/day) for both groups. Chloramphenicol and oral prednisolone were discontinued after one week and betamethasone was gradually tapered and discontinued over 12 weeks. Refractive errors were determined 1-2 weeks postoperatively and glasses were prescribed if needed. Follow-up examinations included best-corrected and uncorrected visual acuity (BCVA and UCVA), slitlamp biomicro-

scopy, IOP measurement and funduscopy. 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).[9]

Considering a prevalence of 6.8% and 42.8% for PCO in the vitrectomy and non-vitrectomy[10] groups respectively, study power of 80% and significance level of 0.05, a sample size of 19 eyes was calculated for each group; however, due to prolongation of the study process, we concluded the study with a smaller number of cases. Statistical analyses were performed using *t*-test and Fisher's exact test.

RESULTS

Overall, 17 eyes (5 bilateral and 7 unilateral cases) of 12 patients (including 9 female and 3 male subjects) with mean age 12.3±1.5 (range 10-15) years were operated and followed for a mean period of 18.7±11.2 (range 6-36) months. There was no significant difference between the two groups in terms of sex, age, preoperative BCVA and follow-up duration (table 1).

The outcomes of surgery were comparable in the 2 groups with no statistically significant difference (table 2). No intraoperative complication such as extension of the anterior or posterior capsulorrhexis, vitreous loss through the incision or loss of capsular bag integrity precluding in-the-bag PCIOL implantation occurred in either group. The only postoperative complication was sterile uveitis which occurred with no statistically significant difference between the two groups. Only three cases of grade 1 or 2 PCO developed in the non-vitrectomy group without need for laser or surgical treatment. The visual axis remained clear in all eyes in the vitrectomy group. No case of wound leakage, IOP >21 mmHg, temporary or permanent corneal edema, CSME or RD occurred during the follow-up period and none of the eyes required repeat surgery.

Table 1 Preoperative patient characteristics

	Vitrectomy group	Non-vitrectomy group	P value*
Number of eyes	8	9	-
Male/female ratio	6/2	6/3	1
Amblyopic cases	2	2	1
Age at surgery (Mean±SD)	12.1±1.7	12.4±1.3	0.6
Preoperative BCVA (logMAR)	1.0±0.4	0.8±0.5	0.5
Follow-up period (month)	18±12	19.3±11.1	0.8

M, mean; SD, standard deviation

* Chi-square (Fisher exact) test for frequency values and *t*-test for mean values

Table 2 Results of surgery at final follow-up (Mean ± standard deviation)

	Vitrectomy group	Non-vitrectomy group	P value*
BCVA (logMAR)	0.1±0.1	0.2±0.4	0.3
IOP (mmHg)	13.2±3.1	13.0±2.4	0.9
SE (diopter)	0.46±1.5	0.54±1.1	0.9
IOL power (diopter)	25.6±3.2	24.0±4.3	0.4
Sterile uveitis	2	4	1
PCO	0	3	0.2

BCVA, best corrected visual acuity; M, mean; SD, standard deviation; IOP, intraocular pressure; SE, spherical equivalent; IOL, intraocular lens; PCO, posterior capsule opacity

* Chi-square (Fisher exact) test for frequency values and *t*-test for mean values

DISCUSSION

PCO is the most common complication of pediatric cataract surgery; opacification of the visual axis decreases visual acuity and may possibly lead to further interventions.[11-14] In the first year of life, the posterior capsule often undergoes opacification if left intact after cataract surgery.[3,4] In addition to age, the type of IOL is another important factor affecting the rate of PCO. Even though heparinized PMMA IOLs have a higher degree of tissue compatibility in young patients as compared to non-heparinized ones, hydrophobic acrylic lenses seem to be a better choice for reducing the rate of PCO.[15,16]

In addition to IOL material, surgical technique affects the rate of PCO after pediatric cataract surgery. In a study by Vasavada et al[17] 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. Nevertheless, Gimbel[18] 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.

Even though PPCCC with or without anterior vitrectomy is generally performed in children less than 6 years of age,[5,6,16,19-23] there is no consensus on performing this procedure beyond this age; this is particularly true in children older than 10. Jensen et al[5] recommended keeping the posterior capsule intact after six years of age, according to Guo et al[6] the posterior capsule should be left intact in children older than 10 years, and Hutchenson et al[7] recommended primary posterior capsulotomy in children younger than 16 years.

In the present study, using hydrophobic acrylic PCIOLs, no case of visual axis opacification occurred in the vitrectomy group undergoing PPCCC. In contrast, 3 of 9 eyes with intact posterior capsules developed some degree of PCO however, none required surgical or laser treatment. With the sample size enrolled in this study, this intergroup difference failed to reach statistical significance. In another study from Iran by Baradaran et al[10] on 12 eyes with developmental or congenital cataracts in patients aged ≤15 years, PMMA IOLs were implanted in all eyes leaving the posterior capsule intact in 7 eyes and performing PPCCC plus anterior vitrectomy in 5. None of the latter 5 cases developed opacification of the visual axis, nonetheless, three of the former 7 eyes developed visual axis opacification requiring Nd:YAG laser capsulotomy. Therefore, they suggested that PPCCC with anterior vitrectomy is beneficial for patients up to the age of 16. Advantages of the present study as compared to the study by Baradaran et al[10] is the clinical trial design and use of hydrophobic acrylic IOLs. However, both studies suffer from limited follow-up and small sample size. The main reason for the low number of patients is the low incidence of cataracts among children older than 10 years of age. Considering the risk of amblyopia, most patients with visually significant pediatric cataracts are usually operated before the age of 10 and the rest rarely required cataract surgery thereafter. At our center, which is one of the major referral centers in the country, we were only able to include 17 eyes from 12 patients during a 42 month period. Furthermore, those suffering from traumatic or metabolic cataracts, which comprise most cases of cataracts in children above 10 years of age, were not eligible for enrollment in our study.

Considering the low incidence of PCO as well as little loss of visual acuity in cases who only underwent lensectomy and PCIOL implantation in the current study, PPCCC and anterior vitrectomy seems unnecessary in children aged 10 to 15 years. Whenever Nd:YAG laser and hydrophobic acrylic lenses are available, the preferred method of cataract surgery in this age group probably consists of lensectomy and PCIOL implantation without performing anterior vitrectomy leaving the posterior capsule intact.

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