

Maintenance and repair of filtering bleb after trabeculectomy.

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Abstract

This study is to investigate the methods of maintenance and repair of filtering bleb after trabeculectomy. 180 patients (210 eyes with glaucoma) with primary glaucoma were performed by trabeculectomy. In the early postoperative period, the functional filtering blebs of 130 patients (155 eyes with glaucoma) were maintained and the corresponding repair of dysfunctional filtering blebs for 50 patients (55 eyes with glaucoma) was performed. And the patients were followed up for 6 months to 4 years. In early stage after trabeculectomy, the maintenance of functional filtering bleb can make the patients' intraocular pressure be controlled well, which can improve the surgical results. After repairing dysfunctional filtering blebs for 50 patients (55 eyes with glaucoma), the dysfunctional filtering blebs of 49 patients (54 eyes with glaucoma) were converted to functional filtering bleb, reaching 98.2%. Filtration surgery plays a significant role in the maintenance and repair of filtering bleb function of glaucoma patients. Functional repair in early stage after surgery can improve the success rate of the operation.

Keywords: Glaucoma, Trabeculectomy, Filtering bleb, Maintenance, Repair.

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Introduction

The glaucoma is an optic nerve disease caused by retinal gangliocyte progressive degeneration, which finally leads to the loss of optic disc and eyesight [1]. Glaucoma is the second blindness factor in the world [2]. There are nearly 70 million people suffered from glaucoma every year all over the world. Among them, 10% of patients would have irreversible blindness [3]. Its pathogenetic process involves more than one gene expression and abnormal cell signalling transduction. And the main pathogenic factor is the elevated intraocular pressure [4]. Glaucoma filtration surgery is the main treatment on using drugs to control intraocular pressure, but the effect is not good [5]. At present, the compound trabeculectomy is the main surgical method [6]. Functional filtering bleb reaching ideal effect is an important symbol of the success of filtering operation. To maintain the function of filter blebs, it is important to maintain filtering bleb and repair dysfunctional filtering bleb in the early period of postoperation. In this paper, after the establishing functional filtering bleb by surgery, the author studied the maintenance method of filtering bleb and repair method of dysfunctional filtering bleb after operation.

Materials and Methods

Materials

180 patients (210 eyes with glaucoma) with primary glaucoma in hospital from December, 2012 to June, 2014 were performed

by trabeculectomy and accepted long-term follow-up after surgery. Patients were in 45-75 years old. Patients who cannot accept long-term follow-up due to geographical location were excluded. And patients with drug allergy history, heart failure, myocardial infarction, asthma, Chronic Obstructive Pulmonary Disease (COPD), recurrent glaucoma and intraocular surgery recently were also excluded.

In the treatment of postoperative follow-up, intraocular pressure of 130 patients (155 eyes) was normal, and that of 50 patients (55 eyes) was elevated. Among the 50 patients (55 eyes), there were 14 patients with open angle glaucoma, 24 patients with acute angle-closure glaucoma and 12 patients with chronic angle-closure glaucoma. The profiles of the 50 patients were as follows: 23 males, 27 females; age range: 45~75 years old; mean age: 56.5 years old; average intraocular pressure: 33.17 ± 4.92 mmHg (1 mmHg=0.133 kPa) from 6 months to 10 years after surgery (Table 1).

Methods

Maintenance of functional filtering blebs: There are three methods used to maintain functional filtering blebs. (1) The eyes of patients were dropped with tobramycin and dexamethasone eye drop for 1-2 weeks; (2) eyeball massage: turning eyeball down as eyelid closed, sclera wall of ciliary body (at ten and two o'clock) was massaged by two index fingers, or turning eyeball up, the sclera below the eyeball wall was slightly pressed with index fingers. Patients were massaged 3 times a day, lasting for 5 minutes. When patients

were massaged, the finger power should be gentle, or in accordance with the tolerance of patients. (3) Adjuvant therapy of anti-proliferation drug: 5-FU was continuously injected into the conjunctiva for many times within 2 weeks after operation. Once two days, 10 mg at a time, and the total dose did not exceed 50 mg.

Repair of failing and failed filtering blebs in early and late stage

There are three methods used to repair failing and failed filtering blebs in early and late stage. (1) There were 10 eyes with failure of filtering bleb in the early stage among 55 eyes. The 10 eyes would go well after massaged. (2) Increased intraocular press, filtering bleb with low level hyperemia and internal filtration obstruction occurred in 16 eyes in the first month after operation among the 55 eyes. It was necessary for 16 eyes to be performed by trabeculectomy combined with mitomycin C (MMC, 0.2 mg/L) again. The surgical site leaned to the nasal and bitemporal side of original sclera flap. (3) There were 19 eyes with outer filter passage obstruction among 55 eyes. The eyes of patients with tight sutured sclera flap, and dysfunctional filtering bleb under the sclera flap and irreversibly elevated intraocular pressure that was caused by exceed pressure outside the sclera flap were dropped with 2% tetracaine 3 times. Then disposable syringe needle with the 5th was used to stab into bulbar conjunctiva in 5-10 mm outside the filtering bleb in order to break off 1 or 2 sutures in suture linked the two corners of the sclera flap, meanwhile, 2 mg dexamethasone was injected into the same place. Acupuncture separation and drug injection were adopted to treat the adhesion of sclera flap. The eyes of patients were dropped with 2% tetracaine for 3 times. Sterile syringe needle with 1 ml was employed to stab into the place where was the 5 mm outside the filtering bleb under the slit-lamp microscope. Sodium hyaluronate was injected into the sclera flap with separating the adhesion of the sclera flap, 1 time every week.

Repair of symptomatic filtering bleb

The treatment methods of 4 eyes with symptomatic filtering bleb were as follows: (1) 3 eyes among the 4 eyes were treated with acupuncture separation and 5-FU injected into conjunctiva of filtering bleb and conservative treatment of massaging the eyeball; (2) Another 1 eye was treated with partial excision of the filtering bleb and amniotic membrane transplantation. The trabeculectomy was performed under the microscope on the conjunctival flap based on the fornix by electric coagulation haemostasis. The size of sclera flap was 4 mm × 4 mm, and its thickness was half of the thickness of sclera. 1.3 mm × 2.5 mm of filtering bleb was removed. Peripheral iris was also removed. The ready-made amniotic graft was repaired into 4 mm × 6 mm (slightly bigger than the sclera flap) to transplant under the sclera flap. The epithelial surface of trimmed amniotic graft was upturned. The rest of amnion backward near the fornix was tiled between the conjunctiva and the sclera. 10-0 nylon suture was adapted to interruptedly suture sclera flap, to fix amniotic graft and to

suture conjunctival flap. 20 thousand units of gentamicin and 2.5 mg dexamethasone were injected under the bulbar conjunctiva at the end of the operation. The eyes of patients were dropped with tobramycin dexamethasone eye drops after the operation.

Repair of leaking filtering bleb

There were 2 eyes with slightly low intraocular pressure and good vision, and without low intraocular pressure maculopathy and corresponding infection of the filtering blebs among 55 eyes. After a period of observation, the leakage part of the filtering bleb was closed by itself. There were 4 eyes with whole sclera flap and without necrosis and melting, and with defective and regressive conjunctival flap or bigger and thin-wall filtering bleb. The autologous conjunctival covering operation was performed on the 4 eyes. The lesion or erosion of conjunctival tissue was cut off. The upward fornix and bulbar conjunctiva were separated. Note: do not damage the superior rectus. The bulbar conjunctiva is covered on the sclera flap. The corneal rim was connected well, which was interruptedly sutured. If the tension is too large, bulbar conjunctiva could be radially cut in the bitemporal or nasal side, or decompressive incision in fascia tissue of bulbar conjunctiva was performed in the fornix without suturing (Table 2).

Results

The patients were followed up for 1 year to 3 years after the operation, with an average of 24 months. After maintenance for functional filtering bleb of 130 patients (155 eyes with glaucoma) and repair for dysfunctional filtering bleb of 50 patients (55 eyes with glaucoma), the intraocular pressure of patients was maintained at a normal level, and mean intraocular pressure was 14.62 ± 3.09 mmHg. Compared with the mean intraocular pressure (33.17 ± 4.92 mmHg) before the operation, the difference had statistical significance ($P < 0.01$). After repair for dysfunctional filtering bleb of 50 patients (55 eyes with glaucoma), the dysfunctional filtering bleb of 54 eyes of 49 patients had turned into functional filtering bleb, and repair for leaky filtering bleb failed in 1 case, and the percent conversion of functional filtering bleb was 98.2% (54/55). Meanwhile, obvious complications did not occur in patients (Table 3).

Table 1. Patients' base data after trabeculectomy.

Item		Elevated intraocular pressure cases)	Normal intraocular pressure (130 cases)	P
Gender	Male	23	76	
	Female	27	54	
Age		56.5 ± 10.2	54.2 ± 9.8	0.67
Open glaucoma	angle	14	0	

Acute angle-closure glaucoma	24	0	
Chronic angle-closure glaucoma	12	0	
Intraocular pressure (mmHg)	33.17 ± 4.92	15.23 ± 4.01	<0.001

Table 2. Types of filtering bleb.

Types	Eyes	
Failing and failed filtering blebs	45	
Symptomatic filtering bleb	4	
Leaking filtering bleb	No maculopathy and follicular infection	2
	Defective and regressive conjunctival flap or bigger and thin-wall filtering bleb	4

Table 3. Postoperative follow-up results.

	Before operation	After operation	P
Intraocular pressure	33.17 ± 4.92	14.62 ± 3.09	0.009
Dysfunctional filtering bleb	55 eyes	1	

Note: T test was applied to take statistical analysis. When P was less than 0.05, the difference has statistical significance.

Discussion

The functional filtering bleb established by filtration surgery is the main treatment method for glaucoma patients with poor effect in using drug control intraocular pressure [7]. Trabeculectomy is the classic operation for patients with glaucoma. The evaluation of surgical efficacy includes the intraocular pressure, complications and the shape of filtering bleb. In our research, the results showed that there were still 50 patients with elevated intraocular pressure and dysfunctional filtering bleb after trabeculectomy. Filtering bleb plays a significant role in the process of aqueous humor drainage. So, the dysfunctional filtering bleb could lead to the increase of intraocular aqueous humor, elevated intraocular pressure, and further cause glaucoma [8].

Although the doctor treating glaucoma clearly know the significance of functional filtering bleb, it is difficult to get the ideal effect of functional filtering bleb due to many uncontrolled factors, such as the medical history before operation, the history of treatment, the operation during surgery, complications after operation, etc. In recent years, due to the application of MMC in the glaucoma filtration surgery, the success rate of operation has been improved [9-11], but it brings about a certain side-effect on ocular tissues [12,13]. For the obstructive filtering bleb in the early period, the blocked filtering fistula mouth can open again by eyeball massage, but it is important to well grasp the time when massage the eyes of patients. In the late stage, the combination of acupuncture segregation and sodium hyaluronate injection or 5-FU injection

can be adopted to treat the obstructive filtering bleb, which can inhibit the scar formation and turn the filtering bleb without function into the filtering bleb with function. In the process of acupuncture segregation, it should avoid causing the bleeding below the bulbar conjunctiva that will affect the operation and clinical efficacy [14,15]. The leakage of filtering bleb after operation is a serious complication which may occur in the early and late stage after glaucoma filtration surgery. The longer the time, the greater the chance of that happening [16]. The leakage of the filtering bleb can be caused by related factors of filtration surgery. For example, the incision site of the conjunctiva and the sclera is not appropriate and the suture of the incision is not sufficient, and non-surgical reasons involve the types and location of filtering bleb, the age of patients and so on [17]. The corresponding treatment includes conservative treatment and operation therapy [18]. The profile of conservative treatment is as follows: pressure dressing, wearing collagen shields, soft corneal contact lens, the use of tissue adhesive [19], the injection of autologous blood into filtering bleb [20], etc. For the patients with poor effect after conservative treatment, the effective surgical treatment should be taken; otherwise, the failure of the conservative treatment will bring about intraocular infection, the front disappearance, the corneal endothelium decompensation, the formation of cataracts [21], etc. The surgical repair can directly adopt the suture of sclera flap, the autologous or allogeneic sclera transplant, the excision of the lesion of filtering bleb tissues, the dissociation and transfer of new conjunctival flap [7,22], etc. In this research, after treated with specific treatment according to filtering bleb function, 49 cases (54 eyes, 98.2%) of 50 cases (55 eyes) were significantly improved filtering bleb function and returned to normal intraocular pressure without obvious complication.

In conclusion, filtration surgery plays a significant role in the repair and improvement of filtering bleb function for patients with glaucoma. The maintenance of filtering bleb and the repair of the dysfunctional filtering bleb in the early period after operation could increase the success rate of operation.

Conflict of Interest Statement

None

References

- Weinreb RN, Khaw PT. Primary open-angle glaucoma. *Lancet* 2004; 363: 1711-1720.
- Coleman AL. Glaucoma. *Lancet* 1999; 354: 1803-1810.
- Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol* 2006; 90: 262-267.
- Dautriche CN, Szymanski D, Kerr M, Torrejon KY, Bergkvist M, Xie Y, Danias J, Stamer WD, and Sharfstein ST. A biomimetic Schlemms canal inner wall: A model to study outflow physiology, glaucoma pathology and high-throughput drug screening. *Biomaterials* 2015; 65: 86-92.

5. Kountouras J, Zavos C, Chatzopoulos D. Primary open-angle glaucoma: pathophysiology and treatment. *Lancet* 2004; 364: 1311-1312.
6. Gedde SJ, Schiffman JC, Feuer WJ, Herndon LW, Brandt JD. Treatment outcomes in the Tube Versus Trabeculectomy (TVT) study after five years of follow-up. *Am J Ophthalmol* 2012; 153: 789-803.
7. Yamanaka O, Kitano-Izutani A, Tomoyose K, Reinach PS. Pathobiology of wound healing after glaucoma filtration surgery. *BMC Ophthalmol* 2015; 15 Suppl 1: 157.
8. Sugimoto Y, Mochizuki H, Ohkubo S, Higashide T, Sugiyama K. Intraocular pressure outcomes and risk factors for failure in the collaborative bleb-related infection incidence and treatment study. *Ophthalmology* 2015; 122: 2223-2233.
9. Chen CW, Huang HT, Bair JS, Lee CC. Trabeculectomy with simultaneous topical application of mitomycin-C in refractory glaucoma. *J Ocul Pharmacol* 1990; 6: 175-182.
10. Mwanza JC, Kabasele PM. Trabeculectomy with and without mitomycin-C in a black African population. *Eur J Ophthalmol* 2001; 11: 261-263.
11. Rodrigues AM, Junior AP, Montezano FT, de Arruda Melo PA, Prata J Jr. Comparison between results of trabeculectomy in primary congenital glaucoma with and without the use of mitomycin C. *J Glaucoma* 2004; 13: 228-232.
12. Kyprianou I, Nessim M, Kumar V, O'Neill E. Long-term results of trabeculectomy with mitomycin C applied under the scleral flap. *Int Ophthalmol* 2007; 27: 351-355.
13. Casson R, Rahman R, Salmon JF. Long term results and complications of trabeculectomy augmented with low dose mitomycin C in patients at risk for filtration failure. *Br J Ophthalmol* 2001; 85: 686-688.
14. Feldman RM, Tabet RR. Needle revision of filtering blebs. *J Glaucoma* 2008; 17: 594-600.
15. Iwach AG, Delgado MF, Novack GD, Nguyen N, Wong PC. Transconjunctival mitomycin-C in needle revisions of failing filtering blebs. *Ophthalmology* 2003; 110: 734-742.
16. Budenz DL, Chen PP, Weaver YK. Conjunctival advancement for late-onset filtering bleb leaks: indications and outcomes. *Arch Ophthalmol* 1999; 117: 1014-1019.
17. Chen P. *Complications: Bleb leaks*. Springer Berlin Heidelberg 2010.
18. Leung DY, Tham CC. Management of bleb complications after trabeculectomy. *Semin Ophthalmol* 2013; 28: 144-156.
19. Smith MF, Doyle JW. Use of tissue plasminogen activator to revive blebs following intraocular surgery. *Arch Ophthalmol* 2001; 119: 809-812.
20. WuDunn D, Cantor LB, Palanca-Capistrano AM, Hoop J, Alvi NP, Finley C, Lakhani V, Burnstein A, Knotts SL. A prospective randomized trial comparing intraoperative 5-fluorouracil vs mitomycin C in primary trabeculectomy. *Am J Ophthalmol* 2002; 134: 521-528.
21. Soltan JB, Rothman RF, Budenz DL, Greenfield DS, Feuer W. Risk factors for glaucoma filtering bleb infections. *Arch Ophthalmol* 2000; 118: 338-342.
22. Melo AB, Razeghinejad MR, Palejwala N, Myers JS, Moster MR. Surgical repair of leaking filtering blebs using two different techniques. *J Ophthalmic Vis Res* 2012; 7: 281-288.

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