Comparision of outcome of implantation of hydrophobic acrylic versus hydrophilic acrylic IOL during pediatric cataract surgery prospective randomized study

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Abstract

Introduction: There are 1.5 million blind children (corrected visual acuity <20/400 in the better eye) in the world and one million of them live in Asia. 1-3 the prevalence of childhood cataract has been reported as 1 to 15 cases in 10,000 children in the developing countries. It is estimated that globally, there are 200,000 children blind from bilateral cataract.

Aims and Objective: Purpose of this study is to evaluate foldable hydrophilic and hydrophobic acrylic IOLs implantation in pediatric cataract surgery and to know the incidence of complication in both groups.

Materials and Methods: it is a randomised prospective study over a period of one year and collection of patients done in outpatient Department of Ophthalmology at BRDMC, Gorakhpur.

Results: The study has been carried out on 40 eyes of 27 patient with pediatric cataract divided into two groups (n=20) each group patient undergone phacoaspiration, primary posterior capsulotomy, and anterior vitrectomy by single surgeon with implantation of hydrophilic and hydrophobic iols respectively after one year study we found that The incidence of complications are more in hydrophilic iol than in hydrophobic iol like percentage of PCO was 80% and 20% ($p<0.05$, significant) respectively likewise uveitis is more in hydrophilic 66.7% and 33.3% in hydrophobic iols ($p>0.05$, insignificant). So our study concluded that hydrophobic iols are better than hydrophilic iols.

Keywords: Anterior vitrectomy, Hydrophilic, & hydrophobic iols lens, Pediatric cataract, PCO, Primary posterior casulotomy.

Introduction

There are 1.5 million children suffering from blindness (corrected visual acuity <20/400 in the better eye) in the world and 1 million of them live in Asia.[1-3] In developing countries the prevalence of childhood cataract has been reported as 1 to 15 cases in 10,000 children, on the other hand globally, there are 200,000 children suffering from bilateral cataract.[3]

It is seen in the developing nation, a child becomes bilaterally blind every minute. Of the 1.5 million blind children in the world, 1.3 million live in Asia and Africa, and 75% of all causes are preventable or curable.[4] The prevalence of blindness varies according to the socioeconomic development of the country and the mortality rate of those under 5 years of age.[5] In developing countries the rate of blindness can be as high as 1.5 per 1000 population.[6] Compared to industrialised countries, this figure is 10 times higher in various developing countries.[7] The main etiological factor behind the infantile cataract are hereditary, metabolic disorders, premature birth and intrauterine infections.[8] However idiopathic etiology is the most commonly seen in the Indian data.[9]

It is very essential to operate the pediatric cataract timely because the development of the visual system is affected by visual deprivation. So, the denser cataract is operated first; followed by other eye.[10] Now a days outcome of pediatric cataract become better because of improved surgical techniques and correction of aphakia with intraocular lens (IOL) implantation.[11] With the help of automated vitrectomy equipment, at the time of surgery, efficacious anterior vitrectomy procedures can be performed that aid in maintenance of a clear visual axis simulataneously with the help of anterior and posterior capsulotomy procedure also prevent PCO formation.[12]

Biomaterials used for manufacture of IOL can be divided into two major groups acrylic and silicone. Acrylic lenses can be further divided as follows: Rigid lenses manufactured from PMMA and soft or foldable lenses manufactured either from hydrophobic acrylic materials or from hydrophilic acrylic.

PMMA Lenses: Rigid implant manufactured from polymethylmethacrylate (PMMA). PMMA are associated with lower biocompatibility and higher rate of complications.[13]

Hydrophilic Acrylics or Hydrogels Lenses: These iols are soft and have superb biocompatibility because of their relatively hydrophilic lens surface. They are flexible and show little or no surface changes or damage from folding with insertion.[14] these iols shows high uveal biocompatibility and damage potentials when corneal endothelial cells is incidentally touched due to hydrophilic property. However, hydrogels have a lower capsular biocompatibility, resulting in more lens epithelial cell outgrowth, anterior capsule contracture and PCO formation after cataract surgery.[15]

Hydrophobic Acrylic Lenses: Are made up of copolymers of acrylate and methacrylate, which makes them flexible and durable. They have higher refractive index (1.44-1.55) than silicone (1.41-1.46) and PMMA (1.49), therefore lense are usually thinner. The biocompatibility of hydrophobic acrylic lenses exceeds that of PMMA lenses with fewer posterior synechiae and fewer lens deposits when implanted in children.[16] They are easier to insert in a small eye and the squared edge of IOL optic design may result in delayed posterior capsule opacification in young eyes. The

hydrophobic acrylic iols has been shown to be very biocompatible for pediatric eyes.[17]

In pediatric age group post-operative complications after intraocular surgery are high due to intense inflammatory response. So they need regular follow up, early detection and management of complications.

Uveitis: Postoperative uveitis (fibrinous or exudative) is a common finding in children. It can be managed with the intensive use of topical steroids and cycloplegics in the postoperative period.

Posterior Capsular Opacification: Posterior capsular opacification is the most common complication after cataract surgery in children with or without intraocular lens implantation. It is of two types, thin and thick PCO. Thin PCO can be managed by Nd:YAG laser i.e non invasive procedure while thick PCO requires surgical posterior capsulotomy. Primary posterior CCC and anterior vitrectomy reduces PCO rate.

Pupillary Capture: The incidence of pupillary capture is 8.5% to 33%.It is said to occur when optic portion of iol passes anterior to iris. To minimize the incidence of this complication, iol must be placed in capsular bag.

Decentration of IOL: IOL must be placed in capsular bag not in sulcus to reduce this complication.

Glaucoma: The incidence of glaucoma varies from 3% to 32% following pediatric cataract surgery. Due to pupillary block or peripheral anterior synechie formation, glaucoma occurs soon after cataract surgery. On the other hand open-angle glaucoma may occur late, which point up the need for the life-long follow-up of these children. In pseudophakic glaucoma, peripheral iridectomy may prevent pupillary block. Intraocular pressure should be timely recorded to detect and treat this dreadful complication.

Secondary Membrane Formation: After pediatric cataract surgery secondary membranes formation are common complications. To prevent this primary posterior capsulotomy and anterior vitrectomy with capsular bag implantation of square-edge IOL is significantly helpful. In early stage of secondary membrane formation Nd;YAG Laser is sufficient while in dense secondary membrane formation, surgical membranectomy and anterior vitrectomy is required.

Retinal Complications: Retinal detachments are usually a late complication of pediatric cataract surgery and its incidence range between 1-1.5%,. & occurs in high myopia and in case of repeated intraocular surgeries.

Amblyopia: Amblyopia is one of the most urgent vision threatening complications following pediatric cataract surgery. So the aphakic or pseudophakic child must be provided with suitable optical correction. In cases of unilateral congenital or developmental or traumatic cataract patching of normal eye is done postoperatively to achieve binocular vision and stereopsis.[18,19]

Aims and Objective

Purpose of this study is to evaluate foldable hydrophilic and hydrophobic acrylic IOLs implantation in pediatric cataract surgery and to know the incidence of complication in both groups.

Materials and Methods

It is a randomised prospective study for one year duration in department of ophthalmology at Nehru Chikitsalaya B.R.D. Medical college Gorakhpur. Data for the study was collected from patients age group 0-12yrs attending to outpatient. Department of ophthalmology. Sample size of study is 40 eyes of 27 patients divided into two groups, Group A hydrophilic iol in 20 eyes and Group B hydrophobic iols in 20 eyes. Informed consent were taken from the parents of the children before enrolling them in the study.

Inclusion Criteria

1. Age 0-12year
2. Developmental cataract
3. Congenital cataract

Exclusion Criteria

1. Monoocular patient.
2. Cataract associated with ocular abnormalities (colobomas, glaucoma, uveitis, microphthalmos, microcornea, & posterior lenticonus,) or systemic diseases, traumatic and complicated cataracts.

Evaluation of Patient & Work Plan

Patient particulars-name, age, sex were noted and presenting history.-whitish reflex noted by parents, decreased visual acuity were recorded. Children were randomly divided into 2 groups. All participants underwent phacoaspiration, primary posterior capsulotomy, and anterior vitrectomy in needful patient.

Group A (n=20) eyes were implanted with hydrophilic acrylic intraocular lenses (IOLs), and those of Group B (n = 20) were implanted with hydrophobic acrylic IOLs.

The children were evaluated for anterior chamber reaction, IOL position, visual axis opacification, intraocular pressure, best-corrected visual acuity (BCVA), corneal status, and refractive errors. Patients will be followed for a minimum period of 12 months.

Iol power calculation patient above 4yrs of age, SRKII formula used for IOL power calculation, Patient under 4yrs of age Dahan et al approach based on the axial length isused.[8]

Examination: General examination of CNS, CVS, respiratory system, Systemic investigation- Hb, TLC, DLC, RBS, ESR serum urea, creatinin, HIV, HBsAg, conjuctival smear examination were done. Local examination -Visual acuity assessment, with Snellen's visual acuity chart or illiterate 'E' chart and fixation pattern were noted in uncooperative patients were done. Fundus examination-direct or indirect ophthalmoscope to rule out any retinal pathology were done.

Surgical Procedure: All the surgical procedures under general anaesthesia by a single surgeon. All patient underwent phacoaspiration, primary posterior capsulotomy, and anterior vitrectomy in needful patient with hydrophilic iols implantation in group A and hydrophobic iol implantations in group B.

Postoperative Treatment: On postoperative day 1st, topical antibiotics (moxifloxacin 0.5%) were used 4 times and corticosteroid drops (prednisolone 0.1%) were used 4 times a day (the frequency was titrated according to the severity of the inflammation). Cycloplegics (homatropine 2%) were used on cea day for 6 weeks.

Children were evaluated on day 1, at 1 week, 4 weeks, 12 weeks, and 24 weeks postoperatively, then every 6 months thereafter.

Observation and Results

The study has been carried out on 40 eyes (28 male eye 12 female eye, table1) of 27 patient with pediatric cataract divided into two groups (Group A Hydrophilic abd Group B Hydrophobic). Each group patient undergone phacoaspiration, primary posterior capsulotomy, and anterior vitrectomy in needful patient by single surgeon with implantation of hydrophilic and hydrophobic iols respectively. Age group divided in three groups < 2 years, 2-8 years, > 8 years showing in table 2.

After 1 year follow up we can conclude that in pediatric age group mature cataract (40%, 45%) was found more followed by posterior subcapsular (30%, 25%) in both the groups showing in Table 3.

Preoperative visual acuity was found fixation and following light to <6/18-6/60 in both group maximum patient presented with <1/60-PL positive i,e 55% & 70% respectively (Table 4)

Postoperative BCVA (6/6-6/18) was found better in group B 75% (hydrophobic) than group A (hydrophilic) 70% (Table 4).

The incidence of complications are more in group A (hydrophilic) than group B (hydrophobic)like percentage of PCO was 80% and 20% respectively (Table 5). Likewise uveitis is more in group A (66.7%) and (33.3%) in group B (Table 6).

Other complications like pupillary capture was found equally in both the groups. Neither of the groups shows pigment dispersion, synechiae, irregular pupil, iol decentration, glaucoma and endopthalmitis.

Table 1: Showing gender distribution in study

Gender	Frequency	Percentage
Male eyes	28	70%
Female eyes	12	30%

Table 2: Showing age distribution in both groups

Age group	Group A (hydrophilic iols)	Group B (hydrophobic iols)
<2yrs	3(15%)	4(20%)
2-8yrs	5(25%)	9(45%)
>8yrs	12(60%)	7(35%)

Table 3: Showing morphological type of cataract

Cataract type	Group A (hydrophilic group)	Group B (hydrophoboic group)
Mature	8(40%)	9(45%)
Lamellar	3(15%)	2(10%)
Nuclear	2(10%)	3(15%)
Posterior subcapsular	6(30%)	5(25%)
Anterior polar	1(5%)	1(5%)

Table 4: Showing pre and post op vision

Vision acuity	Hydrophilic iols		Hydrophobic iols	
	Preoperative vision	Post operative vision(BCVA)	Preoperative vision	Post operative vision(BCVA)
6/6-6/18	0	14(70%)	0	15(75%)
<6/18-6/60	1(5%)	3(15%)	0	2(10%)
<6/60-3/60	3(15%)	0	1(5%)	0
<3/60-1/60	2(10%)	0	2(10%)	0
<1/60-PL	11(55%)	0	14(70%)	0
Fixation and following light	3(15%)	3(15%)	3(15%)	3(15%)

Table 5: Shows PCO complications in both groups

Type of Lens	PCO			
	Yes	No	Total no.	P value
Hydrophilic lens (Group A)	8(80.0%)	12(40.0%)	20(50.0%)	0.028
Hrdrophobic lens (Group B)	2(20.0%)	18(60.0%)	20(50.0%)	

X^2=4.80, df=1,p<0.05)

Table 6: Shows uveitis complications in both groups

Type of Lens	Uveitis			P value
	Yes	No	Total no.	
Hydrophilic lens (Group A)	2(66.7%)	18(48.6%)	20(50.0%)	0.548
Hrdrophobic lens (Group B)	1(33.3%)	19(51.4%)	20(50.0%)	

Conclusion

So we have found that in our study that incidence of PCO formation is more in hydrophilic (80%) versus hydrophobic (20%), ($p<0.05$, significant) likewise incidence of uveities more in hydrophilic (66.7%) versus hydrophobic (33.3%) ($p>0.05$, insignificant).

So our study concluded that hydrophobic iols are better than hydrophilic iols.

Conflict of Interest: None.

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How to cite this article: Kumar R, Sarswati. Comparision of outcome of implantation of hydrophobic acrylic versus hydrophilic acrylic IOL during pediatric cataract surgery prospective randomized study. *Indian J Clin Exp Ophthalmol* 2019;5(1):127-130.