SHORT TERM RESULTS OF PRIMARY ACRYSOF HYDROPHOBIC ACRYLIC FOLDABLE INTRAOCULAR LENS IMPLANTATION IN CHILDREN AT PRIMARY CHILDREN MEDICAL CENTER UNIVERSITY OF UTAH USA

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ABSTRACT

Objectives: To study short term results of primary acrysof hydrophobic acrylic foldable intraocular lens implantation in children.

Study design: A descriptive hospital based study

Place and duration of Study: Pediatric Eye Unit, Primary Children Medical Center, University of Utah USA, where study was conducted from 1st July 2004 to 31st December 2007.

Patients and Methods: Thirty five children aged 2 years to 13 years with congenital cataract who underwent phaco aspiration with posterior capsulotomy and anterior vitrectomy with acrysof hydrophobic acrylic foldable intraocular lens implantation in year 2004 to 2007 were included in the study. Outcome measures were visual acuity, clarity of the visual axis, postoperative inflammation and intra ocular pressure measurement.

Results: Out of 35 children 4 had bilateral cataract and 31 had unilateral cataract. There was family history of congenital cataracts in 3 children. Preoperatively 25 eyes (64.1%) had visual acuity of < 20/80, 12 eyes (30.8%) had 20/80 and 2 eyes (5.1%) had 20/60. Two weeks postoperatively 28 eyes (71.7%) had visual acuity of 20/20, 8 eyes (20.7%) of 20/40 and 3 eyes (7.6%) 20/60. One year after surgery 9 eyes (23.07%) had visual acuity of 20/20, 12 eyes (30.76%) 20/40, 6 eyes (15.39%) 20/60, 3 eyes (7.70%) 20/80 and 9 eyes (23.08%) had visual acuity of < 20/80. Two weeks postoperatively 31 eyes (79.50%) were emmetrope and 8 eyes (20.50%) had astigmatism. One year after surgery 33 eyes (84.6%) were myope and 6 eyes (15.4%) had astigmatism. At the end of first year postoperatively children age 2-5 years showed mean change of refraction of 2.5 diopters, 6-9 years showed 2 diopters and 10-13 years showed 1 diopter change after one year.

Postoperative inflammatory membranes occurred in 9 eyes (23.07%). Five eyes (12.8%) responded to topical steroids while 4 eyes (10.2%) required pars plana membranectomy. Visual axis/posterior capsular opacification occurred in 10 eyes (25.64%). Secondary posterior capsulotomy was performed in 9 eyes (23.07%) while Neodynium Yag Laser capsulotomy was performed in one eye (2.56%). Intraocular pressure recorded during postoperative period was normal in all the ages.

Conclusions: The primary acrysof hydrophobic acrylic foldable intraocular lens implantation in children with posterior capsulotomy and anterior vitrectomy is a safe technique resulting in good visual acuity and normal intraocular pressure measurement postoperatively. Visual axis/posterior capsular opacification, postoperative inflammatory membranes and myopic shift are recognized complications of hydrophobic acrylic intraocular lens implantation.

Key words: Pseudophakia in children, Pediatric IOL implantation, IOL in children

INTRODUCTION

Implantation of posterior chamber intraocular lenses (IOLs) in children is becoming more common and accepted as initial results continue to be encouraging [1-7]. Despite the demonstrated efficacy and safety of pediatric IOL implantation, one of the most difficult challenges faced with paediatric cataract surgery is the choice of implant power to use as the children's eyes continue to grow over time the myopic shift must be considered. Although good data is present in literature analyzing growth patterns of normal phakic eyes in children, surgical predictions of appropriate IOL power become increasingly complicated in children under age 6 years, especially those children under 1 year of age [8].

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In addition small dimensions of the child eye, decreased scleral rigidity and increased tissue reactivity leading to excessive postoperative inflammation and capsular opacification make pediatric IOL implantation particularly challenging.

The objectives of the study were to analyse short term results of primary hydrophobic acrylic foldable intraocular lens implantation in children, considering visual acuity, myopic shift, post capsule opacification and postoperative IOP rise.

PATIENTS AND METHODS

This descriptive study was conducted at Primary Children Medical Center University of Utah USA from 1st July 2004 to 31st December 2007. Eyes which had structural abnormalities such as persistent hyperplastic primary vitreous or microphthalmos were excluded from the study. Biometry was performed on all children at time of surgery using hand held Nidek keratometer and axial length measurements were made using Allergan Humphrey Ultrasonic Biometer 820 preoperatively. Lens power calculation were done using SRK II formula. The aim was to make the eye postoperatively emmetropic with an idea that leaving the children with initial hyperopic correction postoperatively to prevent myopic anisometropia when child is older, the initial residual hyperopia could also induce anisometropia and be potentially amblyogenic. The myopia induced by myopic shift can be corrected with glasses or contact lenses and at later stage with excimer laser. Pupil was dilated with tropicamide 1% and phenylephrine 2.5%.Corneal incision was given. A Continuous curvilinear capsulorrhexis was initiated with cystitome and completed with uttrata forceps after injecting Sodium hyaluronate into the anterior chamber. Hydrodissection was performed with sodium hyaluronate. Nucleus and cortical aspiration was done using automated irrigation aspiration. Posterior vitrectomy was done with vitrectomy cutter after posterior capsulotomy. Acrysof UV absorbing hydrophobic acrylic foldable multi piece modified C biconvex anterior asymmetric intraocular lens (Model: MA60AC) was placed into capsular bag after injecting sodium hyluronate. The corneal incision was closed with 10/0 vicryl. At the end of operation dexamethsone sulphate 2 mg was given subconjunctively. In bilateral cases the cataract of the other eye was operated within two weeks. Dilated retinoscopy was performed by ophthalmologist two weeks after surgery and on regular follow ups spectacles were provided where needed.

RESULTS

Out of 35 patients 4 (11.4%) had bilateral cataract and 31 (88.6%) had unilateral cataract. There was family history of congenital cataract in 3 (8.6%) children. Tests were performed to rule out different causes of cataract. Genetist was consulted for genetic counseling. Type of cataracts varied but nuclear cataract was seen in majority 23 (58.97%) of the eyes. One (2.8%) patient had chronic juvenile arthritis. Preoperatively axial length ranged from 18.12mm to 24.27mm, 2 (5.13%) eyes had axial length of 18-19mm, 16 (41.03%) eyes 20-21mm, 14 (35.90%) eyes 22-23mm and 7 (17.94%) eyes had 24mm or more. In most of the cases axial length was related with the age of the child. Younger children had shorter axial length while older children had longer axial length. Intraocular lens power ranged from 10 to 33 diopters. One (2.56%) eye had IOL measurement of 10 diopters, 14 (35.89%) eyes 15 to 20 diopters, 7 (17.95%) eyes 20-25 diopters, 16 (41.02%) eyes 25-30 diopters and 1 (2.56%) eye more than 33 diopters. In all patients Acrysof UV absorbing hydrophobic acrylic foldable multi piece posterior chamber foldable biconvex, modified C anterior asymmetric lenses (Model: MA60AC) were used. Follow up of children was done for a period of 1 year.

Preoperatively 25 (64.1%) eyes had visual acuity of < 20/80, 12 (30.8%) eyes 20/80 and 2 (5.1%) eyes 20/60. Two weeks postoperatively 28 (71.8%) eyes had visual acuity of 20/20, 8 (20.5%) eyes 20/40 and 3 (7.7%) eyes 20/60. One year after surgery 9 (23.08%) eyes had visual acuity of 20/20, 12 (30.77%) eyes 20/40, 6 (15.38%) eyes 20/60, 3

(7.69%) eyes 20/80 and 9 (23.08%) eyes had visual acuity of < 20/80 (Table).

Two weeks postoperatively 31 (79.49%) eyes were emmetrope and 8 (20.51%) eyes had astigmatism. One year after surgery 33 (84.6%) eyes were myope and 6 (15.4%) eyes had astigmatism. Children age 2-5 years showed mean change of refraction of 2.5 diopters after one year. Children age 6 -9 years showed mean change of refraction of 2 diopters after one year. Children age 10-13 years showed mean change of refraction of 1 diopter after one year (Figure).

Postoperative inflammatory membranes occurred in 9 (23.07%) eyes. Five (12.8%) eyes responded to topical steroids while 4 (10.2%) eyes required pars plana membranectomy. Visual axis/posterior capsular opacification occurred in 10 (25.64%) eyes. Secondary posterior capsulotomy was performed in 9 (23.07%) eyes while Neodynium YAG Laser capsulotomy was performed in one (2.56%) eye. Intraocular pressure recorded during postoperative period was normal in all the ages.

Table: Preoperative visual acuity versus postoperative visual acuity (n=39)

Visual Acuity	Preoperative	Postoperative After 2 weeks	Postoperative After 1 year
20/20	0 (0%)	28 (71.79%)	9 (23.08%)
20/40	0 (0%)	8 (20.51%)	12 (30.77%)
20/60	2 (5.13%)	3 (7.69%)	6 (15.38%)
20/80	12 (30.77%)	0 (0%)	3 (7.69%)
Less than 20/80	25 (64.10%)	0 (0%)	9 (23.08%)

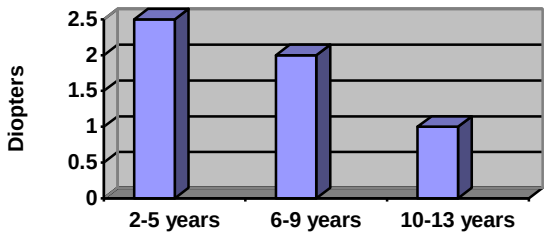

Figure: Change in refraction after one year of surgery

DISCUSSION

In our study 1 year after surgery 9 (23.07%) eyes had visual acuity of 20/20, 12 (30.76%) eyes 20/40, 6 (15.39%) eyes 20/60, 3 (7.70%) eyes 20/80 and 9 (23.08%) eyes less than 20/80. These results can be compared to the study done at Lady Reading Hospital Peshawar Pakistan on 29 eyes of 25 children who were below 16 years of age. Out of 29 eyes visual acuity was restored to 6/18 or better in 12 (41.37%) eyes, 6/18 to 6/60 in 7 (24.13%) eyes, and 6/60 to 3/60 in two (6.89%) eyes. While in 7 (24.13%) cases final visual acuity was less than 3/60. In one (3.44%) child final vision could not be checked accurately because child was uncooperative due to young age [9].

In our study children age 2 -5 years showed a mean change of refraction of 2.5 diopters after one year. Children age 6 -9 years showed mean change of refraction of 2 diopters after one year. Children age 10-13 years showed mean change of refraction of 1 diopter after one year. The rate of myopic shift is high in children under age 4 years at the time of surgery. Plager et al demonstrated that children definitely experience a myopic shift with age, with a mean myopic shift 4.60D in children aged 2 -3 years in their study1. Crouch et al also have shown that the greatest change in refractive power of a child's eye occurs between 1 and 3 years of age, following a more linear trend after age 3 years [5]. Children 1 – 2 years of age at the time of surgery had a myopic shift averaging -5.96D, decreasing to -2.03D in the 7 – 8 years group at time of surgery. McClatchey and Parks [10] and Crouch et al [5] have documented that aphakic eyes of children follow a logarithmic change in myopic shift over time, as children grow. Dahan et al have shown a myopic shift of 6.39D in children undergoing IOL surgery from 1 to 18 months of age, yet decreasing to 0.76D in children 3-8 year of age [11].

One of the significant complications of modern cataract surgery in pediatric patients is posterior capsule opacification (also referred to as a secondary membrane, after-cataract capsular fibrosis, and epithelial pearls). In our study visual axis/posterior capsular opacification occurred in 10 children. Secondary posterior capsulotomy was performed in 9 while Neodynium YAG laser capsulotomy was performed in 1 child. Despite primary posterior capsulotomy (PPC) lens epithelial cells can grow on the anterior vitreous phase which may result in secondary opacification of visual axis. Most cases of clinically significant posterior capsule opacification are caused by postoperative proliferation and migration of residual lens epithelial cells and their transformation to myofibroblasts [12, 13]. Adequate size of primary posterior capsulotomy and sufficient anterior vitrectomy (nearly 1/3 of anterior vitreous) is important to reduce the rate visual axis/posterior capsular opacification. Posterior capsule opacification has been reported to range from 44% to 100% in pediatric patients [12-15].

The younger the child, the higher the incidence and the earlier the onset of posterior capsule opacification. The severity of posterior capsule opacification is worse in children younger than 6 years [16]. Sharma et al [17] reviewed 39 pediatric eyes in which cataract extraction and IOL implantation were performed with intact posterior capsules. Posterior capsule opacification occurred in 87.2% of these patients. A total of 74.3% of the eyes needed treatment for posterior capsule opacification, including Neodynium – YAG laser capsulotomy in 19 eyes (48.7%) and surgical membranectomy in 10 eyes (25.6%).Posterior capsule opacification may cause amblyopia and is a major obstacle of cataract extraction and IOL implantation in the pediatric population [18].

Lens aspiration using intracameral heparin, combined with posterior capsulorhexis and optic capture of a heparin – coated IOL, is a useful techniques to prevent secondary visual axis opacification in pediatric cataracts [19].

In our study Acrysof UV absorbing hydrophobic acrylic foldable multi piece posterior chamber lenses were used. Postoperative inflammatory membranes occurred in 9 patients. Five patients responded to topical steroids while 4 patients required parsplana membranectomy. The increased tissue reactivity in small children predisposes them to the risk of severe postoperative inflammation but there is no large-scale study to pinpoint the appropriate IOL material for these infants. Trivedi et al. reported visual axis opacification with AcrySof IOL in 37.9% children less than one year of age even though a pars plana capsulotomy with anterior vitrectomy had been performed [23]. Vasavada et al found that the anterior vitreous face is more reactive in infants and can act as a scaffold not only for lens epithelial cell proliferation but also pigment epithelial cells, fibrinous exudates and cells that result from the breakdown of the blood aqueous barrier [24]. Posterior capsular opacification in eyes with a hydrogel IOL is significantly more extensive than in eyes with hydrophobic acrylic IOL and results in a significant impairment of visual acuity [20] Primary implantation of foldable soft acrylic IOLs in pediatric eyes may allow few ever perioperative complications and have lower PCO rates than rigid PMMA IOLs [21].

There was one patient with chronic JRA Uveitis and cataract. Ocular complications, such as cataract, glaucoma and band keratopathy are common in children with uveitis especially in those in whom the ocular inflammation is associated with juvenile reheumatoid arthritis (JRA). Compared with those with non-JRA – associated uveitis, children with JRA associated uveitis tend to have more manifestations of the disease when first seen and after surgery, but there is no significant difference in postoperative course or complications. An intraocular lens implantation including small incision, foldable intraocular lenses are well tolerated, when combined with aggressive medical treatment, for controlling inflammation. Intraocular lens implantation is not contra

indicated in those with pediatric uveitis, including uveitis with JRA [22].

When choosing an IOL for implantation in very young infant's special consideration must be given to the small size of the eye and selection of a biomaterial that will be compatible with the eye for a lifetime. Knight-Nanan et al. implanted IOLs in seven eyes of congenital cataract aged between one to 22 months with favorable outcome [16].

The goals of long term success in surgically treating children undergoing cataract surgery with posterior chamber IOLs should be to have good visual acuity in operated eye, one should effectively eliminate anisometropia and promote fusional ability. This is possible by accurately anticipating long term changes in the growth of child's eye. The patient age at the time of surgery and the refractive power of the fellow eye are all factors to consider in a final decision of what power IOL to surgically implant in a pediatric cataract patient. Further improvements in IOL design, surgical instrumentation and implantation techniques, and IOL calculation formulas designed specifically for children and better understanding of growth parameters of pediatric eyes will improve our ability to deal with complex group of children [25].

CONCLUSIONS

The primary acrysof hydrophobic acrylic foldable intraocular lens implantation in children with posterior capsulotomy and anterior vitrectomy is a safe technique resulting in good visual acuity and normal intraocular pressure measurement postoperatively. Visual axis/ posterior capsular opacification, postoperative inflammatory membranes and myopic shift are recognized complications of hydrophobic acrylic intraocular lens implantation.

We report short term results of cataract surgery with hydrophobic acrylic foldable intraocular lens implantation in children, which are comparable to results of such other studies published internationally. Long term follow up of these children is required for evaluation of final visual outcome, glaucoma and visual axis/posterior capsular opacification.

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