

Management of congenital cataract with different technique: phacoemulsification I/A and 23-gauge system

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Abstract

• **AIM:** To evaluate the efficacy and safety of two different surgical techniques on congenital cataract on children.

• **METHODS:** Twenty-two children (1-3 years old) with congenital cataract were randomly divided into two groups (group A and group B). With group A (10 patients, 20 eyes), we applied 23-gauge (23G) trans corneal limbus vitrectomy system to complete lens cortex getting, posterior capsulotomy and anterior vitrectomy; With group B (12 patients, 24 eyes), we used the phacoemulsification I/A to complete lens cortex getting, and performed anterior vitrectomy with anterior vitreous cutting instrument. After that, the differences in intraoperative and postoperative complications between two groups were compared.

• **RESULTS:** In group A, the width of corneal limbal incision was 0.6mm, the incision was self-sealing, and the anterior chamber was stable and iris did not prolapse during the surgery. In group B, the width of corneal limbal incision was 3mm, anterior chamber was unstable and intraoperative iris prolapse occurred in 14 eyes (58%). And the incision need to be stitched up after surgery. In the postoperative follow-up of 6-24 months (an average of 14 months), we found that corneal neovascularization did not occur in group A, while in group B, corneal neovascularization occurred in four eyes (17%); Other complications, such as posterior capsular opacification, retinal detachment, glaucoma, hypotony or endophthalmitis did not occur in either group.

• **CONCLUSION:** The 23G trans corneal limbus vitrectomy system used in pediatric cataract surgery is safer and more effective than phacoemulsification I/A. It is promising in treatment of congenital cataract on children.

• **KEYWORDS:** congenital cataract; 23-gauge vitrectomy; cataract surgery

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INTRODUCTION

Congenital cataract, usually develops in the first year after birth, is partial or total lens opacities in children. It is a main cause of children amblyopia and amblyopia. At present, the domestic prevalence rate is 0.05%. Cataract not only affects vision, but also undermines the development of attention reflection, stereo vision and color vision function^[1,2]. Thus, children with congenital cataracts should have surgery as early as possible to restore vision. In our hospital from April 2007 to October 2009, we applied the conventional phacoemulsification I/A and 23-gauge (23G) self-sealing sutureless trans corneal limbus vitrectomy system to perform operation of congenital cataract on 22 children patients 44 eyes, with the consent of children's parents. This study compared the result of two different techniques, and investigated the efficacy of 23G self-sealing sutureless trans corneal limbus vitrectomy system in the management of congenital cataracts in children.

MATERIALS AND METHODS

Patients This study was approved by the Ethics Committee of Medical School of Xiamen University and carried out in compliance with the tenets of the World Medical Association's declaration of Helsinki. In this prospective and comparative study from April 2007 to October 2009 in Xiamen Eye Center, 22 children (12 males and 10 females), whose ages ranged from 1-3 (an average of 1 year and 9 months old), were divided into two groups. Group A of 10 patients 20 eyes was treated with 23G self-sealing sutureless trans limbus vitrectomy system, with the limbus incision perfusion. The lens was aspirated, the central of posterior capsular was cut, and partial core anterior vitrectomy was performed. Group B of 12 patients 24 eyes, after the phacoemulsification I/A lens cortex getting, the central of posterior capsular and core anterior vitreous were performed by anterior vitreous cutting instrument. All patients were all-body examined medically prior to the surgery, with B ultrasonic examination to exclude vitreous and retinal diseases, traumatic cataract, uveitis, and other surgical contraindication.

Methods Group A: 23G self-sealing sutureless trans corneal limbus vitrectomy system (Accurus, Alcon Laboratories), 23G high-speed probe, with cutting frequency of 2500 cuts per minute; Group B: Phacoemulsification and the anterior vitreous cutting instrument (manufactured by Alcon Inc, United States) with cutting frequency of 450 cuts per minute.

Viscoelastic of Healon, and the surgical suture (10/0 silk), made by Alcon Inc, were used in both groups. All operations were carried out by the same trained surgeon, all patients were prepared for standard cataract surgery preoperatively with the addition of general anesthesia. Surgical steps were as follows.

Group A: Before operation all eyes were sterilized with povidone-iodine (Betadine), the lashes were isolated and the lid speculum was inserted. At 11 o'clock an about 0.6mm self-sealing limbus incision was made by 0.6mm clearport paracentesis knife (Sharp Point Surgical Specialties Corp.), and at 2 o'clock, infusion cannula (about 1mm) was introduced (the infusion was not opened), then viscoelastic Healon was injected into anterior chamber. In a low perfusion state, the anterior capsule was circle-cutted with 23G high-speed probe. And then in the suction state (the cut rate was 800 cuts per minute and maximum suction pressure was 350mmHg), lens cortex gettering was performed and the viscoelastic Healon was re-injected. In a low perfusion state, about 4-5mm of the central of posterior capsular, and anterior vitreous which was in the central of visual axis were cutted off, with a cut rate of 2000 cuts per minute and maximum suction pressure of 150mmHg. Then the BSS was injected to seal the limbus incision.

Group B: at 11 o'clock a 3mm limbus tunnel incision was cut. After viscoelastic Healon was injected into anterior chamber, continuous curvilinear capsulorhexis in anterior capsule was completed with a diameter of about 5mm. After cortex was hydrated, the cortex gettering using phacoemulsification I/A was performed, and the viscoelastic Healon was re-injected, then continuous curvilinear capsulorhexis was performed on central of posterior capsule with needle, and anterior vitreous which was in the central of visual axis was cut off with anterior vitreous cutting instrument, finally the incision was sutured with 10/0 silk. Both Groups were applied the same post-surgery treatment, 5g/L tobramycin eye drops, compound neomycin eye drops, and tropicamide mydriasis treatment. With group B stitches were removed one month after surgery. And both groups were left a phakic state and they began to receive amblyopia training one month after surgery.

To compare the difference between two groups of intraoperative limbus incision self-sealing, the rate of iris prolapse, postoperative corneal trauma, corneal neovascularization, iris pigment removal and other related complications, we used the SPSS 10.0 software to do the statistical analysis. The *t*-test was performed between the measurement of 2 groups data, and χ^2 test was performed to compare the count data. $P < 0.05$ was regarded as statistically significant.

RESULTS

Intraoperative Complications We found that in group A, because the limbal incision width was only about 0.6mm and self sealing, during the surgery. The irrigation was initiated through the anterior chamber maintainer to sustain intraocular pressure well, and no significant iris prolapse occurred. In group B, the limbal incision width was about 3mm, and it was less self sealing. During the surgery, the anterior chamber

Table 1 Postoperative complications in children cataract surgery

Complications	Eye (%)	
	Group A	Group B
Iris pigment off	0(0.0 ^a)	14(58.3)
Iris adhesions	0(0.0 ^a)	2(8.3)
Corneal incision neovascularization	0(0.0 ^a)	4(16.6)
Posterior capsular opacification	2(10.0 ^a)	2(8.3)

^a $P < 0.05$ vs Group B.

was shallow, and intraocular pressure was instable because of wound weak, iris partly prolapse occurred in 14 eyes (58%). During the surgery, the corneal collapse usually suggested low intraocular pressure, and in group A, low IOP occurred in 3 eyes (15%), and in group B, 20 eyes (83%); there was statistically significant difference between two groups ($P < 0.05$).

Postoperative Complications We continuously observed postoperative complications for 6-24 months (an average of 14 months), then compared the rates of iris pigment removal and iris adherence, and the probability of postoperative corneal neovascularization of two groups (Table 1). Other complications such as after-cataract, retinal detachment, glaucoma, hypotony, entophthalmia etc. didn't occur in either of the groups.

DISCUSSION

The 0-3 year old period is very important for children's visual development. If congenital cataract develops, we should do surgery as soon as possible, so that the children could receive adequate visual stimulation to promote visual development. As technology advances, the congenital cataract surgical techniques have developed from traditional capsule discission, needle aspiration, intracapsular cataract extraction, to the modern extracapsular cataract extraction and intraocular lens implantation, and ultrasound phacoemulsification with the anterior vitreous cutting^[1]. The suitable age for intraocular lens implantation should be 2-3 years old. For children younger than 2 years old, their eyes haven't yet developed mature and refractive state may change significantly. Therefore, most specialists suggest it is improper to do the primary intraocular lens implantation during cataract surgery. It is believed that the suitable age was 2-3 years old, when eye development is almost complete. In the two groups we discussed above, in the postoperative observation, with amblyopia training, these children's visual acuity had been improved significantly. Because lens epithelial cells are much more active in infants and young children, after the cataract surgery, lens cells may proliferate, migrate, cause metaplasia, and produce collagen fibers. And it can easily lead to posterior capsule opacification^[2,3]. To avoid posterior capsule opacification occurring, we should cut the central of posterior capsule and anterior vitreous with cataracts extraction simultaneously, or cut the central of posterior capsule with Nd:YAG laser after cataracts extraction surgery. Anterior vitreous vitrectomy could effectively reduce the probability of occurrence of after-cataract in children under 5 years old. In China, a research conducted by Luo *et al*^[3] showed that, in pure lens cortex gettering, the probability of posterior capsular

opacification is 76.9%. On the other hand, posterior capsule cutting together with anterior vitreous vitrectomy can significantly reduce the probability (down to 11.8%). Therefore, in the surgery for children with congenital cataract, we need to combine posterior capsule cutting and anterior vitreous vitrectomy to reduce the possibility of the occurrence of after-cataract. In the 22 cases we discussed, the cataract extraction surgery all combined with posterior capsule cutting and anterior vitreous vitrectomy. In the postoperative observation (6-24 months), the ratio of posterior capsule opacification occurrence was 9.1%, approximate to other study's reports.

There are two main choices of incision in cataract extraction surgery for children; scleral incision and corneal limbus incision. Yun^[4] said that glaucoma might occur after cataract surgery, making scleral incision need cut conjunctiva, and it would increase the proliferation of conjunctival fibroblasts and inflammatory cells, and lead to the failure of trabeculectomy. Therefore, many surgeons choose scleral tunnel incision, and seal the incision after surgery. In China, most surgeons use phacoemulsification I/A to remove the cortical and soft nucleus^[5], but I/A probe usually need the width of corneal incision to be 3mm. Because the elasticity of anterior capsule is big, radial capsule dehiscence usually occurs during the continuous curvilinear capsulorhexis, which causes huge inconvenience to the surgery. For children, their eyes are still in the developmental stages, scleral rigidity is low, eyeballs are relatively small, and pressure of vitreous cavity is high^[6]. When I/A getters the cortex, the exit is relatively large, and the perfusion of anterior chamber is relatively insufficient. These two causes usually induce shallow anterior chamber during surgery. On the other hand, because the incision located upside, the upper cortex is difficult to getter by I/A. Because of the wide and less self-sealing incision, the fluid outflows during surgery could cause the iris to prolapse, and to become flabby, and de-pigmentation. For the anterior vitrectomy machine, because of the low cutting frequency and high pressure of aspiration, the traction on the vitreous is increased, and it could lead to complications such as tears in peripheral retina, suprachoroidal hemorrhage and so on. After surgery, incision requires stitches to maintain the anterior chamber depth and intraocular pressure, the suture stimulation and the removal of sutures under general anesthesia bring side effect to incision recovery and risk and inconvenience to children^[7]. In Bar-Sela's^[8] research on congenital cataract surgery of 58 cases, using 10/0 polyester suture to seal incision, there were 10 cases (17%) developed corneal neovascularization. In contrast, the diameter of the probe of 23G vitrectomy system is only 0.55mm, and the diameter of perfusion cannula is 0.9mm, and the main incision and the side incision are both not larger than 1mm. With high-frequency cut, central anterior and posterior capsular cutting and cortex suction can be performed successfully and conveniently, because of small and self-sealing incision, good perfusion in the anterior chamber, it is much easier to getter the upper cortexes. The high-speed is

2500 cuts per minute, so it is much safer and more effective to cut the central of capsular and anterior vitreous. As the incision is well self-sealing, the liquid is difficult to run iris out of incision during surgery, and incision does not need to be stitched up when operation is completed. In our study, in the 10 cases with 23G vitrectomy system, there were no obvious iris prolapse occurred during the surgery, and the low intraocular pressure was only 15%; yet with conventional I/A system, the iris prolapse occurrence rate was 58%, low intraocular pressure was 83%, both were significantly higher than those with 23G vitrectomy system.

There are very few reports about the micro-incision technique applied to congenital cataract surgery in children as far as I know. Chalam *et al*^[9] had applied self-sealing sutureless 25-gauge pars plana vitrectomy for the management of vitreous loss during phacoemulsification. They considered this new technique superior with following advantages; the infusion in the anterior chamber allows the fluid to push the vitreous posteriorly through the capsular defect. The procedure is performed in a closed chamber, avoiding IOP fluctuations, thereby reducing the chances of suprachoroidal hemorrhage, and the high-speed cutter exerts minimal vitreous traction. On the other hand, Er^[10] did not agree with Chalam's opinions that the 25-gauge vitrectomy system would eliminate or minimize the chance of suprachoroidal hemorrhage, because he considered that the 25-gauge vitrectomy from pars plana for anterior vitreous cutting might increase the chance of post-operative hypotony and hypotony-related complications. At the same time, he doubted that pars plana technique does not provide enough distance for cleaning the vitreous in the anterior chamber and corneal wound.

Chee *et al*^[11] applied 25-gauge vitrectomy system from limbal side ports for the treatment of 14 patients younger than 1 year-old with congenital cataracts. The success rate of the surgery is 95%. Only in one case high intraocular pressure occurred. He found that the limbal wound made by the 0.6mm clearport paracentesis knife could remain watertight better than by which the trocar in 25G pack. In our study, we all made wound by 0.6mm knife, we found the wound was well self-sealing. Xie *et al*^[12] applied sutureless 25-gauge pars plana vitrectomy to cut anterior vitreous in 30 cases of cataract in children, and found that after surgery, all pupils were round and centered, and no iris adhesion and after-cataract occurred. Inflammatory reaction after surgery was mild. In this paper we found that, compared to traditional I/A surgical technique, continuous use of 23-gauge vitrectomy system to cut the central of capsule, to get the cortex, and cut the anterior vitreous just need small incision and maintain the stability of the anterior chamber well, and the limbal incision does not need sutures after surgery. It is a much safer, faster, and more convenient method for cataract surgery on children. In our study, there was no postoperative hypotony, endophthalmitis, or tearing in peripheral retina occurred during the follow-up. This favorable result might result from a relatively small number of samples and the corneal limbus incisions we chose. The long-term effects need further follow-up observation.

In summary, the 23-gauge self-sealing sutureless trans corneal limbus vitrectomy treatment of congenital cataracts on children has many advantages; smaller incision, more stable anterior chamber structure, lower rates of iris prolapse and lower incidence of postoperative corneal neovascularization. And the sutureless incision also saves the removal of stitches (it is a big trouble on children). It is a promising, safe, convenient and relatively effective technique that offers quick rehabilitation and fewer complications.

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两种不同术式治疗儿童先天性白内障的疗效观察

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摘要

目的:评价两种不同术式治疗儿童先天性白内障的疗效。

方法:将1~3岁儿童先天性白内障22例44眼,随机分为A、B两组。A组10例20眼应用23G玻璃体切割机(简称玻切)完成晶体皮质吸除及前节玻切,B组12例24眼应用常规超声乳化I/A头吸除晶体皮质后,应用前节玻切机切除前部玻璃体。所有手术均由同一医生进行。比较不同术式的术中切口闭合情况,虹膜脱出率,术后角膜新生血管及其他相关并发症的差异。

结果:A组角膜缘透明切口宽0.6mm,手术及关闭切口时均能维持前房眼压稳定,B组角膜缘透明切口宽3mm,术中切口欠密闭,前房维持不佳,术后需缝合切口;A组术中未发生虹膜脱出现象,B组术中发生虹膜脱出14眼(58%);A组术中3眼(15%)出现低眼压,B组术中20眼(83%)出现低眼压。术后随访6~24(平均11)mo,A组术后角膜透明,未发生新生血管,B组术后4眼出现缝线处角膜新生血管,占17%;A组后发障发生率为10%(2眼),B组后发障发生率为8%(2眼);随访中其他并发症如:视网膜脱离、青光眼、低眼压、眼内炎等两组均未发生。

结论:应用23G玻璃体切割机直接行儿童白内障晶体皮质吸除及前节玻切手术,术中能够维持前房稳定,降低术中虹膜脱出及术后缝线处角膜新生血管发生率,更安全,更有效,是一种值得推广的I期治疗儿童白内障手术方式。

关键词:先天性白内障;23G玻璃体切除术;白内障手术