

Clinical study on non-penetrating trabecular surgery with human umbilical vein and mitomycin C

Xun Li, He-Nan Liu, Dian-Wen Gao

Department of Ophthalmology, Shengjing Hospital of China Medical University, Shenyang 110004, Liaoning Province, China

Correspondence to: Xun Li. Department of Ophthalmology, Shengjing Hospital of China Medical University, Shenyang 110004, Liaoning Province, China. lixun@sj-hospital.org

Received:2011-03-21 Accepted:2011-05-10

Abstract

• **AIM:** To investigate the clinical therapeutic effects of human umbilical vein (HUV) implantation and mitomycin C (MMC) in non-penetrating trabecular surgery (NPTS).

• **METHODS:** A total of 32 patients (46 eyes) with uncontrolled primary open angle glaucoma (POAG) were divided into two groups: HUV + MMC group ($n = 25$), SKGEL + MMC group ($n = 21$). The procedure commenced with the creation of a limbus based conjunctival flap. After the dissection of a superficial limbus based rectangular scleral flap, MMC (0.4mg/mL) was used superior and inferior surface of the superficial scleral flap for three minutes. A second limbus based scleral flap was carefully dissected beneath the previous one towards the choroid. Schlemm's canal was deroofed during the extension of the deep scleral flap to its limbal edges. HUV or SKGEL fixed on the bed of sclera in experimental group. Postoperative examinations were performed at 1 week, 2, 4 weeks, 2, 6, 12 months. IOP, best-corrected visual acuity (BCVA), functional blebs and success rate were examined.

• **RESULTS:** There were no statistically differences with postoperative IOP in HUV + MMC group and SKGEL + MMC group ($P > 0.05$) during 1 week to 12 months. There was no difference with postoperative function blebs and the change of BCVA during 1 week to 12 months between HUV + MMC group and SKGEL + MMC group ($P > 0.05$). At 12 months after surgery, the success rate was 84% in HUV + MMC group, 86% in SKGEL + MMC group.

• **CONCLUSION:** The application of HUV in NPTS can prevent the adhesion of filtering channel and it can improve the success rate of NPTS. Compared with SKGEL, HUV has lower price. So it is a better implant.

• **KEYWORDS:** human umbilical vein; non-penetrating trabecular surgery; IOP

DOI:10.3969/j.issn.1672-5123.2011.06.002

Li X, Liu HN, Gao DW. Clinical study on non-penetrating trabecular surgery with human umbilical vein and mitomycin C. *Guji Yanke Zazhi (Int J Ophthalmol)* 2011;11(6):943-946

INTRODUCTION

Nowadays, trabeculectomy is a typical operation method of anti-glaucoma. Due to cutting off the whole trabecular tissue, there are many complications during and after operations. Some ophthalmologists constantly find more safe and effective operation method with less complications. Non-penetrating trabecular surgery (NPTS) is a new anti-glaucoma operation to treat primary open angle glaucoma (POAG) recently. It has been accepted by many ophthalmologists both at home and abroad. The key point of NPTS is to retain the thin trabecular meshwork-Descemet membrane window. But the maintenance of the long effect after the operation is decided by whether the tissue interspace (aqueous humor-cisterna) can exist persistently or not. In order to keep the existence of the aqueous humor-cisterna, many ophthalmologists put different implants between the space of cornea and sclera. Among these implants, SKGEL has been widely used in clinical, and the effect is good. But the cost of SKGEL is expensive, which limits the development of the operation all over the country. To low down the cost of the operation, we consider self-made human umbilical vein (HUV) as implants and compare the clinical therapeutic effects of HUV implantation and 0.4mg/mL MMC with SKGEL in NPTS.

MATERIALS AND METHODS

Materials A total of 32 cases (46 eyes) were diagnosed as intermediate and advanced stage POAG from department of ophthalmology in Shengjing Hospital of China Medical University. There were 18 cases in male (26 eyes) and 14 cases in female (20 eyes). The age of the patients ranged from 21 to 58 years old. There were no intraocular operation histories in these eyes, and the IOP of all these eyes could not be controlled to normal with medical treatment before operations. All the angle of anterior chambers were open after the gonioscope examination. The patients were randomly paired into 2 groups with 17 and 15 cases in each group. Group I were treated with HUV + MMC ($n = 25$), and group II were treated with SKGEL + MMC ($n = 21$). The follow-up duration was 12 months.

Methods

Preparation of HUV^[1] Chorda umbilicalis of newborns who were term delivery were selected and put them in the fridge at 4°C for 12 hours after washing with normal sodium. Epidural tubes ($d = 1\text{mm}$) were interpolated into umbilical veins, 5g/L glutaric dialdehyde was soaked, the umbilical veins fixed for 36 hours at room temperature. The whole

integrated umbilical veins were decoherenced without anaesthetic tubes, soaked in 75mL/L alcohol to conserve. Samples were taken to make bacterium and mycetes cultivation. If the results were negative for 3 times continuously, then keeping them in 75mL/L alcohol in the fridge at 4°C to use any time. Before using them, soaked in normal sodium for half an hour. All of HUV, the inner diameters was 3.0-4.0mm, external diameter was 4.0-5.0mm.

Operation method A fornix-based conjunctival flap was made. A limbus-based, 5.0mm × 6.0mm rectangular scleral flap about 1/3-1/4 scleral thickness was dissected 1.0mm anterior into the clear corneal limbus. 2mg of freeze dried power of MMC was diluted to 0.4mg/mL with normal saline and 0.1mL of it was injected into a 4.0mm × 5.0mm cotton sheet, which was then put under the conjunctival flap and the space between scleral flap and scleral bed for 3 minutes. The cotton sheet was taken away, irrigating the scleral flap and conjunctiva with 40mL normal saline. A 4.0mm × 4.0mm triangular or trapezoid deep sclera under episcleral flap was cut off. In group I (HUV + MMC), the umbilical vein was cut into 1.0mm sections, then it was set on the deep scleral bed vertically to the corneal limbus, with a 0.5-1.0mm tail out of the scleral flap, sutured by 10-0 nylon seam on the scleral bed. In group II (SKGEL + MMC), SKGEL was set on the deep scleral bed. There was no implantation in NPTS group. The scleral flap and the bulbar conjunctiva were interrupted sutured by 10-0 nylon seam.

Observation item Slit-lamp microscope and ocular fundus observation; conditions of incisions healings were observed, filtered bubbles, anterior chamber inflammatory reactions, anterior chamber depth, hemorrhage everyday of the first week after operations and at the 2, 4 weeks; 2, 6, 12 months after operations by slit-lamp microscope. Differences of ocular fundus before and after operations were observed, and whether there were cystoid macular edemas (CME) and other complications. Pre-and post-operative IOP of the two groups were measured at the same time, three times in every eye were examined and the average value was chosen.

Assessment of curative effect Assessments of operative achievement ratio according Kim and Lim^[2]: complete success; IOP was 6-21mmHg without anti-glaucoma drugs. Conditional success; IOP was 6-21mmHg with anti-glaucoma drugs locally. Failure; IOP was lower than 6mmHg or higher than 21mmHg with anti-glaucoma drugs, which were needed a second operation.

Statistical Analysis We used SPSS 12.0 software to analyze the results of the two groups. Comparing the differences of IOP in different stages with bis-independent sample *t*-test; the differences of IOP in different groups were compared with the paired *t*-test; the differences of the persistence of filtered bubbles in different groups, the achievement ratio of operations and the changes of acuity of vision were compared by χ^2 test. $P < 0.05$ was considered statistically significant.

Table 1 Pre-operation comparisons of ages and IOP in two groups $\bar{x} \pm s$

	HUV + MMC	SKGEL + MMC	<i>t</i>	<i>P</i>
Age (yr)	48.75 ± 9.43	47.49 ± 6.82	0.98	0.56
IOP (mmHg)	40.53 ± 6.79	41.42 ± 8.06	1.34	0.35

Table 2 The average of IOP in different stage in the two groups $(\bar{x} \pm s, \text{mmHg})$

	HUV + MMC	SKGEL + MMC	<i>P</i>
Pre-operation	40.53 ± 6.79	38.68 ± 5.08	0.35
1wk	13.59 ± 4.54	13.17 ± 2.26	0.61
2wk	14.43 ± 7.20	14.12 ± 2.87	0.37
4wk	15.08 ± 2.41	14.64 ± 3.91	0.48
2mo	15.29 ± 3.29	15.03 ± 3.47	0.29
6mo	14.98 ± 4.98	15.22 ± 5.68	0.14
12mo	15.72 ± 1.98	15.42 ± 3.17	0.28

Table 3 Complications *n*(%)

	HUV + MMC	SKGEL + MMC
Micro-perforation	2(8)	2(9.5)
Hyphema	3(12)	2(9.5)
Shallow of anterior chamber	0	1(4.8)
Tyndall phenomena	3(12)	4(19)

Table 4 Filtered bubbles *n*(%)

Time	HUV + MMC	SKGEL + MMC	χ^2	<i>P</i>
1wk	23(92)	20(95)	0.21	0.54
2wk	22(88)	20(95)	1.35	0.12
4wk	21(84)	19(90)	1.12	0.27
2mo	19(76)	17(81)	1.28	0.18
6mo	17(68)	14(67)	0.17	0.68
12mo	16(64)	13(62)	0.21	0.54

RESULTS

IOP and ages in different groups before operations was compared (Table 1). The changes of IOP were measured in two groups (Table 2). There was no significant difference at local reactions of eyes post-operatively in two groups ($\chi^2 = 0.78, P > 0.05$, Table 3). Typing filtered bubbles to 4 types according to Kronfeld method. Considering thin wall with multitude capsular or applan diffused filtered bubbles as functionality. Comparison of HUV + MMC group and SKGEL + MMC group from 1 week to 12 months after operations, there was no significant difference (Table 4).

At the last follow-up, there were 21 eyes succeed (complete success and conditional success) in HUV + MMC group, achievement ratio was 84%. There were 18 eyes succeed in SKGEL + MMC group, achievement ratio was 86%. Comparison of the operation achievement ratios between the two groups, there was no significant difference ($P > 0.05$).

DISCUSSION

Nowadays, in our country, the prevalence and final diagnosis

rate of POAG are rising year by year. Since 1968, Cairns^[3] developed trabeculectomy, it has been the typical anti-glaucoma operation method. But there may be many complications after operations, such as hadro-filtered, filter bubbles scars, shallow of anterior chamber, choroidal detachment, corneal edema, intraocular hypotension, cystoid macular edema (CME), intraocular infection, complicated cataract and so on. Since recent years, NPTS has been identified and praised, shallow of anterior chamber and other related complications were decreased obviously. The key point of operations was whether the aqueous humor pool can exist persistently. The operation would be failed if the operational region were scarring, which is hard to set up effective filtered channel^[4]. In order to reduce the formation of scarring and maintain the existence of aqueous humor pool, researchers from all over the world implanted many kinds of inserts on deep sclerotic bed. Generally speaking, ideal inserts should have following characteristics: excellent biocompatibility, no any other toxic-side effect; long degradation time; anti-fibrilla proliferation; convenient getting, simple make manufacture and proper price. Nowadays, after lots of clinical tests, SKGELs were used widely^[5]. But there are some insufficiencies, such as complex manufacture and expensive price, which is hard to be used in poverty-stricken region. Umbilical veins are obtained from chorda umbilicalis of newborns. They are homogeneity bio-haemal canals, which can reduce the inflected dangers caused by the larvaceous virus of animal-source materials and unusual pathogenic bacteria. So the immunological rejections are weak. Umbilical veins which are soaked by 5g/L glutaric dialdehyde have following characteristics: low antigenicity, excellent biocompatibility; long degradation time; cleaning up inflammatory cells, reducing inflammation reactions; the tube wall of umbilical vein is thin, lumina is large (average 3mm), which is suitable to implant into scleral space; abundant resource, simple manufacture, convenient to save. Since 1980s, hydroformylation umbilical veins have been used as vasotransplants in surgery and got well curative effect. We have used hydroformylation umbilical vein as a new aqueous humor drain in refractoriness glaucoma. After animal experiments and clinical uses, the results were satisfactive^[6]. While we have used umbilical veins in NPTS on animal experiment, and the result was satisfactory. In this study, we used umbilical veins and mitomycin C in NPTS. The studies before manifested that^[7], the complete success rate of NPTS was 44.6%-75.6%, the whole success rate was 79%-97.7%. In this study, by the last follow-up, 21 eyes were succeed in HUV + MMC group, the success rate was 84%; 18 eyes were succeed in SKGEL + MMC group, the success rate was 86%. Compared with previous study results, both results of the two groups got close to the high points of complete and quantitate success rates, which demonstrated that the operation success rate was rised obviously when implanting HUV or SKGEL during NPTS. There were no statistical difference with

operation success rates in HUV + MMC group and SKGEL + MMC group ($P > 0.05$). There were no statistical differences with postoperative IOP in HUV + MMC group and SKGEL + MMC group ($P > 0.05$) during 1 week to 12 months. So we can conclude that the lowering IOP effect of implanting HUV in NPTS was as well as SKGEL, and the effect was stably. There was no difference with postoperative function blebs and the change of best corrected visual acuity during 1 week to 12 months between HUV + MMC group and SKGEL + MMC group ($P > 0.05$). In addition, we used HUV combined with MMC, which reduced the formation of scar between the conjunctival flap and the episclera flap, episclera flap and scleral bed^[8]. At the same time, we put umbilical vein vertically to the limbus corneae, with the tail out of the scleral flap. These measures are to maintain scleral depressing chamber, which can depress IOP effectively, and avoid visual function damaged utmostly.

Then on the aspect of complications after operations, as simplex NPTS and combined with implanting SKGEL, there were appearance of microperforation, hyphema, shallow of anterior chamber and so on, but the incidence rate of these complications was not rised. Because the complications above were decided by the operation style of NPTS. Otherwise, there were no exposition and expulsion phenomenon appeared among the eyes which were implanted with umbilical veins, and there were no obvious inflammation and disunion of incision.

In a word, NPTS with HUV implantation is a new anti-glaucoma operation style we designed. Through clinical observation, the effect of lowering IOP was well, the complications were less, and the human umbilical veins are easy to get, economic and safe, and there are no limitations to use. So it is a ideal implant during NPTS, the application prospect is fine. But in this study, the size of sample needs to increase, the follow-up time needs to prolong, we will improve these insufficiencies in the further investigations, thus we can evaluate the clinical therapeutic effect of NPTS with HUV implantation more allroundly.

REFERENCES

- 1 Gao DW, Chen LZ, Gui DM, Wang AY, Cao YM. The preparation of umbilical artery tube and its usage in the mechanical drainage operation. *Chin J Pract Ophthalmol* 2001;19 (4):279-280
- 2 Kim DM, Lim KH. Aqueous shunts;single-plate molteno vs ACTSEB. *Acta Ophthalmol Scand* 1995;73(3):277-280
- 3 Cairns J. Trabeculectomy: a preliminary report of a new method. *Am J Ophthalmol* 1968; 66(4):673-674
- 4 Wang Y, Sun XH, Meng FR, Wang JJ. The failure causes of non-penetrating trabecular surgery and reoperation. *Chin J Ophthalmol* 2003; 39(2):87-90
- 5 Guo Y, Xia XB, Jiang HB, Wang PB, Huang PG, Liu SZ, Xun XL. The clinical observation of nonperforating trabecular surgery with reticulated hyaluronic acid implant for treatment of open-angle glaucoma. *Guji Yanke Zazhi* 2006;6(1):92-96
- 6 Gao DW, Gao W. Application of the Umbilical Artery Tube in Refractory Glaucoma Surgery. *Journal of China Medical University* 2001; 30(2):117-118

7 Sourdille P, Santiago PY, Villain F, Yamamichi M, Tahi H, Parel JM, Ducournau Y. Reticulated hyaluronic acid implant in non-perforating trabecular surgery. *J Cataract Refract Surg* 1999;25(3):332-339

8 Kozobolis VP, Christodoulakis EV, Tzanakis N, Zacharopoulos I, Pallikaris IG. Primary deep sclerectomy versus primary deep sclerectomy with the use of mitomycin C in primary open-angle glaucoma. *J Glaucoma* 2002;11(4):287-293

脐带静脉管联合 MMC 在非穿透性小梁手术中的应用

李迅, 刘鹤南, 高殿文

(作者单位:110004 中国辽宁省沈阳市, 中国医科大学附属盛京医院眼科)

作者简介:李迅,男,硕士,讲师,主治医师,研究方向:青光眼。

通讯作者:李迅. lixun@sj-hospital.org

摘要

目的:研究人脐带静脉管(HUV)植入联合应用丝裂霉素 C(MMC)在非穿透性小梁手术(NPTS)中应用的临床效果。

方法:选取中、晚期原发性开角型青光眼病例 32 例(46 眼)。患者分为两组:HUV + MMC 组($n = 25$),透明质酸

生物胶(SKGEL) + MMC 组($n = 21$);行非穿透性小梁手术,HUV + MMC 组将 HUV 置于巩膜床内,SKGEL + MMC 组将 SKGEL 缝合固定于巩膜床上。术后分别于 1,2,4wk;2,6,12mo 裂隙灯下观察术口愈合情况、滤过泡情况、前房炎症反应、前房深度、有无出血等。测量眼压、最佳矫正视力,计算手术成功率。

结果:HUA + MMC 组的术后眼压平均在 16mmHg, HUA + MMC 组与 SKGEL + MMC 组在术后 1,2,4wk;2,6,12mo 时 $P > 0.05$,差异无显著性;功能性滤过泡术后 1wk ~ 12mo 时 HUA + MMC 组与 SKGEL + MMC 组比较无显著性差异($P > 0.05$),末次随访 HUA + MMC 组成功(完全成功和条件成功)21 眼,成功率 84%;SKGEL + MMC 组成功 18 眼,成功率 86%。两组末次随访手术成功率比较无显著性差异($P > 0.05$)。

结论:HUV 联合 MMC 在 NPFS 中对术眼有明显而稳定的降压作用,大大提高了 NPTS 的手术成功率。脐带静脉管取材方便,抗原性低,有良好的组织相容性,眼局部反应轻,无毒副作用,且与 SKGEL 植入物相比,价格便宜,是理想的 NPTS 中的植入物。

关键词:人脐带静脉管;非穿透性小梁手术;眼压