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Mid-Term Results of Filtering Surgery in Corticosteroid-Induced Glaucoma Patients

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Abstract

Aim: To analyze the mid-term effect of filtering surgery in patients with

corticosteroid-induced glaucoma (CIG).

Methods: This case-series study consisted of 20 eyes of 15 corticosteroid-induced glaucoma patients who received trabeculectomy or non-penetrating trabecular surgery (NPTS) from March 2005 to March 2008. Both preoperative and postoperative intraocular pressure (IOP), cup –disk ratio, Humphrey visual fields, number of glaucoma medications were recorded. Characteristics of postoperative blebs were analyzed with Ultrasound biomicroscope (UBM), and slit-lamp. Bleb grading and Ultrasound biomicroscope were performed on all glaucoma surgery eyes at a single final time point.

Results: 14 eyes were performed trabeculectomy, 6 eyes were performed NPTS. Mean IOP before and after trabeculectomy were 30.5±13.1 and 11.4±3.8 mmHg ($p<0.01$), respectively. Mean IOP before and after NPTS were 20.3±4.7 and 12.2±3.1 mmHg ($p<0.01$), respectively. The mean vertical cup-disk ratio (VCDR) was 0.54 before surgery compared with 0.55 just after surgery. No significant changes were found in visual fields before and after surgery ($P=0.06$). According to the outcome of final IOP, success rate was 100% .Based on slit-lamp and Ultrasound biomicroscope evaluation of the bleb, 90% of blebs were functional and 10% were non-functional.

Conclusions: The mid-term glaucoma management in CIG patients undergoing surgery indicated a successful outcome in final IOP and fairly good prognosis for visual function, without antiglaucoma medication.

Keywords: Corticosteroid-induced glaucoma; IOP; Visual field; Filtering bleb; Slit-lamp; Ultrasound biomicroscope

Introduction

Corticosteroid has long been recognized to raise intraocular pressure (IOP) [1,2]. IOP rise is related to duration of treatment, corticosteroid type and dose as well as individual susceptibility [3]. Steroid has been shown to produce an IOP rise over a period of weeks in both normal and glaucomatous eyes [4-6].

Ending corticosteroid treatment is the first step to reduce IOP. However, IOP cannot be controlled medically in some patients even after discontinuing corticosteroid therapy and progressive vision loss and glaucomatous optic neuropathy occur. Therefore, trabeculectomy or non-penetrating trabecular surgery (NPTS) is needed to prevent further optic nerve damage. Several clinical studies have evaluated bleb morphology and the effectiveness of trabeculectomy and NPTS in lowering IOP in primary open angle glaucoma, pigmentary glaucoma, pseudoexfoliation glaucoma, and normal tension glaucoma [7,8]. However, it remains uncertain whether these two surgeries are really effective in controlling IOP and protecting the optic nerve. Therefore, we conducted this case series study on patients who underwent trabeculectomy or NPTS to report the mid-term effects of the visual field outcome as well as the IOP control outcomes .The hypothesis of this study is that corticosteroid-induced glaucoma (CIG) patients get good results after surgery.

Methods

Our study was a case series. Twenty eyes of 15 patients diagnosed with corticosteroid-induced glaucoma were included. All patients underwent trabeculectomy or NPTS at the Department of Ophthalmology, Beijing Tongren Hospital from March 2005 to March 2008; they were called in for follow up in December 2009. We studied postoperative effects, including IOP, vertical cup/disc ratio (VCDR) and visual field. IOP was measured by Goldmann applanation tonometry .Successful filtration was defined as IOP lower than 21 mm Hg without antiglaucoma medication (no or fewer topical glaucoma medications) [9]. Fundus photography was performed to assess vertical cup-to-disc ratio (VCDR). All subjects underwent static automated white-on-white threshold perimetry with SITA Fast strategy (program 30-2, model 750, Humphrey Instruments, Dublin, CA). This study was approved by Ethics Board of Beijing TongRen Hospital.

Corticosteroid-induced glaucoma diagnostic criteria were as follows: 1) local or systemic use of glucocorticoid for more than 3 months; 2) similar clinical performance to primary open-angle glaucoma; 3) no other type of glaucoma; and 4) no history of ocular trauma or surgery [10]. Maximal medical therapy was tried prior to surgery in all cases. Written informed consent was obtained from all subjects.

A glaucoma specialist (WNL) performed all trabeculectomies and NPTS. The trabeculectomies were performed with a limbus based conjunctival flap with intraoperative 5-fluorouracil or mitomycin C. NPTS were also performed by the same surgeon (WNL) as described in detail in earlier reports [11].

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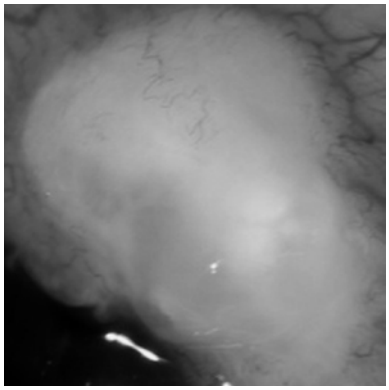

Figure 1: Slit-lamp image of functional filtering bleb.

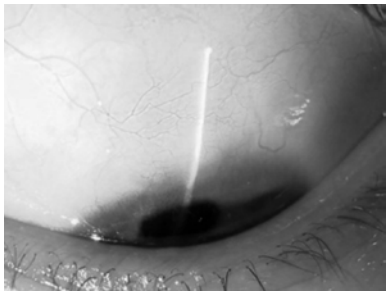

Figure 2: Slit-lamp image of non-functional filtering bleb.

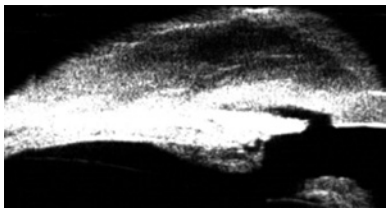

Figure 3: Ultrasound biomicroscope image of low-reflective bleb.

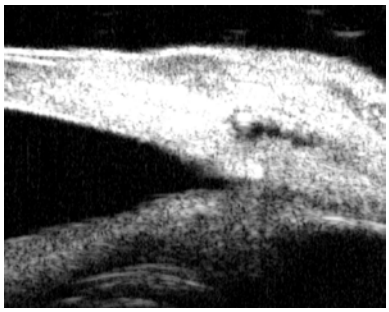

Figure 4: Ultrasound biomicroscope image of high-reflective bleb.

Paired t test was used to analyze the data. P value less than 0.05 was considered statistically significant.

Bleb evaluation by slit-lamp

Morphology of blebs was classified into four types according to Kronfeld's [12] standard: type I, small vesicle (Figure 1); Type II, diffuse; type III, encapsulated; type IV, flat (Figure 2). Type I and II are functional filtering blebs; type III and type IV are non-functional filtering blebs [13]. All blebs were classified prospectively by one examiner (FJ).

Bleb evaluation by Ultrasound biomicroscope

Ultrasound biomicroscope examination was performed 21-57 months after surgery (mean: 40.3±13.0 months) using the Ultrasound biomicroscope SW3200 (Tianjin Suoer, China). The Ultrasound biomicroscopewas set at a 5.0×5.0 mm field of view with 76dB of gain, 5 dB of gain compensation and 1-3 mm delay. With aid of a normal saline-filled cup, we scanned the entire filtering structure. For each eye, we recorded six images.

A total of 22 filtering blebs after trabeculectomy or NPTS were analyzed by Ultrasound biomicroscope. Taking into account the characteristics of internal reflectivity and scleral flap, we classified the blebs into four types according to the method of Yamamoto [14]. All Ultrasound biomicroscope was performed by the same operator (MDP).

Results

Twenty eyes of 15 patients were included in the study. Follow up period ranged from 21 to 57 months (mean: 40.3±13.0months). The mean age of patients was 30.4±16.9 years (13-66 years). Six were male and nine female. Mean duration of steroid usage pre-operative was 17.1±19.2 months. All patients had open angles with gonioscopy examination.

Preoperative patient characteristics are presented in Table 1, which shows methods of steroid administration in corticosteroid-induced glaucoma patients. None of the patients used the antiglaucomatous drugs after filtrating surgery.

The most common reasons for steroid use were allergic conjunctivitis and LASIK (4 patients, each, topical dexamethasone 0.1%), nephritis (2 patients, prednisolone, oral), renal transplant (2 patients, prednisolone, oral), pemphigoid (1 patient, oral prednisolone), systemic lupus erythematosus, SLE (1 patient), macular edema due to retinal vein occlusion (1 patient, injection of triamcinolone acetonide).

No previous glaucoma surgery had been performed before this study. After surgery all patients had IOP less than 21mmHg without further medication. As described in Table 2, the mean IOP before and after trabeculectomy were 30.5±13.1 and 11.4±3.8 mmHg ($p<0.01$) respectively. Mean IOP before and after NPTS were 20.3±4.7 and 12.2±3.1 mmHg ($p<0.01$), respectively ($p<0.001$). All patients had used 1-4 antiglaucomatous drugs preoperatively, mean± SD (1.87±1.19),

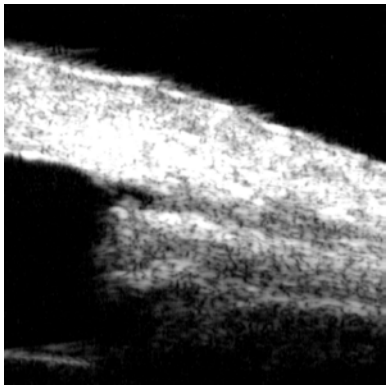

Figure 5: Ultrasound biomicroscope image of flat bleb.

Patients	Sex	age	cause of CIG	corticosteroid type	methods of steroid administration	steroid treatment duration (months)	preoperative edications	surgery
1	Female	18	allergic conjunctivitis	dexamethasone	topical	60	1	NPTS
2	male	14	allergic conjunctivitis	dexamethasone	topical	4	1	Trab
3	Female	48	allergic conjunctivitis	dexamethasone	topical	24	2	NPTS
4	Female	21	LASIK	dexamethasone	topical	1	4	Trab
5	Female	32	SLE	prednisone	oral	60	1	Trab
6	Female	66	CRVO	triamcinolone acetonide	intravitreal injection	1	1	Trab
7	male	32	LASIK	Fluorometholone	topical	4	3	Trab
8	male	13	LASIK	dexamethasone	topical	12	1	NPTS
9	Female	24	nephritis	dexamethasone	topical	12	3	NPTS
10	Female	19	renal transplant	prednisone	oral	12	4	Trab
11	Female	45	allergic conjunctivitis	prednisone	oral	24	3	Trab
12	male	21	renal transplant	dexamethasone	topical	24	2	Trab
13	male	50	nephritis	prednisone	oral	10	1	Trab
14	male	21	LASIK	Fluorometholone	topical	3	3	Trab
15	Female	15	pemphigoid	prednisone	oral	8	1	Trab

CIG= corticosteroid-induced glaucoma ,Trab=trabeculectomy

Table 1: Preoperative characteristics of corticosteroid-induced glaucoma patients.

IOP	Preoperative (mean±sd)	Postoperative (mean±sd)	p
Trab(n=14 eyes)	30.5±13.1	11.4±3.8	<0.0001
NPTS(n=6 eyes)	20.3±4.7	12.2±3.1	<0.0001

IOP=intraocular pressure, NPTS= non-penetrating trabecular surgery, Trab=trabeculetomy

Table 2: Preoperative and last postoperative IOP.

	Preoperative (n=22)	Postoperative (n=22)	P
Mean Deviation	-19.73±8.43	-18.95±10.95	0.49
Pattern Standard Deviation	9.18±2.99	9.41±3.67	0.57
cup-disk ratio	0.54	0.55	0.06

Paired t test was used to evaluate the data

Table 3: Preoperative and Postoperative Mean Deviation and Mean Pattern Standard Deviation and cup-disk ratio in the CIG patients.

such as timolol, adrenergic agents, beta-blocking agents, pilocarpine or latanoprost, but none used the above drugs after filtrating surgery.

The mean VCDR was 0.54 before surgery compared with a VCDR of 0.55 just after surgery. No significant changes were found in visual fields before and after surgery (P>0.05) (Table 3), consistent with mean VCDR which is also an indicative of the glaucoma progression.

According to Slit-lamp evaluation by Kronfeld's standard, 90% (18 blebs) of blebs were type I and type II, or functional filtering bleb (Figure 1). The other10% was type IV, or non-functional filtering bleb (Figure 2).

Ultrasound biomicroscope evaluation of blebs showed that, of the 20 blebs, 90% (18 blebs) were L (low-reflective) type (Figure 3), 5% (1 bleb) were H (high-reflective) type (Figure 4) ,5% (1 bleb) was F (flat) type with a non-visible scleral flap (Figure 5),none was E (encapsulated) type.

Discussion

Most patients with elevated IOP after corticosteroid usage can be successfully managed with topical glaucoma medication. If medication is unsuccessful in controlling IOP and the optic nerve is threatened, filtering surgery should be considered. CIG patients were performed NPTS or trabeculectomy in this study is due to the following reasons:

firstly, IOP could not be controlled even after discontinuing corticosteroid therapy; secondly, some patients have poor compliance with medication; thirdly, patients with systematic disease cannot stop corticosteroids, such as renal transplant recipients.

Previous studies have showed good success rate of filter surgery on primary open angle glaucoma (POAG). Inaba reported an overall success rate of 75% in POAG cases from 3 months to 5 years [15]. Lamping [16] found an overall success rate of 85%. Ehrnrooth found success rates of 82% at 1 year, 70% at 2 years, 64% at 3 years and 52% at 4 years [17]. Ahmet evaluated the efficacy of non-penetrating glaucoma surgery, with 68.7% of cases achieving <21mm Hg after filtration surgery [18]. In our study, the mid-term filter surgery success rate of corticosteroid-induced glaucoma was better than the success rate of POAG, if success was defined as lowering the preoperative, maximally treated IOP by more than 20% in addition to a postoperative IOP level lower than 21 mmHg without using further glaucoma medication,. All patients in our study have reached the target IOP after filter surgery. However, we should highlight that the criteria for success differ in these studies.

Satisfied controlled IOP depends on functional filter bleb. In our Ultrasound biomicroscope study, the filter tunnel under the scleral flap was visible and reflectivity from inside the bleb was low in 20 of 22 eyes after trabeculectomy. This result was consistent with that of slit-lamp photography, as 90.9% were classified as good pattern. Michael's study [19] showed that the main cause of failure of trabeculectomy was subconjunctival fibrosis. Both in vivo and in vitro cell studies showed that steroid can inhibit fibrosis [20,21] which indicates that long time use of corticosteroids, especially systemic use, can increase the filtering success rate.

One eye in our study had no bleb formation and the tunnel under the scleral flap was not visible, but its IOP remained normal; another

eye had high reflectivity inside the bleb, however both eyes' IOP were less than 21mmHg (table 1, patient 7 and patient 13) during the fellow up. A possible explanation is that trabeculectomy may help the patient to pass through the time of higher IOP and protect optic nerve; even the bleb is non-functioning at the end of follow up time, the outflow of aqueous humor back to normal.

Our results are meaning for patients with systematic disease who cannot stop corticosteroids, such as renal transplant recipients. In-time filtering surgery is necessary, not only for the patient's well-being, but also to prevent further damage to the optic nerve. Our findings suggest that surgery may be a good alternative for the treatment of parts of corticosteroid-induced glaucoma patients.

Our study was subject to limitations; first the sample size is relatively small. Second, 7 of the patients have had both eyes included in our study, as it is possible that both eyes in the same person will respond in the same manner this may generate bias in outcomes. Third, Laser trabeculoplasty was not carried out in TongRen hospital at that time; the surgeons tend to perform surgery on CIG patients.

In summary, our mid-term results indicated that patients with corticosteroid-induced glaucoma may have a good outcome after trabeculectomy or NPTS. In time surgery may help patients passing through the period of high IOP and prevent optic nerve damage and corresponding visual field loss.

References

1. Mohan R, Muralidharan AR (1989) Steroid induced glaucoma and cataract. Indian J Ophthalmol 37: 13-16.
2. Covell LL (1958) Glaucoma induced by systemic steroid therapy. Am J Ophthalmol 45: 108-109.
3. Feldman-Billard S, Heron E (2008) Systemic tolerance of corticosteroid therapy in ophthalmology depending on the route of administration. J Fr Ophtalmol 31: 1026-1036.
4. Armaly MF (1963) Effect of Corticosteroids on Intraocular Pressure and Fluid Dynamics. Ii. The Effect of Dexamethasone in the Glaucomatous Eye. Arch Ophthalmol 70: 492-499.
5. Diotallevi M, Bocci N (1965) Effect of systemically administered corticosteroids on intraocular pressure and fluid dynamics. Acta Ophthalmol (Copenh) 43: 524-527.
6. Cantrill HL, Palmberg PF, Zink HA, Waltman SR, Podos SM, et al. (1975) Comparison of in vitro potency of corticosteroids with ability to raise intraocular pressure. Am J Ophthalmol 79: 1012-1017.
7. Mendrinos E, Mermoud A, Shaarawy T (2008) Nonpenetrating Glaucoma Surgery. Survey of Ophthalmology 53: 592-630.
8. Rothman RF, Liebmann JM, Ritch R (2000) Low-dose 5-fluorouracil trabeculectomy as initial surgery in uncomplicated glaucoma: Long-term followup. Ophthalmology 107: 1184-1190.
9. El Sayyad F, Belmekki M, Helal M, Khalil M, El-Hamzawey H, et al. (2000) Simultaneous subconjunctival and subscleral mitomycin-C application in trabeculectomy, Ophthalmology 107: 298-301
10. Shi HM (2009) Clinical analysis of 35 cases glucocortloid glaucoma. Int J Ophthalmol 9: 573-574.
11. Shaarawy T, Karlen M, Schnyder C, Achache F, Sanchez E, et al. (2001) Five-year results of deep sclerectomy with collagen implant. J Cataract Refract Surg 27: 1770-1778.
12. Kronfeld PC (1969) Functional characteristics of surgically produced outflow channels. Am J Ophthalmol 67: 451-463.
13. Cantor LB, Mantravadi A, WuDunn D, Swamynathan K, Cortes A (2003) Morphologic classification of filtering blebs after glaucoma filtration surgery: the Indiana Bleb Appearance Grading Scale. J Glaucoma 12: 266-271.
14. Yamamoto T, Sakuma T, Kitazawa Y (1995) An ultrasound biomicroscopic study of filtering blebs after mitomycin C trabeculectomy. Ophthalmology 102: 1770-1776.
15. Inaba Z (1982) Long-term results of trabeculectomy in the Japanese: an analysis by life-table method. Jpn J Ophthalmol 26: 361-373.
16. Lamping KA, Bellows AR, Hutchinson BT, Afran SI (1986) Long-term evaluation of initial filtration surgery. Ophthalmology 93: 91-101.
17. Ehrnrooth P, Lehto I, Puska P, Laatikainen L (2002) Long-term outcome of trabeculectomy in terms of intraocular pressure. Acta Ophthalmol Scand 80: 267-271.
18. Hondur A, Onol M, Hasanreisoglu B (2008) Nonpenetrating glaucoma surgery: meta-analysis of recent results. J Glaucoma 17: 139-146.
19. Im MJ, Mulliken JB, Hoopes JE (1975) Effects of intralesional injection of triamcinolone on glucose-6-phosphate dehydrogenase and alanine aminotransferase activity in keloids. Plast Reconstr Surg 56: 660-663.
20. Ramalingam A, Hirai A, Thompson EA (1997) Glucocorticoid inhibition of fibroblast proliferation and regulation of the cyclin kinase inhibitor p21Cip1. Mol Endocrinol 11: 577-586.
21. Nguyen KD, Lee DA (1992) Effect of steroids and nonsteroidal antiinflammatory agents on human ocular fibroblast. Invest Ophthalmol Vis Sci 33: 2693-2701.