

# The effect of water sac under the conjunctival flap formation in the compound trabeculectomy

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## 结膜瓣下水囊的形成在复合式小梁切除术中的应用

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### 摘要

**目的:**探讨复合式小梁切除术中结膜瓣下水囊的形成对预测和控制术后滤过量及减少并发症的疗效。

**方法:**186例200眼原发性青光眼随机分为观察组与对照组。观察组行结膜瓣下水囊的形成结合复合式小梁切除术(即可拆缝线、丝裂霉素C和小梁切除术),对照组行复合式小梁切除术。同期进行疗效观察对比。指标包括视力、眼压、滤过泡、前房深度及并发症,随访12mo。

**结果:**术后早期,观察组浅前房、滤过泡渗漏及并发症的发生率明显低于对照组,术后远期,观察组眼压明显低于对照组,视力下降及非功能性滤过的发生率也明显低于对照组。

**结论:**结膜瓣下水囊的形成可有效控制眼压,减少术后滤过泡渗漏、浅前房、恶性青光眼等并发症发生。

**关键词:**青光眼;复合式小梁切除术;结膜瓣下;水囊

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### Abstract

• **AIM:** To observe the outcome of application of water sac under the conjunctival flap formation combining with adjustable suture in estimating and controlling the post-operational filtering outflow in compound trabeculectomy.

• **METHODS:** Totally 200 eyes of 186 cases of primary glaucoma were randomly divided into observation group and compared group. All eyes of observation group underwent application of water sac under the conjunctival flap formation combining with adjustable suture and

mitomycin - C in compound trabeculectomy. Eyes in control group underwent compound trabeculectomy only. All cases were observed for 12 months, including visual acuity, intraocular pressure (IOP), filtering blebs, depth of anterior chamber, and other complications.

• **RESULTS:** In the early term after operation, the shallow anterior chamber and other complication in observation group was obviously less than that in control group. In the far term after operation, the IOP in observation group was lower than that in control group, visual loss and non functional blebs in observation group was obviously less than that in control group.

• **CONCLUSION:** Water sac under the conjunctival flap formation combining with adjustable suture in compound trabeculectomy is useful for controlling IOP, and less complication (bleb leakage, shallow anterior chamber, malignant glaucoma etc.)

• **KEYWORDS:** glaucoma; compound trabeculectomy; under the conjunctival flap; water sac

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### INTRODUCTION

Invention of trabeculectomy by Cairns (1968) is one of present most commonly used anti - glaucoma surgery methods. Functional blebs is the key which the filterable surgery succeeds, the ideal filters was mainly rely on the organization of conjunctiva and the sclera flap organization's incomplete cicatrization, the home and abroad scholars<sup>[1-3]</sup> in the surgery technical operation aspect have made certain result. Although this technology have made many improvements and very big progress, the technique failure rate is still high in 2 years after operation. Between October 2007 and October 2011, we used water sac under the conjunctival flap formation combing with compound trabeculectomy (*i. e.* adjustable suture, mitomycin-C and compound trabeculectomy), discussed one kind of safer and effective method to treat glaucoma, and summarized as follows:

### SUBJECTS AND METHODS

**Subjects** Primary glaucoma 186 cases (200 eyes) in our hospital between October 2007 and October 2011 were divided into observation group and control group stochastically (each 100 eyes, male, age 40-60 years old). Observation group:

water sac under the conjunctival flap formation combining with adjustable suture and mitomycin-C in compound trabeculectomy; Control group: underwent compound trabeculectomy only. Before operation, observation group intraocular pressure was 35-54.4 mmHg, averages (40.40 ± 5.56) mmHg; Control group intraocular pressure was 32-48.2 mmHg, average (42.13 ± 6.38) mmHg. All patients best-corrected visual acuity was 0.3 or better in all of the eyes.

**Methods** All cases were performed retrobulbar anesthesia, combined with subconjunctive anesthesia operation. Bulbar conjunctival flap was made as the basal fornix. 3.5 mm × 4 mm, 1/2 thickness sclera flap was made and was separated to the transparent zone of cornea limbus; 0.5 mL mitomycin-C of 0.4 mg/mL and 0.5 mL dexamethasone were fixed humidity cotton piece and was set into the conjunctiva for 3 minutes<sup>[4,5]</sup>, 2 mm × 1 mm trabeculectomy and the corresponding peripheral iris excision were performed in sub-sclera flap, filtering rate was inspected with the cotton bud. Anterior chamber did not become shallow when aqueous humor was flowing out slowly. The anterior chamber was normal without detectable leakage of aqueous humor. The both sides waist of sclera flap were sutured with removable suture for 1-2 needles. Needle with removable suture entered from the cornea surface (approximately 1/2 cornea thickness) to the sclera flap lateral. After the sclera flap was mattress sutured, the needle was withdrawn from the surrounding of the needle entering position, and then a slipknot was tied on the corneal surface. The suture was adjusted by observing the depth of anterior chamber after irrigation. The bulbar conjunctival flap continuously was sutured with 10-0 nylon line, then the eyeball was pushed upwardly with the squint hook to the center. Dissemination water sac under the conjunctiva flap was formed, the anterior chamber depth change was observed once more. If the anterior chamber depth changed shallow obviously, the right amount physiological saline should be poured into or the treatment of the tropicamide dilating the pupil was applied. The control group has not formed the water sac with the squint hook under the conjunctiva flap. Latter 5-10 days adjustable sewing thread was removed according to the intraocular pressure, filtering blebs and anterior chamber under the slit lamp microscope. The condition of hyperemic conjunctiva and the intraocular pressure were observed and the eyeball was massaged after operation to choose the right time of removing the suture. Intraocular pressure below 18 mmHg after the injection the 5-Fluorouracil (5-FU, each time 5 mg, aside the blebs) is an effective standard.

The patient vision, the anterior chamber depth, situations of blebs, complication and so on were observed. All patients were checked the vision with slit lamp microscope, non-contact eye pressure and ophthalmoscope inspection after surgery in 7 days and the 1 month, 3, 6 and 12 months.

**Statistical Analysis** SPSS 13.0 was used for the Windows statistics software package. The data measured was performed single factor variance analysis and  $\chi^2$  examination statistics processing.

## RESULTS

**Vision and Intraocular Pressure** Before surgery, the difference of two groups' intraocular pressure value had not remarkable significance ( $F = 1.024, P = 0.597$ ). After surgery, at the early time (1 week, the first month), the intraocular pressure value difference had not remarkable significance ( $F = 3.135, 3.030, P = 0.066, 0.081$ ). At the later period (the 3, 6 and 12 month), the intraocular pressure value difference had the remarkable significance ( $F = 4.087, 3.880, 4.506, P = 0.029, 0.038, 0.022$ ), the average intraocular pressure of observation group was obviously lower than the control group. After 1 month, patients' vision was stable, differences of the two group vision changes were not remarkable significance ( $P > 0.05$ ) (Table 1). Table 2 shows the complication comparison after surgery.

**The Shallow Anterior Chamber** According to the Spaeth classification, in the latter 1 week, the observation group had formed normal anterior chamber 98 eyes, 2 eyes had I shallow anterior chamber, 1 eye had II shallow anterior chamber, 1 eye had III degree shallow anterior chamber. The shallow anterior chamber rate of observation group is 4.0%. The control group had formed normal anterior chamber 86 eyes, 6 eyes had I shallow anterior chamber, 4 eyes had II shallow anterior chamber, 3 eyes had III degree shallow anterior chamber. The shallow anterior chamber rate of control group is 14.0%. The observation group of the shallow anterior chamber rate is lower than the control group obviously ( $\chi^2 = 6.11, P = 0.013$ ).

**Filtering Blebs** According to Kronfeld filtering blebs classification, after the surgery, the functionality filters in the observation group had 88 eyes (88.0%), the control group had 69 eyes (69.0%) ( $\chi^2 = 10.69, P = 0.001$ ). Bleb leakage occurred in 3 eyes of the observation group (3.0%), and was 9 eyes less than the control group (12.0%) ( $\chi^2 = 5.84, P = 0.016$ ). In 7 days 8 eyes of observation group had hyperemic conjunctiva, the control group had 19 eyes. The conjunctiva 5-FU injection was performed; amount of 5-FU used was >15 mg, 4 eyes in the observation group were 5 eyes less than the control group ( $\chi^2 = 5.18, P = 0.023$ ).

**Other Complication** One week after operation, complication included choroidal detachment. There were 2 eyes in observation group while there were 10 eyes in control group. The differences between the two groups were significant. ( $\chi^2 = 5.67, P = 0.017$ ). After 3 days, observation group had 1 eye with hyphema while control group had 12 eyes. One week later, all eyes with hyphema had been absorbed. The differences between the two groups were significant ( $\chi^2 = 9.96, P = 0.002$ ). After 1 month, observation group had 2 eyes with malignant glaucoma while control group had 9 eyes, the differences between the two groups were significant ( $\chi^2 = 4.71, P = 0.030$ ). Two groups had not other complications, such as corneal epithelial defect, lens opacity, persistent ocular hypotony, hypotonous maculopathy and so on.

**Table 1 Comparison of intraocular pressure, and visual acuity between observation group and control group**  $\bar{x} \pm s$

Time	Intraocular pressure (mmHg)				Visual acuity			
	Observation	Control	<i>F</i>	<i>P</i>	Observation	Control	<i>F</i>	<i>P</i>
Preoperative	41.00±9.15	41.63±9.09	1.024	0.597	0.48±0.32	0.39±0.30	14.1	0.067
Postoperative								
1 week	10.62±4.86	16.44±2.76	3.135	0.066	0.44±0.35	0.37±0.30	4.34	0.198
1 month	11.12±3.25	16.50±2.82	3.030	0.081	0.43±0.32	0.34±0.28	3.28	0.178
3 months	12.88±2.87	18.18±6.31	4.087	0.029	0.46±0.33	0.34±0.25	25.96	0.149
6 months	15.22±3.49	17.93±6.95	3.880	0.038	0.47±0.34	0.34±0.27	4.21	0.357
12 months	16.00±3.88	18.62±5.25	4.506	0.022	0.41±0.33	0.41±0.28	5.01	0.108

**Table 2 The comparison of complication in observation group and control group after operation**  $n = \text{eyes}$

Groups	Shallow anterior chamber			Bleb		5-FU(mg)		Bleb leakage	Choroidal detachment	Hyphema	Malignancy glaucoma
	I	II	III	Functionality	Non-functionality	≤15	>15				
Observation ( <i>n</i> )	2	1	1	88	12	4	4	3	2	1	1
Control ( <i>n</i> )	6	4	3	69	31	10	9	12	10	12	3
$\chi^2$		6.11			10.69		5.18	5.84	5.67	9.96	4.71
<i>P</i>		0.013			0.001		0.023	0.016	0.017	0.002	0.030

**DISCUSSION**

The traditional trabeculectomy is a classical surgery method to treat glaucoma at present, but has the early shallow anterior chamber, low intraocular pressure and the later period there were scar adhesion, intraocular pressure ascension and so on. In view of the traditional trabeculectomy insufficiency, many improvement of the technique appeared, like the subsclear lake shaping, adjustable sutures, the antimetabolite and the filling material application [6-10]. Analyzing the advantages and disadvantages of each trabeculectomy method, we utilized water sac under the conjunctival flap formation combing with adjustable suture in estimating and controlling the post-operational filtering outflow in compound trabeculectomy, and we obtained good effect at reducing the early complication and enhancing the forward curative effect aspect.

The mechanisms of subconjunctival water sac flap formation, trabeculectomy and application of adjustable suture for the treatment of glaucoma are various: 1) the external drainage function of conventional trabeculectomy; 2) water sac formation under the conjunctival flap helps forming the diffusive filtering blebs at the early time. It can cut off the adhesion of conjunctiva, sclera and sclera flap. The drainage amount of aqueous humor was confirmed early intra-operation. Meanwhile the early stage shallow anterior chamber can be dealt during the operation according to the change of anterior chamber. Early time shallow anterior chamber occurrence can be reduced, corresponding also the malignant glaucoma formation rate was reduced; 3) the conjunctiva flap sutures were confirmed without the leakage once more, the shallow anterior chamber caused by the filtering bleb leakage was reduced, the intraocular infection rate was reduced; 4) application of adjustable suture was important. The degree of the sclera flap suture can influence the amount of filtering excessively. through suturing tightly sclera flap, making 1-2 removable suture in addition to that, normal anterior chamber

can be maintained through the relatively reliable sclera flap suture rapidly. The low intraocular pressure at the early time caused by the anterior chamber water excessively flowing out, the shallow anterior chamber and the choroidal detachment and other complications can be prevented; According to the glaucoma patients' characteristics, such as age, glaucoma type, fascia plump degree, the filtering amount was controlled. We did the filtering outflow experiment to observe filtering amount and to predict the filtering condition post-operation [11,12]. 5) anti-metabolism medicine application (mitomycin-C, dexamethasone, 5-FU) was also important. The tight sutures of sclera flap may effectively resist the complications caused by mitomycin-C at the early time after operation. The combined application of dexamethasone and mitomycin-C reduced the conjunctiva hyperemia. After the recovery of the conjunctival wound, the adjustable suture could be removed flexibly according to filters and the intraocular pressure. Through the controlling of adjustment sewing thread, the eyeball massage, and the 5-FU application, a long time and disseminates filters can be formed, and then the intraocular pressure can be decreased again.

This group of materials demonstrated that, the shallow anterior chamber formation rate of the observation group was 4.0%, comparing with 14.0% of the control group, there was statistically significance difference ( $P = 0.013$ ). The functionality filters in observation group was 88.0%, the functionality filters in control group was 69.0%, the difference had statistics significance ( $P = 0.001$ ). After the operation, intraocular pressure of observation group was lower than the control group, the difference had statistics significance ( $P = 0.022$ ).

Our experience are as following: 1) this surgery way is simple, the study curve is short, the application is promoted widely; 2) when performing the infiltration anesthesia above

ball conjunctiva, the surgeon should avoid filters area, simultaneously separate the fascia and the sclera as far as possible; 3) after paracentesis of anterior chamber was performed to decrease the intraocular pressure, then the corneoscleral limbus was cut thoroughly, and the aqueous humor was emitted slowly. Thus, visual acuity decrease and other complications caused by aqueous humor outflow too fast can be prevented; 4) 1-2 detachable sewing thread in this foundation were made according to the anterior chamber and the intraocular pressure situation, auxiliary filters was massaged. 5) we should steer clear of the conjunctiva margin and the corneoscleral limbus when laying mitomycin - C, which may prevent filters leakage.

Comparing to Zhang's [13] deep sclerectomy, subscleral lake shaping with sodium hyaluronate (NAHA), this operation type is simpler. It does not need to cut off in-depth sclera. The eyeball structure was relative complete. NAHA injection will not influence the observation of filtration amount; Combining with Chen's [11] filter test, this surgery can be simple and effective; using the dexamethasone, the fixed humidity method to control amount of mitomycin-C and the post-operative amount of 5-FU, the complications caused by medicine can be obviously reduced. It is helpful to form filters and control the ideal intraocular pressure, and is a good surgery method to treat glaucoma and worth promoting widely. In conclusion, water sac formation under the conjunctival flap helps learning the actual filtered amount, reducing the sclera flap adhesion obviously, enhancing the surgery success ratio obviously, and reducing the complication.

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