

Clinical effect of improved viscocanalostomy for the treatment of primary congenital glaucoma

Yong Yu, Zhi-Li Liu, Lei Cao, Qing-Zhu Nie

Foundation item: Scientific and Technological Research Projects in Liaoning Province, China (No. 2009225021)
Department of Ophthalmology, Shengjing Hospital, China Medical University, Shenyang 110004, Liaoning Province, China

Correspondence to: Qing-Zhu Nie. Department of Ophthalmology, Shengjing Hospital, China Medical University, Shenyang 110004, Liaoning Province, China. nieqz_pro@163.com

Received: 2012-02-19 Accepted: 2012-06-20

Abstract

- **AIM:** To evaluate the clinical effect of improved viscocanalostomy in patients with primary congenital glaucoma.
- **METHODS:** Retrospective analysis of improved viscocanalostomy was performed on 51 eyes of 42 patients with primary congenital glaucoma. The outcome evaluation included postoperative intraocular pressure (IOP), corneal diameter, cup/disc ratio and complications. All patients were followed up at week 1, month 1, 3, 6 and 12.
- **RESULTS:** The results revealed that postoperative IOP was decreased from (38.57 ± 13.61) mmHg to (10.53 ± 3.91) mmHg, (14.89 ± 5.26) mmHg, (15.42 ± 5.11) mmHg, (13.82 ± 3.46) mmHg, (13.16 ± 5.29) mmHg at follow-up time of 1 week, 1, 3, 6, 12 months ($P < 0.001$). The postoperative corneal diameter was decreased significantly ($P = 0.002$); The mean cup/dish ratio wasn't significantly different ($P = 0.148$) before and after the surgery, the cup/dish ratio of successful surgery was evidently decreased (preoperative 0.7 ± 0.2 , postoperative 0.6 ± 0.3 , $P = 0.007$), but the complications like unformed anterior chamber were not observed. The mean follow-up period was 12 months.
- **CONCLUSION:** Improved viscocanalostomy improves the clinical effects of the patients with primary congenital glaucoma, such as higher success rates, lower postoperative mean IOP and fewer complications.
- **KEYWORDS:** primary congenital glaucoma; improved viscocanalostomy; intraocular pressure

DOI:10.3980/j.issn.2222-3959.2012.04.11

Yu Y, Liu ZL, Cao L, Nie QZ. Clinical effect of improved viscocanalostomy for the treatment of primary congenital glaucoma. *Int J Ophthalmol* 2012;5(4):466-468

INTRODUCTION

Primary congenital glaucoma is one of the major blinding diseases of children. Developmental anomalies of the anterior chamber angle and trabecular meshwork lead to a defective and decreased outflow of aqueous, resulting in markedly raised intraocular pressure (IOP) and associated symptoms and signs. Although relatively responsive to medical treatment in the short term, this type of glaucoma has long been proved to be a surgical disease. Primary surgeries include goniotomy, trabeculotomy, trabeculectomy and combined trabeculotomy-trabeculectomy^[1]. The success rate of these techniques has been reported to range between 80% and 85%. However, their effectiveness seems to be short lived in patients, in whom the disease has a tendency to require the second surgery due to poorly controlled postoperative IOP, moreover, hyphema rates was high. Improved viscocanalostomy is a kind of non-penetrating trabecular surgery(NPTS)^[2], which is associated with a good success rate and with less complications than other surgeries. It is not affected by the degree of corneal transparency, and its mechanism of action requires a normal canal of Schlemm, but is not sensitive to the arrangement of the other angle structures.

Since 2008, our department has adopted improved viscocanalostomy for the treatment of primary congenital glaucoma. The mean follow up period was 12 months. The results showed that the operation had satisfactory clinical effects which are reported as follows.

SUBJECTS AND METHODS

Subjects Improved viscocanalostomy was performed on 51 eyes of 42 patients with primary congenital glaucoma (in reference to the Diagnostic Criteria in 1987 recommended by National Glaucoma Group) in Department of Ophthalmology of Shengjing Hospital Affiliated to China Medical University between September 2009 and September 2011. Finally, 33 cases (42 eyes) were followed up, including 25 male cases (32 eyes), 8 female cases (10 eyes), in which the right eyes were 23 cases, left 19 cases. Patients

Table 1 Preoperative and postoperative IOP

($\bar{x} \pm s, n=42$)

Parameter	Preoperation	Postoperation				
		1wk	1mo	3mo	6mo	12mo
IOP(mmHg)	38.57±13.61	10.53±3.91	14.89±5.26	15.42±5.11	13.82±3.46	13.16±5.29

$P < 0.001$.

under operation were at the age of 12 days to 5 years old. The following were not included: 1) patients with other ocular congenital abnormalities; 2) patients after the angle dissection and trabeculotomy; 3) follow-up period <6 months.

Methods

Inspection items All cases were anesthetized by chloralhydrate for measuring IOP by Schiots tonometer, corneal diameter by the feet compasses and cup/disc ratio by ophthalmoscope. Corneal edema, Haab line or muddy were observed simultaneously. Preoperative IOP was 25mmHg-52mmHg (1mmHg=0.133kPa), on the average of (38.57±13.61)mmHg.

Surgical procedure After the success of the general anesthesia, under surgical microscope, a superior fornix-based conjunctival flap was created after stabilizing the eye with a superior rectus 4-0 silk traction suture^[3].

Compression hemostasis was attained by gelatinsponge application on the wound so that the sclera was cleaned.

A sharp blade was used to make a ligulate and superficial scleral flap, a one-third of scleral thickness 5mm×5mm in limbus-based scleral flap was dissected 1.5mm-2mm into the clear cornea.

Half a millimetre inside the distal border of the superficial scleral flap, a deep scleral flap was also dissected using a sharp blade, 1.5mm-2mm into clear cornea. The incision was gradually deepened until aqueous started seeping into the groove.

The dissection of the second flap was deepened at the apex to partially expose the choroid. The dissection was then carried forward to the scleral spur until of Schlemm's canal appeared on both sides.

A paracentesis was carried out at the 3 o'clock position, and gentle pressure with a gelatinsponge was exerted on Schwalbe's line to separate Descemet's membrane from the corneoscleral junction. The deep scleral flap was excised with microscissors.

Taking the sclera ridge at the junction of white sclera and corneoscleral limbus and the permeability drops of anterior ciliary vein on the sclera flat bed as themark identified positively and removed the external wall of Schlemm's canal and corneal stroma, teared apart the inwall of Schlemm's canal by Blunt forceps and aqueous outflow started to seep significantly.

High-viscosity sodium hyaluronate (Healon GV) was injected 4mm-6mm into both sides of the canal. This was repeated 6-7 times. In order to avoid the damage of the

external wall of Schlemm's canal, insert depth was within 1-1.5mm. Expansion of 1-2 hour range near both ends of Schlemm's canal, appeared progressively after injection. The superficial flap was sutured with two separate 10-0 nylon sutures after injecting Healon GV beneath it. The conjunctiva was sutured with two separate 10-0 nylon sutures, and a subconjunctival injection in the lower fornix completed the surgery. To low bias to minimum, all surgeries completed by the same ophthalmologist who has excellent surgical skills, exact anatomical knowledge of anterior chamber angle and strong foundation of microsurgery.

Postoperative follow-up Postoperative evaluations included the changes of IOP, corneal diameter, cup/disc ratio and complications. All patients were followed up at week 1, month 1, month 3, 6 and 12.

Statistical Analysis Data were statistically analyzed using SPSS 13.0. The paired-samples Student's *t*-test was applied on parameters such as IOP, corneal diameter and cup/disc ratio to study the statistical significance of differences between preoperative and postoperative measurements, $P < 0.05$ (two sided) as a statistically significant difference.

RESULTS

The success criteria of the operation is with no or local application of glaucoma medications, less than 21mmHg of IOP, clear cornea, corneal diameter and cup/disc ratio reduced or not progressed.

Preoperative and postoperative IOP IOP after improved viscocanalostomy was decreased significantly compared to preoperation, the difference was statistically significant. Postoperative 1 week, the mean IOP is the lowest, and then gradually approached to stable at 3 months as following (Table 1).

Preoperative and postoperative corneal diameter Corneal diameter of improved viscocanalostomy within 3 months had no significant difference ($P > 0.05$). But after 3 months, compared to preoperation, it had significant difference ($P < 0.05$).

Preoperative and postoperative cup/disc ratio Cup/disc ratio of postoperative 18 eyes decreased, those of 24 eyes did not progress. The mean cup/disc ratio was not significantly different ($P = 0.148$) before and after the surgery, the cup/disc ratio of successful surgery was evidently decrease (preoperative 0.7±0.2, postoperative 0.6±0.3, $P = 0.007$).

Observation of postoperative complications Hyphema occurred in 7 of 42 eyes (21.2%), but it had no influence on

the decrease of IOP after operation. The rest of the patients had no serious complications such as unformed anterior chamber, detachment of Descemet's membrane and choroidal, prolapse of vitreous, synechia and intraocular infection.

DISCUSSION

Primary congenital glaucoma is due to abnormal embryonic development which make the structure of anterior chamber angle abnormal, causing a defective and decreased outflow of aqueous and leading to increase of IOP and associated symptoms and signs, but the different hypothesis still existed^[4]. Barkan argues that blocking of aqueous outflow due to a layer of impermeable film covering anterior chamber angle. Maumenee argues that the underdevelopment of scleral spur and abnormal attachment of ciliaris longitudinal fibers on trabecular meshwork make the trabecular plate to tightened, trabecular gap closed and Schlemm's tube atrophied when ciliaris contracted, which caused increased the resistance of aqueous outflow. Then, a series of clinical manifestations of congenital glaucoma appeared due to above congenital abnormality.

In fact, traditional viscocanalostomy^[5,6] had been developed in recent years in order to improve the safety of conventional filtering procedures. The goal of non-penetrating filtering procedures is to reduce IOP by enhancing the natural aqueous outflow channels, while reducing outflow resistance located in the inner wall of the Schlemm's canal and the juxtacanalicular trabecular meshwork^[7,8]. In the last few years, viscocanalostomy has become the most popular nonpenetrating filtering procedures. Both involve removal of a deep scleral flap, the external wall of Schlemm's canal and corneal stroma behind the anterior trabeculum and Descemet's membrane, thus creating an intrascleral space. The aqueous humour leaves the anterior chamber through the intact trabeculo-Descemet's membrane into the scleral space, from where it will egress into different pathways. While improved viscocanalostomy uses gelatinsponge for compression hemostasis, reduces the possibility of future scarring because of burning. The traditional viscocanalostomy stresses dense suture of shallow sclera flap (5 needles) which did not result in effective conjunctival filtering bleb after surgery. While in the improved viscocanalostomy, 2 needles at two top corners of superficial scleral flap with to strengthen the formation of diffused conjunctival filtering bleb which can better reduce IOP by the way of enhancing outflows channels further.

Improved viscocanalostomy might improve the clinical effects of the patients with primary congenital glaucoma, such as higher success rates, lower postoperative mean IOP, better long-term effects and less complications in the

follow-up 12 months. We considered that because scarring and fibrosis of filtering bleb had not yet begun, the mean IOP was the lowest at week 1 after the surgery. From postoperative 3 months, the IOP reached stability at a lower level due to persistent aqueous outflow.

We also considered, the high success rate of improved viscocanalostomy attributed to not only the increase of the pathway of aqueous outflow, but also the inhibiting function of Healon against scarring and fibrosis of filtering bleb.

Sodium hyaluronate can prevent the vascular regeneration at the area of surgery, restrain the scarring and fibrosis of filtering bleb, keep the aqueous outflow smooth. Therefore, the successful rate of operation was raised. From what we studied, the complications such as unformed anterior chamber, choroidal detachment and prolapse of vitreous did not appear in patients of postoperative follow-up period of 12 months.

Improved viscocanalostomy that appears to be a promising modification of filtering surgery, compared to the traditional trabeculotomy, acquired better effects either on IOP control for longer durations or enhancing success rates. It is also obviously safe with less serious postoperative complications. But, further randomized prospective studies with large cases are needed for generalized conclusions for a large population.

REFERENCES

- 1 Nouredin BN, El-Haibi CP, Cheikha A, Bashshur ZF. Viscocanalostomy versus trabeculotomy ab externo in primary congenital glaucoma: 1-year follow-up of a prospective controlled pilot study. *Br J Ophthalmol* 2006; 90(10): 1281-1285
- 2 Li X, Liu HN, Gao DW. Clinical effect of non-penetrating trabecular surgery with human umbilical vein implant and mitomycin C for treatment of primary open angle glaucoma. *Int J Ophthalmol (Guoji Yanke Zazhi)* 2010;10(10):1895-1896
- 3 Al-Hazmi A, Awad A, Zwaan J, Al-Mesfer SA, Al-Jadaan I, Al-Mohammed A. Correlation between surgical success rate and severity of congenital glaucoma. *Br J Ophthalmol* 2005;89(4):449-453
- 4 Levy J, Carmi R, Rosen S, Lifshitz T. Primary congenital glaucoma presenting within the first three months of life in Bedouin population: prognostic factors. *J Glaucoma* 2005;14(2):139-144
- 5 Stangos AN, Whatham AR, Sunaric-Megevand G. Primary viscocanalostomy for juvenile open-angle glaucoma. *Am J Ophthalmol* 2005;140(3): 490-496
- 6 Mendrinos E, Mermoud A, Shaarawy T. Nonpenetrating glaucoma surgery. *Surv Ophthalmol* 2008;53(6):592-630
- 7 Schwenn O, Springer C, Troost A, Yun SH, Pfeiffer N. Deep sclerotomy using a hyaluronate implant versus trabeculectomy. A comparison of two glaucoma operations using mitomycin C. *Ophthalmologie* 2004;101(7): 696-704
- 8 Luke C, Dietlein TS, Jacobi PC, Konen W, Krieglstein GK. A prospective randomised trial of viscocanalostomy with and without implantation of a reticulated hyaluronic acidimplant(SK GEL) in open angle glaucoma. *Br J Ophthalmol* 2003;87(5):599-603