Pars Plana Capsulectomy and Vitrectomy for Posterior Capsular Opacification in Pseudophakic Children

Lixin Xie, MD; Yusen Huang, MD, PhD

Abstract

Purpose: To evaluate the safety and efficacy of pars plana capsulectomy and vitrectomy for posterior capsular opacification (PCO) in pseudophakic children.

Methods: Pars plana capsulectomy and vitrectomy was performed for PCO in 63 pseudophakic eyes of 57 children with an infusion through sutureless clear cornea. The patients' ages ranged from 3 to 12 years (mean: 5.8 ± 1.9 years). Surgical technique, intraoperative and postoperative complications, visual acuity, intraocular pressure (IOP), and corneal endothelial cell density were recorded.

Results: The surgical procedure was performed uneventfully in all patients. The mean follow-up was 2.4 ± 1.4 years (range: 6 months to 5.2 years). During the follow-up period, no incision leakage or other complications were noted and no eye developed recurrent PCO. All eyes had an improvement of visual acuity. Mean postoperative IOP was 13.8 ± 2.6 mm Hg (range: 8 to 19 mm Hg). Mean overall endothelial cell loss was 3.4%.

Conclusions: Pars plana capsulectomy and vitrectomy with an infusion through sutureless clear cornea appears to be a safe and effective approach for thick PCO in pseudophakic children.

[J Pediatr Ophthalmol Strabismus 2008;45:362-365.]

Introduction

Intraocular lens (IOL) implantation has become an increasingly popular method of correcting aphakia in children. A major problem in pediatric IOL implantation is the high incidence of posterior capsular opacification (PCO). Various surgical techniques to reduce the incidence of PCO include primary posterior capsulotomy,[1] posterior capsulorhexis with anterior vitrectomy,[2] and posterior capsulorhexis with optic capture.[3] Despite the use of these techniques, PCO remains a major complication of cataract extraction and IOL implantation in young children.[4]

Early visual rehabilitation by creating an adequate and clear visual axis is an important step in the management of pediatric cataracts. Nd:YAG laser may be used to create a posterior capsulotomy when PCO occurs in children, but there are some disadvantages to this procedure. For young patients

From the State Key Lab Cultivation Base, Shandong Provincial Key Lab of Ophthalmology, Shandong Eye Institute, Qingdao, People's Republic of China.

Originally submitted November 8, 2006.

Accepted for publication February 27, 2007.

Supported in part by the National Natural Science Foundation of China (30600698), Ministry of Education of China (20051065003), and Qingdao Municipal Science and Technology Bureau (02KGYSH-01).

The authors thank Ms. Ping Lin for her help in editing the manuscript.

Address correspondence to Lixin Xie, MD, Shandong Eye Institute, 5 Yanerdao Road, Qingdao 266071, People's Republic of China.

who cannot cooperate with treatment by Nd:YAG laser capsulotomy under topical anesthesia, a second general anesthesia is required. The dense membrane is often difficult to disperse using the laser and the Nd:YAG capsulotomy does not provide a long-lasting clear visual axis because the anterior hyaloid face acts as a scaffold for the growth of lens epithelial cells.[5] Medicare studies may underestimate the relative risks because the incidence of retinal detachment after Nd:YAG laser posterior capsulotomy may be higher in younger patients.[6] Other potential complications of Nd:YAG laser posterior capsulotomy include cystoid macular edema, intraocular pressure elevation, and damage to or dislocation of the IOL.[7-9] Therefore, surgical removal of the opacification has been recommended to provide better visual rehabilitation after cataract surgery.[10-12]

We report successful removal of PCO after congenital or traumatic cataract surgery in 63 eyes via pars plana capsulectomy and vitrectomy with an infusion through sutureless clear cornea. It is easy for anterior segment surgeons to perform this surgical procedure.

TABLE

Best-Corrected Visual Acuity Before and After Pars Plana Capsulectomy and Vitrectomy[a]

BCVA	Preoperative	Postoperative
⩽ 20/400	23 (38.3%)	2 (3.3%)
20/400–20/250	8 (13.3%)	4 (6.7%)
20/200–20/80	26 (43.3%)	22 (36.7%)
20/63–20/40	3 (5%)	15 (25%)
⩾ 20/40	0 (0%)	17 (28.3%)

BCVA = best-corrected visual acuity.
[a]Fifty-four patients (60 eyes) were able to cooperate with acuity testing.

Patients and Methods

Medical records of pseudophakic pediatric eyes with PCO undergoing pars plana capsulectomy and vitrectomy with an infusion through sutureless clear cornea between May 1999 and May 2005 at our institution were reviewed. Fifty-seven patients (63 eyes) were included in this study. There were 40 boys and 17 girls, with a mean age at surgery of 5.8 ± 1.9 years (range: 3 to 12 years).

All eyes had undergone cataract extractions by aspiration with an irrigation/aspiration handpiece or phacoemulsification, and primary IOLs were implanted. Twenty-six patients (32 eyes) received the treatment for congenital cataracts and 31 patients (31 eyes) for traumatic cataracts. Seven eyes (11.1%) had posterior continuous curvilinear capsulorhexis and primary anterior vitrectomy. In the other 56 eyes (88.9%) with intact posterior capsules, 48 had cataract extraction at other hospitals before referral to our institution. Secondary membrane occurred in 3 eyes with the intact posterior capsule after Nd:YAG laser capsulotomy. PCO in all eyes involved the visual axis, resulting in a decrease in visual acuity.

Visual acuity before pars plana capsulectomy and vitrectomy ranged from hand motions at 10 cm to 20/80 (Table). Three patients (3 eyes) were not cooperative enough to perform visual acuity testing by Snellen chart. Endothelial cell density was measured by noncontact specular microscopy (SP-2000P; Topcon, Tokyo, Japan), and posterior segment pathologic status was detected by B-scan ultrasonic examination. The mean interval between IOL implantation and pars plana capsulectomy and vitrectomy was 18 months (range: 1 to 80 months).

Surgical Technique

Preoperatively, the pupil was dilated with 0.5% tropicamide and 0.5% phenylephrine hydrochloride (Mydrin-P; Santen, Osaka, Japan). General anesthesia or peribulbar anesthesia was used according to children's level of cooperation. All surgery was performed by one surgeon (LX).

The procedure started with a 3-mm conjunctival incision in the superotemporal quadrant at the 11-o'clock position approximately 4 mm posterior to the limbus, which was followed by electrocautery for stanching. Then a 1-mm clear cornea incision was made in the superonasal quadrant at the 2-o'clock position using a 1-mm diamond knife (Meyco, Biel-Bienne, Switzerland), and an infusion cannula (MVS1031; Bausch & Lomb, Rochester, NY) was inserted into the incision. Subsequently, a point was marked at 3.5 mm from the limbus at the superonasal quadrant in the left eye or temporal quadrant in the right. A microvitreoretinectomy (MVR) blade was used to make a sclerotomy through the pars plana area at the marked point. An opening was created in the posterior capsule using the MVR blade.

A vitrectomy cutter (Accurus 400VS; Alcon Laboratories, Fort Worth, TX) was introduced through the sclera before capsulectomy and vitrec-

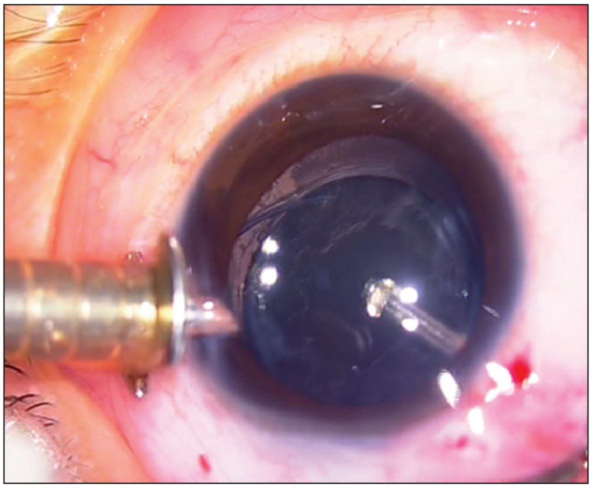

Figure 1. Pars plana capsulectomy and vitrectomy for posterior capsular opacification with an infusion through corneal incision.

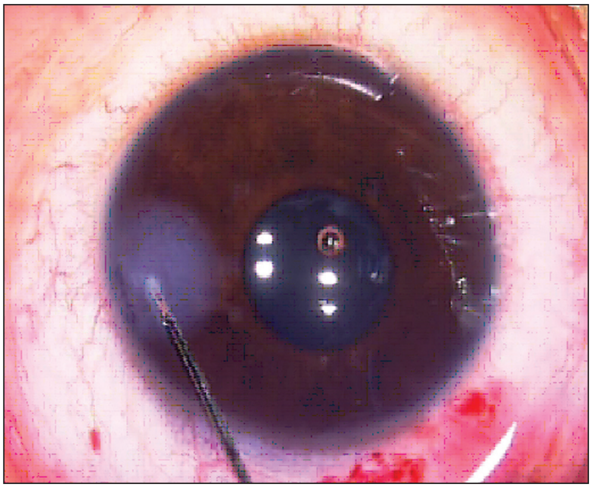

Figure 2. Stromal hydration is accomplished by irrigating balanced salt solution into stroma with a 27-gauge cannula.

tomy was performed. The vacuum aspiration was set at 200 mm Hg, the cutting rate at 750 cuts per minute, and the bottle height at 60 cm (Fig. 1). After complete removal of the opaque posterior capsule and anterior vitreous, the vitreous cutter and the infusion cannula were removed from the eye. The sclera was sutured, and the conjunctival incision was closed by electrocautery. The wound was tested for watertightness and hydrated when necessary.

Stromal hydration was accomplished by placing the tip of a 27-gauge cannula in the side walls of the corneal incision and gently irrigating balanced salt solution into the stroma (Fig. 2). The ocular fundus was examined with an indirect ophthalmoscope at the end of the procedure to detect any iatrogenic retinal breaks, after which the pupil underwent miosis with 1% acetylcholine chloride. Tobramycin and dexamethasone were injected into the subconjunctival space.

Postoperative Management

Topical 0.1% tobramycin and prednisolone were used 4 times a day for 2 weeks after the surgical treatment. Visual acuity, IOP, and integrity of the wound were assessed at 1 and 3 days, 1 week, 1, 3, and 6 months, and 1 year after surgery and as necessary thereafter. Endothelial cell density was reexamined at 3 months. Amblyopia treatment was instituted when appropriate.

Results

The mean follow-up was 2.4 ± 1.4 years (range: 6 months to 5.2 years). All postoperative courses were uneventful, and all IOLs were stable. There was no occurrence of corneal edema after surgery. No significant leakage from the cornea incision was detected by Seidel test, and no PCO recurred in any eyes.

Visual acuity improved in all eyes (Table). Intraocular pressure was 5 mm Hg or less in 3 eyes (4.7%) on the first postoperative day but became normal after 1 to 2 days with no additional intervention. Mean IOP at 1 month was 13.8 ± 2.6 mm Hg (range: 8 to 19 mm Hg). Mean endothelial cell density decreased from 2,826.8 ± 623.8 cells/mm^2 (range: 1,379 to 3,900 cells/mm^2) before surgery to 2,732.6 ± 617.3 cells/mm^2 (range: 1,298 to 3,782 cells/mm^2) at 3 months after surgery, with a mean percentage of endothelial cell loss at 3.4% ± 2.0%.

Discussion

PCO is a common problem after cataract extraction and IOL implantation in children. Although a primary posterior capsulectomy and anterior vitrectomy is standard care for young children to avoid multiple surgeries for PCO, concerns exist about the consequences of removing the anterior vitreous gel in a developing eye.[13] Although a primary posterior capsulectomy and anterior vitrectomy was performed, PCO may not be avoided thoroughly.[14,15]

Management of PCO in infants and young children is more complex than in adults. Nd:YAG laser capsulotomy is not always effective, especially for children with thick PCO. Repeated Nd:YAG laser capsulotomy has failed to clear the visual axis. Brady et al.[16] reported 41% recurrence of secondary membrane in 27 eyes. Many eyes ultimately required pars plana membranectomy. Moreover, laser capsulotomy in these cases required high energy due to the thickness of the PCO, which resulted in various complications.[7-9] Because delayed visual rehabilitation after surgery may lead to deep amblyopia,[17] early visual rehabilitation by creating an adequate and clear visual axis is an important step in the management of pediatric cataracts.

Capsulectomy and vitrectomy may be a good choice for cases with thick PCO and corneal opacity, which are difficult to treat by Nd:YAG laser capsulotomy. Surgical removal of the thickened membrane can be achieved via an anterior approach through the limbus, but a risk of IOL destabilization arises. Some surgeons recommend adopting 25-gauge transconjunctival sutureless vitrectomy through a two-port pars plana.[10,11] Advantages include easy manipulation with smaller instruments in the management of PCO in pseudophakic children. The procedure is in line with the concept of minimally invasive surgery in pediatric patients. However, this system has limitations.[11] If the posterior capsule opaque membrane is too dense, the system might be inadequate to remove the opacity completely. Because of the smaller vitrectomy port and less aspiration flow compared with the conventional 20-gauge vitrectomy system, the removal of dense and hard membrane is not easy. Therefore, case selection is important when using this system.

We have described capsulectomy and vitrectomy with the conventional 20-gauge vitrectomy system via an infusion through sutureless clear cornea for PCO in pseudophakic children. It has some advantages over 25-gauge transconjunctival sutureless vitrectomy in removing PCO and vitreous opacity. This procedure is easy to perform because there is only one port in the pars plana, which also decreases the risk of ciliary detachment and retinal dialysis. It is convenient to remove the infusion cannula from the cornea incision. Most important is that the thickened membrane can be removed quickly and completely for a larger vitrectomy port and more aspiration flow compared with 25-gauge transconjunctival sutureless vitrectomy. The infusion through cornea helps regulate the depth of the anterior chamber, which benefits capsulectomy and vitrectomy. There is no need to suture the corneal wound and hydration is enough when necessary, which correspondingly makes surgical time (< 15 minutes) no more than that of the 25-gauge transconjunctival sutureless vitrectomy. There is also less discomfort from suture irritation.

Pars plana capsulectomy and vitrectomy with an infusion through sutureless clear cornea using the conventional 20-gauge vitrectomy system appears to be a good choice for anterior segment surgeons in the treatment of thick PCO in pseudophakic children for its safety and efficacy.

REFERENCES

1. Lischetti P. New technique for posterior capsulotomy. *Eur J Implant Refract Surg.* 1990;2:77-79.
2. Ahmadieh H, Javadi MA. Intraocular lens implantation in children. *Curr Opin Ophthalmol.* 2001;12:30-34.
3. Gimbel HV, Neuhann T. Development, advantages and methods of the continuous circular capsulorhexis technique. *J Cataract Refract Surg.* 1990;16:31-37.
4. Emery J. Capsular opacification after cataract surgery. *Curr Opin Ophthalmol.* 1999;10:73-80.
5. Basti S, Ravishankar U, Gupta S. Results of a prospective evaluation of three methods of management of pediatric cataracts. *Ophthalmology.* 1996;103:713-720.
6. Rickman-Barger L, Florine CW, Larson RS, Lindstrom RL. Retinal detachment after Neodymium:YAG laser posterior capsulotomy. *Am J Ophthalmol.* 1989;107:531-536.
7. Apple DJ, Solomon KD, Tetz MR, et al. Posterior capsule opacification. *Surv Ophthalmol.* 1992;37:73-116.
8. Mamalis N, Craig MT, Price FW. Spectrum of Nd:YAG laser-induced intraocular lens damage in explanted lenses. *J Cataract Refract Surg.* 1990;16:495-500.
9. Tuft SJ, Talks SJ. Delayed dislocation of foldable plate-haptic silicone lenses after Nd:YAG laser anterior capsulotomy. *Am J Ophthalmol.* 1998;126:586-588.
10. Lam DS, Fan DS, Mohamed S, Yu CB, Zhang SB, Chen WQ. 25-gauge transconjunctival sutureless vitrectomy system in the surgical management of children with posterior capsular opacification. *Clin Experiment Ophthalmol.* 2005;33:495-498.
11. Lee HK, Kim CY, Kwon OW, et al. Removal of dense posterior capsule opacification after congenital cataract extraction using the transconjunctival sutureless vitrectomy system. *J Cataract Refract Surg.* 2004;30:1626-1628.
12. Mitra S, Ganesh A. Pars plana capsulectomy and vitrectomy for posterior capsular opacification in children. *Ophthalmic Surg Lasers Imaging.* 2003;34:327-331.
13. Ram J, Brar GS, Kaushik S, Gupta A, Gupta A. Role of posterior capsulotomy with vitrectomy and intraocular lens design and material in reducing posterior capsule opacification after pediatric cataract surgery. *J Cataract Refract Surg.* 2003;29:1579-1584.
14. Yao Z, Xie L, Huang Y, Wang Z. Preliminary results of foldable intraocular lens implantation in children with cataract [article in Chinese]. *Zhonghua Yan Ke Za Zhi.* 2002;38:488-490.
15. Kugelberg M, Zetterström C. Pediatric cataract surgery with or without anterior vitrectomy. *J Cataract Refract Surg.* 2002;28:1770-1773.
16. Brady KM, Atkinson CS, Kilty LA, Hiles DA. Cataract surgery and intraocular lens implantation in children. *Am J Ophthalmol.* 1995;120:1-9.
17. Koller HP. IOL implantation in children. *EyeNet.* 2000;8:9-11.