Recent Trends in Management of Pediatric Cataract

ESSAY
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List of contents

List of Abbreviations

AAPOS	American Association for Pediatric Ophthalmology and Strabismus
AC	Anterior Chamber
ACD	Anterior Chamber depth
AL	Axial length
ASCRS	American Society of Cataract and Refractive Surgeons
ATS	Amblyopia Treatment Studies
CCC	Continuous curvilinear capsulorhexis
CME	Cystoid macular oedema
ECP	Endocyclo photocoagulation
GAGS	Glycosaminoglycans
IA	Irrigation /Aspiration
IOL	Intraocular Lens
MVR	Micro Vitreoretinal
OVD	Ophthalmic Viscosurgical Device
PCO	Posterior Capsular Opacification
PFV	Persistent Fetal Vasculature
PHPV	Persistent Hyperplastic Primary Vitreous
PMMA	Poly Methylmethacrylate
PSC	Posterior Subcapsular Cataract
VA	Visual Acuity

List of Figures

List of Figures

Introduction

Cataract is one of the major causes of childhood blindness, with a prevalence of 1.2 to 6.0 cases per 10,000 births ***(Lambert, 2005)***.

Pediatric cataracts are not just cataracts in smaller eyes. Their presentation, surgery and follow up differ markedly from adult cataracts. There may be almost a two year delay between a cataract forming in a child's eye and its actual presentation for surgery. Thus deprivational amblyopia is common and postoperative visual results are not comparable to adult cataracts. There is decreased scleral rigidity and increased vitreous up thrust, which makes surgical manipulation more difficult, as well as more chances of increased postoperative inflammation ***(Cogate & Muhit, 2009)***.

Bilateral congenital cataract is the most common cause of preventable blindness in children. A recent report indicated that infants with bilateral congenital cataract who underwent early surgery (performed within one month of age) and received appropriate optical rehabilitation could obtain visual acuity of better than 0.4 and could even achieve stereopsis ***(Lundvall & Kugelberg, 2002)***.

In unilateral cases, there is not only deprivation of formed vision by the cataract but also a suppression effect on binocular competition that can result in severe amblyopia. Although techniques for removal of cataracts in young children have improved over the past years, visual rehabilitation for children with unilateral cataracts remains challenging ***(Lambert, 2005)***.

Dense congenital cataract often causes severe visual impairment because of form deprivation during the sensitive period of visual development. The results suggest that the timing of congenital cataract surgery is the most important factor for visual prognosis, with earlier cataract extraction having a better visual outcome. The most critical period of motor fusion development is probably the first 2 to 4 months of life ***(Ye He-hua et al., 2007)***.

The treatment of congenital cataract poses well known problems such as the selection of operable age, choice of surgical technique, rehabilitation and additionally in the case of bilateral congenital cataract whether to operate on both eyes at the same sitting or in separate sessions. Simultaneous surgery for bilateral congenital cataract is a controversial subject. Some authors maintained that simultaneous surgery is preferable to deferred surgery, because it both reduces anesthesiologic risk in high risk patients and decreases the risk of deprivation amblyopia. While others are against simultaneous surgery in bilateral cataract as they maintain there is an increased risk of complications such as endophthalmitis. However, endophthalmitis rarely presents as a complication of cataract surgery ***(Magli et al., 2009)***.

Pediatric cataract surgery and aphakia correction after cataract removal presents unique management problems rarely encountered in adult patients. Because of the risk of deprivation amblyopia, cataract surgery in children cannot be delayed once a cataract has developed. With the amblyogenic factor removed, visual development of the operated eye is threatened by anisometropia. Unilateral aphakia correction with glasses produces up to 35% image difference, while the use of contact lenses reduces this to 10%. Intraocular lens implantation results in aniseikonia of 0 to 4% ***(Jung et al., 2007)***.

Children treated during their first year of life for unilateral congenital cataract had improved visual outcomes with primary IOL implantation compared with infants with contact lenses. He suggested that this is because IOLs provide full-time correction of an aphakic eye with optics that closely simulate those of a crystalline lens. Primary IOL implantation provides a stable retinal image with minimal aniseikonia and offers a permanent method of optical correction ***(Autrata et al., 2005)***.

Preoperative examination with fully dilated pupils if necessary under anesthesia is mandatory in both eyes. This should include examination under operating microscope or slit lamp biomicroscope to assess the cataract, tonometry to rule out any association of glaucoma, measurement of corneal diameter, posterior segment evaluation, keratometry and biometry. The surgeon should look for a preexisting posterior capsule defect, which may turn out to be a camouflaged catastrophe ***(Vasavada et al., 2004).***

The surgeon should strictly adhere to the principles of the closed chamber technique, such as valvular incision, injection of viscoelastic before removing any instrument from the eye, bimanual irrigation–aspiration and two-port anterior vitrectomy. A three mm wide limbal valvular incision with one to one and half mm internal entry or a scleral incision is preferred. Most surgeons prefer to suture these incisions in view of the low scleral rigidity and a child's tendency to rub the eyes. This suturing may induce astigmatism; hence it is advisable to remove the suture within four to six weeks of surgery. Bradfield and colleagues demonstrated that small-incision clear corneal cataract extraction with IOL implantation led to minimal postoperative astigmatism that remained stable over time ***(Bradfield et al., 2004).***

The anterior capsulotomy shape, size and edge integrity are now recognized as being very important for long-term centration of a capsule bag fixated IOL. Manual continuous curvilinear capsulorhexis (CCC) is a popular anterior capsulotomy technique for adult cataract surgery. The anterior capsule in children, however, is very elastic. Manual CCC is therefore difficult to perform and control in pediatric eyes. This has led researchers and surgeons to search for alternative methods to open the anterior capsule in children. Alternatives currently available include vitrectorhexis, radio-frequency diathermy and Fugo plasma blade ***(Wilson et al., 2004).***

Options for optical correction following pediatric cataract surgery are primary IOL implantation, aphakic glasses and contact lenses. Primary IOL implantation has become a preferred approach in children above two years. IOL implantation is still questioned in children less than two years as these eyes are most susceptible to intense PCO and excessive uveal inflammation ***(Dahan et al., 2000).***

Intraocular lenses (IOLs) have become the most commonly used means of optically correcting aphakia during childhood, but their implantation during infancy remains controversial because of the increased re-operation rate and large myopic shift that has been reported after their use during infancy ***(Lambert et al., 2004).***

The three piece acrylic IOLs may be preferred in order to decrease the rate of Nd:YAG capsulotomy after IOL implantation. one piece IOLs were developed more recently and are not as well studied as the three piece IOLs. Further study of the one piece IOLs, with longer follow up, may help identify the lens of choice. This study shows a higher incidence of Nd:YAG capsulotomy in patients who receive the one piece acrylic AcrySof lens compared to patients who receive the three piece acrylic AcrySof lens ***(Mian et al., 2005).***

Suturing of a broken CCC can restore at least some of the strength/elasticity of the CCC. This can be important before intraocular lens (IOL) implantation for the safety of the implantation or after the implantation to ensure proper fixation of the IOL ***(Kleinmann et al., 2006).***

Posterior capsular opacification (PCO) is by far the most common complication of cataract surgery in children. Various surgical techniques to reduce the incidence of PCO that have been described in the literature include primary posterior capsulotomy, posterior capsulorhexis with anterior vitrectomy despite the use of these techniques, PCO does occur, necessitating Nd:YAG laser capsulotomy ***(Mitra et al., 2003).***

Posterior capsulotomy using the 25-gauge TSV system appears to be a safe and effective approach in the management of PCO in pseudophakic children. Advantages include easier manipulation with the smaller instruments in these small eyes, and it can be considered in appropriate cases ***(Lam et al., 2005).***

Aim of the Essay

To review the recent advances in management of pediatric cataract including the recent surgical techniques, types of IOL dealing with complication and post operative rehabilitation.

Anatomy of the Lens

The lens is part of the anterior segment of the eye. Anterior to the lens is the iris, which regulates the amount of light entering into the eye. The lens is suspended in place by the zonular fibers, which attach to the lens near its equatorial line and connect the lens to the ciliary body. Posterior to the lens is the vitreous body, which, along with the aqueous humor on the anterior surface, bathes the lens. The lens has an ellipsoid, biconvex shape. The anterior surface is less curved than the posterior. In the adult, the lens is typically circa 10 mm in diameter and has an axial length of about 4 mm, though it is important to note that the size and shape can change due to accommodation and because the lens continues to grow throughout a person's lifetime, as seen in figure 1, ***(Jaffe et al., 1997)***.

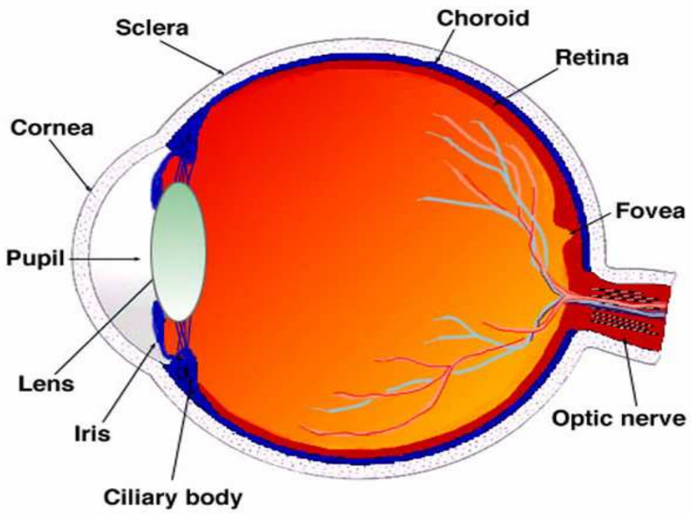

Fig.1: Longitudinal sagittal section of the human eye ***(Forrester et al., 1996)***.

Structure of the lens:

The lens has three main parts: the lens capsule, the lens epithelium, and the lens fibers. The lens capsule forms the outermost layer of the lens and the lens fibers form the bulk of the interior of the lens. The cells of the lens epithelium, located between the lens capsule and the outermost layer of lens fibers, are found only on the anterior side of the lens ***(Forrester et al., 1996)***.

Lens capsule:

The lens capsule is a smooth, transparent basement membrane that completely surrounds the lens. The capsule is elastic and is composed of collagen. It is synthesized by the